California Energy Commission

COMISSION REPORT

Electric Program Investment Charge 2017 Annual Report

California Energy Commission

Edmund G. Brown Jr., Governor

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ABSTRACT

The California Energy Commission is the state's primary energy policy and planning agency. As part of its overall mission, the Energy Commission administers several clean energy research and development programs that drive innovation and advance science and technology in the fields of energy efficiency, renewable energy and advanced clean generation, energy-related environmental protection, energy transmission and distribution, and transportation. The Energy Commission is one of the administrators of the Electric Program Investment Charge (EPIC) Program. In administering EPIC, the Energy Commission awards funding for investments in clean energy technologies and approaches that will benefit electricity ratepayers of California's three largest investor-owned utilities and lead to technological advancement and breakthroughs to overcome the barriers that prevent the achievement of the state's statutory energy goals. EPIC funding is authorized for applied research and development, technology demonstration and deployment, and market facilitation.

This report outlines the progress and status of Energy Commission activities funded by EPIC from January 1, 2017, through December 31, 2017. It has been prepared in accordance with applicable California Public Utilities Commission decisions and California Public Resources Code Section 25711.5.

Keywords: California Energy Commission, Electric Program Investment Charge, energy research, innovation pipeline, RD&D, energy efficiency, advanced generation, renewable energy, demand response, energy storage, buildings, distributed generation, transmission, smart grid, transportation, environmental, climate change, smart infrastructure, ratepayer benefits, public interest program, electricity, energy policy, loading order, jobs, greenhouse gas, California Public Utilities Commission

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TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Program Overview

In 2012, the Electric Program Investment Charge (EPIC) was established by the California Public Utilities Commission (CPUC) to fund public investments in research that create and advance new energy solutions, foster regional innovation, and bring ideas from the lab to the marketplace. The California Energy Commission and the state's three largest investor-owned electric utilities – Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company – were selected to administer the EPIC funds and advance innovative technologies, tools, and approaches that provide benefits to their electric ratepayers. This report focuses on the portion of the EPIC program administered by the Energy Commission.

The mandatory, primary guiding principle for these investments is providing electricity ratepayer benefits, defined as promoting greater reliability, lower costs, and increased safety. Complementary guiding principles include:

- Providing societal benefits.
- Reducing greenhouse gas emissions and increasing adaptation in the electricity sector at the lowest possible cost.
- Supporting the loading order which establishes that the State would invest first in energy efficiency and demand-side resources, followed by renewable resources and then clean, conventional electricity supply.
- Advancing low-emission vehicles/transportation.
- Increasing economic development.
- Using ratepayer funds efficiently.

The Energy Commission is committed to ensuring public participation in its research and development programs. This commitment reflects the rich and diverse characteristics of California, its people, and its innovative spirit.

This report provides an overview of the program accomplishments in 2017, describes the programmatic areas of EPIC research, highlights key activities, and provides a status update on all 268 EPIC projects active or completed in 2017. It also describes Energy Commission activities related to its administration of EPIC funds in 2017, and efforts in disadvantaged communities.

EPIC Program Accomplishments and Highlights

During 2017, EPIC administrators implemented the administrators' approved investment plans. The Energy Commission approved 72 new projects (from solicitations released in 2016 and 2017) at Energy Commission business meetings, totaling more than $134 million. Of the 268 projects that were active in 2017, seven projects were completed in 2017. The completed projects focused on:

- Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socioeconomic and Ethnic Groups Using a large-Scale Quasi-Experiment

- Cultural Factors in the Energy Use Patterns of Multifamily Tenants
- Improving Short-Term Wind Power Forecasting Through Measurements and Modeling of the Tehachapi Wind Resource Area
- High-Temperature Hybrid Compressed Air Energy Storage
- Building a Healthier and More Robust Future: 2050 Low-Carbon Scenarios for California
- Public Health Research Roadmap on Emerging Electricity Generating Systems
- Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System

Energy Commission staff will distribute the project results through the Energy Innovation Showcase, list serves, and to interested parties. In addition, the Energy Commission posted a "notice of proposed awards" for two solicitations in late 2017, and the chosen projects will be considered for approval at an Energy Commission business meeting in early 2018.

- **Accomplishments**
  - **Grant solicitations**: 11 competitive solicitations issued in 2017
  - **Funds encumbered**: $134 million, for 72 new projects approved in 2017
  - **Number of projects**: Of the 268 active projects in 2017, seven were completed. Final reports, including comprehensive project descriptions, detailed findings and results will be available at the Energy Commission website.
  - **Benefits**: EPIC projects funded in 2017 have the potential to provide some of the following benefits: reduce energy use and costs, decrease greenhouse gas emissions, increase grid flexibility, and benefit disadvantaged communities.
  - **Disadvantaged communities**: As of December 31, 2017, 97 demonstration sites were within a disadvantaged community. Furthermore, about 32 percent of total EPIC encumbrances for technology demonstration and deployment projects, to date, were located in a disadvantaged community.
  - **Public workshops:** The Energy Commission held five topical workshops throughout California in 2017 to solicit stakeholder input on topics related to electricity research and development. The Energy Commission also held 11 public preapplication workshops, one or more for each solicitation, to explain open solicitations and answer questions before the due date for applications or bids. The Energy Commission held a stakeholder workshop to gather input on the proposed investments before developing the *EPIC 2018-2020 Investment Plan*. Three joint public workshops were held with all EPIC administrators to provide a program overview and solicit public comment on each of the administrators' draft Investment Plans.
  - **EPIC evaluation:** Evergreen Economics conducted an independent evaluation of the EPIC Program. The evaluation determined that Energy Commission practices are in line with research organization best practices and that its administration includes strong linkages to state policy. It further stated that the Energy Commission has a transparent planning process that engages external stakeholders, results in competitive selection of projects, and uses a robust process to comprehensively report on project benefits. The

evaluators lauded the Energy Commission for sharing project scopes in a timely manner, as well as doing its due diligence to identify projects where EPIC funding is most effective (in other words, would not move forward without EPIC funding, or would progress more slowly). The results of this evaluation were published in September, 2017. These evaluation results were also reflected in CPUC Decision 18-01-008, which concluded that the California Energy Commission's 2018-2020 investment plan appropriately addresses safety and resiliency matters. Also, the CPUC concluded that the Energy Commission 2018-2020 investment plan complies with the criteria established in D.12-05-037, D.13-11-025, and D.15-04-020, and the funding to support those investments is just and reasonable. The CPUC approved the California Energy Commission's 2018-2020 investment plan on January 11, 2018 in D.18-01-008.

- **Highlights in Key Topic Areas**
    - **Climate Change Challenge – Developing technologies and strategies to reduce GHG emissions and slow the impacts of climate change**. A research project started in 2015 identified critical technologies needed to reduce the cost of meeting the state's climate and environmental goals. This project developed options for improving electricity planning that will need to evolve over the next 15 to 30 years and assessed how current policy choices will impact long-term climate outcomes. The study, completed in 2017, identified long-term energy scenarios for meeting the state's 2030 and 2050 GHG reduction goals. The study indicated that the GHG reduction goals are manageable with swift and diligent action and that electricity is expected to be the main energy carrier in California. Study findings indicate that the state will need to increase renewable energy generation, increase electric vehicle use, drive major increases in electrification of energy-using services, and develop advancements in energy efficiency.
    - **Grid Flexibility and Resilience - Fostering transformation of the electricity grid to accept greater quantities of renewable generation and distributed energy resources**. Research underway is focused on increasing the penetration of renewable energy resources such as solar and wind to benefit customers and the electric grid. This research includes testing demand response with various end uses, developing and field testing smart inverters with communications capability to ensure proper operation with the electric grid, testing new energy storage technologies, and demonstrating the integration of distributed energy resources, control strategies, optimal designs, and best practices in microgrids. For instance, the community microgrid demonstration at the Blue Lake Rancheria in Humboldt County is demonstrating how to build and operate a low-carbon microgrid for resilience. The research involves demonstrating how such a microgrid can optimize the use of energy storage, demand response, and renewables to provide resiliency and to document cost, performance, and benefits. The Blue Lake Rancheria microgrid leverages on-site generation and grid power to provide services at its Red Cross safety shelter-in-place facility in the event of an emergency. It also keeps electricity prices low for the tribe.
    - **Customer Empowerment - Empowering customers with tools to manage their energy consumption efficiently and provide grid support when needed.**

Research is underway to develop strategies and tools that help consumers respond to real-time signals for their benefit and the mutual benefit of the grid. The research aims to overcome technical, institutional, and regulatory barriers that prevent expansion of demand response participation, energy efficiency, community solar and storage integration into advanced energy communities. Also, this research is developing consumer tools to increase customer procurement of distributed energy resources. One researcher has developed a social media platform and gamification strategy that includes game-like elements to encourage large numbers of small residential customers to engage and participate in real-time response to demand response signals. The project engaged more than 15,000 California residential customers to cut load at critical times to support the grid and provides financial rewards for their actions. Another researcher has created a tool to reduce home idle loads using a smartphone application called "Dr. Power." The application allows residents to know where energy is used in their homes so that they can take appropriate action. Preliminary results show a potential 10 percent reduction in idle loads energy use per home by residential users.

- **The Energy Innovation Ecosystem - Creating a sustainable marketplace for entrepreneurs, consumers and researchers to turn advanced technologies and concepts into deployable products.** EPIC has formed the foundation for a sustainable ecosystem where clean energy innovation can flourish. The Innovation Ecosystem consists of a small grant program, the California Sustainable Energy Entrepreneur Development Initiative, and four regional energy innovation clusters. Together, these projects provide energy entrepreneurs with seed funding and a suite of commercialization assistance and services. In 2017, the California Sustainable Energy Entrepreneur Development Initiative received more than 331 applications and awarded 28 small grants, and the four innovation clusters accepted more than 70 clean energy companies into their cohort programs. The high level of interest in the Innovation Ecosystem demonstrates California is brimming with ideas and strategies to advance clean energy solutions.
- **Disadvantaged Communities – Bringing the benefits of advanced technologies to those in disadvantaged communities.** The Energy Commission advances energy equity for disadvantaged communities when considering the customers and benefits of EPIC research. The EPIC program prioritized disadvantaged communities in four of its 2017 solicitations by setting aside specific amounts for projects in disadvantaged communities or providing bonus points for demonstration or test sites in and benefitting disadvantaged communities. Two additional solicitations did not provide set aside or preference points for disadvantaged communities but emphasized tools to benefit or positively target customers in disadvantaged communities. As of December 30, 2017, 97 demonstration sites were within disadvantaged community. Furthermore, about 32 percent of total EPIC encumbrances for technology demonstration and deployment projects, to date, were located in a disadvantaged community. As an example, one of the funded projects benefits disadvantaged communities by providing training and apprenticeship programs for advanced technologies. This training program is recruiting

workers from disadvantaged communities into apprenticeship programs at California Joint Apprentice Training Centers. The program provides comprehensive classroom and on-the-job training on the installation and maintenance of automated demand response communications equipment in buildings in disadvantaged communities across California. As of the end of 2017, 321 electricians and acceptance test technicians have successfully completed the automated demand response training, with an additional 250 individuals undergoing training. The program also completed training for the International Brotherhood of Electrical Workers instructors. These instructors will be training apprentices from disadvantaged communities. Training of apprentices from disadvantaged communities will begin in the second quarter of 2018.

Status of Program

In 2017, the Energy Commission continued to issue competitive solicitations, award funds, conduct public workshops and manage existing and new projects. The summary was highlighted previously and the details are found in Chapter 1, and the specific information on grant recipients are found in Chapters 2 and Appendices B and C. One of the major activities in 2017 was the development of the 2018-2020 investment plan.

EPIC 2018-2020 Investment Plan

After engaging in a rigorous public process to develop the plan, on May 1, 2017, the Energy Commission submitted its application for approval of the *EPIC 2018 – 2020 Triennial Investment Plan* to the CPUC. The CPUC held a public workshop on September 8, 2017, to consider the investment plans of all the EPIC administrators and discuss strategies to increase equity in developing and deploying clean energy technologies. Additionally, the CPUC held a workshop on September 20, 2017, to review the recommendations from the EPIC evaluation, conducted in 2017 by Evergreen Economics on behalf of the CPUC. On January 11, 2018, the CPUC approved the Energy Commission *EPIC 2018-2020 Investment Plan*. While funding amounts, priorities, and research initiatives and outreach strategies proposed by the Energy Commission were approved, as submitted, several changes were made to administering the EPIC program.

The Energy Commission must receive state Budget Act Authority from the Legislature before awarding funds under the *EPIC 2018-2020 Triennial Investment Plan*. If approved, funding awards are anticipated after July 2018.

Beginning in 2018, the Energy Commission's EPIC Program will implement Assembly Bill (AB) 523 (Reyes, Chapter 551, Statutes of 2017), which was signed into law in October 2017 and is effective January 1, 2018. This bill requires specific amounts of EPIC funds be expended on technology demonstration and deployment at sites located in, and benefiting, disadvantaged communities and low-income communities.

CHAPTER 1:
EPIC Program Background, Highlights and Components

This chapter includes information about the EPIC program and highlights specific actions and activities from 2017. Section I provides specific project highlights and Sections II through V provide the programmatic activities as described in the EPIC Administrator Annual Report Outline by the CPUC.

I. Background

General Description of EPIC

The Electric Program Investment Charge was established by the California Public Utilities Commission to fund public investments in research that create and advance new energy solutions, foster regional innovation, and bring ideas from the lab to the marketplace. The California Energy Commission and the state's three largest investor-owned electric utilities – Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company – were selected to administer the EPIC funds and advance innovative technologies, tools, and approaches that provide benefits to their electric ratepayers. The mandatory, primary guiding principle for these investments is providing electricity ratepayer benefits to promote greater reliability, lower costs, and increase safety. Additional information on the EPIC program can be found in the EPIC Program Components in section II.

Value of Research and Development

Energy research, development, and demonstration (RD&D) is vital to achieving California's energy and climate goals by supporting and advancing technologies required to make the necessary leaps toward improving system reliability, affordability, and public safety. Figure 1 identifies a scenario that captures the scope and scale of needed transformations to meet 2030 GHG reduction goals. This information helps shape the energy research needed to achieve the state's climate and environmental goals. It suggests that the GHG reduction goals are manageable with swift and diligent action.

Figure 1: One Scenario of GHG Reduction Strategies to Achieve 2030 GHG Goals

	Sector	2030 GHG reduction strategy
Efficiency	Buildings	10% reduction in total building energy demand relative to 2015 (~2x additional achievable energy efficiency)
	Transportation	12% reduction in per capita light-duty vehicle miles traveled relative to 2015
	Industry	30% reduction in total industrial energy demand relative to 2015
Electrification	**Buildings**	**50% new sales of water heaters and HVAC are electric heat pumps**
	Light-duty vehicles	**6 million ZEVs (20% of total) and >60% of new sales are ZEVs**
	Trucks	4% of trucks are BEVs or FCEVs (6% of trucks are hybrid & CNG) 32% electrification of buses, 20% of rail, and 27% of ports
Low carbon fuels	**Electricity**	**74% zero-carbon electricity, including large hydro and nuclear (~70% RPS)**
	Advanced Biofuels	10% of total (non-electric power generation) fossil fuels replaced with advanced biofuels
Non-combustion GHGs	Reductions in methane and F-gases	37% reduction in methane and F-gas emissions relative to 2015 19% reduction in other non-combustion emissions relative to 2015

Source: E3, Inc.

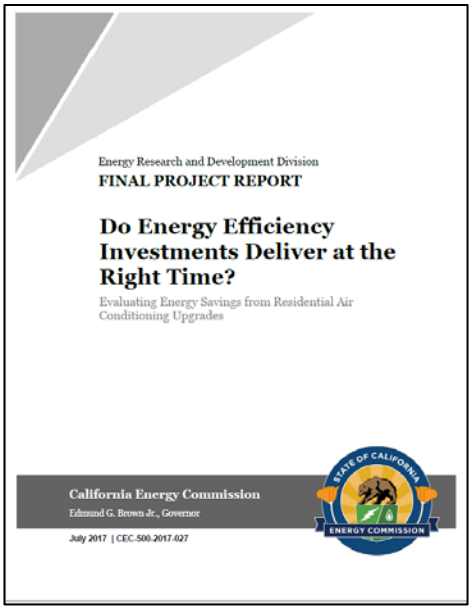
The Energy Commission's transparent and public process for investment plan development, competitive award selection, and benefits reporting advances the next generation of clean energy technologies, systems, tools and strategies. An independent company, Evergreen Economics, evaluated the Energy Commission's practices and concluded they are in line with research organization best practices. Furthermore, the evaluation determined that the program's administration is strong and transparent, engages stakeholders, provides a public process for selecting projects, and comprehensively reports on project benefits. In line with the evaluation recommendations, the program will continue coordinating among administrators and will expand outreach and dissemination of project results. These actions include more frequent updates of the Energy Innovation Showcase, which provides information on all EPIC-funded projects and related benefits. It also includes an Energy Commission commitment to increase sharing of EPIC project status and results through technology forums and other ongoing activities such as technical advisory meetings, critical project reviews, social media reporting, and annual reports. (See Section V for more information.)

Results and Project Highlights

The EPIC program investments are starting to show results. In 2017, there were seven completed projects; six final reports are posted on the Energy Commission website. The seventh report is part of California's Fourth Climate Change Assessment and therefore, will be published later in 2018. Chapter 3 provides details for the seven completed projects, including Web links to final reports, but a few of the findings are presented here:

- **Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socioeconomic and Ethnic Groups Using a Large-Scale Quasi-Experiment (EPC-14-026).** Consumers are failing to adopt seemingly cost-effective investments in energy efficiency. The research included a quasi-experimental, econometric study of energy efficiency adoption and energy savings with a focus on differences between social, cultural, and socioeconomic groups. The data collection performed for this project shows the potential for future data collection using smart meter data. Project findings suggest that climate is the strongest variable for customer participation in Southern California Edison's Quality Installation Program. (Participants in hot areas saved about 1,100 kilowatt-hours [kWh] annually, compared to 300 kWh in warm areas and none in mild areas.) Savings were higher for lower-income homes than for high-income homes, but lower-income homes participated less frequently. The most significant hours for achieving energy savings were shown to be 3-9 p.m., when energy cost was highest. The project found that since energy savings are influenced by climate, the investor-owned utility (IOU) incentive funds should be focused in hot areas and eliminated in mild areas. When considering a timing premium, savings resulting from this program are 50 percent higher due to efficiency gains. Understanding social, cultural, and behavioral aspects of customers can help investor-owned utilities (IOUs) better market their efficiency programs to especially hard-to-reach customer groups. Results from this project confirmed that SCE's original stepped incentive structure based on climate zone did not encourage increased adoption across the different climate zones. These findings can pave the way for improved incentive program design that targets highest value projects and provides more effective incentive amounts. The report has been sent to the IOUs and the CPUC.

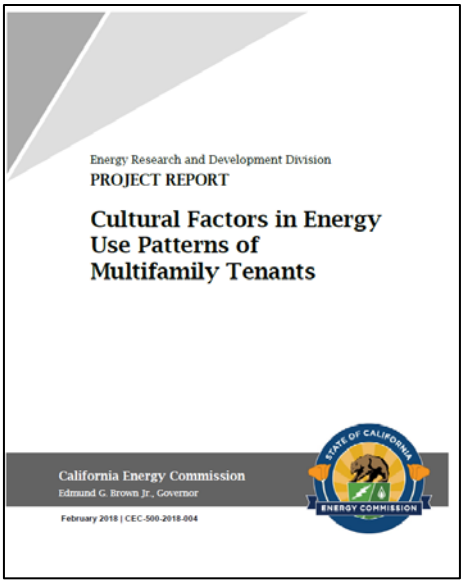
Figure 2: Final Report for EPC-14-026



Source: California Energy Commission

- **Cultural Factors in the Energy Use Patterns of Multifamily Tenants (EPC-14-039)**. The research project examined the cultural and demographic factors that correlate with multifamily tenants' electric energy-use patterns, before-and-after energy efficiency upgrades, and tenant engagement. The project found that the differences among load profiles are also correlated with demographic and cultural factors, such as the race/ethnicity of the occupants as well as the amount of plug loads they use. For example, after the retrofit, some tenants installed equipment that was not energy-efficient. The survey found that these plug loads substantially affect energy use in multifamily units. These are second-order effects to the weather-dependent energy use, such as use of cooling energy in the hot Central Valley versus relatively mild coastal areas. The multivariate analysis shows that no single demographic or cultural factor (nor interactions with others) by themselves explain the differences more than, or as much as, the effects of location and climate. The results of the project were presented at the 2016 and 2017 Behavior Energy and Climate Conference (BECC), and have been accepted for a presentation at the 2018 BECC Summer Study. Pacific Gas and Electric, Sacramento Municipal Utility District, and San Diego Gas and Electric have expressed interest in the project results, and meetings are planned with the grant recipient to discuss the results.

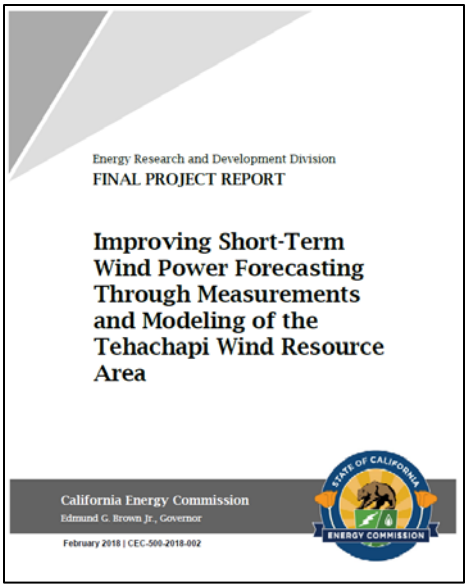
Figure 3: Final Report for EPC-14-039



Source: California Energy Commission

- **Improving Short-Term Wind Power Forecasting Through Measurements and Modeling of the Tehachapi Wind Resource Area (EPC-14-007)**. This project included coordinated atmospheric field measurements and computational modeling improvements to improve the accuracy of prediction of short-term wind ramps in the Tehachapi Pass Wind Resource Area. The improved forecast reduced aggregated, or collective, power forecast error by 13.5 percent for the Tehachapi resource area. This includes a 6.9 percent reduction of error for ramp rate forecast, and improved the prediction of large ramp events (over 750 MW) by 2.5 to 8.8 percent. This improvement is based on a composite metric called Critical Success Index that takes into account the number of predicted ramp

Figure 4: Final Report for EPC-14-007

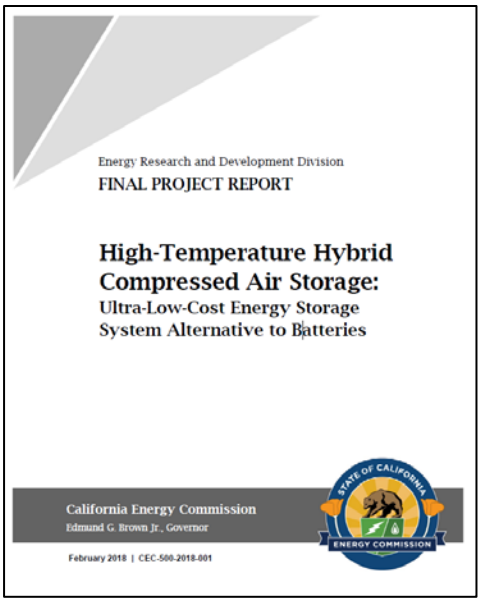


Source: California Energy Commission

event hits, misses, and false alarms. Improving the accuracy or prediction of short-term wind ramps can reduce grid operation costs by an estimated $28 million to $100 million in the Western Electricity Coordinating Council (WECC)[1] area, assuming 14 to 24 percent wind penetration. This project produced high-quality data from models to help forecasters better predict future wind ramp events. It produced several quantifiable improvements in wind speed forecasting that can be immediately implemented in forecasts provided to the California Independent System Operator, utilities and wind plant operators.

- **High-Temperature Hybrid Compressed Air Energy Storage (EPC-14-027).** This project designed a low-cost 74 kW pilot High-Temperature Hybrid compressed Air Energy Storage System (HTH-CAES) that can store grid-level energy and release the energy when needed to meet peak demand. The technology was designed by the University of California, Los Angeles (UCLA), which estimated that the system can reduce the cost of energy storage to about $100/kWh and have 85 percent efficiency. However, further research is needed to develop a prototype for a pilot-scale demonstration to verify the actual performance and cost savings. This research has resulted in two U.S. patents on the new low-cost energy storage system and six technical journal papers. The research has resulted in interest by several microgrid companies interested in the HTH-CAES system. Several utilities, including Southern California Edison, Southern California Gas and Eversource, have also expressed interest in learning more about the system.

Figure 5: Final Report for EPC-14-027



Source : California Energy Commission

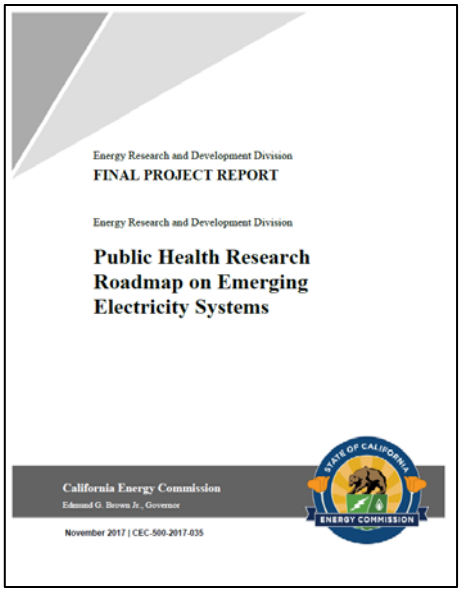
- **Building a Healthier and More Robust Future: 2050 Low-Carbon Energy Scenarios for California (EPC-14-072)**. Three researcher teams (Lawrence Berkeley National Laboratory [LBNL], Energy, Environmental, and Economics [E3], and the University of California, Irvine [UCI]) developed long-term scenarios (described in the following subsection) for California that comply with GHG emission targets and goals. LBNL, in its study (EPC-14-072), modeled the entire WECC to investigate if a changing of geographical coverage can affect long-term energy scenarios. One of the findings from this study is that clean electricity generation technology adoption beyond the baseline used for the study does not necessarily provide the greatest improvement in local air quality and public health but this varies across the geographic area studied. The baseline used for this study included 50% zero carbon electricity in addition to large hydropower by 2030. However, to comply with the 40% GHG reduction

1 WECC is a non-profit corporation that exists to assure a reliable bulk electric system in the geographic area known as the Western Interconnection, which covers the 14 western states, 2 Canadian provinces, and the northern portion of Baja Mexico.

mandate, higher levels of carbon free electricity are needed. For example, in the Central Valley, decarbonizing residential fuel combustion, including wood-burning stoves and fireplaces, and diesel-powered transportation are more beneficial than other options to reduce emissions from power plants. This project is part of a set of complementary studies on long-term energy scenarios for California and could inform the CPUC's work on integrated resource planning. In addition, the study results could also inform the Energy Commission's future Integrated Energy Policy Reports and other efforts focused on how the energy system in California should change to drastically reduce greenhouse gas emissions by 2050.

- **Public Health Research Roadmap on Emerging Electricity Generating Systems (EPC-15-034).** Researchers evaluated several emerging energy technologies, such as solar PV, concentrating solar, small hydropower, and storage technologies, and the public health impacts associated with deployment of these technologies. The roadmap includes recommendations on the need for further emerging technology research. While there is limited information on health impacts on emerging technologies, the roadmap identified research opportunities to minimize the overall health impacts of new energy technologies and systems. Furthermore, the researchers found that public health impacts from emerging technologies paled in comparison to those associated with climate change and emphasized this as a major consideration in any assessment of system transformation. The roadmap will inform the Energy Commission's future proposed funding initiatives on public health issues and the electricity system.

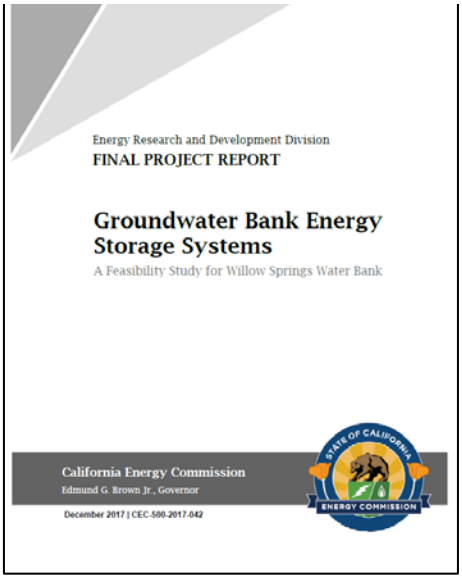
Figure 6: Final Report for EPC-15-034



Source: California Energy Commission

- **Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System (EPC-15-049)**. This study evaluated the potential to integrate pumped storage with groundwater banking operations for two types of pumped storage systems: peak-hour pumped storage, with all the components above ground, and aquifer-pumped hydropower, which uses the aquifer as the lower reservoir. The project team also assessed hydropower generation and demand response potential of groundwater banking projects in addition to pumped storage. Properly configured, peak-hour pumped storage facilities at groundwater banks will increase the capability of the California electricity grid to integrate renewable energy and provide reliable energy to ratepayers. The study estimated that statewide peak-hour pumped storage potential of 44 megawatts (MW) could address up to 1 percent of California's storage requirements and, on average, reduce annual GHG emissions by 44,000 metric tons of carbon dioxide equivalent (CO_{2e}). The analytical tools and other results from this project are being used in a new project funded by the Energy Commission at the Willow Spring Water Bank to integrate onsite renewable energy generation to achieve energy neutrality at the facility.

Figure 7: Final Report for EPC-15-049



Source: California Energy Commission

The next sections will discuss key themes that have emerged within the EPIC portfolio and highlight the progress made toward addressing the challenges of climate change and investing in advancements in grid transformation and resilience, customer empowerment, creating an energy innovation ecosystem and assisting disadvantaged communities.

Climate Change Challenges and Strategies to Reach the State's 2030 and 2050 GHG Reduction Goals: Energy and Environmental Economics, Inc. (E3) (EPC-14-069) is developing long-term energy scenarios to inform policy makers about key choices needed to reduce the cost of meeting the state's climate and environmental goals. This work has been guided by California's principal energy agencies including the CPUC, California Independent System Operator (California ISO), and the California Air Resources Board (CARB). These scenarios provide insights on needed critical technology innovation and are informing efforts associated with Long-Term Procurement and Integrated Resource Planning at the CPUC. Key findings for achieving 2030 and 2050 climate and environmental goals are summarized as follows:

- To comply with the mandate to reduce GHG emissions by 40 percent by 2030, renewable power generation needs to exceed the current RPS requirement of 50 percent set for 2030, to about 70 percent.
- More electric vehicles (EVs) would be needed than were anticipated based on earlier analyses.

- The electrification of energy services (e.g., space heating, transportation) with electric units such as heat pumps and electric vehicles seems to be a robust strategy.
- Additional RD&D is needed to chart a path for hard-to-electrify end uses (for example, heavy-duty trucks, industry).
- To meet California's 2050 goal of 80 percent emissions reductions relative to 1990, the electricity system must consist of 85 percent to 95 percent zero-carbon electricity by 2050.
- Diversity in renewable energy systems and integration solutions will be critical for reducing the cost of a low-carbon electricity grid.
- Consumer behavior is the key to meeting 2030 targets. For example, the goals can be met most effectively if consumers play a key role through investing in energy efficiency improvements in existing buildings, purchase and drive zero-emission vehicles, and install electric heat pumps for heating, ventilation, and air conditioning (HVAC) and water heating.
- Advances in energy efficiency are more important than ever to the compliance with the 2030 GHG target because it requires substantial reductions in a relatively short period of time.
- The electrification of energy services (such as higher penetration of electric vehicles) will result in substantial improvement in air quality. The E3 study prioritizes market transformation in light-duty transportation and calls for 6 million zero emission vehicles on the road by 2030.

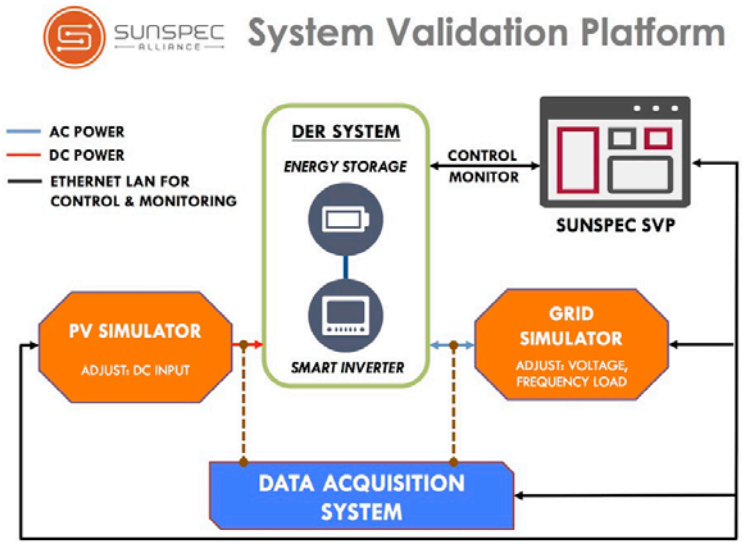
These findings have been shared with the CPUC, CARB, Governor's Office of Planning and Research, and other state agencies that participate on the Policy Advisory Committee for this research portfolio.

Grid Challenges and Need for Flexibility and Resilience to Address Power Disruptions: Grid challenges will become more acute as climate change causes more frequent extreme weather and increases the risk of subsequent service disruptions and grid outages. Adding renewable generation is an important step toward a low carbon grid. However, the characteristics of some renewable generation (for example, variability, uncertainty, and nonsynchronous generation) present challenges for the utilities and the California ISO to manage the grid.

EPIC is funding research on smart inverters, energy storage, and the commercialization of microgrids, showing how these technologies can be used in conjunction with renewables to control, balance and properly manage the grid during normal operations and during a grid outage. Examples include the following:

- Sunspec Alliance (EPC-14-036) is developing a complete smart solar photovoltaic (PV)-based Distributed Energy Resources (DER) system that addresses key barriers impeding the progress toward high penetration of solar and DER. The work includes development of a California Rule 21 test framework and test scripts, compliance testing of smart inverters with functionality, monitoring and controlling inverter operating functions to allow participation in ancillary services (those electrical services necessary to support the transfer of electricity from the generator to the customer) for diverse DER assets, and increased PV penetration and cost-effectiveness. All of this while enhancing safety and reliability of the California grid. This research has defined a standardized method for communicating, testing, and demonstrating smart inverter functions, and has delivered free-to-the-public software test scripts for evaluating smart inverter functions for compliance with the Phase 1 requirements of California's Rule 21 proceeding.[2] This proceeding applies to the interconnection requirements that must be followed by the IOUs. This covers interconnection requirements on the distribution grid. In 2017 field tests were conducted on smart inverters from inverter manufacturers. These tests will be followed with actual field testing and deployment of the smart inverters with high-density PV and storage on an IOU grid to validate ratepayer benefits and forge connections to the California ISO markets. The potential benefits include cost avoidance for grid upgrades estimated to be $0.16 to $0.30 per installed watt. Standardization could provide $0.05 per installed watt of savings in avoided switching costs, with $0.02 of savings per watt due to decreased need for specialized labor and reduced supply chain costs leading to plug-and-play-compliant smart inverters.

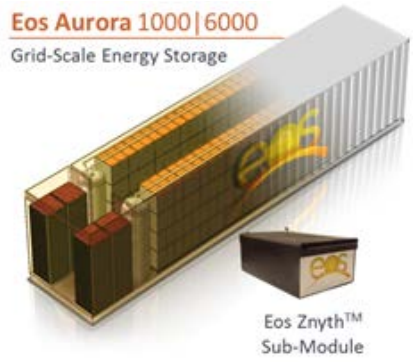
Figure 8: Smart Inverter Platform



Source: Sunspec Alliance

2 California Rule 21, or California Public Utilities Commission, Electric Tariff Rule 21, establishes the requirements for inverters used in solar projects and the interconnection requirements. The revisions to Rule 21 are implemented in three phases. Phase One, effective September 9, 2017, requires that solar projects interconnected to the grid must use eligible advanced inverters that can autonomously perform certain grid-supporting functions. Phase Two will establish communication requirements for inverters and Phased Three will require additional advanced inverter functions that respond to signals from utilities or other grid operators.

Figure 9: Eos Zynth Battery™



Source: Eos Energy Storage, LLC

- Eos Energy Storage (EPC-14-023) is testing a low-cost alternative chemical battery called Znyth™ (zinc hybrid cathode technology), suitable for grid applications. This advanced battery is only one of the few emerging battery technologies not based on lithium-ion technology, and it is nonflammable and nontoxic. Eos is performing a pilot test of its energy storage system at PG&E's testing facility in San Ramon. System performance will be characterized for a variety of use cases, including ancillary services peak shaving[3], load following[4], and frequency regulation[5]. In advance of the installation in 2017, a test plan and interconnection requirements were developed along with utility industry criteria and interconnection needs. Successful performance in this project will allow the technology to compete for adoption in the upcoming 1.3 GW of energy storage procurement process being conducted by the California IOUs in 2018 and 2020.

Figure 10: Blue Lake Rancheria Microgrid Solar Array

Source: Humboldt State University

- Blue Lake Rancheria (EPC-14-054) in Humboldt County is one of four microgrids funded by EPIC that focuses on developing best practices for microgrid design and operation at critical facilities. The microgrid has been installed and includes on-site renewable generation of 420 kW solar PV, coupled with 500 kW of energy storage to allow it to provide services as a Red Cross safety shelter in the event of an emergency and to reduce grid demand during non-emergency operations. The microgrid keeps electricity prices low for the tribe by using the Siemens microgrid controller with five load shed options to perform energy arbitrage and peak shaving. This has resulted in a 30% reduction in annual energy costs, which was approximately $200,000 for the first year of full operation and is slated to be $300,000 for the second year.

  The Blue Lake Rancheria microgrid is reducing GHG emissions by using solar power instead of the 1 Mw and 80 kW legacy diesel generators saving approximately 195 metric tons of CO2. Blue Lake Rancheria states that the microgrid increased tribal employment by 10 percent and helps

3 Peak shaving is a technique that is used to reduce electrical power consumption during periods of maximum demand on the power utility.

4 Load following is a technique to match and adjust the power available as the demand for electricity fluctuates.

5 Frequency regulation is the addition or subtraction of electrical energy into the grid to keep the frequency as close to 60 Hz as possible.

support the local rural/regional solar and storage companies and related workforce according to the Schatz Energy Research Center (SERC) at Humboldt State University.[6] The project recently was awarded the DistribuTECH project of the year award and is under consideration as a finalist for two prestigious industry awards from S&P Global and Pennwell.[7]

Customer empowerment that provides mutual benefits to consumers and the grid. Energy efficiency, demand response, programmable devices, community solar, storage, and electric vehicles are all part of the strategy to help support the grid, while maximizing residential, commercial, industrial, and agriculture customer empowerment.

EPIC funded projects aim to simplify and integrate equipment controls from multiple energy systems, such as lighting and HVAC, or help consumers to be more informed about their energy use. Examples include smart thermostats integrated with other smart devices such as ceiling fans and HVAC systems and behavioral based strategies that allow consumers to take action based on information provided by the tool or other data sources, such as smart meters.

- The Center for the Built Environment, at UC Berkeley (EPC-14-013), is designing very low-cost wireless airflow sensors for measuring room airflow to provide information to building operators of wasteful HVAC malfunctions or underperformance. Using these sensors, building operators can easily determine appropriate air flows in buildings, leading to reduced energy bills by an estimated $26 million annually, for all California building types, assuming applicability to 25-75 percent of the buildings. Both in-lab and actual building testing occurred in 2017 and will continue into 2018. A private company has expressed potential interest in commercializing the sensors.

Figure 11: Room Anemometer Prototype

Source: UC Berkeley

6 https://microgridknowledge.com/airport-microgrid-humboldt-county/.

7 http://www.schatzlab.org/news/2018/01/blue-lake-rancheria-microgrid-wins-project-of-the-year-award-at-distributech-conference/.

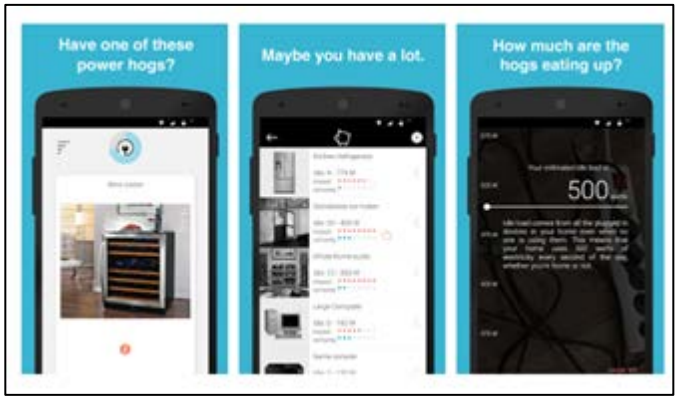
- Research by LBNL (EPC-14-010) indicates that for homes in all 16 California climate zones, painting the east, and west walls with “cool wall” products that are highly reflective can reduce annual building HVAC energy use by 3 to 25 percent in all climate zones. The amount of savings was highest in homes built before implementation of California Building Energy Standards in 1978 due to minimal or no insulation in the walls. Figure 9 show a paint exposure rack to determine the impacts of weather and aging of cool wall products over a 24 month period. The researchers are quantifying the energy savings, peak demand reduction, urban cooling, and air quality improvements attainable from using cool wall products. The research is also assessing the performance of existing cool wall technologies and those in development and is collaborating with government agencies, utilities, and industry to create a cool-wall infrastructure that includes application guidelines, product ratings, incentives, and building code credits. The results of this research apply directly to meeting zero-net energy and maximizing energy efficiency in buildings.

Figure 12: Exposure Rack for Cool Wall Products Constructed Onsite at LBNL

Source: LBNL

- Home Energy Analytics (EPC-15-025) is creating a tool that empowers customers to reduce home idle loads. With a smartphone, building owners can use an engaging EPIC-funded app called Dr. Power to provide information on energy use by miscellaneous electric loads (MELs) in their homes. The app also correlates any operational changes made on MELs to smart meter data so that residents can see the energy impact of their actions. Providing customers with this knowledge can lead to changes in equipment operating behavior. Dr. Power is being piloted in all IOU service areas, and preliminary results show a 10 percent energy reduction in idle loads per home.

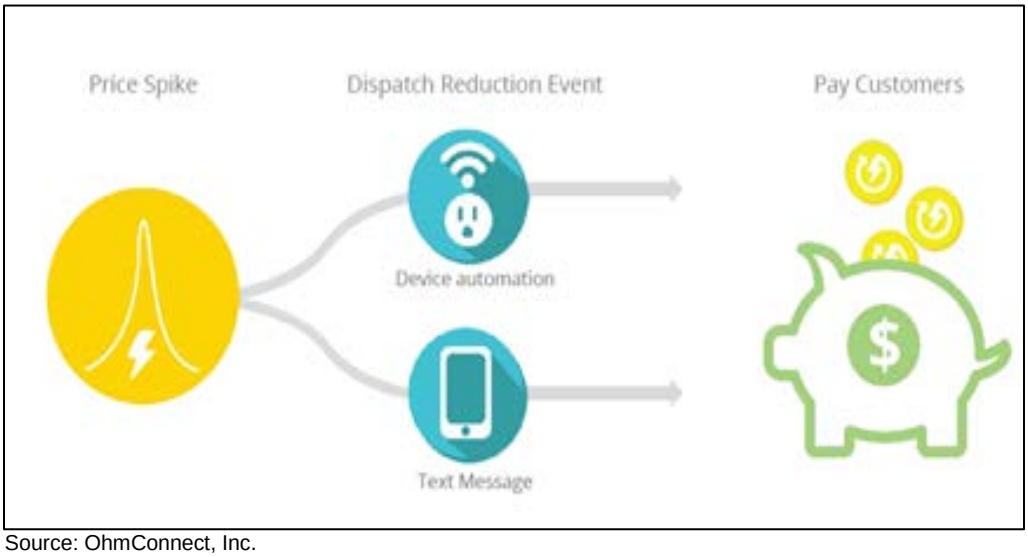
Figure 13: Dr. Power App for Smartphones
Source: Home Energy Analytics



Source: Home Energy Analytics

- OhmConnect, Inc. (EPC-15-083) has developed a social media platform and gamification strategy to encourage real-time response to DR signals from large numbers of small residential customers. The project provides policy makers and regulators with information to develop policies and limitations for a third-party demand response market. A method for residential telemetry is also proposed, to empower prosumers (producer/consumer) to interact effectively with the grid market operators, via their Internet of Things (IoT) devices, allowing them to supply electricity and save money. Preliminary results show 8 to 35 percent lower energy consumption for program participants. There appears to be high participation in homes in disadvantaged communities. Participation in OhmConnect's demand response program has grown from about 15,000 when the grant was awarded in 2015 to about 300,000 in all three IOU service territories as of the beginning of 2018. Of those, a sample of over 15,000 users has been included in the EPIC-funded experiment to assess different user engagement strategies for impact and persistence. The program bids 1-hour load reductions from the entire user base into CAISO markets through the Demand Response Auction Mechanism (DRAM), rewarding participating customers who are able to reduce their consumption for those hours with "points" that can be redeemed for cash or energy savings devices such as smart thermostats or automated plug strips, or donated to charities or local projects such as school PTA fundraisers.

Figure 14: OhmConnect Product



Source: OhmConnect, Inc.

Energy Innovation Ecosystem – creating a sustainable marketplace for entrepreneurs, consumers, and researchers for advanced technologies and concepts: EPIC has formed a set of programs aimed at creating a sustainable marketplace for entrepreneurs, consumers, and researchers. The Energy Innovation Ecosystem connects entrepreneurs with the training, resources, and expertise they need to turn advanced technologies and concepts into products that can be deployed for the benefit of consumers, companies, and utilities. These foundational programs include:

Figure 15: Members of the First Cohort of CalSEED Awardees Gather of a Kick-off Meeting

Source: CalSEED

- California Sustainable Energy Entrepreneur Development Initiative (CalSEED) (300-15-007). This initiative provides small grants to test the feasibility of energy concepts. In 2017 the CalSEED initiative conducted one round of funding and received 331 applications, of which 28 were selected for an award. One of the awardees, Opcondys, Inc., is developing a high-voltage, optically controlled, solid-state power electronic device for high-efficiency electric power grid control that will enable better electric fault detection and recovery. This technology was named one of the winners of the Cleantech Open business accelerator's Western Region competition in October 2017 and advanced to the Cleantech Open Global Forum competition held January 2018 in downtown Los Angeles.
- Regional Energy Innovation Clusters. In 2016, the Energy Commission launched the four regional energy innovation clusters that complement the CalSEED Initiative by providing clean energy

entrepreneurs a suite of community-based commercialization assistance and services, including access to laboratory testing facilities and mentorship on business development, commercialization, scale-up, and intellectual property considerations. In 2017, the activities accomplished by the clusters include:

- Los Angeles Regional Energy Innovation Cluster (Los Angeles Cleantech Incubator, EPC-16-015): This cluster accepted its first cohort of portfolio companies into the Energize California program to receive services, such as a customized 12-month technology development plan, access to state-of-the-art testing and prototyping laboratories, one-one-one mentoring and counseling, and access to a network of technical and financial subject matter experts. This cohort includes companies developing solutions in commercial/industrial HVAC, on-site solar, insulation, grid management software, and electric vehicle mobility infrastructure. In 2017, the project also solidified the outreach approach to incorporate investors, startups, academia, business development groups, accelerators, and incubators into Energize California's network of resources for their portfolio companies. Energize CA has received $1,440,500 from non-EPIC grant funding opportunities; this additional funding will bolster the project's ability to support clean energy companies.

Figure 16: LA Regional Energy Innovation Cluster

Source: Los Angeles Cleantech Incubator

- San Diego Regional Energy Innovation Cluster (Cleantech San Diego, EPC-15-030): This cluster accepted more than 15 companies into its network. One cohort company, Nuvve, is developing vehicle-to-grid solutions that enable bidirectional charging aligned to the needs of the grid. Nuvve was able to secure EPIC funding under the Cal SEED initiative due to the support it received from the San Diego Regional Innovation Network.

Figure 17: Cleantech San Diego

Source: San Diego Regional Energy Innovation Cluster

- Bay Area Regional Innovation Cluster (Activation Energy, EPC-15-032): Began accepting its first cohort of entrepreneurs into the Cyclotron Road program. Entrepreneurs will be granted full access to the state-of-the-art facilities at Lawrence Berkeley National Lab, along with a wide network of business development mentors. Non-EPIC funded achievements include receiving two DOE grants – one will develop a simple standardized partnership agreement that reduces the time and complexity of forming partnerships between large industry

Figure 18: Bay Area Regional Innovation Cluster

Source: Bay Area Region Innovation Cluster

corporations and early-stage technology developers; the other will build a fund that provides early investors with technology testing data rather than company equity. These two additional grants complement the EPIC-funded project's goal of supporting clean energy entrepreneurs by developing additional means for entrepreneurs to receive the support they need either by forming partnerships with industry, or attracting early investor funding.

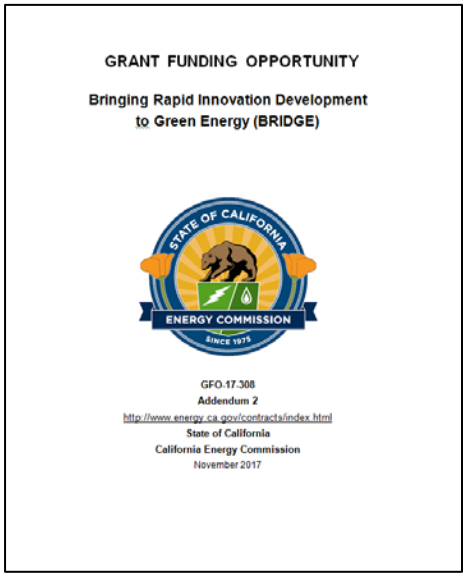
- BlueTechValley Innovation Cluster (California State University Fresno, EPC-15-038): Accepted and supported 56 companies into their program to start receiving support services, of which 49 were in 2017. Non-EPIC funded achievements include receiving $2,995,000 in private capital funding and $500,000 in grant funding from the Regional Innovation Strategies i6 Challenge and Seed Fund Support Grants competition. This follow-on funding will allow BlueTechValley to support a greater number of clean energy entrepreneurs, expanding the reach and supporting the goals of the EPIC funded project.

Figure 19: BlueTechValley Innovation Cluster

Source: California State University Fresno

- Bringing Rapid Innovation Development to Green Energy (BRIDGE): Released in 2017, this solicitation will pilot a new mechanism to competitively award follow-on funding for the most promising energy technologies previously funded by an eligible Energy Commission program or United States federal agency research program. This funding will allow researchers to continue their technology development without losing momentum or pausing funds from private sources.

Figure 20: BRIDGE Solicitation



Source: California Energy Commission

- Increasing Adoption of Emerging Clean Energy Technologies through Procurement: Released in 2017, this solicitation will fund the development and scale up of new tools and resources to increase customer procurement of (DER) with intent to overcome barriers that energy technology developers and large institutional and commercial customers face in pursuing large-scale procurement of advanced DER technologies. Awards will be announced in the second quarter of 2018.

Disadvantaged Communities – bringing the benefits of advanced technologies: The Energy Commission is committed to ensuring equity for disadvantaged communities, which have been

disproportionately affected by a combination of adverse health, economic, and environmental factors.[8] Reaching consumers in disadvantaged communities with energy innovation represents a significant energy savings and environmental justice opportunity, however, without assistance, customers in disadvantaged communities may have limited access to benefits from the energy opportunities afforded by advanced technologies developed through the EPIC program. Recognizing this, the EPIC program prioritized disadvantaged communities in four of its 2017 solicitations by setting aside specific amounts for projects in these areas or providing bonus points for demonstration or test sites in and benefitting disadvantaged communities. This is discussed in Section V of Chapter 1. As a result, many of the EPIC projects funded to date are in disadvantaged communities. As of December 31, 2017, 97 demonstration sites were within a disadvantaged community. Furthermore, about 32 percent of total technology demonstration and deployment encumbrances were located in a disadvantaged community. Examples of these projects include the following:

- **The Center for Sustainable Energy (EPC-15-010)** is providing training on AutoDR communications. In 2017, workbooks and instructor guides were developed for online coursework, and a new website was established to allow facilities and contractors to explore resources, incentives, and other assistance (http://energycenter.org/demand-response). The online classroom and training infrastructure were also established, with equipment being commissioned and delivered to training centers across the state. As of the end of 2017, 321 electricians and acceptance test technicians have successfully completed the ADR training, with training for an additional 250 individuals in progress. The program also completed training for the International Brotherhood of Electrical Workers (IBEW) instructors that will be training IBEW apprentices from disadvantaged communities. Training of apprentices from disadvantaged communities will begin in the second quarter of 2018.

Figure 21: Classroom Training

Source: Center for Sustainable Energy

8 The California Environmental Protection Agency (CalEPA) is responsible for identifying disadvantaged communities for targeting cap-and-trade investment funds in California. CalEPA has developed a map-based online tool, CalEnviroScreen, to determine disadvantaged communities. https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30.

Figure 22: Installing PV Panels

Source: ZNE Alliance

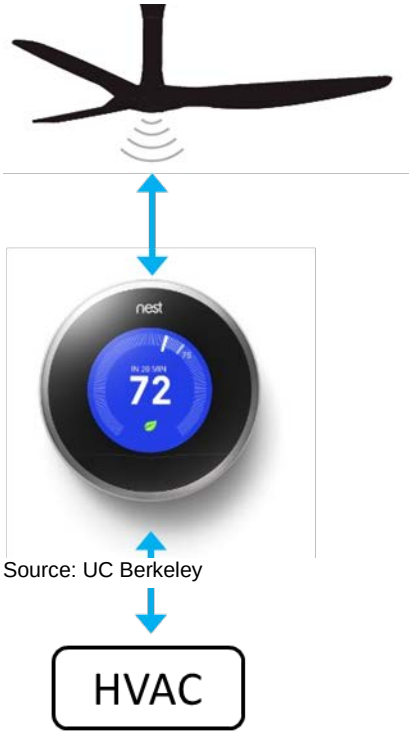
- **The Zero Net Energy (ZNE) Alliance, (EPC-15-076**) is converting abandoned and blighted homes into ZNE homes by developing case studies for the designing, planning, permitting, and financing of ZNE homes. These case studies can then be used by the City of Richmond and other local governments to guide transformation of homes in blighted and abandoned areas.
- **Electric Power Research Institute (EPC-15-053)** is demonstrating advanced technologies to improve energy efficiency and comfort to residents in low income properties while showing the value proposition to property owners. The goal is to reduce energy use by 30-40 percent. Device and monitoring hardware was installed to wirelessly collect data over two years. This includes baseline data to assess typical energy use in multi-family residences prior to installation of energy efficiency measures. Selection of energy efficiency measures such as advanced lighting and controls, heat pump water heaters, smart thermostats, window glazing, and attic insulation were started in 2017 for the demonstration sites. Once installation of all measures is complete, monitoring and verification will determine post energy use and indoor air quality impacts associated with the installed measures.

Figure 23: Seasons Senior Apartment in Ontario

Source: EPRI

- **The Regents of the University of California, Berkeley, and (EPC-16-013)** is testing the integration of smart ceiling fans and smart thermostats in low-income multifamily properties to reduce air-conditioning cost while increasing comfort and control flexibility to residents and building owners. The researchers estimate that the integrated solution could reduce cooling and heating energy use by 37 percent and 15 percent, respectively. In 2017, on-site data monitoring equipment was installed to capture baseline energy use, alongside laboratory testing of the mock-up units. Installation of the smart ceiling fans and smart thermostats will occur in 2018.

Figure 24: Auto Controlled, Learning Ceiling Fans and Thermostats



Source: UC Berkeley

The following sections of the chapter will focus on the EPIC program components, regulatory process, coordination, and the public process and solicitations.

II. EPIC Program Components

Creating EPIC

Following a deliberative process, the CPUC created the EPIC program in December 2011 and authorized the utilities to collect EPIC funds for renewable energy and RD&D purposes. In May 2012, the CPUC adopted Decision 12-05-037, as modified, which initiated much of the framework for CPUC oversight of the administration of EPIC. Investments funded by EPIC are administered by the Energy Commission and the state's three largest electric IOUs: Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E). The administrators submitted proposed triennial investment plans for EPIC funds to the CPUC in November 2012, April 2014, and April 2017. The *2012–2014, and the 2015-2017 EPIC Investment Plans* were approved as modified by the CPUC in November 2013 and April 2015, respectively. The CPUC's decision on the Energy Commission's *2018-2020 EPIC Investment Plan* was approved by the CPUC on January 11, 2018.

The Legislature first authorized the Energy Commission to spend EPIC program funds in Senate Bill 1018 (Committee on Budget and Fiscal Review, Chapter 39, Statutes of 2012) and provided program direction in Senate Bill 96 (Committee on Budget and Fiscal Review, Chapter 356, Statutes of 2013). In 2017, the Legislature passed two bills that added new policy goals for the EPIC program. Assembly Bill 523 (Reyes, Chapter 551, Statutes of 2017) requires 25 percent of the EPIC technology demonstration and deployment funds to be expended on projects located in and benefitting disadvantaged communities and 10 percent toward projects with sites located in and benefitting low-income communities.[9] The bill also requires the Energy Commission to "take into account, when applicable, the adverse localized health impacts of proposed projects." Moreover, Assembly Bill 1400 (Friedman, Chapter 476, Statutes of 2017) prohibits EPIC funds designated for microgrid projects to be used to purchase diesel generators. The Legislature has authorized expenditure of EPIC funds for the Energy Commission's EPIC program annually since 2013, with the most recent allocation in Assembly Bill 97 (Ting, Chapter 14, Statutes of 2017).

Guiding Principles

In Decision 12-05-037, the CPUC established the mandatory guiding principle of EPIC is to invest in clean energy technologies and approaches that benefit electricity ratepayers by promoting greater reliability, lower costs, and increased safety. In addition, complementary guiding principles include:

- Providing societal benefits.

9 Disadvantaged communities are defined as areas representing census tracts scoring in the top 25 percent in CalEnviroScreen 3.0. Low income communities means communities within census tracts with median household incomes at or below either of the following levels: a) 80 percent of statewide median income; or b) the applicable low income threshold listed in the state income limits updated by the Department of Housing and Community Development and filed with the Office of Administrative Law pursuant to subdivision (c) Section 50093 of the Health and Safety Code. Maps delineating disadvantaged communities and low income communities can be found at: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/communityinvestments.htm

- Reducing greenhouse gas emissions and increasing adaptation in the electricity sector at the lowest possible cost.
- Supporting the loading order.
- Advancing low-emission vehicles/transportation.
- Increasing economic development.
- Using ratepayer funds efficiently.

Public Resources Code (PRC) Section 25711.5 provides additional guidance to the Energy Commission towards its administration of the EPIC program.[10] This code section directs the Energy Commission to award EPIC funds for projects that will benefit electricity ratepayers and lead to technological advancement and breakthroughs to overcome the barriers that prevent achieving the state's statutory energy goals. PRC 25711.5 also directs the Energy Commission to select EPIC investments to result in a portfolio of projects that is strategically focused and sufficiently narrow to advance the most significant technological challenges that shall include, but not be limited to, energy storage, renewable energy and integration into the electrical grid, energy efficiency, integration of electric vehicles into the electrical grid, and accurately forecasting the availability of renewable energy for integration into the grid.

Additionally, EPIC considers the principles articulated in Public Utilities Code Sections 740.1 and 8360, which govern utility expenditures in the areas of RD&D and smart grids and provides administrative direction.[11] Section 740.1[12] states that in evaluating RD&D projects, consideration will be given to:

- Projects providing reasonable probability of ratepayer benefits.
- Projects with a low probability of success being minimized.
- Projects consistent with the utility corporation's resource plan.
- Projects not duplicating previous or current research by other electrical or gas corporations or research organizations.
- Projects supporting one or more of these objectives:
    - Environmental improvement
    - Public and employee safety
    - Conservation by efficient resource use or by reducing or shifting system load

10 http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=25711.5&lawCode=PRC

11 A *smart grid* consists of interactive equipment and communication protocols allowing electricity system operators and customers to adjust energy consumption and energy generation in response to price signals or information about the status of the electricity system to help maintain affordability, safety, and reliability.

12 Public Utilities Code Section 740.1:
http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PUC&sectionNum=740.1

- Developing new resources and processes, particularly renewables resources and processes to advance supply technologies
- Improving operating efficiency and reliability or otherwise reduce operating costs

Section 8360 states the requirements for the state's electrical transmission and distribution system to maintain safe, reliable, efficient, and secure electrical service to meet future growth and demand to achieve all of the following, which together characterize a smart grid:[13]

- Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.
- Dynamic optimization of grid operations and resources, including appropriate consideration for asset management and use of related grid operations and resources, with cost-effective full cybersecurity.
- Deployment and integration of cost-effective distributed resources and generation, including renewable resources.
- Development and incorporation of cost-effective demand response, demand-side resources, and energy-efficient resources.
- Deployment of cost-effective smart technologies, including real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices for metering, communications concerning grid operations and status, and distribution automation.
- Integration of cost-effective smart appliances and consumer devices.
- Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
- Provide consumers with timely information and control options.
- Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.
- Identify and lower unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.

Investment Areas

CPUC Decision 12-05-037 approved the Energy Commission to administer EPIC funds in the following investment areas:

- **Applied Research and Development**: Activities supporting pre-commercial technologies and approaches designed to solve specific problems in the electricity sector, including research

13 http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PUC&sectionNum=8360.

leading to advancements in energy efficiency, renewable energy, and smart grid technologies. Activities that address environmental and public health impacts of electricity-related activities and support clean transportation with links to electricity sector ratepayer benefits also fall into this area.

- **Technology Demonstration and Deployment**: Installing and operating pre-commercial technologies or employing operational strategies at a sufficient scale to assess functional and performance characteristics and financial risks.
- **Market Facilitation**: Activities to support clean energy technology and strategy deployment. These activities include incubating statewide clean energy innovation and entrepreneurship efforts, reducing barriers to deployment of emerging clean energy solutions, developing the workforce needed to achieve the state's energy goals, encouraging greater participation from diverse businesses and communities, regulatory assistance and permitting, market research, program tracking, education and outreach to support clean energy technology, and strategy deployment. The CPUC Decision 12-05-037 further clarifies that this category should not necessarily be limited to renewable energy and may include any other clean energy technologies or approaches or both.

Total EPIC funding for the Energy Commission activities is summarized in Chapter 2.

Connections to the Electricity Value Chain

EPIC investments are mapped or correlated to the different elements of the electricity "value chain," which is composed of grid operations/market design, generation, transmission, distribution, and demand-side management. Based on the guiding principles, each EPIC Investment Plan maps strategic initiatives clearly to the appropriate section of the value chain. Each project funded through EPIC also maps clearly to the appropriate section of the value chain, consistent with an approved EPIC Investment Plan. (See Appendix B, Project Write-Ups)

EPIC Investment Strategy

California energy policy frames a vision for the state's electricity future to include a significant transition from fossil generation to renewable sources; highly efficient homes, businesses, industries, and agricultural and water practices; identification of climate-related vulnerabilities to the electricity system and deployment of technologies and systems to increase grid resilience; and electrification of portions of the transportation system.

Through a competitive process, EPIC funds projects to bridge gaps along the energy innovation pipeline.

III. EPIC Program Regulatory Process

The CPUC has regulatory authority over the Energy Commission's administration of EPIC funds, including approving investment plans. In addition, the Legislature must grant the Energy Commission spending authority to disburse EPIC funds for project awards and use EPIC funds for administrative expenses.

This annual report is provided to the CPUC in accordance with Decision 12-05-037, as modified, in Rulemaking 11-10-003; Decision 13-11-025 in Application 12-11-001, as consolidated; and Decision 15-04-

020 in Application 14-04-034, as consolidated. To ensure consistent reporting for all administrators, these decisions specify the outline of this report and the reporting requirements for projects awarded EPIC funds. The Energy Commission also provides this EPIC annual report to the Legislature, as specified in California Public Resources Code Section 25711.5, and makes the report publicly available on its website.

The Energy Commission administers the EPIC program according to all applicable state laws and standards and follows the investment plans approved, as modified, by the CPUC to administer EPIC funds. Through investment plan approval and oversight, the CPUC ensures that innovations funded by EPIC provide IOU electricity ratepayer benefits. The CPUC also reviews proposed initiatives in each investment plan to confirm EPIC investments are aligned with the electricity value chain, which includes grid operations/market design, generation, transmission, distribution, and demand-side management.[14] The Legislature, in California Public Resources Code Section 25711.5, directs the Energy Commission to fund projects that will benefit electricity ratepayers and lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals. Furthermore, the Energy Commission is directed to award funding for projects that result in a portfolio of projects that is strategically focused and sufficiently narrow to advance the most significant technological challenges. These challenges include, but are not limited to, energy efficiency, integration of renewable energy into the electrical grid, energy storage, integration of electric vehicles into the electrical grid, and accurately forecasting the availability of renewable energy for integration into the grid.

IV. Coordination

The Energy Commission is committed to ongoing coordination and collaboration with the three IOU administrators of EPIC funds and other energy innovation stakeholders in developing and implementing their EPIC investment plans. This coordination is important to ensure funded EPIC projects address priority topics and critical funding gaps, as well as leverage other public and private funding sources.

EPIC Administrator Coordination

Through 2017, EPIC administrators have coordinated to develop investment plans for three triennial funding periods and implement the first and second triennial investment plans, including meetings to identify each administrator's area of focus and synergistic opportunities for further collaboration.

Under CPUC Decision 12-05-037, the CPUC requires the four EPIC administrators to consult with interested stakeholders no fewer than twice a year, during the development and execution of each investment plan and during its execution. CPUC Decision 15-04-020 requires one of these two annual consultations to be an EPIC Innovation Symposium intended to share progress, results, and plans; improve coordination and understanding among administrators, parties, and the CPUC; raise awareness and visibility of EPIC investments; and promote program transparency.

During 2017, Energy Commission staff collaborated with the three IOU administrators (PG&E, SCE, and SDG&E), conducting biweekly conference calls, coordinating notification and outreach for upcoming

14 CPUC Decision 12-8u05-037 in Rulemaking 11-10-003, ordering paragraph 12.

events, and participating in public workshops on EPIC. The following highlights EPIC administrator coordination for 2017:

- In 2017, the Energy Commission held meetings with the IOUs to discuss research needs and opportunities in distribution modeling and cybersecurity. These meetings led to follow-up discussions in the biweekly administrator telephone calls and helped inform development of the Energy Commission's solicitation titled "Distribution System Modeling Tools to Evaluate Distributed Energy Resources," released on September 11, 2017. Furthermore, the discussions helped the administrators better understand their respective roles in addressing cybersecurity research issues.
- In 2017, the administrators held joint public workshops on planning the Third Triennial EPIC Investment Plan, including March 9 hosted by PG&E, March 14 hosted by the Energy Commission, and March 24 hosted by SCE. Moreover, the Energy Commission hosted the following public workshops that highlighted EPIC's research and further scoped research areas for the Third Triennial EPIC Investment Plan (See EPIC 2018-2020 Investment Plan Proceeding section later in this chapter for additional information).
    - Distributed Energy Resources Scoping Workshop – March 13
    - Potential Areas of Research on Climate Change for the Electricity and Natural Gas Systems – March 16
    - Incorporating Community Focused Equity in Research Funding – March 20 and 27
- On October 18, 2017, Energy Commission staff joined the IOUs for the 2017 EPIC Fall Symposium in La Jolla (San Diego County) hosted by SDG&E. This public symposium provided an overview of EPIC program activities and showcased EPIC projects that support distribution system automation.
- On October 12, 2017, Energy Commission staff met with IOU members of the Emerging Technologies Coordinating Council to discuss EPIC and other research projects associated with building-related energy efficiency technologies, community-scale projects, and demand response in industrial agriculture and water activities. The purpose was to exchange and share information about the IOUs' Emerging Technology Programs (ETP) and the Energy Commission's energy efficiency R&D program and projects. Discussions focused on potential synergies and opportunities for collaborative efforts and handoff of successful R&D projects to IOU programs. Future areas for more in-depth discussions were identified, such as IOU administrative processes, exchange of program information for manufactured homes, plug loads, wastewater treatment, indoor agriculture, support for engineering calculations and webinars. The attendees included staff from the Energy Commission, PG&E, SCE, SDG&E, Southern California Gas (SoCalGas), Sacramento Municipal Utility District (SMUD), Los Angeles Department of Water and Power (LADWP), CPUC, and Livingston Energy Innovations.
- On December 7, 2017, Energy Commission staff and IOU staff met to continue discussion on some of the items from the October 12, 2017, meeting including R&D associated with

manufactured homes and food processing. Information was exchanged about past and current programs and projects, along with potential contacts and resources.

- Energy Commission staff participated in biweekly conference calls with the EPIC and IOU administrators throughout 2017 to coordinate activities such as administrator invoicing and implementing the EPIC investment plan implementation, as well as to provide updates on research, annual reports, and CPUC proceedings. These meetings also included preparation and logistical coordination for the October 18, 2017, EPIC Fall Symposium in La Jolla; coordination in developing the Third EPIC Investment Plans, such as preparing a joint matrix comparing all proposed research initiatives for the Third Triennial Plan to ensure no unnecessary duplication or overlap; and coordination for the EPIC program evaluation.
- On December 5, 2017, IOUs participated in Energy Commission workshops on vehicle grid integration (VGI), which included utility VGI pilot updates, as well as discussion on how future efforts could enable vehicle grid integration in the medium- and heavy-duty vehicle sectors.
- Energy Commission staff and IOU staff held two webinars to provide information to the public on related research and emerging technology activities:
    - March 9, 2017, Getting to Zero-Net-Energy Buildings: Present and Future. This webinar focused on the results from an existing multifamily building retrofit in Lancaster, California) and the future of direct current buildings in meeting ZNE goals.
    - August 16, 2017, Emerging Technologies: Phase Change Materials This webinar focused on the results of using phase change material to enhance the efficiency of building envelopes.

In 2018, the EPIC administrators will continue to work together and coordinate in the following areas, in addition to those identified under Section V of Chapter 1 (refer to EPIC Evaluation Final Report):

- **Information Sharing and Coordinated Planning**

  The administrators will continue to collaborate to address common goals, consistent with the state's energy and environmental policies and the guiding principles for EPIC as stated in CPUC Decisions, including Decisions 12-05-037 and 15-04-020. The Energy Commission also engages with the IOUs in developing research scope when utility input is particularly important. The administrators share information regarding their investment plans, programs, and projects to maximize the efficient use of funds and ease dissemination of results to benefit electric utility ratepayers. When research is related to grid-related activities, the EPIC administrators also will coordinate workshops for implementing the 2018-2020 EPIC Investment Plans during regularly scheduled biweekly coordination meetings.

- **Leveraging Funding and Avoiding Duplication of Projects**

  To the extent legally permissible, the administrators will continue work together to avoid unnecessary duplication of efforts, consistent with Public Utilities Code Section 740.1, and leverage funds for the benefit of electric utility ratepayers.

- **Coordinated Input and Advice from Stakeholders**

When research is related to grid-related activities, the administrators will continue to work together to schedule, solicit, and respond to comments and advice from stakeholders on their respective proposed and ongoing plans and programs.

Coordination With Other Energy Innovation Efforts

In 2017, the Energy Commission engaged in several coordination efforts with other state and federal entities involved in similar RD&D activities, including:

- **California's Fourth Climate Change Assessment** – The Energy Commission participated in quarterly meetings with researchers, federal, state and local government agencies, and stakeholders from various sectors to discuss progress on the research portfolio that will make up the Fourth Climate Change Assessment, which includes 13 EPIC-funded energy research studies in a portfolio of more than 50 studies.
- **California Climate Equity Coalition** - On October 13, 2017, Energy Commission staff attended the California Climate Equity Coalition's Annual Convening. California's leaders in climate equity discussed relevant legislation passed in 2017 and the associated impact on climate investment programs for disadvantaged communities and low-income communities. Furthermore, staff gained insights on different strategies for advancing climate equity and justice. Insight gained at the event will assist staff as they implement efforts for SB 350, AB 523, and other policy goals regarding clean energy investment for the state's low-income and disadvantaged communities.
- **Joint Agency Workshops on Microgrid Roadmap** – In 2017, the Energy Commission, CPUC, and California ISO held joint agency workshops to develop a roadmap that will help commercialize microgrids in California. Each workshop had over 200 attendees, with participation and feedback received from industry, utilities, academia, and government. A draft roadmap was released on October 2, with comments accepted until mid-November. A roadmap is expected to be published early 2018.[15]
- **Joint Meetings with the U.S. Department of Energy (DOE), Building Technologies Office** – In 2017, the Energy Commission initiated joint coordination meetings and calls with DOE's Building Technologies Office. The purposes were to exchange and share information on building-related research and to identify opportunities for collaboration in such areas as HVAC, plug loads, demand response, building controls, and gas energy efficiency.
- **Joint Meeting with U.S. DOE ARPA-E (Advance Research Projects Agency-Energy)** – On December 14, 2017, the Energy Commission and ARPA-E staff met to discuss and share information on common areas of R&D including energy efficiency, transportation, DERs, and power electronics.

15 http://www.energy.ca.gov/research/microgrid/.

- **Public Participation** – Energy Commission staff held solicitation scoping workshops and released several requests for public input. This public input helped refine the scope of solicitation topics. Preapplication workshops were also held in 2017 for the following solicitations:
    - GFO-16-310: Improving Performance and Cost-Effectiveness of Wind Energy Technologies
    - GFO-16-311: Advancing the Resilience and Environmental Performance of California's Electricity System
    - GFO-17-301 Increasing Adoption of Emerging Clean Energy Technologies Through Procurement
    - GFO-17-302 : Demonstrate Business Case for Advanced Microgrids in Support of California's Energy and GHG Policies
    - GFO-17-304 Programmatic Approach to Existing Buildings Research, Development, and Demonstration Program
    - GFO-17-305 Distribution System Modeling Tools to Evaluate Distributed Energy Resources
    - GFO-17-308 Bringing Rapid Innovation Development to Green Energy (BRIDGE)
    - RFP-17-307 Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology
    - RFP-17-306 Research Roadmap for System Transformation to Enable High Penetration of Distributed Energy Resources
    - RFP-17-303 Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation
    - RFP-17-301 Sharing California's Energy Innovations: Communicating EPIC Research Through Special Events, Forums, and Multimedia Production

V. Public Process and Solicitation Activities

The Energy Commission is committed to a public process in all phases of EPIC administration, including investment plan development and approval, competitive solicitation processes, and project approval and management.

To help ensure a public process, the Energy Commission maintains a Web page (http://energy.ca.gov/research/epic/) that provides the following information:

- EPIC program overview
- Previous and upcoming workshops
- Public comments
- Upcoming events.
- How to sign up for the listserv

- Documents associated with the program

The page also serves as a resource for Energy Commission proceedings related to developing future triennial EPIC investment plans. Interested stakeholders can navigate to Energy Commission EPIC policy documents, presentations, funding solicitations, annual EPIC reports, workshop announcements, and other resources that promote participation in the program. EPIC solicitations and requests for comments to inform selected solicitation development are available online at http://www.energy.ca.gov/contracts/epic.html. Information on public workshops is available online at http://www.energy.ca.gov/research/epic/documents/. In addition, the Energy Commission established Docket 16-EPIC-01, called the EPIC Ideas Exchange. In 2017, interested stakeholders could file their ideas under this docket for consideration in future solicitations. In 2018, the Energy Commission plans to create a new ideas exchange docket to encompass both EPIC and Natural Gas R&D stakeholder comments. Figure 23 provides a screenshot of the EPIC Web page, and Figure 24 shows a screenshot of the EPIC documents Web page.

The Energy Commission maintains an active Facebook, Twitter, and blog to educate and inform the public about Energy Commission activities and opportunities.[16] The Energy Commission has also created a LinkedIn group page to provide a user-driven platform to help potential applicants – including disabled veteran-, women- and minority-owned businesses – connect and partner on proposals for solicitations funded through the EPIC program.[17]

16 The Energy Commission's Facebook page: https://www.facebook.com/CAEnergy/; Twitter page: https://twitter.com/CalEnergy; and Blog: http://calenergycommission.blogspot.com/.

17 California Energy Commission LinkedIn Networking Hub: https://www.linkedin.com/groups/6925861.

Figure 25: California Energy Commission EPIC Website

Research Division EPIC homepage, http://energy.ca.gov/research/epic/

Source: California Energy Commission

Figure 26: EPIC Documents Websites

All EPIC-related documents, http://www.energy.ca.gov/research/epic/documents/

Source: California Energy Commission

EPIC Evaluation

In Decision 12-05-037, the California Public Utilities Commission (CPUC) stated, "An independent evaluation of the EPIC program should be conducted by a consultant under contract to the Commission in 2016."[18] The CPUC selected Evergreen Economics to conduct this evaluation. In the winter of 2016-2017, Energy Commission staff participated in interviews and responded to data requests from Evergreen Economics in support of the evaluation.

The EPIC Evaluation Final Report was released on September 8, 2017.[19] Table 1 summarizes the evaluation results. In general, the Energy Commission supports the findings of the independent evaluation conducted by Evergreen Economics. The EPIC Evaluation Final Report found that the four EPIC administrators are in compliance with the program requirements. The report further found that the Energy Commission's practices are in line with research organization best practices and acknowledged the Energy Commission's robust administration, including that it has "strong and transparent linkages to state policy," "plans transparently and engages external stakeholders," has a "transparent and public process for selecting projects," and "uses a robust process...to comprehensively report on project benefits."[20] However, the Energy Commission does not agree with the EPIC Evaluation Final Report finding that it is "deficient regarding justifying their use of non-competitive bidding."[21] In the Opening Comments of the California Energy Commission Regarding Electricity Program Investment Charge Evaluation, the Energy Commission indicated that the evaluators used the wrong decision to reach this conclusion.[22] The correct decision, D.13-11-025, described the process for noncompetitive awards, which the Energy Commission followed.

The EPIC Evaluation Final Report highlights recommendations to increase coordination among administrators, reporting requirements, and outreach. The Energy Commission will take steps to respond to these recommendations with the following actions:

- The Energy Innovation Showcase (innovation.energy.ca.gov) annually provides updates on all EPIC-funded projects and related benefits, and will be updated on a rolling basis when new agreements are executed or when a final report is published. These more frequent updates will provide stakeholders with more information about EPIC-funded projects.
- In 2017, the Energy Commission released a solicitation titled "Sharing California's Energy Innovations: Communicating EPIC Research Through Special Events, Forums and Multimedia Production (RFP-17-301)." This solicitation will select a contractor to develop and execute a plan to increase sharing of EPIC project status and results. The plan will include conducting three

18 D. 12-05-037 p. 91.

19 EPIC Evaluation Final Report is available here: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454674.

20 EPIC Evaluation Final Report, p. 1-10.

21 EPIC Evaluation Final Report, p. 11-2 and 11-6.

22 Opening Comments of the California Energy Commission Regarding Electricity Program Investment Charge Evaluation, p. 3

technology forums a year to highlight and share developments on a particular topic. These meetings, in conjunction with the two stakeholder symposiums held each year, technical advisory meetings, critical project reviews, online innovation showcase updates, social media reporting, and annual reports, among other activities, will provide ample opportunities to share information with the CPUC and the public.

Table 1: EPIC Evaluation Final Report Summary Table

Administrative Process	CEC	IOUs
Program Management and Administration	Awards grants to **external** organizations that conduct their research. ✓	Conduct their research using **internal** staff with use of vendors.
	Administration is managed by a **core team with RD&D program expertise**, with technical support provided by both internal and external experts. ✓	
	Four-administrator model.	
Investment Planning	Identifies a series of strategic objectives with **strong and transparent linkages** to state policy goals. ✓	Develop Investment Plan priorities **internally**, predominantly relying on their own technical experts and management to identify and prioritize research areas, with linkages to policy **less transparent**.
	Relies mostly on input from multiple external stakeholders; develops its Investment Plans **transparently and engages external stakeholders** throughout the process. ✓	Rely mostly on external input from a single utility-focused stakeholder; **insufficient transparency** in developing Investment Plans.
Project Selection	Uses a **transparent and public process** for selecting projects and shares project scopes of work in a timely manner. ✓	Use a **less transparent, internal process** for selecting projects and do not share project scopes of work in a timely manner.
	Due diligence is being done to identify projects that, absent EPIC funding, would not move forward or would move forward more slowly. ✓	
Project Assessment	**Shares information** about projects while they are being implemented but less frequently than optimal.	
	Uses a robust process for collecting the necessary quantitative data needed to comprehensively report on project benefits and disseminate results. ✓	**Lacks a robust process** for collecting the necessary data needed to comprehensively report on project benefits and disseminate results.

✓ = consistent with peer RD&D program practices

Source: Evergreen Economics

EPIC 2018-2020 Investment Plan Proceeding

In January 2018, the Energy Commission received approval from the CPUC for its *EPIC 2018–2020 Investment Plan*.[23] This approval followed a rigorous stakeholder input process that took place at the Energy Commission and the CPUC.

As noted previously, the Energy Commission held a stakeholder workshop in Sacramento on February 3, 2017, to gather stakeholder input on the proposed investments before developing the *EPIC 2018-2020 Investment Plan*. The Energy Commission released a draft of all proposed research initiatives on March 10, 2017. The Energy Commission, along with the other EPIC administrators, held three joint workshops on March 9 and March 14, 2017, in Northern California and March 24, 2017, in Southern California to provide an overview and solicit public comment on each of the administrators' draft investment plans. The Energy Commission also held five topical workshops that fed into investment plan development for the following:

- Distributed Energy Resources Scoping Workshop on March 13, 2017, in Sacramento.
- Potential Areas of Research on Climate Change for the Electricity and Natural Gas Systems on March 16, 2017, in Sacramento.
- Incorporating Community Focused Equity in Research Funding on March 20, 2017, in Fresno and on March 27, 2017, in Los Angeles.
- Customers of Climate Science Research on April 11, 2017, in Sacramento.

The workshops were also broadcasted online; the presentations and workshop recordings can be found on the Energy Commission Website. [24] The Energy Commission released the draft *EPIC 2018-2020 Investment Plan* on April 17, 2017, which allowed for an additional public comment period prior to consideration of the plan for adoption at the Energy Commission Business Meeting on April 27, 2017.

The Energy Commission then submitted its application for approval of the *EPIC 2018–2020 Triennial Investment Plan* to the CPUC on May 1, 2017. The CPUC held a stakeholder workshop on September 8, 2017, to consider the investment plans of all four EPIC administrators. The CPUC also held a workshop on September 20, 2017, to examine how the recommendations resulting from the EPIC Evaluation Final Report might affect administration of the EPIC program.

Disadvantaged and Low-Income Communities

In 2017, four solicitations were released that provided either preference points or funding set asides for projects located in and benefiting disadvantaged communities (Table 2). Two solicitations did not provide set aside or preference points for disadvantaged communities but emphasized tools to benefit or positively target electricity customers in disadvantaged communities.

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23 http://www.energy.ca.gov/research/epic/17-EPIC-01/

24 Documents, presentations, and workshop recordings related to Energy Commission hosted workshops on the EPIC 2018 – 2020 Investment Plan can be found here: http://www.energy.ca.gov/research/epic/17-EPIC-01/documents/

Table 2: Solicitations Targeting Disadvantaged Communities

Solicitation Number and Title	Disadvantaged Community Inclusion
GFO-17-304: Programmatic Approach to Existing Buildings Research, Development And Demonstration Program	Set Aside
GFO-17-302: Demonstrate Business Case for Advanced Microgrids in Support of California's Energy and GHG Policies	Set Aside
GFO-16-310: Improving Performance and Cost-Effectiveness of Wind Energy Technologies	Preference Points
GFO-16-311: Advance the Resilience and Environmental Performance of California's Electricity System	Preference Points
GFO-17-305: Distribution System Modeling Tools to Evaluate Distributed Energy Resources	*
GFO-17-301 Increasing Adoption of Emerging Clean Energy Technologies Through Procurement	*

* No set aside funding, but one of the funding groups emphasizes tools to benefit or positively target electricity customers in disadvantaged communities. Group 1 of GFO-17-305, Microgrid Valuation and Optimization Tool, will develop, test, and validate a publicly available modeling tool that determines the optimal size of the microgrid, optimal combination of DER in the microgrid for a given location and the maximum benefit to individual customers. This resource planning tool will identify and assess the greatest value for microgrids by geographic location and use case (critical facility, high penetration renewables, others) and be able to identify if these locations are within disadvantaged communities, and identify whether the benefits would apply to the disadvantaged community. The purpose of the GFO-17-301 is to develop and scale-up new tools and resources to increase customer procurement of DERs, including energy efficiency, renewable distributed generation, and distributed storage. Group 4 of this solicitation, Advance Innovations in Software to Streamline Customer Procurement, will pilot or scale-up software solutions to streamline customer procurement of advanced, commercial DER and facilitate aggregated procurement to maximize purchasing options for institutional and commercial customers, community-based organizations and others working to increase access to or deploy advanced, clean energy technology products to disadvantaged communities.

As an example, **Demonstrate Business Case for Advanced Microgrids in Support of California's Energy and GHG Policies (GFO-17-302)** had a specific group (Group 2) targeted at demonstrating the commercial business case for microgrids located in a disadvantaged community. Proposals for the other two groups (Groups 1 and 3) were given extra points if they included microgrids in disadvantaged communities.

As of December 31, 2017, 97 demonstration sites were within a disadvantaged community. Furthermore, about 32 percent of total technology demonstration and deployment encumbrances were located in a disadvantaged community. Figure 25 shows the location of all demonstration sites with active projects in 2017 that were located in disadvantaged communities.

In 2017, AB 523 (Reyes, Chapter 551, Statutes of 2017) was approved by the State Legislature and signed by Governor Edmund G. Brown Jr.[25] This bill effective January 2018, requires the following of the Energy Commission:

- Expend at least 25 percent of EPIC funds on technology demonstration and deployment at projects sites located in and benefitting disadvantaged communities.
- Expend at least 10 percent of EPIC funds on technology demonstration and deployment at project sites located in and benefiting low-income communities.
- The Energy Commission to take into account any adverse localized health impacts of proposed projects to the greatest extent possible.

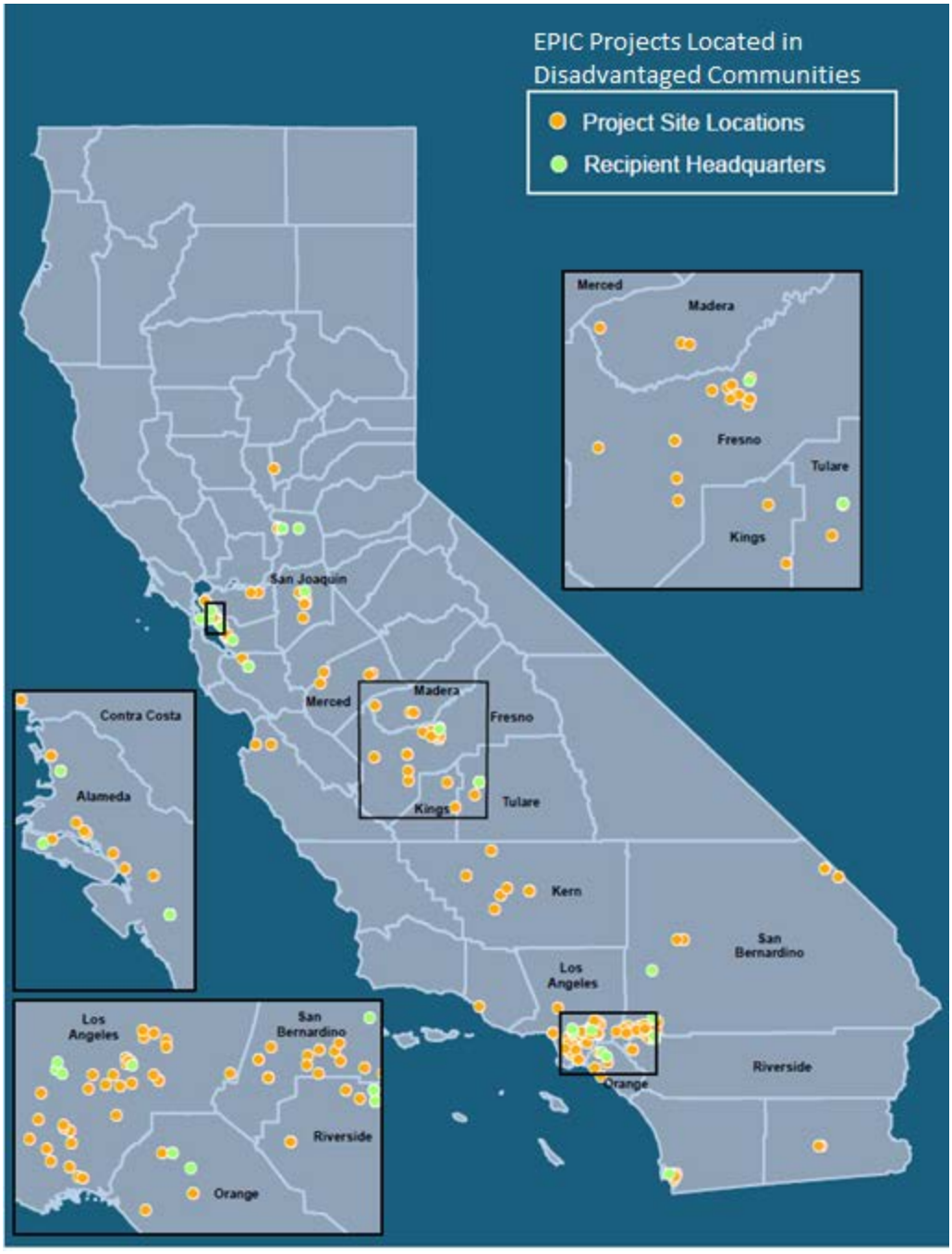
In the spring of 2018, the Energy Commission will hold workshops to receive stakeholder input on implementation of the AB 523 requirements.

In addition, the Disadvantaged Communities Advisory Group (DACAG), resulting from SB 350, was created in 2017 to provide advice to the CPUC and the Energy Commission on ways to help disadvantaged communities benefit from proposed clean energy and pollution reduction programs, and have access to clean energy technologies and receive affordable services.[26] The group will consist of representatives from disadvantaged communities. The charter for the advisory group was adopted at the Energy Commission's December 2017 business meeting, and members will be selected in 2018. The DACAG is likely to play a significant role in guiding the approach to disadvantaged community involvement in future solicitations and targeted projects.

25 https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB523.

26 http://www.energy.ca.gov/releases/2017_releases/2017-12-13_disadvantaged_communities_advisory_group_nr.html.

Figure 27: Active EPIC Projects Located in Disadvantaged Communities (2017)



Source: California Energy Commission

Commitment to Diversity

In April 2015, the Energy Commission unanimously approved a formal diversity policy resolution, consistent with state and federal law, to improve fair and equal opportunities for small businesses; women-, disabled veteran-, minority-, and LGBT-owned business enterprises; and economically disadvantaged and underserved communities. The goal was to increase these group's participation in and benefits from Energy Commission programs.

On October 8, 2015, Governor Brown signed AB 865 (Alejo, Chapter 583, Statutes of 2015), which directs the Energy Commission to establish a diversity task force to consider and make recommendations about diversity in the energy industry.

These efforts build upon the outline that Energy Commission Chair Robert B. Weisenmiller submitted in a letter to the CPUC in November 2013.[27] Weisenmiller's letter committed to increasing the participation of businesses owned by women, minorities, and disabled veterans through a comprehensive outreach plan to ensure that a diverse range of potential applicants know about, and understand how to participate in, EPIC program activities, especially solicitations for projects. The plan comprised four main tenets, including:

- Continuing and advancing an outreach plan to ensure women, minorities, LGBT individuals, and disabled veterans are informed about EPIC program activities and encouraged to participate in R&D project funding opportunities.
- Targeting particular geographic regions within the state for specific program activities to better benefit electric ratepayers throughout all the designated IOU territories. Such efforts could include, for example, job training or energy efficiency retrofits in economically depressed communities.
- Continuing and advancing efforts to address energy-related challenges and opportunities in economically depressed communities.
- Continuing to track, monitor, and report the number of California-based entities and women, minority-, disabled veteran-owned, and small businesses that receive EPIC awards using the same definitions used by the IOUs via CPUC General Order 156.[28]

In 2017, the Energy Commission implemented activities that promoted a diverse range of applicants to participate in EPIC opportunities. These activities included informing stakeholders about available Energy Commission funding opportunities and providing strategies to develop successful proposals.

Building on a Comprehensive Diversity Outreach Plan

27 Letter to CPUC President Michael Peevey from California Energy Commission Chair Robert Weisenmiller, http://www.energy.ca.gov/research/epic/documents/2013-11-07_Letter_from_the_Chair_re_AB_340-Docket_12-EPIC-01.pdf.

28 General Order 156 seeks to increase the participation of women-, minority-, and disabled veteran-owned business enterprises (WMDVBE) in utility procurement, and requires the IOUs to submit annual plans to the CPUC for increasing WMDVBE participation in procurement and to submit annual reports on the implementation of those plans. Refer to CPUC Decision 13-11-025, p. 108.

In 2017, Energy Commission staff established a new diversity outreach plan. This plan included:

- Meeting with dozens of community leaders, various stakeholders, and representatives of California business organizations.
- Building an email distribution list of outreach contacts.
- Enhancing the Energy Commission's website to reflect the agency's commitment to diversity.
- Convening various public workshops, internal communications meetings, the EPIC forum, and the annual EPIC Symposium.
- Creating easy-to-read informational materials to increase awareness of EPIC funding opportunities.
- Engaging with disadvantaged and hard-to-reach communities throughout the State.
- Increasing the use of Twitter and other social networking platforms to educate and inform.
- Collaborating with the Energy Commission's Public Adviser to promote research funding opportunities with individuals interested in participating in EPIC solicitations.

Broad stakeholder outreach activities include:

- Enhancing the LinkedIn group page initiated by the Energy Commission's "California Energy Commission's Research and Development Networking Hub" to provide additional networking opportunities for potential applicants. The open group has 1,421 members and provides a user-driven platform to help potential applicants including disabled veteran-, women- and minority-owned businesses, to connect and partner on proposals for solicitations funded through the EPIC program.
    - In 2017, Energy Commission staff hosted a networking webinar as an opportunity for interested applicants to introduce themselves, explain their interests in specific solicitations, and possibly find potential project partners.
- Continuing to provide funding materials translated for non-English speakers, including opportunity postcards (Figure 26) and relevant materials in Spanish, Chinese, Tagalog, Korean, and Japanese. The Energy Commission promoted funding opportunities in other languages on multiple media platforms.
- Distributing EPIC materials at more than 35 key expositions, conferences and webinars in 2017, including:
    - Small Business Workshop & Business Exchange, presented by the Sacramento Hispanic Chamber of Commerce, Sacramento Black Chamber of Commerce, and the Sacramento Rainbow Chamber of Commerce (January 18).
    - Food Processing Expo 2017, presented by the California League of Food Producers (February 7-8).
    - Transformative Climate Communities Stakeholder Summit, presented by the California Strategic Growth Council (February 10).

- World Agricultural Expo, presented by the International Agri-Center (February 16).
- CSUS College of Engineering and Computer Science 2017 Career Day, presented by CSU, Sacramento (February 17).
- Informational Open House on Military, presented by the Governor's Office of Planning and Research and the Governor's Military Council and Navy Region Southwest (February 28).
- Diversity Career Fair, presented by the California Energy Commission (March 30).
- Customers of State Climate Science Research, presented by the California Energy Commission and the California Public Utilities Commission (April 11).
- Exploring Dimensions of Community Engaged Scholarship, presented by the University of California, Davis (May 5).
- Merced Safeguarding California Workshop, presented by the California Natural Resources Agency (May 16).
- Bay Area Safeguarding California Workshop, presented by the California Natural Resources Agency (May 22).
- Los Angeles Safeguarding California Workshop, presented by the California Natural Resources Agency (May 31).
- LA Energy Cluster Meeting & Regional Energy Innovation Cluster Launch, presented by the Los Angeles Cleantech Incubator (May 31).
- Sierra Nevada Safeguarding California Workshop, presented by the California Natural Resources Agency (June 14).
- IEPR - Joint Agency Workshop on Renewable Gas, presented by the California Energy Commission, the California Public Utilities Commission, and the California Air Resources Board (June 27).
- IEPR Joint Agency Workshop on Application of Distributed Energy Resources on the California Grid , presented by the California Energy Commission, California Public Utilities Commission, and the California Independent System Operator (June 29).
- Microgrid Roadmap Scoping Workshop, presented by the California Energy Commission, California Public Utilities Commission, and the California Independent System Operator (July 26).
- Joint Agency Workshop on SB 350 Low-Income Barriers Study Implementation, presented by the California Energy Commission and the California Public Utilities Commission (August 1).
- IEPR Workshop on Barriers to Demand Response, presented by the California Energy Commission (August 8).

- IEPR Workshop on Climate Adaptation and Resilience for the Energy System, presented by the California Energy Commission and the California Public Utilities Commission (August 29).
- Fourth Assessment Quarterly Meeting, presented by the California Energy Commission, the California Natural Resources Agency, and the Department of Water Resources (September 11).
- Cal-Adapt User Needs Assessment Workshop, presented by the UC Berkeley Geospatial Innovation Facility (September 12).
- Civic Spark 2017 Orientation, presented by the Local Government Council (September 13).
- Energy Efficiency in Domestic Appliances and Lighting (EEDAL) Conference 2017, presented by the California Plug Load Research Center at the University of California, Irvine (September 13-15).
- Secrets to Successful Proposals in CA, presented by Pacific Gas and Electric (September 18).
- SBIR Workshop, presented by the Small Business in Research Program (September 25).

- Hosting public workshops to discuss and promote the incorporation of community-focused equity measures in EPIC research initiatives, including:
  - The SB 350 Workshop on Doubling Energy Efficiency at the California Energy Commission in Sacramento (September 7).
  - The EPIC Investment Plan Stakeholder Workshop at the CPUC in San Francisco (September 8).
  - R&D Funding Opportunities for Disadvantaged /Low-Income Communities Workshop in Fresno (March 20)
  - R&D Funding Opportunities for Disadvantaged /Low-Income Communities Workshop in Los Angeles (March 27).

Figure 28: EPIC Postcards in Different Languages

Source: California Energy Commission

Tracking Diverse and Inclusive EPIC Funding Recipients

Energy Commission staff continues using a voluntary survey for EPIC funding recipients to better track participation of self-reported California-based entities, women-, minority-, LGBT-, disabled-veteran-owned businesses, and small businesses between prime recipients and their subcontractors. Furthermore, the surveys allow staff to identify opportunities for future outreach efforts to encourage program diversity.

The Energy Commission received diversity results for 61 recipients that were approved for an EPIC award in 2017, which identified the following:

- Twenty-seven of the 61 recipients include a small or micro-business as either a prime or subcontractor. (Thirteen were prime.)
- Eight of the 61 recipients include a woman-owned business as either a prime or subcontractor. (Two were prime)

- Nine of the 61 recipients include a minority-owned business as either a prime or subcontractor. (Four were prime)
- Two of the 61 recipients include an LGBT-owned business from subcontractors.
- One of the 61 recipients includes a disabled-veteran-owned business from either a prime or a subcontractor.
- Sixty of the 61 recipients include certified California-based entities. (Fifty-eight were prime)

In 2018, the Energy Commission plans to continue efforts to ensure that participation in the EPIC program reflects the rich and diverse characteristics of California and its people. These efforts include, but are not limited to:

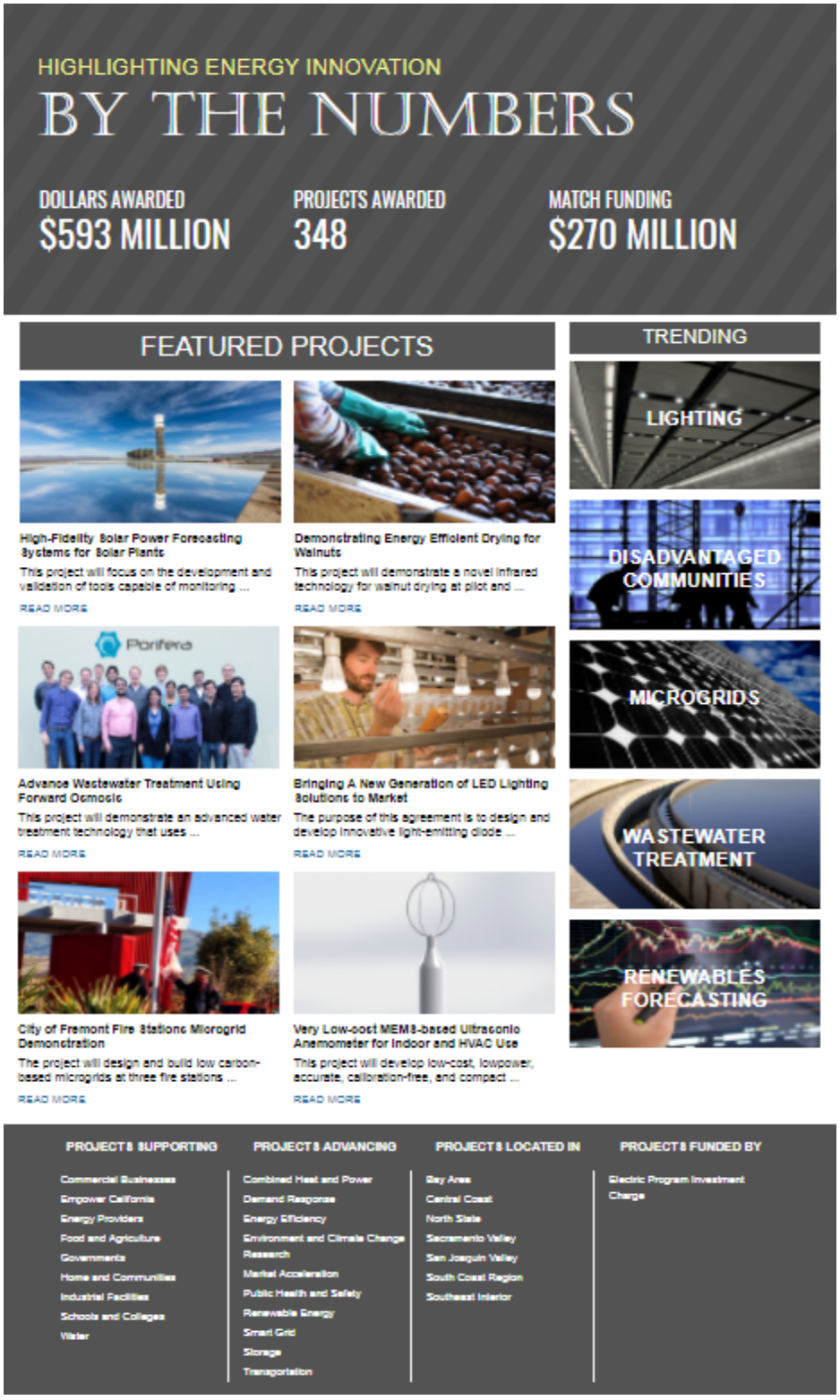
- Collecting diversity data and providing reports identifying the diversity of Energy Commission program participants.
- Meeting with small businesses, veteran, women, minority, and other interested groups to provide information on partnering for success through the EPIC program. The materials will also be available on the Energy Commission EPIC Web page.
- Holding regional preapplication and prebid workshops throughout the state to explain requirements for grant and contract funding opportunities, answer questions, and encourage networking and partnering among potential applicants.
- Developing and enhancing resources to allow new and diverse applicants to more easily navigate the application process.
- Further leveraging the Regional Energy Innovation Clusters and other project partners to reach underrepresented communities.

Highlighting Projects and Diversity

In addition, the Energy Commission launched a website called the Energy Innovation Showcase[29] in May 2016. The graphical Web page gives insight to the various projects, lists the award recipients and funding amount, and explains how projects benefit ratepayers. Projects can be searched by location, by areas of support, and by research topic. Visitors can also see what energy activities are trending. Figures 27 and 28 provide examples of the Energy Innovation Showcase Web pages that include both EPIC and natural gas R&D projects.

29 http://innovation.energy.ca.gov/SearchHome.aspx?ti=636523886311713691.

Figure 29: Energy Innovation Showcase Website



Source: California Energy Commission

Figure 30: EPIC Showcase Example

Source: California Energy Commission

The page also highlights the Energy Commission's goal of increasing diversity in the energy sector and its expanded outreach to women, minority, disabled veteran, and LGBT communities.

Competitive Solicitation Process and Activities

In 2017, the Energy Commission issued 11 competitive solicitations to fund initiatives outlined in the second EPIC Investment Plan. To ensure a fair and transparent competitive solicitation, Energy Commission staff conducted the following for each solicitation:

- Posted the solicitation on the Energy Commission's website and notified interested parties of the solicitation through the Opportunity listserv, the EPIC listserv, and the LinkedIn Networking Hub. The Opportunity listserv contains 5,092 subscribers, and the EPIC listserv contains 1,328 subscribers. (There is some overlap.) The LinkedIn Networking Hub has 1,421 subscribers.
- Held at least one publicly noticed workshop for each solicitation to review the purpose, requirements, eligibility, and innovation topics of the solicitation with interested parties. The public workshop also provided an opportunity for potential applicants to participate remotely and ask questions about the solicitation and the application process.
- Provided interested parties the opportunity to submit written questions about the solicitation.
- Posted staff responses to solicitation questions on the Energy Commission's website to ensure that all potential applicants had access to the same information. These responses are also sent out on the Opportunity listserv.
- Posted on the Energy Commission's website and sent to the Opportunity listserv any revisions made to the solicitation (via addenda).
- For solicitations where scoring was completed in 2017, the Energy Commission released a notice of proposed awards (NOPA) identifying proposed funding recipients.
- For recipients not awarded funding for these solicitations, an opportunity was provided to receive a debriefing.

In addition to the administrative standards and practices listed, the Energy Commission conducts activities to ensure that the competitive solicitation process — including solicitation development — is fair and transparent. The Energy Commission's *2015-2017 EPIC Investment Plan* states that, to benefit from coordination among EPIC administrators and to ensure fairness for all bidders in competitive solicitations, IOUs may not submit bids to those solicitations they help develop. Similarly, state agencies, universities, and other stakeholders that provide input on the development of a solicitation are precluded from submitting bids unless the input is provided through a public forum (such as a workshop, webinar, or staff survey) where other entities have the same opportunity to provide input.

Project Approval and Management

After a NOPA is issued, Energy Commission staff works with each awardee to develop a grant agreement or contract. Before research begins, the grant agreement or contract must be approved by the Energy Commission at a publicly noticed business meeting. In 2017, the Energy Commission approved 72 EPIC projects. Project details are provided in Chapter 3.

Once agreements are approved, Energy Commission staff manages the agreement, which includes tracking project progress, facilitating technical advisory committee and critical project review meetings, possible site visits, and reviewing project deliverables. Project results are shared through fact sheets and final reports that are posted on the Energy Commission's website. Except when valid reasons exist for confidentiality, the Energy Commission will make available upon request all data, findings, results, computer models, and other products developed through the EPIC program, consistent with the treatment of intellectual property requirements.[30] In addition, each annual report includes summaries and metrics for all active projects and all projects completed during the past year, and these are included in Appendix C.[31]

30 As required in CPUC Decision 13-11-025, Ordering Paragraph 13.

31 As required by Public Resources Code Section 25711.5 and CPUC Decision 13-11-025, Ordering Paragraphs 14, 23, and 27.

CHAPTER 2:
Budget

I. Authorized Budget

The CPUC approved a final EPIC budget for the first triennial investment cycle (2012-2014) in Decision 13-11-025. The Energy Commission's total EPIC funding allocation of $368.7 million for funds collected in 2012-2014 included $331.8 million in project funds for three program areas, as well as $36.9 million for program administration (Table 3). Decision 12-05-037, as modified, caps program administrative costs for each EPIC administrator at 10 percent.

Table 3: CPUC-Approved Energy Commission EPIC Funding 2012-2014

Funding Element/Program Area	Total (in millions)
Applied Research and Development	$158,700,000
Technology Demonstration and Deployment	$129,800,000
Market Facilitation	$43,300,000
Subtotal	**$331,800,000**
Program Administration	$36,900,000
Total	**$368,700,000**

Source: California Energy Commission

The Energy Commission's approved *2015-2017 EPIC Investment Plan* proposed a total of $388.8 million over the three-year period. In 2015, the CPUC approved an additional $17 million in funding over the three-year period as a result of Consumer Price Index (CPI) and other adjustments.[32] This amount brings the adjusted total for project awards to $365 million and $40.78 million for program administration (Table 4).

32 CPUC Decision 15-04-020 modified and approved the proposed *2015-2017 EPIC Investment Plan*. The approved budget is listed in Appendix B, Table 5.

Table 4: CPUC-Approved, Escalated Energy Commission EPIC Funding 2015-2017

Funding Element/Program Area	Total
Applied Research and Development	$158,166,500
Technology Demonstration and Deployment	$151,271,600
Market Facilitation	$55,566,400
Subtotal	**$365,004,500**
Program Administration	$40,782,600
Total	**$405,787,100**

Source: California Energy Commission

The Energy Commission has committed all project funds in completed, active, and planned solicitations for both 2012-2014 and 2015-2017 investment plans.

The Energy Commission's administrative costs for EPIC include all research planning, project management, and administrative and program oversight work performed by Energy Commission staff. Within the EPIC program, staff:

- Research available energy technologies and identify the most promising emerging technological solutions.
- Develop solicitations to reach performance targets and to attract proposals that provide the most promise in delivering energy technologies that are cleaner, safer, more reliable, and affordable.
- Manage research agreements to achieve technological goals for the EPIC-funded grants, contracts, and awards. Managers visit select sites, evaluate agreement progress and potential for funded technologies to achieve their objectives and goals, and determine if research is on track. Corrective action is taken to redirect projects or stop work if research is not meeting expectations.
- Execute EPIC research, development, and demonstration, and market facilitation programs, including planning, contracting, and awarding grants, as defined in the approved investment plans.
- Conduct workshops, meetings, and Web conferences on policy impacts and the current state of the energy and technology markets. These events also provide opportunities for public input and assist in developing competitive solicitations to help prepare initiatives for future investment plans.
- Conduct benefits analyses
- Develop, coordinate, publish, and submit required annual reports and documents to the CPUC and the Legislature.

- Research, coordinate, develop, and submit to the CPUC proposed investment plans.
- Participate in CPUC EPIC-related proceedings and workshops.

II. Funding Commitments and Encumbrances

CPUC Definitions of Commitments and Encumbrances

To clarify the difference between commitments and encumbrances for the EPIC program, the CPUC adopted the following definitions in Decision 13-11-025:

"'Committed funds' are funds identified during the planning of a solicitation for a specific project that will be needed to fund a contract or grant for that project at the conclusion of a planned or released solicitation ... 'Encumbered funds' are funds that are specified within contracts and grants signed during a previous triennial investment plan cycle and associated with specific activities under the contract or grant. All activities carried out under a contract or grant during a specific triennial investment plan cycle need not be completed and funds need not be spent during that particular program cycle if the activities undertaken pursuant to the contract or grant are expected to be completed. Only funds that are committed or encumbered during the prior program cycle are eligible for being rolled into the following program cycle."[33]

Approved Awards in 2017

Table 5 shows projects that were approved for funding at an Energy Commission business meeting in 2017. A full list of submitted projects is available in the Energy Commission's NOPA for each solicitation.[34]

33 CPUC Decision 13-11-025, Ordering paragraphs 44 and 45.

34 More information on proposed awards can be found at http://www.energy.ca.gov/contracts/epic.html#closed.

Table 5: Approved EPIC Funding Awards in 2017

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Development, Demonstration, and Deployment of Environmentally and Economically Sustainable Biomass-to-Energy Systems for the Forest and Food Waste Sectors (GFO-15-325) Applied Research and Development				
EPC-17-012	Taylor Energy	Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	*2015-2017 Investment Plan*	$1,499,000
EPC-17-013	Altex Technologies Corporation	Small-Scale Forest Waste Power System	*2015-2017 Investment Plan*	$1,499,994
EPC-17-016	The Regents University of California, Davis	An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	*2015-2017 Investment Plan*	$1,222,284
EPC-17-017	All Power Labs, Inc.	The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	*2015-2017 Investment Plan*	$1,500,000
Applied Research and Development (AR&D) Subtotal				**$5,721,278**
Development, Demonstration, and Deployment of Environmentally and Economically Sustainable Biomass-to-Energy Systems for the Forest and Food Waste Sectors (GFO-15-325) Technology Demonstration and Deployment				
EPC-17-011	HZIU Kompogas SLO Inc.	Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	*2015-2017 Investment Plan*	$4,000,000
EPC-17-018	The Regents University of California, Davis	Demonstrating the Potential for On-Site Electricity Generation From Food Waste Using Containerized Anaerobic Digestion Units	*2015-2017 Investment Plan*	$2,411,007
EPC-17-019	Fall River Resource Conservation District	Burney-Hat Creek Bioenergy	*2015-2017 Investment Plan*	$5,000,000
EPC-17-022	Lystek International Limited	Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing With Cogeneration Capabilities	*2015-2017 Investment Plan*	$1,589,163
Technology Deployment and Demonstration (TD&D) Subtotal				**$13,000,170**
Subtotal				**$18,721,448**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Improving Performance and Cost-Effectiveness of Small Hydro, Geothermal. and Wind Energy Technologies (GFO-16-301) Applied Research and Development				
EPC-16-019	Regents of the University of California (University of California, Davis)	21st Century Solutions for 20th Century Wind Projects	*2015-2017 Investment Plan*	$810,438
EPC-16-024	San Gabriel Valley Water Company	San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	*2015-2017 Investment Plan*	$500,000
EPC-16-025	Stantec Consulting Services Inc.	Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	*2015-2017 Investment Plan*	$400,000
EPC-16-037	Amador Water Agency	The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	*2015-2017 Investment Plan*	$750,000
EPC-16-043	Natel Energy	Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	*2015-2017 Investment Plan*	$954,715
Subtotal				**$3,415,153**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Advance Breakthrough and Piezoelectric-Based Systems Development to Increase Market Penetration of Distributed Renewable Generation (GFO-16-302) Applied Research and Development				
EPC-16-036	AltaRock Energy, Inc.	Thermoelectric Generator Application and Pilot Test in a Geothermal Field	*2015-2017 Investment Plan*	$1,280,000
EPC-16-042	Lawrence Berkeley National Laboratory	Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	*2015-2017 Investment Plan*	$2,000,000
EPC-16-049	University of California - Merced	Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	*2015-2017 Investment Plan*	$1,270,000
EPC-16-050	The Regents of the University of California, San Diego	Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	*2015-2017 Investment Plan*	$1,450,000
EPC-16-052	Pyro-E, LLC	Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	*2015-2017 Investment Plan*	$1,000,000
Subtotal				**$7,000,000**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Advanced Vehicle-Grid Integration Research and Demonstration (GFO-16-303) Applied Research and Development				
EPC-16-054	Electric Power Research Institute (EPRI)	Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	*2015-2017 Investment Plan*	$1,500,000
EPC-16-055	Zeco Systems dba Greenlots	Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services With Integrated Multiple DC Fast Chargers	*2015-2017 Investment Plan*	$826,250
EPC-16-057	Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)	Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	*2015-2017 Investment Plan*	$1,500,000
EPC-16-059	Lawrence Berkeley National Laboratory	Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	*2015-2017 Investment Plan*	$1,500,000
AR&D Subtotal				**$5,326,250**
Advanced Vehicle-Grid Integration Research and Demonstration (GFO-16-303) Technology Demonstration and Deployment				
EPC-16-058	Prospect Silicon Valley	Advanced Transit Bus VGI Project	*2015-2017 Investment Plan*	$1,899,199
EPC-16-060	Motiv Power Systems, Inc.	Adaptive Chargers for Delivery Customers Demonstrating California Advances in Charging	*2015-2017 Investment Plan*	$4,529,956
EPC-16-061	Nuvve Corporation	Intelligent Electric Vehicle Integration (INVENT)	*2015-2017 Investment Plan*	$4,200,000
EPC-16-065	Zero Net Energy (ZNE) Alliance	California E-Bus to Grid Integration Project	*2015-2017 Investment Plan*	$3,327,953
EPC-17-020	Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)	Demonstration of Vehicle-Grid Integration Under Non-residential Scenarios	*2015-2017 Investment Plan*	$2,340,000
TD&D Subtotal				**$16,297,108**
Subtotal				**$21,623,358**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Emerging Energy-Efficient Technology Demonstration (EEETD) (GFO-16-304) Technology Demonstration and Deployment				
EPC-16-032	New Buildings Institute, Inc.	Leading in Los Angeles: Demonstrating Scalable Emerging Energy-Efficient Technologies for Integrated Façade, Lighting and Plug Loads	*2015-2017 Investment Plan*	$4,981,000
EPC-16-033	CSU Long Beach Research Foundation	Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	*2015-2017 Investment Plan*	$2,509,946
EPC-16-034	Zero Net Energy (ZNE) Alliance	Automated Cloud-Based Continuously Optimizing Building Energy Management System	*2015-2017 Investment Plan*	$2,500,000
EPC-17-001	Taylor Engineering	Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	*2015-2017 Investment Plan*	$2,966,716
EPC-17-008	Center for Sustainable Energy	Empowering Energy Efficiency in Existing Big-Box Retail/Grocery Stores	*2015-2017 Investment Plan*	$2,824,685
EPC-17-009	Willdan Energy Solutions	Bundle-Based Energy Efficiency Technology Solutions for California (“BEETS for California”)	*2015-2017 Investment Plan*	$3,994,256
EPC-17-014	Newcomb Anderson McCormick, Inc.	Advanced Plug Load Controls and Management in the Educational Environment	*2015-2017 Investment Plan*	$5,000,000
Subtotal				**$24,776,603**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Advancing Cutting-Edge Technologies and Strategies to Reduce Energy Use and Costs in the Industrial, Agriculture, and Water Sectors (GFO-16-305) Applied Research and Development				
EPC-16-026	Electric Power Research Institute (EPRI)	Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	*2015-2017 Investment Plan*	$3,000,000
EPC-16-027	Irrigation for the Future, Inc.	Facilitating On-Farm Participation in Energy Demand Management Programs	*2015-2017 Investment Plan*	$1,588,872
EPC-16-028	Advanced Microgrid Solutions, Inc.	Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	*2015-2017 Investment Plan*	$1,403,465
EPC-16-029	Antelope Valley Water Storage, LLC	Water/Energy Bank Proof-of-Concept	*2015-2017 Investment Plan*	$1,000,000
EPC-16-030	Regents of the University of California, Riverside Campus	Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	*2015-2017 Investment Plan*	$1,783,118
EPC-16-044	Terzo Power Systems, LLC.	Hyper-Efficient Pump Motor Unit WITH Fully Integrated Permanent Magnet Motor and Motor Controls With Combined Liquid Cooling	*2015-2017 Investment Plan*	$2,311,050
EPC-16-045	Polaris Energy Services Inc.	Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time-of-Use Rates	*2015-2017 Investment Plan*	$2,884,912
EPC-16-046	Institute of Gas Technology (dba Gas Technology Institute [GTI])	Pilot Testing of Isothermal Compression	*2015-2017 Investment Plan*	$2,570,946
EPC-16-048	Electric Power Research Institute (EPRI)	Development and Testing of an Energy Efficient Ultra-Low-Charge Ammonia Refrigeration System in a Food Processing Plant	*2015-2017 Investment Plan*	$2,406,054
EPC-16-051	PowWow Energy, Inc.	Increased Energy Efficiency via Programmable Irrigation and Fertigation	*2015-2017 Investment Plan*	$2,992,660
EPC-16-062	Regents of the University of California, Davis	Advancing Demand Response in the Water Sector	*2015-2017 Investment Plan*	$2,984,983
Subtotal				**$24,926,060**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Addressing Air Quality and Environmental Impacts of Conventional and Emerging Electricity Sector Technologies in a Changing Climate (GFO-16-306) Applied Research and Development				
EPC-16-038	Regents of the University of California (University of California, Davis)	Use of Indoor Rearing for Head-Starting Desert Tortoises	*2015-2017 Investment Plan*	$493,089
EPC-16-039	The Regents of the University of California, Irvine	A Life-Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	*2015-2017 Investment Plan*	$600,000
EPC-16-040	The Regents of the University of California, Davis Campus	Assessing Cooling Tower PM2.5 and PM10 Emissions Using Advanced Instrumentation, Plume Transects, and Plume Modeling	*2015-2017 Investment Plan*	$700,000
EPC-16-041	Lawrence Berkeley National Laboratory	Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	*2015-2017 Investment Plan*	$500,000
EPC-16-047	Humboldt State University Sponsored Programs Foundation	California Biopower Impact Project	*2015-2017 Investment Plan*	$1,000,000
EPC-16-053	Zoological Society of San Diego dba San Diego Zoo Global	Habitat Influences on Desert Tortoise Translocation Success	*2015-2017 Investment Plan*	$499,605
EPC-16-063	University of California, San Diego Scripps Institution of Oceanography 0955	Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	*2015-2017 Investment Plan*	$1,399,888
EPC-16-064	US Geological Survey	Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	*2015-2017 Investment Plan*	$499,785
Subtotal				**$5,692,367**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Solar +: Taking the Next Steps to Enable Solar as a Distribution Asset (GFO-16-309) Applied Research and Development				
EPC-16-068	Electric Power Research Institute (EPRI)	Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	*2015-2017 Investment Plan*	$2,976,991
EPC-16-069	Advanced Microgrid Solutions, Inc.	Demonstrate the Phase III Functions of a PV Smart Inverter and a Storage Inverter With a Communications Gateway.	*2015-2017 Investment Plan*	$2,729,943
EPC-16-077	Regents of the University of California, Riverside Campus	Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	2015-2017 Investment Plan	$2,110,657
EPC-16-079	Electric Power Research Institute (EPRI)	Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	*2015-2017 Investment Plan*	$2,935,822
EPC-17-002	Humboldt State University Sponsored Programs Foundation	Scaling Solar+ for Small and Medium Commercial Buildings	*2015-2017 Investment Plan*	$1,500,000
EPC-17-003	Clean Power Research, L.L.C.	Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	*2015-2017 Investment Plan*	$750,000
EPC-17-004	Energy and Environmental Economics, Inc. (E3)	Enhanced Modeling Tools to Maximize Solar + Storage Benefits	*2015-2017 Investment Plan*	$987,379
EPC-17-005	Electric Power Research Institute (EPRI)	Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	*2015-2017 Investment Plan*	$1,491,764
EPC-17-006	Electric Power Research Institute (EPRI)	Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	*2015-2017 Investment Plan*	$749,740
EPC-17-007	Center for Sustainable Energy	Integrated Community Solar and Storage at a Low-Income Mobile Home Park	*2015-2017 Investment Plan*	$2,005,923
AR&D Subtotal				**$18,238,219**
Solar +: Taking the Next Steps to Enable Solar as a Distribution Asset (GFO-16-309) Technology Demonstration and Deployment				
EPC-16-070	Electric Power Research Institute (EPRI)	Integrating Front-of-the-Meter Energy Storage With Smart PV Inverters and Solar Forecasting	*2015-2017 Investment Plan*	$1,832,770
EPC-16-073	Natural Capitalism Solutions, dba Clean Coalition	Valencia Gardens Energy Storage	*2015-2017 Investment Plan*	$1,994,687
TD&D Subtotal				**$3,827,457**

Subtotal	**$22,065,676**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Improving Performance and Cost Effectiveness of Wind Energy Technologies (GFO-16-310) Applied Research and Development				
EPC-17-023	RCAM Technologies	High-Performance, Ultra-Tall, Low-Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	*2015-2017 Investment Plan*	$1,249,982
Subtotal				**$1,249,982**

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved
Federal Cost Share Under the Electric Program Investment Charge (PON-14-308) Applied Research and Development				
EPC-16-031	SLAC National Accelerator Laboratory	VOLTTRON Testing Tool Kit	*2015-2017 Investment Plan*	$70,000
EPC-16-035	Sunpreme, Inc.	High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	*2015-2017 Investment Plan*	$2,430,000
EPC-16-056	Lawrence Berkeley National Laboratory	Performance Evolution, Specification, and Verification of Building Control Sequences	*2015-2017 Investment Plan*	$1,000,000
EPC-16-067	Lawrence Berkeley National Laboratory	Robust Super Insulation at a Competitive Price	*2015-2017 Investment Plan*	$100,000
EPC-17-010	Lawrence Berkeley National Laboratory	Integrated Heat and Moisture Calculation Tool for Building Envelopes	*2015-2017 Investment Plan*	$125,000
AR&D Subtotal				**$3,725,000**
Federal Cost Share Under the Electric Program Investment Charge (PON-14-308) Technology Demonstration and Deployment				
EPC-17-015	Nevados Engineering, Inc.	Installation and Soft Cost Reduction for Horizontal Single-Axis Trackers (Stage II)	*2015-2017 Investment Plan*	$999,822
TD&D Subtotal				**$999,822**
Subtotal				**$4,724,822**

Total	**$134,195,469**

Source: California Energy Commission

Proposed Awards in 2017

Table 6 shows proposed projects that were recommended for funding through a NOPA in 2017 but were not considered for approval at an Energy Commission business meeting in 2017. It is anticipated that these proposed projects will be considered for approval at the Energy Commission business meeting in 2018. A full list of submitted projects is available in the Energy Commission's NOPA for each solicitation.[35]

Table 6: Proposed EPIC Funding Awards in 2017

Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Recommended
Development, Demonstration and Deployment of Environmentally and Economically Sustainable Biomass-to-Energy Systems for the Forest and Food Waste Sectors (GFO-15-325) Technology Demonstration and Deployment			
Mariposa County Resource Conservation District (MCRCD)	Mariposa Biomass Project	*2015-17 Investment Plan*	$5,000,000
ICF Incorporated, L.L.C.	Camptonville Biomass-to-Energy Project	*2015-17 Investment Plan*	$4,999,830
Subtotal			**$9,999,830**

Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Recommended
Federal Cost Share Under the Electric Program Investment Charge (PON-14-308) Technology Demonstration and Deployment			
Southern California Edison	Electric Access System Enhancement (EASE)	*2015-17 Investment Plan*	$2,000,000
Subtotal			**$2,000,000**

Total	**$11,999,830**

Source: California Energy Commission

Committed Funds in 2017

As of December 31, 2017, the Energy Commission has committed $331.8 million of program funds from the *2012-14 Triennial Investment Plan* and has committed $365,004,500 from the*2015-17 Triennial Investment Plan*, of which, the Energy Commission approved 97 projects totaling $198.77 million from the second investment plan. As noted above in Table 6, about $12 million of proposed projects were recommended for funding in 2017. These projects are expected to be considered for approval at an Energy Commission business meeting in 2018. There is also $162.5 million of committed funds in released solicitations as of December 31, 2017. Table 7 shows EPIC solicitations that were still active on December 31, 2017. Table 8 shows solicitations that were closed and did not yet have a NOPA posted on or before December 31, 2017. The remaining funding from the *2015-2017 Triennial Investment Plan* is committed

35 More information on proposed awards can be found at http://www.energy.ca.gov/contracts/epic.html#closed

in solicitations released in 2017. Resulting proposed awards from these solicitations are scheduled to be considered at a business meeting in 2018.

Table 7: Active Solicitations for Energy Commission EPIC Project Funding

Active EPIC Solicitations as of December 31, 2017 2015-2017 EPIC Investment Plan				
Solicitation Title	**Release Date**	**Program Area/ Strategic Objective**	**Funding Amount (Initial)**	**Application Deadline**
Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation (RFP-17-303)	October 16, 2017	Market Facilitation (S21)	$350,000	**January 8, 2018**
Research Roadmap for System Transformation to Enable High Penetration of Distributed Energy Resources (RFP-17-306)	October 17, 2017	Market Facilitation (S21)	$500,000	**January 8, 2018**
Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology (RFP-17-307)	October 17, 2017	Market Facilitation (S21)	$3,000,000	**January 9, 2018**
Bringing Rapid Innovation Development to Green Energy (BRIDGE) (GFO-17-308)	November 15, 2017	Applied Research and Development (S1) and (S2)	$10,000,000	**February 20, 2018**
		Technology Demonstration and Deployment (S12)	$5,000,000	**February 20, 2018**

Source: California Energy Commission

Table 8: Closed Solicitations for Energy Commission EPIC Project Funding

Closed EPIC Solicitations, With No Notice of Proposed Award (NOPA) Posted as of December 31, 2017* 2015-2017 EPIC Investment Plan				
Solicitation Title	**Release Date**	**Program Area/ Strategic Objective**	**Funding Amount (Initial)**	**Application Deadline**
Advancing the Resilience and Environmental Performance of California's Electricity System (GFO-16-311)	July 7, 2017	Applied Research and Development (S5)	$6,400,000	**October 9, 2017**
Increasing Adoption of Emerging Clean Energy Technologies through Procurement (GFO-17-301)	July 19, 2017	Market Facilitation (S18) and (S19)	$30,000,000	**November 3, 2017**
Demonstrate Business Case for Advanced Microgrids in Support of California's Energy and GHG Policies (GFO-17-302)	August 4, 2017	Technology Demonstration and Deployment (S14)	$44,700,000	**November 9, 2017**
Programmatic Approach to Existing Buildings Research, Development and Demonstration Program (GFO-17-304)	September 11, 2017	Applied Research and Development (S1)	$12,500,000	**November 30, 2017**
		Technology Demonstration and Deployment (S12)	$20,000,000	
Distribution System Modeling Tools to Evaluate Distributed Energy Resources (GFO-17-305)	September 28, 2017	Applied Research and Development (S7)	$9,073,750	**December 1, 2017**
Sharing California's Energy Innovations: Communicating EPIC Research through Special Events, Forums and Multimedia Productions (RFP-17-301)	August 21, 2017	Market Facilitation (S18)	$6,000,000	**December 8, 2017**
**Federal Cost Share Under the Electric Program Investment Charge (PON-14-308)	November 4, 2014	Applied Research and Development (S11)	$7,000,000	**December 31, 2017**
		Technology Demonstration and Deployment (S17)	$8,000,000	**December 31, 2017**

* The applications for these solicitations were still being evaluated as of December 31, 2017, and the NOPAs are anticipated to post in 2018.
** The Federal Cost Share solicitation was ongoing and funds were awarded to passing proposals on a first-come, first-served basis. As of December 31, 2017, 7 project awards for $5.47 million have been approved at an Energy Commission business meeting. Of this amount, $4.47 million of the Applied Research and Development funding and $1 million of the Technology Demonstration and Deployment funding has been approved at an Energy Commission business meeting. In addition, the Department of Energy provided a total of $13.9 million in federal funding for these projects.

Source: California Energy Commission

Federal Cost Share in 2017

The Energy Commission maintained an ongoing federal cost-share solicitation to provide cost-share funding to applicants that apply for and receive an award under an eligible federal funding opportunity announcement (FOA). Table 9 shows the list of FOAs released in 2017 that were eligible for federal cost share under the EPIC program and the number of applications for each FOA that received a letter of cost-share commitment. Of the two applications received in 2017, about $512,000 in federal cost share has been recommended for funding as of December 31, 2017 and will be considered at a business meeting in 2018.

Table 9: Federal Cost-Share Activities in 2017

Federal Funding Opportunity Announcement Number	Federal Funding Opportunity Announcement Name	Funding Opportunity Announcement Description	Number of Applications Receiving a Letter of Cost-Share Commitment	NOPA Posting Date
DE-FOA-0001632	Buildings Energy Efficiency Frontiers & Innovation Technologies (BENEFIT) - 2017	Applied research and development (R&D) for technologies and systems that contribute to reductions in building energy consumption.	2	3/8/2017

Source: California Energy Commission

2017 Encumbered Program Funds

In 2017, the Energy Commission encumbered a total of $134 million for 72 projects from the *2015-2017 EPIC Investment Plan* funds. The total cumulative amount encumbered through December 31, 2017 is $530.57 million for 270 projects from the 2012-2014 and 2015-2017 Investment Plans.

2017 Program Expenditures

The Energy Commission approved about $77.1 million for EPIC Program project invoices in calendar year 2017. The total cumulative funds expended through December 31, 2017, is about $134 million. Invoices are submitted and paid after work is completed. Therefore, “expended” funds are always less than “encumbered” funds.

III. Dollars Spent on Program Administration

2017 Program Administration Funds

The CPUC Budget Requirements cap administrative costs at 10 percent, excluding program evaluation costs. Expenditures for Energy Commission administrative costs totaled about $17.5 million in calendar year 2017.

Administrative expenditures for Energy Commission EPIC Program administrative costs during calendar years 2012 through 2017 for EPIC Plan 1 and Plan 2 are currently nearly $57 million. The CPUC approved a total budget of $77.7 million for program administration in the 2012-2014 and 2015-2017 Investment Plans. As a result, the Energy Commission's administrative costs are within the approved budgeted amount.

IV. Funding Shifts

EPIC administrators may shift up to 5 percent of funds between funding categories or program areas within an approved EPIC triennial investment plan.[36] In 2017, the Energy Commission did not shift funds between funding categories or program areas.

V. Uncommitted/Unencumbered Funds/Interest Accrual

Based on the definitions of "committed funds" and "encumbered funds" discussed in Chapter 2, Section II above, "uncommitted" and "unencumbered" funds are funds that are not identified in solicitation plans or encumbered into project awards. Moreover, these funds are considered "unspent."[37]

Decision 13-11-025 states, "Given the shortened timeframe of the initial investment plan cycle, and for the purposes of the initial investment plan cycle only (2012-2014), the uncommitted and unencumbered funds that would, under normal circumstances, be returned to ratepayers if legally permitted to do so, must be rolled over as if those funds were encumbered or committed. At the conclusion of the second investment plan cycle, if any funds approved for the first investment plan cycle are uncommitted or unencumbered, they must be credited against the approved budget for the third investment plan cycle."[38]

As of December 31, 2017, there were no uncommitted or unencumbered funds from the first or second triennial investment plan cycle. Therefore no funds were credited against the third investment plan cycle.

From the 2015-2017 calendar years, the Energy Commission accumulated approximately $6.2 million in interest from all funds in the account. Interest is subtracted from the Energy Commission's program billing to the IOUs to compensate for interest accruals.

36 In accordance with Decision 13-11-025.

37 See CPUC Decision 13-11-025, Conclusions of Law 114 and 115.

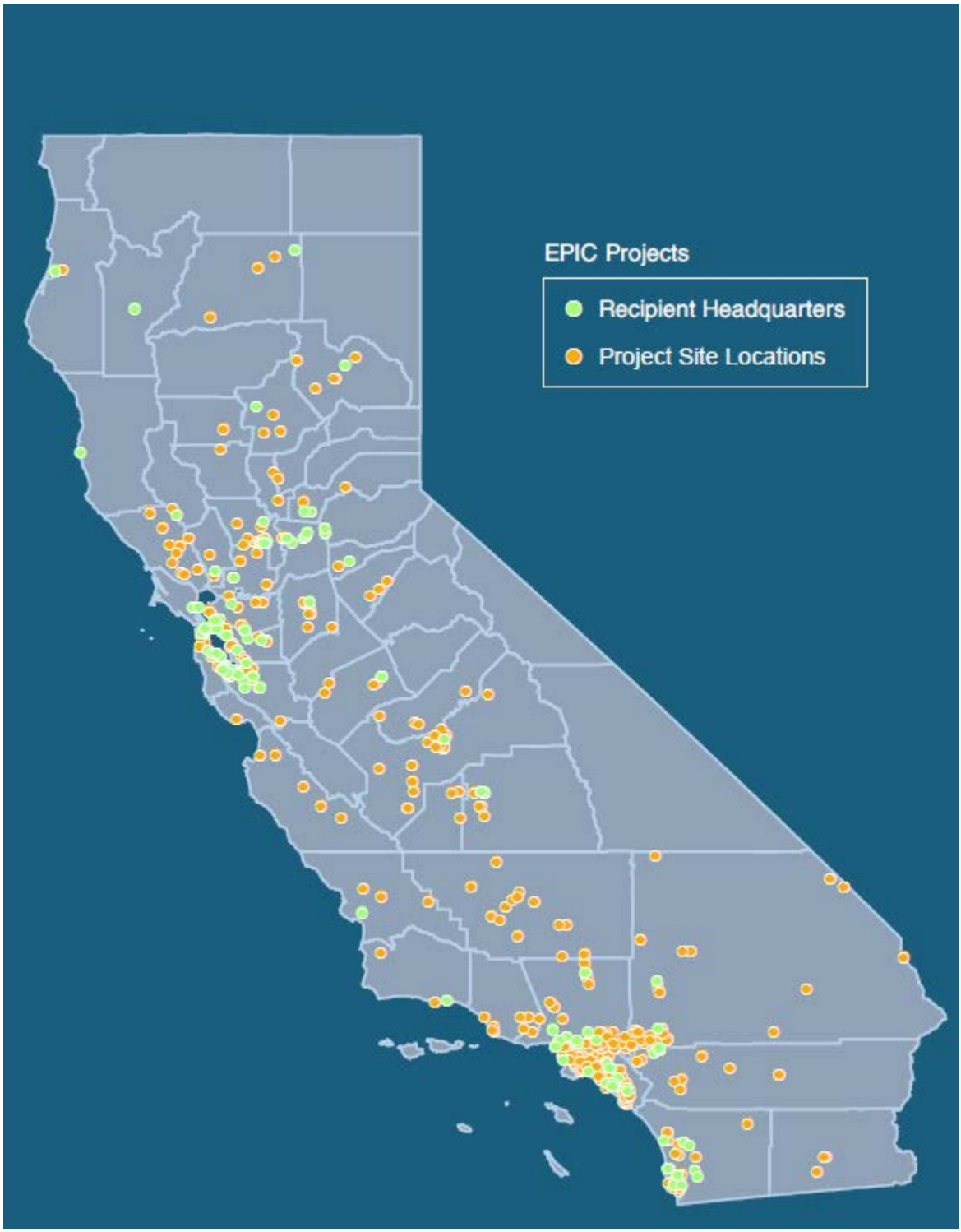
38 CPUC Decision 13-11-025, Ordering Paragraph 39.

CHAPTER 3:
Projects

In 2017, the Energy Commission awarded EPIC funds to 72 new projects encumbering $134 million. Since the beginning of the EPIC program, the Energy Commission has made 270 project awards, encumbering $530.57 million.[39] Figure 29 depicts a map of the projects awarded as of December 31, 2017, with the green dots depicting the addresses of recipients' headquarters and the orange dots depicting project site locations.

39 This does not include two projects that were approved at an Energy Commission business meeting in 2015 and 2016 and later terminated by the recipient. No work was done on these projects and no funds were spent.

Figure 31: Energy Commission EPIC Awarded Projects through December 31,2017



Source: California Energy Commission

I. Summary of EPIC Project Awards

Table 10 summarizes the 270 projects awarded since 2012 by strategic objective, number of projects funded, and total funding. The table covers the two EPIC Investment Plans for 2012-2014 and 2015-2017.

Table 10: Summary of EPIC Projects Awarded by Strategic Objective (2012-2017)

Strategic Objective	Number of Projects (as of December 31, 2017)	Total Funding*** (as of December 31, 2017)
2012-2014 EPIC Investment Plan		
Applied Research and Development		
S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector.	21	$38,815,729
S2: Develop New Technologies and Applications That Enable Cost-Beneficial Customer-Side-of-the-Meter Energy Choices.	10	$30,144,179
S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable.	12	$18,508,646
S4: Develop Emerging Utility-Scale Renewable Energy Generation Technologies and Strategies to Improve Power Plant Performance, Reduce Costs, and Expand the Resource Base.	7	$9,995,832
S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.	35	$19,352,181
S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020.	5	$5,401,868
S7: Develop Operational Tools, Models, and Simulations to Improve Grid Resource Planning.	2	$1,690,055
S8: Integrate Grid-Level Energy Storage Technologies and Determine Best Applications That Provide Locational Benefits.	5*	$8,673,198
S9: Advance Technologies and Strategies That Optimize the Benefits of Plug-In Electric Vehicles to the Electricity System.	5	$6,681,669
S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies.	6	$19,435,655
S11: Provide Cost Share for Federal Awards.	0	$0
Technology Demonstration and Deployment		

Strategic Objective	Number of Projects (as of December 31, 2017)	Total Funding*** (as of December 31, 2017)
2012-2014 EPIC Investment Plan		
S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies.	20	$52,189,861
S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies.	13	$39,941,256
S14: Demonstrate the Reliable Integration of Energy-Efficient Demand-Side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy-Smart Community Development.	11	$37,668,883
S15: Provide Cost Share for Federal Awards.	0	$0
Market Facilitation		
S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure.	12	$17,437,354
S17: Strengthen the Clean Energy Workforce by Creating Tools and Resources That Connect the Clean Energy Industry to the Labor Market.	2	$8,908,107
S18: Guide EPIC Investments Through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach.	7	$16,954,539
2012-2014 EPIC Plan Subtotal	**173**	**$331,799,012**

Strategic Objective	Number of Projects (as of December 31, 2017)	Total Funding*** (as of December 31, 2017)
2015-2017 EPIC Investment Plan		
Applied Research and Development		
S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.	27	$44,467,164
S2: Enable Cost-Effective Demand Respond for California IOU Electricity Customers.	0	$0
S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.	19	$26,398,707
S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.	7	$7,105,218
S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.	7	$5,192,367
S6: Advance the Use of Smart Inverters as a Tool to Manage Areas With High Penetrations of PV.	2	$5,665,765
S7: Develop Advanced Distribution Modeling Tools for the Future Smart Grid.	0	$0
S8: Advance Customer Systems to Coordinate with Utility Communication Systems.	0	$0
S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.	4	$5,326,250
S10: Advance the Early Development of Breakthrough Energy Concepts.	0**	$20,211,957
S11: Provide Federal Cost Share for Applied Research Awards.	6	$4,475,000
Technology Demonstration and Deployment		
S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.	9**	$30,077,342
S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.	4	$13,000,170
S14: Take Microgrids to the Next Level: Maximize the Value to Customers.	0	$0

Strategic Objective	Number of Projects (as of December 31, 2017)	Total Funding*** (as of December 31, 2017)
S15: Demonstrate Advanced Energy Storage Interconnection Systems to Lower Costs, Facilitate Market, and Improve Grid Reliability.	2	$3,827,457
S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.	5	$16,297,108
S17: Provide Federal Cost Share for Technology Demonstration and Deployment Awards.	1	$999,822
Market Facilitation		
S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.	1**	$12,091,373
S19: Facilitate Inclusion of Emerging Clean Energy Technologies into Large-Scale Procurement Processes.	0	$0
S20: Accelerate the Deployment of Energy Technologies in IOU Territories Through Innovative Local Planning and Permitting Approaches.	2	$2,487,609
S21: Inform Investments and Decision-Making Through Market and Technical Analysis.	1	$1,147,406
2015-2017 EPIC Plan Subtotal	**97**	**$198,770,715**

Grand Total*	**270**	**$530,569,727**

* This does not include two projects that were approved at an Energy Commission business meeting in 2015 and 2016 and later terminated by the recipient. No work was done on these projects and no funds were spent.

** Six projects used funds from both the *2012-2014 and 2015-2017 EPIC Investment Plans*. Those projects that include funds from both plans are indicated under the first plan only. Under the *2015-2017 EPIC Investment Plan*, there are an additional four projects under S18 (five projects total), one project under S12 (three projects total), and one project under S10 (one project total) that are not included in the "Number of Projects" column in this table because they were already included in the project totals for the *2012-2014 EPIC Investment Plan*. The numbers in the "Total Funding" column include all projects, even those that are funded under both plans.

***The amounts in the "Total Funding" column represent the project funding that was approved at an Energy Commission Business Meeting and do not include any adjustments made thereafter – adjustments made thereafter are included in Appendix C EPIC Project Status Report of this annual report.

Source: California Energy Commission

II. Description of Projects

EPIC-funded projects, including new awards and active and completed projects in 2017 are highlighted in project write-ups following the report outline requirements listed in Attachment 5 (Item 4c of the outline) of CPUC Decision 13-11-025 and found in Appendix B of this annual report.

III. EPIC Project Status Report

Each project awarded EPIC funds includes specific information in an electronic spreadsheet format using the template provided in Attachment 6 of CPUC Decision 13-11-025 and found in Appendix C of this annual report.

a. Investment Program Period
b. Program Administrator
c. Project Name
d. Project Type
e. A Brief Description of the Project
f. Date of the Award
g. Was This Project Awarded in the Immediately Prior Calendar Year?
h. Assignment to Value Chain
i. Encumbered Funding Amount ($)
j. Committed Funding Amount ($)
k. Funds Expended to Date: Contract/Grant Amount ($)
l. Funds Expended to Date: In-House Expenditures ($)
m. Funds Expended to Date: Total Spent to Date ($)
n. Administrative and Overhead Costs to Be Incurred for Each Project
o. Leveraged Funds
p. Partners
q. Match Funding
r. Match Funding Split
s. Funding Mechanism
t. Intellectual Property
u. Identification of the Method Used to Grant Awards
v. If competitively selected, provide the number of bidders passing the initial pass/fail screening for project.

w. If competitively selected, provide the name of selected bidder.

x. If competitively selected, provide the rank of the selected bidder in the selection process.

y. If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected.

z. If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization.

aa. Does the recipient for this award identify as a self-reported California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?

ab. How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals.

ac. Applicable Metrics From Attachment 4 of D.13-11-025[40]

ad. Project Update

40 http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M081/K773/81773445.PDF.

Completed Projects

The seven EPIC projects completed in 2017 are listed in Table 11. The final report for each of these projects, including a comprehensive description of the project, detailed findings and results, is or will be available at the Energy Commission website. [41] A summary of the outcomes are also included in project write-ups found in Appendix B of this annual report.

Table 11: Completed EPIC-Funded Projects in 2017

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved	Final Report
EPC-14-007	University of California - Davis	Improving Short-Term Wind Power Forecasting Through Measurements and Modeling of the Tehachapi Wind Resource Area	*2012-2014 Investment Plan* Applied Research and Development	$1,000,000	http://www.energy.ca.gov/2018publications/CEC-500-2018-002/CEC-500-2018-002.pdf
EPC-14-026	The Regents of the University of California, Berkeley	Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large-Scale Quasi-Experiment	*2012-2014 Investment Plan* Market Facilitation	$360,632	http://www.energy.ca.gov/2017publications/CEC-500-2017-027/index.html
EPC-14-027	Regents of the University of California, Los Angeles	High-Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	*2012-2014 Investment Plan* Applied Research and Development	$1,621,628	http://www.energy.ca.gov/2018publications/CEC-500-2018-001/CEC-500-2018-001.pdf
EPC-14-039	TRC Engineers, Inc.	Cultural Factors in the Energy Use Patterns of Multifamily Tenants	*2012-2014 Investment Plan* Market Facilitation	$379,019	http://www.energy.ca.gov/2018publications/CEC-500-2018-004/CEC-500-2018-004.pdf

41 CPUC Decision 13-11-025, ordering paragraph 14 requires the Energy Commission to include with its annual report a final report on every project completed during the previous year.

Agreement #	Prime Applicant	Project Title	EPIC Investment Plan	EPIC Funds Approved	Final Report
EPC-14-072	Lawrence Berkeley National Laboratory	Building a Healthier and More Robust Future: 2050 Low-Carbon Energy Scenarios for California	*2012-2014 Investment Plan* Applied Research and Development	$700,000	Final Report is part of the 4th Climate Assessment. This report will be posted fall of 2018 and will be found at the following webpage: http://www.energy.ca.gov/2017publications/
EPC-15-034	Public Health Institute	Emerging Energy Public Health Research Roadmap	*2012-2014 Investment Plan* Applied Research and Development	$151,000	http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-500-2017-035
EPC-15-049	Antelope Valley Water Storage, LLC	Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	*2012-2014 Investment Plan* Applied Research and Development	$197,300	http://www.energy.ca.gov/2017publications/CEC-500-2017-042/index.html

Source: California Energy Commission

CHAPTER 4: Conclusion

I. Key Results for 2017

- In 2017, the Energy Commission released 11 competitive solicitations. The solicitations covered a wide variety of issues and California's policy goals, including vehicle-grid integration, improved air quality, managing tree mortality, and converting food waste to energy.
- As of December 31, 2017, $134 million was encumbered for 72 new projects approved in 2017.
- Seven EPIC projects were completed in 2017. The final report, for each of these projects, including a comprehensive description, detailing findings and results, is or will be available at the Energy Commission website.[42] A brief description of these projects was discussed in Chapter 1 and included:
    - Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socioeconomic and Ethnic Groups Using a Large-Scale Quasi-Experiment (EPC-14-026).
    - Cultural Factors in the Energy Use Patterns of Multifamily Tenants (EPC-14-039).
    - Improving Short-Term Wind Power Forecasting Through Measurements and Modeling of the Tehachapi Wind Resource Area (EPC-14-007).
    - High-Temperature Hybrid Compressed Air Energy Storage (EPC-14-027).
    - Building a Healthier and More Robust Future: 2050 Low carbon Energy Scenarios for California (EPC-14-072).
    - Public Health Research Roadmap on Emerging Electricity Generating Systems (EPC-15-034).
    - Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System (EPC-15-049).
- The Energy Commission held 11 public preapplication workshops, at least one for each solicitation, to explain open solicitations and answer questions before the due date for applications or bids.
- As required, the Energy Commission filed its *EPIC Annual Report* with the CPUC in February 2017 and, in April 2017, sent its *EPIC Annual Report* to the Legislature.
- Development of the Energy Commission's EPIC 2018-2020 Investment Plan included the following public workshops:

42 http://www.energy.ca.gov/2017publications/.

- The Energy Commission held a stakeholder workshop in Sacramento, California on February 3, 2017, to gather stakeholder input on proposed investments before developing the EPIC 2018-2020 Investment Plan.
- The Energy Commission, along with the other EPIC administrators, held three joint workshops on March 9 and March 14, 2017, in Northern California and March 24, 2017, in Southern California to provide an overview and solicit public comment on each of the administrators' draft investment plans.
- The Energy Commission also held five topical workshops that fed into investment plan development for the following: Distributed Energy Resources Scoping Workshop on March 13, 2017, in Sacramento; Potential Areas of Research on Climate Change for the Electricity and Natural Gas Systems on March 16, 2017, in Sacramento; Incorporating Community-Focused Equity in Research Funding on March 20, 2017, in Fresno and on March 27, 2017 in Los Angeles; and Customers of Climate Science Research on April 11, 2017, in Sacramento.
- The Energy Commission approved the EPIC 2018-2020 Investment Plan at a Business Meeting on April 27, 2017
- The Energy Commission submitted its application for approval of the *EPIC 2018–2020 Triennial Investment Plan* to the CPUC on May 1, 2017.

- The CPUC held a workshop on September 20, 2017 to examine how the recommendations resulting from the EPIC Evaluation Final Report might impact administration of the EPIC program.
- Evergreen Economics conducted an independent evaluation of the EPIC program in the winter of 2016-2017. Energy Commission staff participated in interviews and responded to data requests from Evergreen Economics and in support of the evaluation.
  - The evaluation determined that the Energy Commission practices are in line with research organization best practices. The administration is robust, has strong linkages to state policy, plans transparently, engages external stakeholders, has a transparent and public process for selecting projects, and uses a robust process to comprehensively report on project benefits.

II. Next Steps for EPIC

The Energy Commission's next steps for EPIC administration include the following:

- In January 2018, the CPUC modified and approved the Energy Commission's EPIC 2018-2020 Investment Plan. Pending authorization from the Legislature, the Energy Commission will start implementing the EPIC 2018-2020 approved research initiatives. Among the steps are the following:

- The Energy Commission will continue to release competitive solicitations and requests for comment according to the schedule available on the Energy Commission's EPIC Web page (http://www.energy.ca.gov/research/epic/) and update the schedule as needed.
- Consistent with its investment plans, the Energy Commission will continue to release a NOPA for each competitive solicitation and seek approval of each proposed award at a public business meeting.
- The Energy Commission staff plans to bring the remaining projects from NOPAs posted in 2017 to a 2018 business meeting for consideration as indicated in Table 6 in Chapter 2.
- NOPAs on the solicitations listed in Tables 7 and 8 in Chapter 2 will be posted.

- The Energy Commission will take steps to respond to the EPIC Evaluation Final Report recommendations with the following actions:
  - The Energy Innovation Showcase annually provides updates on all EPIC-funded projects and their benefits. The showcase will be updated on a rolling basis when new agreements are executed or when a final report is published.
  - The Energy Commission released a solicitation at the end of 2017 titled "Sharing California's Energy Innovations: Communicating EPIC Research Through Special Events, Forums and Multimedia Production (RFP-17-301)." In 2018, this solicitation will select a contractor to develop and execute a plan to increase sharing of EPIC project status and results.
- In 2017, AB 523 (Reyes, Chapter 551, Statutes of 2017) was passed by the State Legislature and signed by Governor Edmund G. Brown Jr. Pursuant thereto the Energy Commission will implement the following:
  - At least 25 percent of EPIC funds will be expended on technology demonstration and deployment at project sites located in and benefiting disadvantaged communities.
  - An additional 10 percent of EPIC funds will be expended on technology demonstration and deployment at project sites located in and benefiting low-income communities.
  - In the spring of 2018, the Energy Commission will hold workshops to receive stakeholder input on implementation of the AB 523 requirements.
- In 2018, the Energy Commission will continue efforts to ensure that participation in the EPIC program reflects the rich and diverse characteristics of California and its people.

III. Issues

The Energy Commission's EPIC annual report is required to include discussion of issues "that may have major impact on progress in projects, if any."[43]

Table 12 lists the two EPIC projects terminated in 2017. A summary of these projects is also included in project write-ups found in Appendix B of this annual report.

43 Attachment 5, page 2 of CPUC Decision 13-11-025.

Table 12: EPIC Funded Projects Terminated in 2017

Agreement #/ Prime Applicant	Project Title	Project Description	EPIC Investment Plan/ Investment Area	EPIC Funds Expended as of 12/31/17	Reason for Termination	Final Report
EPC-14-034 Interra Energy, Inc.	Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	The purpose of this project was to install and demonstrate an advanced modular bioenergy technology. The pilot-scale demonstration was intended to determine if the performance of the technology, along with biomass co-product value creation enhancement strategy, was sufficient to overcome the affordability burdens that currently block the feasibility of distributed generation bioenergy projects in California.	*2012-2014 Investment Plan* Applied Research and Development	$1,353,332	The system to be developed and demonstrated had major technological issues, and researchers were unable to fulfill the technical tasks for the project. Energy Commission issued a Stop Work Order and two modified Stop Work Orders to allow the recipient to demonstrate satisfactory technical results. The agreement was recommended for termination, and subsequently terminated, following a Critical Project Review meeting and site visit where staff determined the project could not be completed satisfactorily.	None
EPC-14-083 Prospect Silicon Valley	College of San Mateo Internet of Energy	The purpose of this project was to demonstrate and integrate solar PV, energy storage, and advanced power electronics within a single module to significantly increase overall efficiencies by minimizing conversion losses.	*2012-2014 Investment Plan* Technology Demonstration and Deployment	$402,626	The loss of two major subcontractors at different points in the project led to extensive delays and the loss of match funding and project demonstration site. Due to these losses, the project could not be completed within the agreement term. Prospect Silicon Valley agreed to a mutual termination of the agreement.	None

Source: Energy Commission

GLOSSARY

Term	Definition
AB	Assembly Bill
AR&D	applied research and development
ARPA-e	Advanced Research Projects Agency-Energy – a United States Department of Energy Program advancing high-impact energy technologies by providing funding, technical assistance, and market readiness
California ISO	California Independent System Operator
CO_2	carbon dioxide
CPUC	California Public Utilities Commission
Disadvantaged Community	A community that scores at or above 75% in the version of CalEnviroScreen that was available at the time of project application.
EPIC	Electric Program Investment Charge
EPRI	Electric Power Research Institute
FOA	Funding opportunity announcement
Frequency Regulation	The addition or subtraction of electrical energy into the grid to keep the frequency as close to 60 Hz as possible
HVAC	heating, ventilation, and air conditioning
IEPR	*Integrated Energy Policy Report*
IOU	investor-owned utility
Load Following	A technique to match and adjust the power available to the electrical load as the load demand for electricity fluctuates
NOPA	notice of proposed awards
Peak Shaving	A technique that is used to reduce electrical power consumption during periods of maximum demand on the power utility
PG&E	Pacific Gas and Electric Company
RD&D	research, development, demonstration, and deployment
SB	Senate Bill
SCE	Southern California Edison Company
SDG&E	San Diego Gas & Electric Company

Term	Definition
Smart grid	A smart grid is the thoughtful integration of intelligent technologies and innovative services that produce a more efficient, sustainable, economic, and secure electrical supply for California communities.
Smart inverter	An inverter with communications capability to send and receive messages that can ensure proper operation of the electric grid
TD&D	technology deployment and demonstration
U.S. DOE	United States Department of Energy
U.S. EPA	United States Environmental Protection Agency
WECC	Western Electricity Coordinating Council
ZNE	Zero-net energy

APPENDIX A:
Table of Energy Commission EPIC Requirements to Report for 2017

The Energy Commission is committed to full compliance with all guidance and requirements pertaining to its management of EPIC funds for the advancement of energy innovation. The following table lists Energy Commission responsibilities and requirements for administering EPIC for calendar year 2017. These requirements include those specified by the CPUC and by the Legislature in Senate Bill (SB) 96 (Committee on Budget and Fiscal Review, Chapter 356, Statutes of 2013).

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
Project Reporting Requirements in SB 96 (Committee on Budget and Fiscal Review, Chapter 356, Statutes of 2013) and D.13-11-025, Attachment 6 (D.13-11-025, ordering paragraph 23): A brief description of each project awarded or completed in the previous year, as well as an update for each project underway. Among other items, this includes: 1. The name of the recipient, project title, and date and amount awarded. 2. Comply with SB 96 (PRC §25711.5)(f)(1)-(6), provided later in the table.	This annual report identifies the required information for each EPIC project.	12/31/2017
CPUC project reporting requirements: Identify ratepayer benefits, any leveraged or matched funds, any intellectual property, and other information as specified in Attachment 6 of the CPUC final decision (D. 13-11-025 ordering paragraph 23), for each project. Specific formatting requirement for project status reports: "The information below must be reported electronically in spreadsheet format. Information for each project must be listed on separate rows in the columns specified" in Attachment 6.	This annual report identifies the required information for each EPIC project.	12/31/2017

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
CPUC information availability requirement: The EPIC administrators must, “except when valid reasons exist for confidentiality...make available upon request all data, findings, results, computer models and other products developed through the Electric Program Investment Charge program, consistent with the treatment of intellectual property requirements.” (D.13-11-025, ordering paragraph 13)	The Energy Commission will respond to all requests for information in accordance with any relevant confidentiality and intellectual property requirements. Requests for information on Energy Commission EPIC projects should be sent to RandDProjectinfo@energy.ca.gov .	As requested
CPUC project metric reporting requirements: The EPIC administrators "may choose metrics on a project-by-project basis from those included as Attachment 4 or additional metrics where appropriate. However, the Administrators must identify in the Electric Program Investment Charge annual report the metrics used for each project." (D.13-11-025, ordering paragraph 27).	This annual report identifies metrics used for each EPIC project.	12/31/2017
CPUC project reporting requirements: Submit a final report for every project completed during the previous year, including a comprehensive description of the project, detailed findings and results, a summary of all data collected, and how the data may be accessed (D.13-11-025, ordering paragraph 14).	Seven projects were completed in 2017. The final reports for these projects are or will be available at the Energy Commission website. See Table 11 Completed EPIC-Funded Projects in 2017, in this annual report for more information.	12/31/2017
CPUC project reporting requirements: Identify the use of noncompetitive awards (D. 13-11-025, ordering paragraph 15).	N/A. The Energy Commission did not issue noncompetitive bid awards in 2017.	12/31/2017
CPUC project reporting requirements: Provide a justification for every noncompetitive award made (D.13-11-025, ordering paragraph 18).	N/A. The Energy Commission did not issue noncompetitive bid awards in 2017.	12/31/2017

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
CPUC Annual Report Requirements: Follow the report outline agreed to by the EPIC administrators and DRA, and approved by the CPUC as contained in D. 13-11-025 Attachment 5 (D. 13-11-025 ordering paragraph 22).	This report follows the outline indicated in D.13-11-025 Attachment 5.	2/28/2018
CPUC Budget Requirements: 10 percent cap on administrative costs, excluding program evaluation costs (D.12-05-037, ordering paragraph 5). IOU in-house costs are not included in the 10 percent administrative cap (D.13-11-025, Conclusion of Law 40). D.13-11-025, ordering paragraph 31: "The administrative costs to grant and administer the Intellectual Property licenses and royalties are not subject to the Energy Commission's cap on the California Energy Commission's administrative budget for Electric Program Investment Charge."	Energy Commission administrative costs for 2012-2014 and 2015-2017 are less than the capped amount.	12/31/2017
CPUC Budget Requirements: 5 percent cap on fund shifting between the following category areas (D.12-05-037, ordering paragraph 14): applied research and development, technology demonstration and deployment, and market facilitation (D.12-05-037, ordering paragraph 12(b)(i) lists the program areas; program areas are defined in D.12-05-037 Findings of Fact paragraph 3, 4, and 6).	N/A. In 2017, the Energy Commission did not shift funds between funding categories or program areas.	12/31/2017
CPUC Budget Requirements: Report authorized budget (program administration and each category/program area), committed/encumbered funds (administration, program solicitations, and individual project awards), and amount spent. IOUs must also report in-house activities. All administrators must report uncommitted/unencumbered funds. (D.13-11-025, Attachment 5).	The annual report includes authorized budget, committed/encumbered project and administrative funds, amount spent, and uncommitted/unencumbered funds.	12/31/2017

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
CPUC Accumulated Interest Requirements: "Because the CEC cannot administratively return accumulated interest, the CEC must report the accumulated interest in arrears from the previous investment plan cycle, and the IOUs must reduce the amounts transferred to the CEC during the next triennial investment cycle by the reported accumulated interest amount and return an amount equal to the accumulated interest to ratepayers." (D.13-11-025, p. 105)	The report of accumulated interest for the 2012-2014 period was provided in the *2015 EPIC Annual Report*. The accumulated interest for the 2015-2017 period is provided in the *2017 EPIC Annual Report*.	2/28/2018
CPUC Annual Report Distribution Requirements: File annual reports annually on 2/28/13 through 2/28/20 with the CPUC's Energy Division Director (D. 12-05-037 ordering paragraph 16). Annual reports shall be served on all parties in the most recent EPIC proceeding, all parties to the most recent general rate case of each electricity utility named above, and each successful and unsuccessful applicant for an EPIC funding award during the previous calendar year (D. 12-05-037 ordering paragraph 16).	The Energy Commission prepared the service list for this annual report in coordination with the CPUC and the EPIC IOU administrators to ensure the distribution list meets these requirements.	2/28/2018
CPUC Annual Report Distribution (additional): The CPUC Commissioners approving the final decision "encourage the CEC to make its reports accessible to the public on its EPIC webpage and through its Public Advisor." (D.13-11-025, p. 64)	The Energy Commission will post the EPIC annual report on its EPIC Web page and make the report available through the Public Adviser's Office.	2/28/2018

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
CPUC EPIC Report Distribution: In Section 2.15 Annual Reports, CPUC D.13-11-025 states: "PRC Section 25711.5(e) requires the CEC to submit reports to the Legislature on its administration of the EPIC program. The CEC should promptly provide copies of each of these reports to the Commission through the Commission's Executive Director and Energy Division Director." (D.13-11-025, p. 63). In addition, in the section of the CPUC D.13-11-025 discussing treatment of intellectual property interests developed and royalties derived from EPIC-funded CEC grants and contracts (Section 2.18.1), the decision states: "As a condition of approving the CEC's 2012-2014 investment plan, we will require that the CEC provide the Commission (through the Commission's Energy Division Director) a copy of all reports prepared for the Legislature. (D.13-11-025, p. 71-72). In D.13-11-025 ordering paragraph 29(a): "The California Energy Commission (CEC) must: Provide to the Commission copies of the Electric Program Investment Charge (EPIC) reports to the Legislature required by Public Resources Code Section 25711.5(e)."	In progress.	Planned for completion prior to 4/30/2018
SB 96 (PRC §25711.5(a)): Award funds for projects that will benefit electricity ratepayers and lead to technological advancement and breakthroughs to overcome the barriers that prevent the achievement of the state's statutory energy goals and that result in a portfolio of projects that is strategically focused and sufficiently narrow to make advancement on the most significant technological challenges that shall include, but not be limited to, energy storage, renewable energy and its integration into the electrical grid, energy efficiency, integration of electric vehicles into the electrical grid, and accurately forecasting the availability of renewable energy for integration into the grid.	All EPIC-funded projects meet the requirements of SB 96 to benefit electricity ratepayers and lead to technological advancement and breakthroughs to overcome the barriers that prevent the achievement of the state's statutory energy goals.	12/31/2017

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
SB 96 (PRC §25711.5 (b)): In consultation with the Treasurer, establish terms that shall be imposed as a condition to receipt of funding for the state to accrue any intellectual property interest or royalties that may derive from projects funded by the EPIC Program. The Energy Commission, when determining if imposition of the proposed terms is appropriate, shall balance the potential benefit to the state from those terms and the effect those terms may have on the state achieving its statutory energy goals. The Energy Commission shall require each reward recipient, as a condition of receiving moneys pursuant to this chapter, to agree to any terms the Energy Commission determines are appropriate for the state to accrue any intellectual property interest or royalties that may derive from projects funded by the EPIC Program.	Energy Commission staff consulted with the State Treasurer's Office to establish terms and conditions for intellectual property and royalties for EPIC funding awards.	2/2/14
SB 96 (PRC §25711.5 (c)): Require each applicant to report how the proposed project may lead to technological advancement and potential breakthroughs to overcome barriers to achieving the state's statutory energy goals.	Each EPIC solicitation includes this requirement for each applicant project.	Included in first EPIC solicitation released in March 2014 and each solicitation thereafter.
SB 96 (PRC §25711.5(e)): Establish a process for tracking the progress and outcomes of each funded project, including an accounting of the amount of funds spent by program administrators and individual grant recipients on administrative and overhead costs and whether the project resulted in any technological advancement or breakthrough to overcome barriers to achieving the state's statutory energy goals.	Management tools are in place to comply with these requirements. Energy Commission staff uses Attachment 6 of D.13-11-025 to report annual progress and outcomes of each funded project, including the information required by PRC§ 25711.5, subparagraph (d).	12/31/2013

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
SB 96 (PRC §25711.5 (f)): Notwithstanding Section 10231.5 of the Government Code, prepare and submit to the Legislature no later than April 30 of each year an annual report in compliance with Section 9795 of the Government Code that shall include all of the following (see next rows):	This report, including information required by SB 96, will be considered by the Energy Commission for adoption before April 30. The Energy Commission will submit the adopted version of the report to the Legislature no later than April 30, 2018.	Planned for completion prior to 4/30/2018
SB 96 (PRC §25711.5 (f)(1)): A brief description of each project for which funding was awarded in the immediately prior calendar year, including the name of the recipient and the amount of the award, a description of how the project is thought to lead to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals, and a description of why the project was selected.	This report provides this information for the projects awarded EPIC funding in 2017.	12/31/2017
SB 96 (PRC §25711.5 (f)(2)): A brief description of each project funded by the EPIC Program that was completed in the immediately prior calendar year, including the name of the recipient, the amount of the award, and the outcomes of the funded project.	This annual report provides a link to this information for the projects completed in 2017.	12/31/2017
SB 96 (PRC §25711.5 (f)(3)): A brief description of each project funded by the EPIC Program for which an award was made in the previous years but that is not completed, including the name of the recipient and the amount of the award, and a description of how the project will lead to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals.	Projects awarded EPIC funds in 2017 are listed as required for PRC Section 25711.5(e)(1). The Energy Commission will continue to comply in 2018 and beyond.	12/31/2017
SB 96 (PRC §25711.5 (f)(4)): Identification of the award recipients that are self-reported California-based entities, small businesses, or businesses owned by women, minorities, or disabled veterans.	This report provides this information for projects awarded EPIC funds through December 31, 2017. Data were collected, and a summary of these data can be found in the attached 2017 EPIC Annual Report Project Status Report, Column AA.	2/28/2018

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
SB 96 (PRC §25711.5 (f)(5)): Identification of which awards were made through a competitive bid, interagency agreement, or sole source method, and the action of the Joint Legislative Budget Committee pursuant to paragraph (2) of subdivision (g) for each award made through an interagency agreement or sole source method.	Competitive bids were used for all projects awarded in 2017. The Energy Commission did not issue noncompetitive bid awards in 2017.	12/31/2017
SB 96 (PRC §25711.5 (f)(6)): Identification of the total amount of administrative and overhead costs incurred for each project.	Administrative costs for EPIC for calendar year 2017 are reported herein. This report includes administrative and overhead costs incurred for each EPIC project through December 31, 2017.	12/31/2017
SB 96 (PRC §25711.5 (g)): Establish requirements to minimize program administration and overhead costs, including costs incurred by program administrators and individual grant recipients. Each program administrator and grant recipient, including a public entity, shall be required to justify actual administration and overhead costs incurred, even if the total costs incurred do not exceed a cap on those costs that the Energy Commission may adopt.	Administrative costs for EPIC for calendar year 2017 are reported and justified herein. The Energy Commission has established electronic submissions for EPIC proposals, which reduces administrative costs.	12/31/2017
SB 96 (PRC §25711.5 (h)(1)): The Energy Commission shall use a sealed competitive bid as the preferred method to solicit project applications and award funds pursuant to the EPIC Program.	Competitive bids were used for all projects awarded in 2017. The Energy Commission did not issue noncompetitive bid awards in 2017. All other EPIC solicitations released in calendar year 2017 used a competitive selection process.	12/31/2017

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
SB 96 (PRC §25711.5 (h)(2)(A)): The Energy Commission may use a sole source or interagency agreement method if the project cannot be described with sufficient specificity so that bids can be evaluated against specifications and criteria set forth in a solicitation for bid and if both of the following conditions are met (see next two rows):	Competitive bids were used for all projects awarded in 2017. The Energy Commission did not issue noncompetitive bid awards in 2017.	12/31/2017
SB 96 (PRC §25711.5(H)(2)(i)): The Energy Commission, at least 60 days prior to making an award pursuant to this subdivision, notifies the Joint Legislative Budget Committee and the relevant policy committees in both houses of the Legislature, in writing, of its intent to take the proposed action.	N/A. Competitive bids were used for all projects awarded in 2017. The Energy Commission did not issue noncompetitive bid awards in 2017.	12/31/2017
SB 96 (PRC §25711.5(H)(2)(A)(ii)): The Joint Legislative Budget Committee either approves or does not disapprove the proposed action within 60 days from the date of notification required by clause (i).	N/A. Competitive bids were used for all projects awarded in 2017. The Energy Commission did not issue noncompetitive bid awards in 2017.	12/31/2017
CPUC Decision 12-05-037, requires the four EPIC Administrators (the Energy Commission, Pacific Gas and Electric Co., San Diego Gas & Electric Co., and Southern California Edison Co.) to consult with interested stakeholders no less than twice a year. CPUC Decision 15-04-020 (ordering paragraph 27) requires one of these two annual workshops to be an Electric Program Investment Charge Innovation Symposium (EPIC Innovation Symposium) intended to achieve the following: share progress, results, and future plans; improve coordination and understanding among administrators, parties, and the CPUC; raise awareness and visibility of EPIC investments; and, promote program transparency.	On October 18, 2017, Energy Commission staff joined the IOUs for the 2017 EPIC Fall Symposium. This public symposium provided an overview of EPIC program activities and showcased EPIC projects that support distribution system automation. The Energy Commission hosted the EPIC Innovation Symposium on February 7, 2018.	2/28/2018

Energy Commission Responsibility or Requirement	Status for Portion of the EPIC Funds Administered by the Energy Commission	Date Completed or Anticipated Completion Date
CPUC D. 15-04-020 ordering paragraph 6 requires the identification of specific CPUC proceedings addressing issues related to each EPIC project.	CPUC proceedings are identified for each project and are in Appendix B of each annual report.	12/31/2017
CPUC D. 15-04-020 ordering paragraph 24 requires that if there is an IOU and CEC joint project, the IOU shall report the project title and amount of IOU funding used for the joint project(s) and the CEC shall be responsible for all other substantive reporting.	N/A There were no IOU and Energy Commission joint projects in 2017	N/A
CPUC D. 15-04-020 requires that if an IOU administrator chooses to be a necessary partner on a CEC EPIC project the IOU may use its EPIC funds for those in-house costs and the IOU's reports shall identify the CEC project title and amount of IOU funding used, but the CEC shall be responsible for all other substantive reporting as with all its other projects (CPUC D. 15-04-020, page 53).	N/A There were no projects where an IOU was a necessary partner on an Energy Commission EPIC project in 2017	N/A

APPENDIX B: Project Write-Ups of All Active and Approved Energy Commission EPIC Project Awards

In 2017, the Energy Commission made 72 new project awards encumbering $134 million of EPIC Program funds. Overall, the Energy Commission has made 270 project awards, encumbering $530.57 million.[44] Appendix B provides an overview of the project write-ups for all active or approved projects in 2017. Each project write-up includes and expands upon the following information required in Attachment 5 to CPUC Decision 13-11-025:

i. Investment Plan Period (included in Investment Plan)
ii. Assignment to Value Chain
iii. Objective (included in Project Description)
iv. Scope (included in Project Description)
v. Deliverables (included in Project Description)
vi. Metrics
vii. Schedule (included in Project Term)
viii. EPIC Funds Encumbered
ix. EPIC Funds Spent
x. Partners (if applicable)
xi. Match Funding (if applicable)
xii. Match Funding Split (if applicable)
xiii. Funding Mechanism (if applicable)
xiv. Treatment of Intellectual Property (if applicable)
xv. Status Update

Additional items provided in each project write-up include:

i. Program Area and Strategic Objective
ii. Issue
iii. How the Project Leads to Technological Advancement or Breakthroughs
iv. Related CPUC Proceedings
v. Total Budgeted Administrative and Overhead Costs
vi. Number of Initial Passing Applicants/Bidders
vii. Rank of Selected Applicant/Bidder

44 This does not include two projects that were approved at an Energy Commission business meeting in 2015 and 2016 and later terminated by the recipient. No work was done on these projects and no funds were spent.

Contents

1. 300-15-004

Project Name:

Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions

[300-15-004]

Recipient/Contractor:

The Regents of the University of California on behalf of the Merced Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

California has traditionally depended heavily on hydropower as a flexible generation source. However, a warming climate will alter the magnitude and timing of precipitation and runoff, decreasing hydropower generation. Optimization models have been used as a tool to explore ways to maximize hydropower generation without increasing environmental effects. However, such models are of limited utility because they do not address the realities of legal and institutional constraints. Therefore, the purpose of this project is to make an optimization model that addresses the economic and environmental constraints on hydropower generation, as well as the legal imitations on these operations as well.

Project Description:

This research improves upon optimization models for hydropower operations by taking future climate conditions into account, under three greenhouse gas emissions scenarios, and compares the optimized model to a more realistic partial optimization model that considers legal and institutional constraints in hydropower management.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Prior studies of the trade-offs between cost-effective electricity generation and environmental protection have been based on unrealistic studies that do not take real-world policy constraints, such as legal and regulatory limitations into account. The models produced by this research will for the first time create "quasi" optimization models for hydropower generation that can take into account changes in precipitation and runoff due to a warming climate while sustaining downstream environments. These tools will inform decision-making in the context of trade-offs of electricity generation and environmental protection under a changing climate and relevant legal and regulatory constraints.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 2a, 3a, 3f, 4d, 5c

Lower Costs:

When environmental degradation of aquatic habitat reaches the point of conflict, it can lead to additional expenses for utilities to mitigate damages and defend prior action. Models like the one being developed in this project can assist decision-makers to plan in a way that prevents them from incurring those costs.

Greater Reliability:

Greater penetration of renewable energy in California's electricity grid relies in part on ancillary services from hydropower. As climate change influences precipitation and runoff and leads to diminishing hydropower generation, realistic decision support tools are needed to enhance energy production without increasing environmental degradation. The models produced in this study will be more realistic decision support tools to balance energy generation and environmental protection under a changing climate. .

Environmental Benefits:

Hydropower that provides energy and ancillary services to the grid generally depends on the diversion and retention of stream and river flows that may adversely affecting downstream ecosystems. This project will develop a tool to support decision making to balance low cost and reliable energy generation, regulatory and policy constraints and environmental protection.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $114,054	
EPIC Funds Encumbered: $650,000		**EPIC Funds Spent:** $5,141	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: United States Department of Energy : $12,500,000		**Leveraged Funds:** $12,500,000	
Funding Method: Non-competitive	**Funding Mechanism:** Contract-Interagency Agreement	**No. of Initial Passing Applicants/ Bidders:** N/A	**Rank of Selected Applicant/ Bidder:** N/A

If not the highest scoring applicant/bidder, explain why selected:

This interagency agreement (non-competitive) leveraged significant federal funds.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project is part of the U.S.-China Clean Energy Research Center for Water-Energy Technologies (CERC-WET), co-funded by the Department of Energy and the Government of China to partner on water-energy studies. This EPIC funded project *Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions* is one of three research endeavors addressing sustainable hydropower under a warming climate. Work on the project was delayed due to contract negotiations over terms and conditions. Efforts to develop an optimization model that will take into account different climate scenarios have begun, but have been delayed due to personnel changes.

2. 300-15-005

Project Name:

Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change

[300-15-005]

Recipient/Contractor:

The Regents of the University of California, Irvine Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Hydropower is an extremely important clean electricity generation option for California and its importance will grow as it is needed to alleviate the intermittent nature of wind and solar generation units as California continues to its goal of 50% renewables by 2030. At the same time, climate change, without proper management tools, can substantially degrade the availability of hydropower generation. Hydropower scheduling, and near short-term scheduling in particular, is one of the most crucial factors in reservoir operation and clean energy supply.

Project Description:

The main focus of this research project is to develop grid-wide forecasts of inflows and electricity demands based on ground sensors and remotely sensed data, with emphasis on the effects from temperature fluctuations on electricity demands, hydrologic conditions, and grid performance. Furthermore, the project improves the accuracy of an existing near real-time Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN) product, originally developed at UC Irvine's Center for Hydrology and Remote Sensing.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The advancement of tools for hydropower scheduling/prediction will facilitate power exchanges in the electricity markets, reduce unnecessary consumption of non-renewable energy sources, and increase the reliability of energy generation. California will be the study region so that the utility companies in California have the necessary support in their decision making process.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 3f, 5c

Greater Reliability:

More accurate and current information on streamflow will contribute to the increased confidence and higher efficiency of hydropower scheduling decisions generated by reservoir and hydropower dispatch models.

Environmental Benefits:

The improved accuracy of an existing near real-time PERSIANN tool will enable more efficient management of clean energy resources in California and will lead to improved resilience of water and energy systems to future climate change impacts. Improved hydropower management methodology will incorporate ecologically beneficial metrics for ecosystems to minimize adverse ecosystem impacts from the electricity generation.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $144,000
EPIC Funds Encumbered: $720,000	**EPIC Funds Spent:** $0
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: United States Department of Energy : $12,500,000	**Leveraged Funds:** $12,500,000

Funding Method: Non-competitive	**Funding Mechanism:** Contract-Interagency Agreement	**No. of Initial Passing Applicants/ Bidders:** N/A	**Rank of Selected Applicant/ Bidder:** N/A

If not the highest scoring applicant/bidder, explain why selected:

This interagency agreement (non-competitive) leveraged significant federal funds.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team established connections to UCLA and JPL to discuss how to improve PERSIANN output and use satellite data to generate more accurate precipitation/aerosol forecasts. The team published a peer-reviewed article about reservoir inflow forecasts with two case studies: one of which focused on California. The Energy Commission was acknowledged in the article (tp://onlinelibrary.wiley.com/doi/10.1002/2017WR020482/epdf).

The recipient is collecting aerosol data to begin to identify relevant PERSIANN outputs for regions of interest in California. The team will prepare and submit a manuscript to develop an enhanced artificial neural network as a modeling framework for the uses of (1) bias correction PERSIANN output, (2) developing short-term hydrometeorology forecasts, and (3) supporting reservoir and hydropower system decision making and management.

3. 300-15-006

Project Name:

Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction

[300-15-006]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

This project addresses three critical needs for the State of California: (1) Non-traditional waters are available in abundant quantities, but they cannot be used for most industrial, agricultural and municipal applications without the development of new approaches to manage contaminants; (2) Impacts of water conservation on power plants reliant on water for operation; and (3) Stream flow forecasts to date are considered inaccurate and pose a risk of misstating California water supply. Research is needed to illuminate which method or combination of methods will substantially improve forecasting skills and can be used in practical applications.

Project Description:

The purpose of this project is to fund research that reduces the stress on current water infrastructure in California. Research includes: (1) development of high water recovery desalination processes for non-traditional waters, (2) characterizing the potential for non-traditional water use in California, (3) development of recycled water scenarios for electricity generation, and (4) improving the characterization of California's snowpack.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Research conducted will develop flexible, integrated approaches to reduce energy use and costs associated with the use of non-traditional waters, and minimize the volume of waste water produced from their treatment. In addition, the contract will provide guidance on the "best-fit" technologies for California based on geographic area, energy resources and water quality available. Additional research will provide reliability benefits include improving water forecasting scenarios pertaining to recycled water for electricity generation and snowpack forecasting for hydropower operations.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 4a, 4c, 4d, 5a, 5c

Lower Costs:

This project could provide lower energy costs associated with the treatment of non-traditional waters.

Greater Reliability:

This project will provide greater reliability by improving forecasting methods used to predict water resource availability for electricity generation.

Environmental Benefits:

By reducing energy costs associated with treatment of non-traditional water, the project could reduce greenhouse gas emissions.

Energy Security:

This project will improve energy security by expanding on potential sources of water for cooling towers used in electricity generation. Additionally, improved forecasting will allow better water resource management for both cooling towers and hydroelectric generation.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $198,000	
EPIC Funds Encumbered: $1,130,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: United States Department of Energy : $12,500,000		**Leveraged Funds:** $12,500,000	
Funding Method: Non-competitive	**Funding Mechanism:** Contract-Interagency Agreement	**No. of Initial Passing Applicants/ Bidders:** N/A	**Rank of Selected Applicant/ Bidder:** N/A

If not the highest scoring applicant/bidder, explain why selected:

This interagency agreement (non-competitive) leveraged significant federal funds.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

A stakeholder workshop was held in August 2017 with both DOE and all the UC/LBNL project managers associated with the CERC-WET (China Clean Energy Research Center for Water-Energy Technologies) project. Work continues to progress after a temporary delay due to uncertainty around federal funding. There are ongoing internal webinars to provide project status updates to DOE and the Energy Commission project managers.

4. 300-15-007

Project Name:

California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative - Technical Consulting

[300-15-007]

Recipient/Contractor:

California Clean Energy Fund dba CalCEF Ventures

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan 2015-2017 Triennial Investment Plan	4/20/2016 to 3/1/2023

Program Area and Strategic Objective:

Applied Research and Development

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies

Applied Research and Development

S10: Advance the Early Development of Breakthrough Energy Concepts

Issue:

In the past, energy entrepreneurs have had trouble securing very early stage funding for potential breakthrough technologies even if those technologies would merit significant follow-on funding after the proof-of-concept is completed. Additionally, entrepreneurs with technology concepts often do not have adequate access to the mentoring, technical consulting, and business services that they need to successfully bring their technology to market.

Project Description:

The CalSEED Initiative helps develop California's next generation of clean energy entrepreneurs, providing two levels of seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough solutions that will benefit electric ratepayers in Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric service territories.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

CalSEED addresses a critical gap in the early technology development phase where small amounts of funding can have a significant impact in bringing new ratepayer-beneficial innovations to market by providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough clean energy solutions.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Smart grid: R.08-12-009 Smart Inverter: D.14-12-035 (in R.11-09-011) Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3e

Lower Costs:

The CalSEED Initiative will prove out the early technical merits and commercial potential of new energy technology concepts, helping validate whether these concepts merit larger funding amounts.

Economic Development:

The CalSEED Initiative fills important niche in the energy innovation space by providing initial small grant funding to energy entrepreneurs to prove out their technology concept. The results can be used to attract private sector interest and funding for their energy technology venture.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,563,250
EPIC Funds Encumbered: 2012-2014 Plan: $9,788,043 2015-2017 Plan: $20,211,957 Total: $30,000,000	**EPIC Funds Spent:** $523,899
Match Partner and Funding Split: California Clean Energy Fund dba CalCEF Ventures: $1,367,604 (4.1 %) Elemental Excelerator: $100,000 (0.3 %) The Grant Farm, Inc.: $267,591 (0.8 %) Los Angeles Cleantech Incubator: $1,040,000 (3.1 %) Greenlining Institute: $68,700 (0.2 %) Umberg Zipser: $552,328 (1.7 %)	**Match Funding:** $3,396,223
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** N/A	**No. of Initial Passing Applicants/ Bidders:** 5 out of 7 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The CalSEED Initiative was launched in January 2017 to provide seed grants of up to $150,000 for early-stage clean energy projects. Grants totaling $4.2 million have been awarded to 28 entrepreneurs this year for a range of research projects including a new lithium extraction process, a high-efficiency electric power grid control device, and a membrane that removes CO2 while reducing HVAC load.

5. 300-15-008

Project Name:

Research Roadmap for Getting to Zero Net Energy Buildings

[300-15-008]

Recipient/Contractor:

Itron Inc., which will do business in California as IBS

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 5/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies

Issue:

The CPUCs Long-Term Energy Efficiency Strategic Plan calls for all new residential construction and all new commercial construction in California to be Zero Net Energy (ZNE) by 2020 and 2030, respectively. Additionally, AB 758 requires the Energy Commission, in collaboration with the CPUC and stakeholders, to develop a comprehensive program to achieve greater energy efficiency in existing buildings. An up-to-date gaps analysis that summarizes the current ZNE technologies available, what research needs still exist, and the market barriers hindering ZNE technology adoption is needed to inform the development of that comprehensive program.

Project Description:

Itron is working with Energy Commission staff to develop a gaps analysis that identifies, describes and prioritizes research, development, demonstration, and deployment (RDD&D) gaps that need to be addressed to achieve the state's goals for Zero-Net Energy (ZNE) buildings in a safe, equitable and cost-beneficial manner. The gaps analysis is being developed in consultation with stakeholders and subject matter experts through interviews, written comments, and public workshops.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is analyzing the most critical RDD&D gaps that need to be addressed to achieve California's goals of zero net energy buildings for all new construction of residential buildings by 2020 and commercial buildings by 2030. Results of the analyses will be used to strategically target future EPIC investments in a manner that provides optimal benefits to IOU electric ratepayers, and maximizes the use of public research and development investments.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 3e

Lower Costs:

This project will help identify the most promising R&D opportunities that will benefit IOU electric ratepayers; and ensure future R&D funding opportunities leverage and do not duplicate current research underway.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $171,332	
EPIC Funds Encumbered: $999,884		**EPIC Funds Spent:** $28,751	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** N/A	**No. of Initial Passing Applicants/ Bidders:** 5 out of 6 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement 300-15-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: After completing a comprehensive literature review of zero net energy research, the recipient conducted a stakeholder survey designed to understand the research needs surrounding ZNE technology. The survey received over 550 responses the largest ZNE focused survey ever conducted. Stakeholders felt that technologies such as battery storage and grid integration merited technology research much more than lighting or appliance efficiency. As the project continues, more granular detail about the performance and cost targets will be identified. For more information, visit: http://zneroadmap.researchenergy.net/			

6. 300-15-009

Project Name:

Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities [300-15-009]

Recipient/Contractor:

Navigant Consulting, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan 2015-2017 Triennial Investment Plan	6/13/2016 to 3/31/2021

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

Emerging energy technologies sometimes fail to be commercialized because of: difficulty entering the market, inability to find an optimal first customer, and inability to the address what end users actually want. To become viable in the market place, companies need market knowledge and support to develop products that meet customer needs, are cost competitive compared to existing products, and have viable path-to-market strategies that target appropriate early adopters.

Project Description:

This contract will provide market analysis that will address the barriers that hamper commercial development of emerging energy technologies. Tasks under this work authorization contract could include tracking past and current award EPIC technology solutions to monitor successes, more accurately consider future EPIC funding opportunities, inform technology gap analyses, and develop online resources. The deliverables from this project will help prioritize future Energy Commission funding towards technologies that solve the addressed issues.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Recommendations resulting from this agreement will help the Energy Commission better direct EPIC Program technologies towards addressing customer needs and becoming widespread, commercial products.

CPUC Proceedings addressing issues related to this EPIC project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 2a, 3e

Lower Costs:

This project will increase the likelihood that technologies funded through the EPIC Program are successfully commercialized.

Economic Development:

Market research will provide information to develop technologies, or recommend use of technologies that meet customers' needs that will move the technologies to market faster. Moving technologies to market enables job creation improved business models, and market opportunities for technology developers.

Consumer Appeal:

Market research will help better design products and research initiatives to address customer needs, increasing the attractiveness of these products in the marketplace.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $3,302,587
EPIC Funds Encumbered: 2012-2014 Plan: $6,825,763 2015-2017 Plan: $112,126 Total: $6,937,889	**EPIC Funds Spent:** $266,156
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** N/A	**No. of Initial Passing Applicants/ Bidders:** 3 out of 4 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has five work authorization projects:

1. Market Research on Microgrids- review commercial viability of microgrids in California without government support.
2. Benefits Methodology for the Regional Energy Innovation Clusters- evaluate the benefits accomplished by the Regional Energy Innovation Cluster agreements.
3. Needs Assessment for an online portal to support the Energy Innovation Ecosystem- define priorities for an online platform to support the Energy Innovation Ecosystem agreements.
4. Investing in DACs (in progress)- recommend strategies that have been piloted to overcome barriers to mass deployment of DER in existing buildings in DACs.
5. DER Innovations in California's Food Processing Industry- identify and recommend technologies that will reduce costs, increase efficiency, and reduce emissions for California's food processing industry.

7. 300-15-010

Project Name:

Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors

[300-15-010]

Recipient/Contractor:

Energetics Incorporated

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/20/2016 to 5/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies

Issue:

California's industrial, agriculture, and water sectors use nearly 30 percent of all energy consumed in the state. Industry must keep operating costs low, while maintaining environmentally clean and energy-efficient operations. Agriculture is highly dependent on electricity for irrigation and post-harvest food processing, and water-energy intensity varies across the state. New analysis is needed to identify and prioritize research and development gaps for advancing energy technologies and strategies that can benefit electric ratepayers through innovation in the agriculture, industrial, and water sectors.

Project Description:

Energetics Incorporated is working with Energy Commission staff and in consultation with stakeholders and subject matter experts to develop a technical assessment and gaps analysis that identifies, describes and prioritizes key research, development, demonstration, and deployment needs for achieving the state's goals for advancing technologies in the industrial, agricultural, and water sectors.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is analyzing the most critical RDD&D gaps in the industrial, agricultural, water and bioenergy sectors that need to be addressed to achieve California's goals for doubling energy efficiency by 2030. Results of the analyses will be used to strategically target future EPIC investments in a manner that provides optimal benefits to IOU electric ratepayers, and maximizes the use of public research and development investments.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 2a, 3e

Lower Costs:

Identifying research gaps will help prioritize research and lower costs for end users. Establishing end-users' demands for service outputs will enable research to focus on those areas in which new innovations can make the largest impact, driving down costs while increasing technology efficacy and water and energy efficiency for these sectors.

Environmental Benefits:

The industrial sector's share of California's energy consumption in 2013 amounted to nearly one quarter of the total state energy consumption, and in 2008, total irrigation consumption for California farms amounted to 7,129 million gallons. Targeted research will help mitigate the electricity and water usage of California's IAW sectors.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $122,646
EPIC Funds Encumbered: $647,728	**EPIC Funds Spent:** $185,494
Match Partner and Funding Split: Energetics Incorporated: $16,860 (2.5 %) TSS Consultants: $10,000 (1.5 %) Taylor Biomass Energy, LLC: $1,500 (0.2 %) Renewable Oil International LLC: $750 (0.1 %)	**Match Funding:** $29,610
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** N/A	**No. of Initial Passing Applicants/ Bidders:** 3 out of 4 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

After completing a comprehensive literature review on technologies and strategies in the industrial, agricultural and water sectors, the recipient conducted a stakeholder survey designed to understand the research needs surrounding IAW technology. The survey was distributed to over 200 individuals and will help inform a series of 19 webinars designed to illicit further stakeholder input.

8. 300-15-011

Project Name:

California Commercial End-Use Survey

[300-15-011]

Recipient/Contractor:

ADM Associates, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/15/2016 to 3/30/2020

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

A commercial end-use survey is used to calculate various estimates including: commercial floor space, annual whole building energy use, end-use fuel saturations, and annual whole-building hourly load profiles. Various parties throughout California have indicated interest in having forecasts of energy use that are more granular, disaggregated to the local or regional service territory level. The potential for uncertainty and inaccuracy in forecasting increases as the degree of forecasting granularity increases if the data being used do not fully support the granularity. The Energy Commission can reduce this inaccuracy in energy forecasts with a more extensive disaggregation of data.

Project Description:

This project is (1) developing a methodology to conduct a survey of the characteristics of commercial utility customers that will serve as a baseline and support the Energy Commission's work on the demand forecast, (2) implementing the survey, and (3) providing an unbiased, comprehensive analysis of the data. The Commercial End-Use Survey (CEUS) is facilitating the commercial success and market adoption of technologies, strategies, and other innovations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The Commercial End-Use Survey and saturation study activities will provide a more disaggregated sampling of the state's end-uses in the commercial sector, than was historically collected. This level of granularity will lead to more accurate energy forecasts which can assist in keeping rates low as forecasts are used to determine infrastructure needs in long term procurement planning by the CPUC. Furthermore, the data can assist the state in achieving the energy efficiency reduction goals outlined in Senate Bill 350 by supporting the identification and accurate characterization of opportunities for demand-side management, energy efficiency program planning, load shifting, and demand response.

CPUC Proceedings addressing issues related to this EPIC project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 1c, 2a, 5c

Lower Costs:

This project can lead to reduced costs by leading to a more accurate demand forecast for the commercial sector. This can lead to more certainty on base-line end-use consumption and provide a better input into the CPUC's Long-Term Procurement Planning efforts so that only the generation that is truly needed will be planned and procured.

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $3,426,324
EPIC Funds Encumbered: $7,990,063	**EPIC Funds Spent:** $0
Match Partner and Funding Split: ADM Associates, Inc.: $100,893 (1.2 %)	**Match Funding:** $100,893
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** N/A	**No. of Initial Passing Applicants/ Bidders:** 4 out of 4 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The contractor has had many challenges recruiting the California electric investor owned utilities' (IOUs) participation in providing customer billing data necessary to conduct the survey. The contractors began with an initial survey sample in the San Diego Gas & Electric service territory and expect to expand to the other IOU service territories within the next six months.

9. 300-15-013

Project Name:

California Investor-Owned Utility Electricity Load Shapes

[300-15-013]

Recipient/Contractor:

ADM Associates, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/29/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S21: Inform Investments and Decision-Making Through Market and Technical Analysis.

Issue:

Informed electricity generation and transmission decisions require accurate hourly load projections for electricity that account for the impact of demand-side measures and changing customer trends. The Energy Commission, in its current analysis, applies hourly load profiles based on historic patterns to the demand forecast to develop projected hourly usage. These load profiles, however, do not take into account any changes to the mix of end-uses that would be brought on by emerging trends or expected demand-side policies.

Project Description:

This project will develop analysis to characterize existing and future electricity load in the service territories of Pacific Gas & Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company that will inform the Energy Commission's demand forecast. This information will, by including a mix of emerging energy trends and demand-side innovations, be used to identify and target opportunities to further reduce cost, improve safety, and improve reliability through clean energy technology research, development, deployment, and market facilitation opportunities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

DER technology has advanced significantly over the past decade and current loadshapes used to inform the Energy Commission's demand forecast do not account for the current and future deployment of demand-side innovations. Developing improved loadshapes will provide an accurate assessment of the contributions of clean energy technologies to reducing peak demand, integrating renewable energy, and maintaining electricity system reliability as the deployment of clean energy technologies and strategies increases over time. This information will be used to improve the Energy Commission's demand forecast and analysis, and identify and target opportunities for future EPIC research funding to further reduce cost, improve safety, and improve reliability.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 1c, 5c

Greater Reliability:

This project can lead to reduced costs by leading to a more accurate demand forecast for typical usage of appliances and equipment, building type, and implemented demand-side policies. This can lead to more certainty on base-line end-use consumption and provide a better input into the CPUC's Long-Term Procurement Planning efforts so that only the generation that is truly needed, will be planned and procured.

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $430,673
EPIC Funds Encumbered: $1,147,406	**EPIC Funds Spent:** $124,715
Match Partner and Funding Split: ADM Associates, Inc.: $58,330 (4.8 %)	**Match Funding:** $58,330
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** N/A	**No. of Initial Passing Applicants/ Bidders:** 5 out of 5 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was approved at the June 2016 Business Meeting and received approval from the Department of General Services in August 2016. The Recipient and Energy Commission staff has begun the first technical task of examining available data that can be used to develop the baseline load profiles. In 2017, the project is expected to finish collection of all necessary data and begin development of baseline load profiles and the impact of different scenarios.

10. EPC-14-001

Project Name:

Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart

[EPC-14-001]

Recipient/Contractor:

Itron Inc., which will do business in California as IBS

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/15/2015 to 6/29/2018

Program Area and Strategic Objective:

Applied Research and Development

S4: Develop Emerging Utility Scale Renewable Energy Generation Technologies and Strategies to Improve Power Plant Performance, Reduce Costs, and Expand the Resource Base

Issue:

Solar is an intermittent resource, and accurate prediction of when and how this fluctuating renewable resource can be used is essential for grid operators. Increasingly accurate forecasting tools have been developed in recent years, but they have yet to be fully implemented into grid operations to optimize operations for high-penetration solar. Furthermore, none of the California ISO load forecast models include and capture the impact of behind-the-meter solar PV on measured loads. The limitation of integrating state-of-the-art solar forecasts into net-load forecasts is based on the absence of estimates to determine the value of utilizing improved PV solar forecasts into grid operations.

Project Description:

This project improves solar forecasts for grid-connected PV in California, uses those improved forecasts to create enhanced net-load forecasts, and applies these enhanced forecasts to reduce scheduling errors for utilities and the California Independent System Operator (CAISO). Furthermore, this project quantifies the value of improved forecasts for utilities and grid operators. Therefore, this work will reduce the operational uncertainty behind the Duck Chart by producing high accuracy solar generation forecasts for utilities and the CAISO, and linking these generation forecasts to methods for forecasting net loads at higher temporal resolution. This increased fidelity and connection to net load forecasts will provide critical insights to better manage the rapidly evolving grid in California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project reduces resource scheduling uncertainty for California utilities and CAISO by improving solar forecasts, integrating those forecasts into enhanced net-load forecasts, and implementing the forecasts to quantify specific improvements and cost savings. Currently, the CAISO uses a Baseline Load Forecast Model to calculate measured electricity loads of 15 minutes ahead to 10 days ahead, without measuring either in real time or ex post BTM solar PV generation. This project evaluates alternative model approaches for extending the California ISO load forecast framework for incorporating BTM solar PV to improve the load forecast accuracy of the California ISO's existing load forecast models.

CPUC Proceedings addressing issues related to this EPIC project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 4a, 5c

Lower Costs:

Improved net load forecasts reduce the cost of grid regulation required to cover increasing load forecast errors. By reducing the percentage error by just 0.1 percent, the California ISO and California ratepayers can save more than $2 million per year. Therefore, the estimated annual savings resulting from use of the improved forecasts vary from $1.5M to over $7M. As the installed capacity of behind-the-meter PV increases, the annual savings will likely increase. The BTM solar forecast model provides the load model a more accurate prediction, which reduces the cost of operating the electric grid.

Greater Reliability:

The project increases system reliability by significantly increasing the accuracy of solar PV forecasts and the associated net load forecasts. This integration of state-of-the-art solar forecasts into net-load forecasts further enables the growth of PV because it solves the problem that behind the meter (BTM) solar causes to the load model. BTM forecast makes the electric grid more robust, such that it is prepared to adopt distributed generation at any future rate.

Environmental Benefits:

Reduced requirements for regulation services and spinning reserves will help reduce GHG emissions by an estimated 2.7 million tons per year through reduced use of natural gas fired peaker plants.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $998,926	**EPIC Funds Spent:** $273,248
Match Partner and Funding Split: Itron, Inc., dba IBS: $451,062 (31.1 %) Clean Power Research: $2,400 (0.2 %)	**Match Funding:** $453,462
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 18 out of 18 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement

Terms and Conditions.
Update: Researchers evaluated three alternative model approaches for extending the CAISO load forecast framework and present the alternative load forecast frameworks for incorporating BTM solar PV forecasts. The study *Improving Short-Term Load Forecasts by Incorporating Solar PV Generation* is available in the Energy Commission publication database. Furthermore, the project team has integrated irradiance measurements to improve aerosol optical depth and cloud albedo aspects of the solar forecasting model, incorporated near real-time metered PV generation data to fine-tune fleet forecasts of both grid-connected and BTM PV solar and implemented regional PV fleet forecasting model improvements. Currently, Itron is investigating forecast errors and quantifying their costs, and developing a neural network with machine learning algorithms to identify the best forecasts to use in a specific time.

11. EPC-14-002

Project Name:

Investigating Flexible Generation Capabilities at the Geysers

[EPC-14-002]

Recipient/Contractor:

Geysers Power Company, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/5/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S4: Develop Emerging Utility Scale Renewable Energy Generation Technologies and Strategies to Improve Power Plant Performance, Reduce Costs, and Expand the Resource Base

Issue:

Electric system operators are concerned about large quantities of intermittent energy sources being reliably integrated onto the grid. While geothermal energy has served to provide a steady level of baseload energy, reducing impacts of intermittent energy will require quickly dispatchable sources of generation with the flexibility to ramp up or down as needed. Modifying geothermal operations to provide this flexibility would be valuable to system operation. However physical and operational issues are associated with providing such flexible generation from geothermal facilities.

Project Description:

This project is investigating how the operation of Geysers geothermal facilities may be modified in order to address the greater demands imposed on the grid by the significant addition of intermittent resources. To do so, the project is developing an integrated model that simulates the effects of providing flexible operation on the reservoir, wells, pipelines, and power plants. The model is being tested at isolated wells, pipeline and power plant sites, and then at a cross-tied location, to determine the effects of flexible operation on the larger steam field. Results will be used to identify risks to structure and operations. Management and mitigation strategies needed to address specific flexible generation objectives will be identified and tested at a variety of representative problem areas. An evaluation of management strategies and costs will be developed to provide flexible generation and ancillary services.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Integrated computer model simulations along with actual field testing at a geothermal well will identify the effects and risks of flexible operation and the management and mitigation strategies needed to cost-effectively operate the Geysers to provide the flexible capacity needed to integrate renewable energy onto the grid. Costly turbine redesign are avoided through appropriate strategies corresponding to the degree of curtailment, i.e. from small load to extreme curtailment, such as the combination of throttling of steam flow, controlling steam production, and use of a bypass system to directly vent steam to the atmosphere.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Resource Adequacy (RA): R.11-10-023 [Closed] Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 2a, 4a, 5a, 5b

Lower Costs:

Increased flexibility and increased renewable generation will result in lower electricity cost to ratepayers.

Greater Reliability:

If successful, geothermal facilities will have electric generation flexibility allowing integration of intermittent resources and leading to greater reliability.

Environmental Benefits:

Improved geothermal flexibility and increased generation from other renewable resources reduces fossil fuel generation, reducing air pollutants and greenhouse gas emissions.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $3,000,000		**EPIC Funds Spent:** $981,427	
Match Partner and Funding Split: TBD-Major Mechanical Contractor: $2,071,190 (28.1 %) TBD-Reservoir Engineering Contractor: $16,400 (0.2 %) TBD-Major Mechanical Equipment Supplier : $659,223 (9.0 %) Geysers Power Company, LLC: $1,615,560 (21.9 %)		**Match Funding:** $4,362,373	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 18 out of 18 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In late 2016 the agreement was amended to extend the project term by 12 months in response to the disruption by the September 12, 2015 California wildfire, known as the Valley Fire. The project activities were resumed with the modified schedule. On March 7, 2017, a combined CPR and TAC meeting was held on site to discuss the project progress. At the meeting, the Recipient's technical staff presented and discussed several modeling scenarios that were performed to determine how the constraints at the wells impact the generation flexibility. With the modeling phase of the project now complete, the focus is currently on Turbine Bypass work together with installing instrumentation in the steam field for pilot testing. An article on the project was featured in the September-October GRC Bulletin.

12. EPC-14-003

Project Name:

Low- Cost Thermal Energy Storage for Dispatchable CSP

[EPC-14-003]

Recipient/Contractor:

The Regents of the University of California on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/15/2015 to 3/15/2018

Program Area and Strategic Objective:

Applied Research and Development

S4: Develop Emerging Utility Scale Renewable Energy Generation Technologies and Strategies to Improve Power Plant Performance, Reduce Costs, and Expand the Resource Base

Issue:

There is a growing problem facing the California electric grid as more and more electricity is being generated by renewable resources such as wind and solar. While there are many benefits to these resources, by their nature, they are 1) unable to match power production to usage, and 2) highly variable and/or intermittent in their production when compared to traditional electricity sources. A possible solution to these issues is increased use of thermal energy storage (TES) with concentrating solar power (CSP). Unfortunately, current TES technologies are prohibitively expensive and difficult to dispatch.

Project Description:

The purpose of this project is the development and demonstration of a cost-optimal, robust, and low-cost thermal energy storage (TES) fluid, elemental sulfur. Use of sulfur as a TES fluid will enable overall low system costs, long lifetime, and scalability for a wide range of concentrating solar power (CSP) applications and temperatures.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop a low-cost thermal storage fluid, elemental sulfur, which enables overall low system costs, long lifetime, and scalability for a wide range of concentrating solar power applications.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Energy storage: R.15-03-011 Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 3h, 4a, 4b

Lower Costs:

This project aims to reduce the cost of TES to $15/kWh. Compared to current state-of-the-art, this leads to a decrease in LCOE from 3 cents/kWh to 0.4 cents/kWh, providing $0.66 billion to $1.32 billion in annual savings depending on CSP penetration.

Greater Reliability:

Use of TES allows excess harvested solar energy to be stored during the day to be used during peak or non-solar hours, which increases dispatchability of renewable resources and provides load shifting.

Economic Development:

Assuming 5% to 10% penetration of CSP and deployment beginning in 2017, the 10-year net present value of this technology is estimated to be between $680 and $906 million.

Environmental Benefits:

Assuming 5% to 10% penetration of CSP and 1010 MWh of TES by 2020, significant GHG and criteria air pollutant reductions would be achieved: 2791 ton/MW of CO2, 37 ton/MW of SO2, 5 ton/MW of NOx, and 2.4 ton/MW of CO.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $198,528	
EPIC Funds Encumbered: $1,497,024		**EPIC Funds Spent:** $406,076	
Match Partner and Funding Split: Southern California Gas Company: $300,000 (16.7 %)		**Match Funding:** $300,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 18 out of 18 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project has made significant progress including performing detailed heat transfer modeling and simulation, laboratory-scale material compatibility experiments, and laboratory-scale thermal battery testing. Results from the laboratory-scale (10 kWh capacity) system were very promising. The system was successfully operated at high temperature (600 degrees Centigrade) over multiple thermal cycles and demonstrated higher energy density and faster dynamic response (amount of time to charge and discharge) compared to conventional molten salt technology. Future work will design, build, and field test a pilot-scale (30 kWh capacity) thermal battery system at a concentrating solar power facility. Testing the system in a real-world environment is critical to proving it can work with actual solar energy input.

13. EPC-14-005

Project Name:

Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid

[EPC-14-005]

Recipient/Contractor:

The Regents of the University of California, San Diego

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/15/2015 to 3/15/2018

Program Area and Strategic Objective:

Applied Research and Development

S4: Develop Emerging Utility Scale Renewable Energy Generation Technologies and Strategies to Improve Power Plant Performance, Reduce Costs, and Expand the Resource Base

Issue:

The variable nature of solar power is of concern to electric grid operators in California. If short-term solar variability cannot be predicted or reduced, the integration cost of solar power increases through investment in energy storage or regulation capacity by the grid operator. Especially at the microgrid and distribution feeder level, the geographic diversity is less available and solar generation is the primary contributor to net load variability, causing voltage issues affecting service quality and reliability.

Project Description:

This project aims to integrate high-accuracy solar forecasting to optimize the operation of distributed energy resources, and utilize the value of solar forecasting in utility grid operations to improve grid reliability, reduce ratepayer costs and increase safety. The objectives are to apply forecasts to inform control and scheduling decisions for distributed energy resources with emphasis on energy storage and electric vehicle charging control at warehouse photovoltaic clusters in the LA-Orange-Riverside-San Bernardino-San Diego Counties as well as the UCSD microgrid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The uncontrollable generation of renewable energy sources, such as solar photovoltaics poses numerous challenges to the electric grid. The large growth of electric vehicles (EV) has potential to exacerbate those challenges due to increases in load, especially at inopportune times. However, the flexibility of scheduling EV charging around forecasted PV production provides a solution to this problem. Furthermore, the project aims to improve solar energy forecast accuracy by 45% over the existing persistence forecast method to optimize the operation of distributed energy resources. It will mitigate the concerns of electric operations over the variable nature of solar power that contributes to net load variability, causing voltage issues affecting service quality and reliability.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Smart grid: R.08-12-009 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1c, 4a, 5c

Lower Costs:

The integrating tool developed in this project is expected to lower the energy cost by increasing the accuracy of forecasts and developing strategies to reduce electricity peak demand, such as optimization of EV charging schedule, that will generate utility bill savings for savvy customers and lowering operating costs for the grid operator. This tool contributes to a better utilization of existing generation resources and transmission and distribution (T&D) assets, unbundling of EV driver‘s behavior or economical preferences, and lower consumer cost per kWh. The energy cost reduction is estimated at $6.8 million/year per 100 MW of DERs.

Greater Reliability:

The project integrates high-accuracy solar forecasts to distributed energy resources (DERs) and provide the grid operators and balancing authorities the information needed to optimize operations leading to a more responsive and reliable operation of the grid. This integrating tool contributes to a peak load reduction of about 37MW per 100 MW of DERs.

Economic Development:

The tool and strategies developed in the project have the potential of boosting the economic activities associated with the optimized use of distributed solar energy resources and the reduction of grid net load variability. The economic benefits are the improvements in system operation efficiencies, and the creation of skilled people and local jobs that contribute to the advancement toward a green economy.

Environmental Benefits:

Optimized use of distributed solar energy technologies will lead to reduced water consumption and greenhouse gas (GHG) emissions in the energy generation sector. Furthermore, adoption of electric vehicles (EV) as alternative to fixed storage devices will contribute to reduced materials wastes and air pollutant overall. The GHG and NOx Reductions are estimated at 52,194 and 3.1 MT/year per 100 MW of DERs, respectively.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $157,282
EPIC Funds Encumbered: $999,984	**EPIC Funds Spent:** $66,475
Match Partner and Funding Split: San Diego Gas & Electric Company: $250,000 (12.5 %) Strategen: $93,614 (4.7 %) Itron, Inc. dba IBS: $483,032 (24.2 %) University of California, San Diego, San Diego Supercomputer Center: $173,338 (8.7 %)	**Match Funding:** $999,984

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$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
18 out of 18 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 2: Ranked # 1</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-14-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
Results of the intra-hour and ramp solar forecasts using a sky imaging network demonstrated that fisheye cameras can be applied as low-cost primary instrumentation for irradiance and forecasting purposes over wider geographical areas with limited loss of measurement accuracy and forecasting skills. Furthermore, researchers investigated and quantified the value of using solar forecasting to optimally schedule EV loads within a real microgrid. A total of 49 EVs with realistic arrival and departure periods were scheduled every day, considering realistic day ahead PV forecasts. The whole market sale use case was economical only during periods of extreme price peaks and low charging load. The results showed that accurate forecasts of PV production combined with flexible loads has the potential for improved system health and reduced costs.</td></tr>
</table>

14. EPC-14-007

Project Name:

Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area

[EPC-14-007]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Davis campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/15/2015 to 12/31/2017

Program Area and Strategic Objective:

Applied Research and Development

S4: Develop Emerging Utility Scale Renewable Energy Generation Technologies and Strategies to Improve Power Plant Performance, Reduce Costs, and Expand the Resource Base

Issue:

Large, rapid changes (ramps) in wind power production are one of the most significant renewable integration issues for balancing authorities. If not effectively managed, these ramps can impose reliability issues and additional costs on the electric system. Accurate forecasting of wind ramps can ameliorate these impacts. However, this remains difficult because of the complexity of the meteorological processes that drive wind ramps. This is particularly challenging in the Tehachapi Wind Resource Area (TWRA) with its large amount of installed capacity, lack of spatial diversity in generation assets, and complex multi-scale wind patterns across the complex terrain.

Project Description:

This project comprises coordinated atmospheric field measurements and computational modeling improvements to improve the accuracy of prediction of short-term wind ramps (i.e. large, rapid changes in wind power production). The Tehachapi Pass Wind Resource Area is the focus of the project. Since the area features complex terrain and meteorology, the findings can be readily adapted and applied to many other regions.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Improvements to accuracy of short-term (3-15 hours) and very short-term (0-3 hours) wind ramp forecasting would reduce generating reserves scheduled by grid operators, with corresponding decreases in grid operating costs and greenhouse gas emissions, and, simultaneously, increased grid reliability.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 3b, 5c

Lower Costs:

Reducing wind forecast error by a little as 10% will reduce annual grid integration costs by $28 million in the WECC (which includes California) at 14% wind penetration, and as much as $100 million annually at 24% wind penetration.

Greater Reliability:

This project will foster greater grid reliability by more accurately forecasting short-term wind energy ramps.

Environmental Benefits:

Developing more accurate wind forecasting will foster greenhouse gas reductions through accurate predictions of available wind energy and reduction of needed generating reserves.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $247,542
EPIC Funds Encumbered: $1,000,000	**EPIC Funds Spent:** $814,246
Match Partner and Funding Split: Department of Mechanical and Aerospace Engineering - UC Davis: $90,325 (8.3 %)	**Match Funding:** $90,325
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 18 out of 18 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has completed the measuring program that included sodar, ceilometer, radiometer, radar wind profiler, and radio acoustic sounder measurements scattered over six sites and completed a forecast sensitivity study of wind ramping behavior based on suite of physics-based predictive models versus observed sodar data, including obtaining results for a sensitivity study of observed bias of mean absolute error of 0-15 hour energy forecast for Tehachapi wind resource area.

15. EPC-14-008

Project Name:

High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)

[EPC-14-008]

Recipient/Contractor:

The Regents of the University of California, San Diego

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/15/2015 to 3/15/2018

Program Area and Strategic Objective:

Applied Research and Development

S4: Develop Emerging Utility Scale Renewable Energy Generation Technologies and Strategies to Improve Power Plant Performance, Reduce Costs, and Expand the Resource Base

Issue:

Accurate forecasting tools for solar irradiance and solar power output have the potential to increase the reliability of California's energy supply, and the ability to optimize the dispatch of energy sources by reducing the uncertainty created by fast-changing weather conditions. High fidelity solar forecasting is an enabling technology for increasing solar penetration into the grid. However, there is a lack of well-developed forecasting models for components of solar irradiance that are critical to concentrating solar technologies, especially Direct Normal Irradiance (DNI) and Plane of Array (POA), and current high-density ground telemetry is still expensive for many solar power plants.

Project Description:

The purpose of this project is the development and validation of tools capable of monitoring and forecasting DNI and POA irradiance and the power generation accurately, from 5 minutes out to 72 hours in the future, mainly at the Ivanpah Solar Thermal plant, but also at the California Valley Solar Ranch (CVSR) plant. The project also includes the development of tools for predicting wind speed, which affects the heliostats' deployment, and improve the power generation forecast via Resource-to-Power Model (RTP) for Ivanpah CSP and CVSR (Tracking PV) plants. The goal of this system is aimed at reducing uncertainties associated with operation, regulation and scheduling of Ivanpah. The new forecast models will be used as a feed forward input to the RTP model in the solar field controls system that will enable the solar field to preemptively position itself for weather transients.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project introduces a new generation of forecasting methods that fill in a technology gap in prediction DNI, POA irradiance and solar power generation from PV tracking and CSP. This critical need is evident by the relative scarcity of DNI forecasting algorithms discussed in scientific literature and the absence of DNI information from the majority of NWP models. The development of a network of low-cost sensors for distributed monitoring at California Valley Solar Ranch (CVSR) provides a solution to the need for high-density ground telemetry at low cost. The devices provide an unprecedented level of irradiance sensor density, which will be used to develop a new generation of solar forecasting methods. Short-term forecast using sky imagers and distributed data from sensor network improves forecasted data and prepares CVSR for the California ISO intra-hour market.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 California Solar Initiative: R.12-11-005

Applicable Metrics: CPUC Metrics- 1c, 4a, 5c

Lower Costs:

The project developed and validated models that lead to lower operation costs and consumer cost per solar kWh due to: 1) increased ability to absorb short-term ramps and maintain solar production, 2) better utilization of ancillary generation, 3) enhanced capacity of utility-scale CSP power plants due to improved prediction of resource and power output, 4) better integration of solar assets with utility and ISO operations, and 5) decreased down-time tripping events due to solar variability.

Greater Reliability:

The tools developed in this project result in greater reliability by developing high-fidelity models that increase the accuracy of solar energy forecasting to decrease the number of forced outages and associated ancillary reserves.

Economic Development:

The forecasting tools developed in this project will help economic development by reducing solar power plant operating cost by more than 10% and having the ability to substantially affect the effective solar capacity in California. Additionally, the project has created skilled jobs and prepared talented people with research skills for the California job market.

Environmental Benefits:

The project will result in GHG emission reductions by decreasing the uncertainty associated with solar power generation to diminish the need of fossil fuel generation.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $168,624	
EPIC Funds Encumbered: $999,898		**EPIC Funds Spent:** $560,818	
Match Partner and Funding Split: NRG Energy, Inc.: $460,000 (26.1 %) Itron, Inc. dba IBS: $304,019 (17.2 %)		**Match Funding:** $764,019	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 18 out of 18 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-14-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: Researchers assessed the performance of the forecasting models using common error metrics as a function of the forecast horizon (intra-hour, intra-day, day-ahead) and found that the increased ground data results in substantial forecast accuracy improvements. Forecast accuracy improvement intra-hour are 10.2% DNI and 34.1% POA. The resource-to-power models developed and validated for Ivanpah will be implemented in real-time and will use forecasted DNI. Furthermore, the surface wind forecast developed for Ivanpah prevents the heliostats from proper alignment and determines how far a cloud can move in a given time. These two models will also be implemented for CVSR. Additionally, a network of low-cost sensors has been installed for distributed monitoring at the California Valley Solar Ranch (CVSR) power plant. The devices provide a solution to the need for high-density ground telemetry.

16. EPC-14-009

Project Name:

Optimizing Radiant Systems for Energy Efficiency and Comfort

[EPC-14-009]

Recipient/Contractor:

The Regents of the University of California on behalf of the Berkeley campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Application of radiant systems has increased in recent years, as they provide an opportunity to achieve energy and peak demand savings compared to conventional all-air systems. Despite this growth, controls and operation of radiant systems can be challenging due to a lack of familiarity within HVAC design and operation professions. Radiant systems are being designed, installed, and operated with only limited guidance and inappropriate tools to assist designers and building operators. New and/or revised definitions and methods for the design, sizing, and control of effective radiant cooling and heating systems are needed.

Project Description:

This project develops new design and operation tools for radiant cooling and heating systems in order to provide a standardized guidance for radiant systems in commercial buildings. The agreement includes full-scale laboratory experiments, whole-building simulations, development of simplified models for radiant system controls, validation of these new methods in field studies, occupant satisfaction surveys, and an update to Title-24 for radiant systems. The project is expected to produce: 1) a simplified tool for calculating the cooling load and cooling capacity of a radiant slab system, including calculation methods with significant direct solar radiation, 2) a simplified online operational tool for radiant slab systems, and 3) updates to the Title 24 Alternative Calculation Method Reference Manual to enable improved modeling capabilities of radiant systems.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Radiant systems can be an integral part of ZNE and other advanced high performance buildings and reduce energy and peak energy use and cost compared to conventional HVAC systems.

CPUC Proceedings addressing issues related to this EPIC project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 4a

Lower Costs:

The technology could reduce energy consumption and costs in California commercial buildings, as much as 844 GWh/yr and $165M/yr.

Environmental Benefits:

The technology could reduce CO2e emissions due to reductions in energy use for cooling California commercial buildings.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $450,466
EPIC Funds Encumbered: $2,939,964	**EPIC Funds Spent:** $1,761,095
Match Partner and Funding Split: Center for the Built Environment - UC Berkeley: $239,194 (7.4 %) Price Industries: $60,000 (1.9 %)	**Match Funding:** $299,194
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has developed a simulation platform to allow fast simulation of a radiant system coupled with arbitrary control logic sequences to conclusively identify the most appropriate control strategies for thermally massive radiant systems, and to inform field study implementations. Field studies at three different sites are under way, and the field study reports are expected mid- and late-2018.

17. EPC-14-010

Project Name:

Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation

[EPC-14-010]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	3/30/2015 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Increasing the albedo (solar reflectance) of a building's envelope reduces solar heat gain in the cooling season. Raising envelope albedo can also cool the outside air, boosting energy savings and demand reduction by decreasing the air temperature difference across the building envelope. Lowering urban surface and air temperatures improves air quality by slowing the reactions that produce smog, and delays global warming through negative radiative forcing ("global cooling"). Current data are insufficient to accurately predict savings impacts for different cool wall materials; which prevents cool wall technology from being included in building standards or utility rebate programs.

Project Description:

This project (a) quantifies the energy savings, peak demand reduction, urban cooling, and air quality improvements attainable from cool walls in California; (b) assesses the performance of existing cool wall technologies, and develops innovative cool wall solutions; and (c) facilitates collaboration among government agencies, utilities, and industry to create a cool-wall infrastructure that includes application guidelines, a product rating program, incentives, and building code credits.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project is advancing scientific knowledge by quantifying the potential benefits of cool walls, assessing the performance of existing and prototype cool wall technologies, and developing innovative cool wall solutions. High wall albedo can be attained with a reflective coating (e.g., paint or stucco) or cladding. Cool wall products available today include light-colored paints that reflect up to 80% of sunlight when new, but may lose reflectance as they soil; and darker "cool colored" paints that come in a wide palette, but typically reflect less than 50% of sunlight when new. The purpose of this project was to evaluate the direct and indirect energy and environmental benefits of solar reflecting walls, assessing and advancing available and emerging cool wall technology.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)
Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 4a, 5d

Lower Costs:

Solar-reflective “cool” walls reduce absorption of sunlight by the building envelope, which may decrease cooling load in warm weather and increase heating load in cool weather. Changes to annual HVAC energy use depend on climate, wall construction, wall orientation and other factors. Decreasing cooling load will directly reduce customer bills for air conditioning. It could also reduce electricity generation costs when incorporated into the Load Forecast, procurement requirements. Project results show that cool walls can reduce whole-building annual HVAC energy use 3.0% to 25% in single-family homes, 0.5% to 3.7% in medium offices, and 0.0% to 9.0% in standalone retail stores.

Environmental Benefits:

By reducing space conditioning load, annual power plant emissions could be reduced, with consequent reductions in greenhouse gas emissions as well as nitrogen oxides and sulfur dioxide.

Public Health:

Reduced electrical load would lower the risks of grid failure and potential loss of air conditioning, and morbidity/mortality on hot, sunny days. Cool walls will also reduce urban air temperatures, helping mitigate extreme heat events and air pollution episodes.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $908,941
EPIC Funds Encumbered: $2,500,000	**EPIC Funds Spent:** $2,204,820
Match Partner and Funding Split: _3M: $7,600 (0.2 %) BEHR: $33,000 (1.1 %) Metal Construction Association: $88,100 (2.8 %) PPG Industries: $100,000 (3.2 %) Saint-Gobain: $90,000 (2.9 %) Tex-Cote: $10,000 (0.3 %) Valspar: $270,000 (8.7 %) Sherwin Williams: $12,100 (0.4 %)	**Match Funding:** $610,800
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-14-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions. Pre-existing intellectual property identified in agreement EPC-14-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The project is on track on all tasks. The project team met on October 25, 2017 with their project partners and technical advisory committee members to present research results and outline the project's next steps. The project is nearing completion; lab and field studies have been completed, as have the simulation and modeling projects to estimate impacts under different conditions. Also nearing completion is the task of developing the metrics, tools and resources to support creation of a cool walls advisory organization similar to the Cool Roofs Rating Council that would oversee independent testing and rating of commercial products in support of potential building standards. Remaining tasks include completion of the final report

18. EPC-14-011

Project Name:

From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions [EPC-14-011]

Recipient/Contractor:

Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/1/2015 to 3/19/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Adoption of lighting emitting diode (LED) lighting for general illumination is poised to be the largest advancement in lighting building efficiency during the 21st century. A variety of market actors have introduced LED products and made performance claims that have set the technology up with unrealistic performance expectations. LED manufacturers have focused on research into efficacy cost at the expense of quality, resulting in an influx of poor quality LED products with minimal options such as color and dim ability. This has led to a lack of consumer satisfaction, and resulting minimal market share for LED products in key indoor residential and commercial applications.

Project Description:

This project focuses on the design and development of innovative LED lighting solutions for three key general illumination product categories. These solutions are a best-in-class medium, screw-base replacement lamp, linear tubular light emitting diode (TLED) replacement lamps and spectrally optimized, dedicated LED luminaires. Product design requirements are based on consumer light quality and functional performance preferences determined through a series of unique laboratory-based consumer preference and product characterization studies.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project could improve understanding of metrics and test procedures associated with LED quality and performance, increase lamp manufacturer's ability to comply with future energy codes and standards and produce good quality LED products and increase consumer acceptance and satisfaction of LED lamps.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The LED products developed could result in direct electricity and peak demand reduction and cost savings for consumers by an estimated 30%.

Environmental Benefits:

As lighting constitutes 20-30 percent of the electrical use in buildings, the development and

deployment of the developed LED products could reduce electricity use and CO2 emissions.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $557,072
EPIC Funds Encumbered: $2,995,187	**EPIC Funds Spent:** $930,637
Match Partner and Funding Split: Regents of the University of California, Davis - California Lighting Technology Center: $5,000 (0.2 %)	**Match Funding:** $5,000
Leverage Contributors: California Lighting Technology Center - UC Davis : $5,000	**Leveraged Funds:** $5,000

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Project is on track and expected to complete all deliverables on time and within budget. Researchers completed the selection process for products in the lamp characterization study using the test methodology selection guidelines. The recipient completed the lighting performance and function experiment, over 20 participants from all ages were included in the experiment. Preliminary results of the lamp characterization study and the performance and function experiment is posted on the California Lighting Technology Center website https://cltc.ucdavis.edu/. In addition, the research team is working with multiple lighting manufacturers interested in collaborating on new LED lamp development such as optics, quality and architecture.

19. EPC-14-012

Project Name:

Comparing Attic Approaches for Zero Net Energy Homes

[EPC-14-012]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	3/30/2015 to 12/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

As homes approach zero net energy (ZNE), the energy impacts of some emerging construction strategies need investigation to determine their energy impacts. One strategy is to seal and insulate the attic that contains the home's thermal distribution system. However there are questions regarding the level of air sealing and insulation needed, the impact on attic humidity and potential for attic or roof damage, and the overall impact on annual building energy use.

Project Description:

The project focuses on the performance of different attic assemblies and their associated heating, ventilating and air conditioning (HVAC) systems. Field measurements of attic and HVAC system performance are conducted in two new high performance homes in California with sealed and insulated attics. One home will be built to be about 30 percent better than Title 24 and the other is a ZNE home. The attic insulation approach involves a new lower-cost approach using blown insulation that does not use expensive spray-foam. The results of the measurements are used directly to provide technical support for potential changes to Title 24 and provide information to contractors and builders on sealed and insulated attic performance and alternative approaches.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement by offering alternative construction techniques for sealing and insulating attics, compared to conventional methods. The alternative technique involves the use of sealed attics and could lead to electricity savings and peak demand savings when compared to conventional duct systems, and also increase occupant comfort. The recipient is working with building developers on these new techniques which will contribute to achieving ZNE goals for new construction. The techniques can also be applied to home retrofits with HVAC equipment.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The technologies and construction techniques could result in significant reduction in heating and cooling energy cost which is estimated to be 15 percent for new construction and 25 percent for retrofits.

Environmental Benefits:

A 15 percent reduction in energy use associated with unvented attics could result in reductions in greenhouse gas emissions. Assuming 10 percent of new homes are built with the attic approaches recommended in this study, approximately 5,000 metric tonnes of CO2 will be reduced.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $563,439	
EPIC Funds Encumbered: $1,000,000		**EPIC Funds Spent:** $1,000,000	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Recipient has completed over one year of monitoring at a new ZNE home in Fresno and one summer of monitoring at an existing home that is 30% better than Title 24 in Clovis. Data collection will continue through 2018. Over 100 sensors were installed per home, monitoring temperature, relative humidity, heat flux, surface condensation, moisture and HVAC energy use. An improved version of a sophisticated and mature model called Register Capacity (REGCAP) will be validated. Once validated, this model will be used to extend results to all of California's 16 climate zones. The second technical advisory committee meeting and the second critical project review were held in September 2017.

20. EPC-14-013

Project Name:

Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts [EPC-14-013]

Recipient/Contractor:

The Regents of the University of California on behalf of the Berkeley campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	8/25/2015 to 3/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Air velocity and air flow are currently measured using devices such as hot-wire anemometers or are inferred from pressure measurements. These are inaccurate, failure-prone, and often expensive. They limit the applications in which air speeds and their associated energy flows are measured in buildings, causing very large energy costs and health risks.

Project Description:

This project is developing low-cost, low power, accurate, calibration-free, and compact airflow sensors (anemometers) for measuring: (1) room airflow in occupied commercial buildings; and (2) volumetric air flow in heating, ventilation and air conditioning (HVAC) systems. The technology saves energy by using the collected data to correct wasteful HVAC malfunctions that result in inefficient systems and uncomfortable buildings. The anemometers are wireless, able to be inexpensively installed in existing buildings, operate on a battery for years and communicate wirelessly via the internet to the building's control system. The device also senses temperature, and its orientation and location.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Air movement in buildings impacts comfort and ventilation, air quality, occupant health and safety, and is responsible for about half of the energy used in HVAC (11 percent of California's total energy). Currently, airspeed and airflow in buildings cannot be effectively measured due to the expense, power draw, directional sensitivity, and fragility of existing sensors. Communicating wirelessly with the building's control system, these low cost anemometers facilitate more efficient operation of building HVAC systems, resulting in an anticipated savings of 183 GWh/yr and 52,000 metric tons CO2e/yr.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 3a, 4a

Lower Costs:

Estimated savings of $26 million per year in reduced energy bills for building owners/occupants, and reduce operations and maintenance costs, assuming technology applicability in 25-75% of buildings, a 10-15% potential for savings on all HVAC related energy use, and market penetration of 5-25%

Greater Reliability:

HVAC systems can be turned off when measured airflow indicates ventilation requirements have been met, resulting in improved system operation, power reliability, and reduce grid impacts.

Increase Safety:

Safety of occupants is improved when ventilation air is accurately measured, as inaccurate pressure sensors often lead to reduced zone ventilation rates, and malfunctioning outside air dampers often do not provide sufficient minimum outside air.

Economic Development:

This project will provide work for 17 individuals in California for a total of 42,683 hours over the course of 3.5 years. The mature technology has the potential to create high tech manufacturing jobs in California.

Environmental Benefits:

Estimated savings of 112,000 metric tons of carbon dioxide/yr, assuming technology applicability in 25-75% of buildings, a 20-30% potential for savings on all HVAC related energy use, and market penetration of 5-25%.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $595,177	
EPIC Funds Encumbered: $2,488,964		**EPIC Funds Spent:** $986,646	
Match Partner and Funding Split: Price Industries: $40,000 (1.5 %) BAF Technologies Inc.: $45,000 (1.6 %) Chirp Microsystems, Inc.: $120,000 (4.4 %) Center for the Built Environment - UC Berkeley: $14,000 (0.5 %) Vigilent: $30,000 (1.1 %)		**Match Funding:** $249,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-14-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: As of December 2017, the research team has tested both the 4-sensor spherical room anemometer prototype and the dual wand duct anemometer in laboratory test beds to assess signal processing. The tests revealed impacts from light, temperature and humidity on velocity readings. Both designs were revised, including adding special shaping mechanisms or "horns" to focus and amplify sound from certain angles; the room anemometer uses an omnidirectional horn, and the duct flow anemometer's horn is bidirectional. A TAC meeting was held in May, and the team met separately with a company potentially interested in commercialization. The anemometer prototypes were presented and demonstrated at the CBE Industry Advisory Board meeting in late October. In December, the team gave three research partners anemometer prototypes, user interfaces and associated hardware to test in their facilities.

21. EPC-14-015

Project Name:

Direct Current as an Integrating and Enabling Platform

[EPC-14-015]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/15/2015 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Despite the potentially significant benefits of direct current (DC) and alternating (AC)-DC hybrid building systems over traditional AC-powered electric systems, DC and AC-DC buildings face a number of technical and institutional barriers to their adoption. Policymakers and building developers who wish to explore opportunities and pathways to incorporate DC and AC-DC hybrid systems, lack independent baseline information and tools to inform their policy-making, designs and deployment decisions. As a result, they are hesitant to move forward on promoting and implementing the early adoption of DC and AC-DC hybrid systems.

Project Description:

This project is evaluating DC and AC-DC hybrid applications to determine market segments where projects are technically and economically feasible. The research covers existing and new buildings. For the market segments identified, the Team is developing and piloting tools to help building developers incorporate these systems into their building designs. The tools include DC and AC-DC hybrid design guidelines, and design templates.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The potential energy savings and interoperability advantages of DC and AC-DC hybrid systems are estimated to be significant, especially for zero net energy (ZNE) buildings that integrate on-site renewable energy with battery storage and electric vehicle (EV) charging. Prior research estimates energy savings potential of 10% to 30% for DC-powered ZNE buildings that incorporate storage and or EV charging. This project will help accelerate the adoption of DC and AC-DC hybrid applications by compiling existing knowledge, identifying standards and technology gaps, designing tools and identifying a path forward to help ensure successful outcomes for DC and AC-DC hybrid applications in key market segments from which these systems can scale.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

Use of DC power will avoid unnecessary power conversions, improving efficiency, and eliminating the need for some conversion equipment. Total energy savings are estimated to be $800 million over a ten year period, assuming full penetration of DC distribution in all buildings

that install PV between 2015 and 2024.

Greater Reliability:

DC power has a long history of reliability in the telecommunications sector. Similar improvement is expected for DC power use in buildings. DC power use in buildings will improve reliability by eliminating failure in power conversion equipment.

Environmental Benefits:

Reduction in energy use could result in reductions in greenhouse gas emissions. Also, eliminating the need for some conversion equipment could reduce the cost of PV, storage and other related systems.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $495,365	
EPIC Funds Encumbered: $1,000,000		**EPIC Funds Spent:** $1,000,000	
Match Partner and Funding Split: California LMCC IBEW-NECA: $50,000 (4.5 %) EMerge Alliance: $50,000 (4.5 %)		**Match Funding:** $100,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

As of January 2018, the project is on budget and ahead of schedule. A paper titled "DC Appliances and DC Power Distribution: A Bridge to the Future Net Zero Energy Home", based on project findings, was presented at the 2017 EEDAL Conference. A stakeholder workshop was held to solicit input on market and technology assessment, concluding: DC power can save energy; despite increasing activity and interest, DC power in buildings is relatively immature; and a systems approach to DC in buildings that encompasses all potential energy

and non-energy benefits is lacking. Additional activities include completion of a DC schematic designs review meeting, the project's final technical advisory committee meeting, and a briefing of Energy Commission Title 24 staff on relevant findings that could impact future standards. Technical tasks are complete and final project deliverables are being drafted.

22. EPC-14-016

Project Name:

Cost- and Energy-Efficient Attic Designs for California Homes

[EPC-14-016]

Recipient/Contractor:

BIRAenergy

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/29/2015 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

In 2013, new California home construction totaled 85,310 units; 36,878 single family units and 48,432 multifamily units. An estimated 90% of the single family homes had the heating, ventilation and air conditioning (HVAC) equipment and ductwork (ducts) in the temperature extremes of ventilated attics. California homes place the HVAC and ducts in the attic to avoid using valuable living space. Placing ducts in the attic makes duct installations easier and less expensive. However, this practice results in wasted energy estimated at about 4.8 TWh and significant carbon emissions estimated at 1.2 million metric tons of equivalent carbon dioxide emissions (CO2e) each year.

Project Description:

This project demonstrates, evaluates, tests and refines three different attic designs in new California home construction. The project recommends the best approaches to home builders addressing cost-effectiveness and energy-efficiency. The baseline will be the current energy efficiency code practices for ventilated roof attics with no additional attic insulation and ducts within the attic that comply with the current energy code requirements for ducting.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Methods to improve the efficiency of building envelopes have included sealed, insulated attics as well as standard vented attics but are in limited use in the market today. However, these approaches add considerable cost to builders under current practices. The research team is employing new and novel installation methods and materials that have the potential for energy savings on par with ducts in the conditioned space, but at a cost similar to current construction practices.

CPUC Proceedings addressing issues related to this EPIC project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The project could lower energy cost to ratepayers by developing attic assemblies that allow ducts to perform as if they were located in the "conditioned space" and reduce HVAC energy costs. Pilot work on the attic designs have demonstrated that these approaches can

potentially be cost neutral to ratepayers. Assuming a market penetration of 73% of the current single-family market, new construction with these designs could potentially recoup the costs to ratepayers within a single year.

Environmental Benefits:

The new attic designs could save 3700 metric tons of CO2e per year in newly built California homes.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $228,148
EPIC Funds Encumbered: $1,000,000	**EPIC Funds Spent:** $733,217
Match Partner and Funding Split: Owens Corning: $265,000 (20.9 %)	**Match Funding:** $265,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The researchers completed all of the laboratory research and have submitted the corresponding reports entitled "Attic Moisture Management", "Air Sealing Junction of Exterior Wall and Attic", and "Optimize Insulation and Guidelines for Netting Permeance in Sealed Insulated Attic." The researchers have procured monitoring equipment for the project field test, and installed monitoring equipment in the attics of four new homes in Rio Vista in the Fall of 2017. One of the homes is a Title 24 energy code compliant control home that will serve as a baseline. A draft research plan has been prepared and the researchers are working with their builder partner to coordinate the construction, instrumentation and monitoring phases.

23. EPC-14-017

Project Name:

Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy

[EPC-14-017]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/1/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

The greatest difficulty in deploying advanced and intelligent lighting control systems is the lack of multi-vendor interoperability and standard user interface elements. Building owners may have multiple lighting systems that cannot be controlled by whole-building automation because of different user interfaces, and replacing working lighting systems in order to use whole-building automation is costly.

Project Description:

The recipient is developing low-cost lighting components with open communication interfaces that allow seamless integration into whole-building control and automation systems. The project targets future California Building Energy Efficiency Standards (Title 24), and establish methods by which the site-specific configuration and operation of networked lighting controls systems can be effectively addressed, and more easily implemented in the marketplace.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The research focus is on low cost sensing and distributed intelligence that will enhance energy efficiency because it will enables distributed points of controls that will result in greater energy savings and more accurate energy reporting. The research will design and develop a new innovative desk lamps with localized sensing and user control of overhead ambient lighting. This innovative technology alters the lighting retrofit landscape by inexpensively enabling highly granular lighting control at the occupants fingertips (previously only zone-level control existed), to control overhead lighting. In addition, this technology can be enhanced with sensors to measure occupants Circadian lighting exposure to enable system control to ensure human health and productivity is optimized while maximizing energy efficiency attributes.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The technology could reduce energy consumption and costs associated with lighting energy use in commercial buildings by an estimated 40%. Additionally, one of the goals is to develop low cost lighting components which could facilitate easier implementation into the marketplace.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $216,162	
EPIC Funds Encumbered: $1,875,000		**EPIC Funds Spent:** $1,354,000	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 6
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-14-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: As of the last technical advisory committee and critical project review (CPR)meetings, the project is on track to complete all deliverables on time and on budget. Standard data models for connected lighting systems were developed. Communication protocols, methodologies, metrics and control testing for the outcome-based lighting systems are still in progress. FlexLab testing is still monitoring Enlighted's networked lighting control system and comparing reported data types. Draft proposed content for user interface standards was circulated to industry for comments. The second and last CPR is scheduled for April 2018.			

24. EPC-14-021

Project Name:

Development and Testing of the Next Generation Residential Space Conditioning System for California

[EPC-14-021]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 12/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Cooling and heating of buildings to achieve comfortable temperature and humidity levels accounts for a large portion of the electricity bills for Californians. The building sector awaits the promise of novel energy-efficiency technologies that will decrease operating costs of space-conditioning equipment and increase comfort. Many of the technologies that deliver efficiency exist, but are not integrated into a single HVAC system, nor are they optimized for California climates.

Project Description:

This project will develop a next-generation residential space-conditioning system optimized for California climates. The advanced efficiency solutions integrated into the HVAC system will include: variable-capacity compressor and variable-speed fans using state-of-the-art inverter technology; integrated ventilation to harness fresh air for "free cooling;" intelligent dual-fuel technology to decrease energy cost and empower consumers to choose between electricity and natural gas; zonal control to prevent conditioning of unoccupied rooms; demand-response interactivity to grid flexibility and reliability; advanced fault detection and diagnostics to ensure proper installation, operation, and maintenance; and alternative refrigerants for improved operation and significant reductions in the potential for global warming.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop a climate optimized HVAC system that includes advanced energy efficiency features. The technology could reduce electricity use, demand and costs, enhance occupant comfort, and allow the use of alternative refrigerants that reduce the potential for global warming.

CPUC Proceedings addressing issues related to this EPIC project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010

Applicable Metrics: CPUC Metrics- 1e, 1f, 1g, 1h, 4a

Lower Costs:

This technology is estimated to reduce electricity usage by 725 GWh per year, or approximately $108 million annually. In addition the fault detection and diagnostic feature could help reduce operation and maintenance costs on HVAC equipment.

Greater Reliability:

The technology is estimated to reduce peak demand by 1.5 GW which could reduce impacts to the grid.

Environmental Benefits:

The technology is estimated to reduce greenhouse gas emissions by 193,000 metric tons of CO2 emissions annually due to reductions in energy use.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,072,105
EPIC Funds Encumbered: $2,993,005	**EPIC Funds Spent:** $856,557
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $322,281 (9.7 %)	**Match Funding:** $322,281
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 8

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient completed its second round of lab testing and shared the results in the second Critical Project Review, held on October 16, 2017. The final phase, field testing, has already begun. There are three test sites for this project, one in each electric IOU territory. Equipment will be installed into these test homes by the end of 2017. Data collection for a year is underway.

25. EPC-14-022

Project Name:

The Lakeview Farms Dairy Biogas - To - Electricity Project

[EPC-14-022]

Recipient/Contractor:

ABEC #3 LLC, dba Lakeview Farms Dairy Biogas

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 5/14/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

The reasons in favor of dairy-based bioenergy generation systems are compelling; however, many factors hinder their financing, development, demonstration, and deployment. Important factors are the economics and that dairy farmers lack expertise in electricity generation and are not interested in becoming energy managers. California Bioenergy and some dairy farmers in the San Joaquin Valley are pursuing an ownership structure, in which multiple dairies pool their interest across multiple biogas electricity and fuel production projects. This model could be used for California dairy farms interested in dairy biogas systems, but concerned about the economic and technical risks.

Project Description:

ABEC #3 LLC, DBA Lakeview Farms Dairy Biogas is installing and demonstrating an innovative covered lagoon digester system that will process dairy manure into biogas to generate renewable electricity for export to the electricity distribution grid. This particular project is located near 11 other dairies and will help launch the state's first "hub-and-spoke" dairy digester cluster by preparing the 1 MW generator platform to accept 2 MWs of future capacity potentially utilizing biogas from neighboring dairies and providing a means to off-take gas for vehicle fuel use. This hub and spoke approach was initially proposed in a case study prepared for the USDA on the economic feasibility of dairy digester clusters in California. The idea is to allow the dairies to benefit from the aggregation of capital investment and reduce operation and management costs by centrally locating the generators and associated electrical equipment.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will significantly reduce methane emissions and generate renewable electricity helping to achieve the State's GHG emission reductions and renewable electricity goals. Demonstrating the effectiveness of the innovative hub and spoke model could lead to the development of more California dairy digester biogas-to-electricity and biogas-to-fuels projects. The improved digester design will decrease dairy operating costs and provide valuable co-products, such as nutrient-rich, more absorbable irrigation water.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 3a, 4a, 4e

Lower Costs:

The project aims to demonstrate a system that ultimately reduces dairy digester project costs by participating in electricity energy markets and taking advantage of economies of scale from the planned hub and spoke build-out.

Environmental Benefits:

The project will deploy new renewable power generation and destroy methane gas currently vented into the atmosphere. The double-lined lagoon enhances groundwater protection by minimizing leaching of manure into underlying groundwater. The project estimates the Carbon Offsets that would likely be generated over the project's 10 year crediting period at 144,090 tonnes CO2e gross based on ARB's Livestock Protocol.

Consumer Appeal:

The project will improve odor control, through hydrogen sulfide removal, an issue important to the dairy employees and benefits the local community.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $32,107	
EPIC Funds Encumbered: $4,000,000		**EPIC Funds Spent:** $3,369,242	
Match Partner and Funding Split: ABEC #3 LLC, dba Lakeview Farms Dairy Biogas: $4,500,000 (52.9 %)		**Match Funding:** $4,500,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

California Bioenergy LLC Lagoon Digester Systems. Propriety designs, processes, expertise and operational procedures include, for example, developed digester systems to support gas storage, energy storage, flexible liquid and gas volumes, co-digestates, clustered generator configurations, H2S reduction, improved effluent value, farmer savings, and integration with

fuel programs.
Update: The project is progressing and broke ground in fall 2016 and construction is complete. A TAC was held in October 2017 followed by a CPR in November. The project accepted a PG&E 20-year Power Purchase Agreement and began testing in fourth quarter 2017 with full operation and data collection to commence in the first quarter of 2018. A ribbon cutting event is scheduled for February 2018.

26. EPC-14-023

Project Name:

Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits

[EPC-14-023]

Recipient/Contractor:

Eos Energy Storage, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/27/2015 to 3/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S8: Integrate Grid Level Energy Storage Technologies and Determine Best Applications That Provide Locational Benefits

Issue:

Distributed energy storage can provide fast-responding grid services and much needed locational capacity to integrate renewable energy. Despite this great potential, the high cost and short life of current commercial energy storage technologies make their use largely uneconomical. Moreover, safety and energy density limitations have prevented wide-spread deployment of energy storage on a distributed basis. There is minimal experience in integrating these storage systems with traditional utility infrastructure. Safer and more cost-effective energy storage options need to be developed for integration into the electrical grid with input from the electric utilities.

Project Description:

Eos is performing pilot testing of a 125 kW/375 kWh AC-integrated energy storage system consisting of approximately 140 Eos Znyth (Trademark) battery modules. The system is being installed at PG&E's testing facility in San Ramon, CA. System performance is being characterized against a variety of use cases including peak shaving, ancillary services, load following, and frequency regulation. Eos is modeling a portion of PG&E's distribution network to create simulated grid conditions that will allow for dynamic testing of the battery storage system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Eos is the only company offering a Zinc Hybrid Cathode Battery, under the trademark name Znyth. This is an aqueous, zinc-based battery technology that is inherently safer than competing technologies. This technology is non-flammable and non-toxic. In addition to being backed by UL- and ISO-certified quality assurance and control, the manufacturing process involves no toxic or hazardous materials. This demonstration will provide information and data to assess the value and cost savings of utility-scale battery energy storage when interconnected to the grid.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1c, 1i, 2a, 4a, 5b

Lower Costs:

This project will determine any cost savings by testing this battery system and determining how well the battery can cost effectively provide the grid with peak shaving, ancillary services, load following, and frequency regulation. These markets and services may provide a revenue stream for energy storage users.

Greater Reliability:

This project will contribute to more efficient battery storage which will ensure greater reliability for the grid as a whole and increase energy storage use.

Increase Safety:

This zinc-based battery technology is safer than competing technologies because it is non-flammable and non-toxic. The manufacturing process does not involve toxic or hazardous materials.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $691,504	
EPIC Funds Encumbered: $2,156,704		**EPIC Funds Spent:** $251,079	
Match Partner and Funding Split: Eos Energy Storage, LLC: $1,117,607 (33.6 %) Electric Power Research Institute, Inc.: $50,000 (1.5 %)		**Match Funding:** $1,167,607	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 35 out of 38 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

A test plan and determination of interconnection requirements was completed. A survey and review of utility industry criteria interconnection needs and best practices was completed. The inverter and system specification as well as the interconnection checklist were completed. The battery system was installed late in 2017 and system testing has begun.

27. EPC-14-024

Project Name:

Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment [EPC-14-024]

Recipient/Contractor:

West Biofuels LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/13/2015 to 3/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

Community-scale bioenergy infrastructure is critical to support sustainable management of the forested landscape to protect communities, watersheds, and energy infrastructure from the catastrophic wildfire. As identified in the California Bioenergy Action Plan (2012), the utilization of forest waste to promote sustainable forest management practices is of critical importance to the State and to utility ratepayers. While biomass power has existed in the forested settings in California with the deployment of large-scale direct combustion power plants, mostly built in the 1980's, community-scale biomass conversion technology has yet to be successful largely due to cost and performance issues.

Project Description:

This project develops and tests a modular biomass gasification system that can be rapidly deployed to communities across California to promote and support fire-safe management activities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is driving innovation in the bioenergy market for forest residue conversion to renewable grid power by advancing the modular gasification technology system design and integration with a high-efficiency lean-burn engine. The modular system has the potential to reduce the cost and increase the benefits of forest fuel reduction projects in high fire risk regions of the state.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1a, 1c, 4a

Lower Costs:

The IOUs pay an average of more than $11 million per year in fire-related damages to state and federal land management agencies. Reducing wildfire risks would reduce direct costs to utilities and likely also reduce costs of fire insurance. This project aims to reduce direct costs of utility-caused wildfire and protect utility infrastructure.

Increase Safety:

As forest landscapes are treated and excess biomass is removed, wildfire behavior is mitigated. Over time, as result, strategic fire suppression effectiveness will be enhanced as fossil fuels are reduced, lowering the size and intensity of wildfires and promoting defensible communities.

Economic Development:

It is estimated that approximately 4.9 jobs are created per MW of bioenergy generation. Most bioenergy facilities are, and will be, sited in rural areas that are experiencing significant economic hardship.

Environmental Benefits:

This project will help with sustainable forest management by removing overgrowth and dead trees from the surrounding forested area, preserving forest carbon sequestration and protecting key watersheds.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $334,354	
EPIC Funds Encumbered: $2,000,000		**EPIC Funds Spent:** $1,217,824	
Match Partner and Funding Split: West Biofuels, LLC : $510,000 (20.1 %) TSS Consultants: $18,754 (0.7 %) Soper-Wheeler Co. LLC: $8,160 (0.3 %) Christiana Darlington: $3,000 (0.1 %)		**Match Funding:** $539,914	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Researchers examined the biomass availability, harvest, processing, and chemical properties that impact the availability and cost of utilizing forest-sourced feedstock for a community-scale modular biomass-to-electricity system. West Biofuels conducted a number of test runs and measured and analyzed gasifier performance. The tests included thirteen plant startups and shutdowns and the production of over 1500 kW of producer gas, and were performed on raw gas and conditioned gas from representative forest biomass feedstock. Preliminary results showed that the productivity of the system is related to the air input, and the gas produced has sufficient energy content to satisfactorily perform in an engine application, with a higher heat value of 6.29 MJ/kg and a gas composition of 26.59% carbon monoxide and 15.47% nitrogen.

28. EPC-14-025

Project Name:

Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems [EPC-14-025]

Recipient/Contractor:

Sunfolding Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

Solar tracking has taken off in the last few years, but current trackers have run out of options for cost reductions. The state of the art designs use a traditional approach of motors, gearboxes, and bearings. These components are manually assembled with high-cost materials, leading to limits in cost reduction and scale up. Further, this approach includes many points of failure and has high maintenance costs.

Project Description:

The project aims to install and test a 300 kW photovoltaic solar system with air driven trackers. Two key technical innovations are demonstrated. First, the use of mass-manufacturing for the drive system results in an extremely low cost structure and very low part count. Second, only tubing is connected to each actuator, removing requirements for outdoor wiring or individual control hardware. The research involves collecting six-month performance data for the proposed solar PV tracking technology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The PV solar tracking technology tested and validated in this project will result in ratepayer benefits of reduced cost of energy and increased energy supply reliability. The air driven trackers not only reduce the direct product cost to the customers, but it simplifies every step in the project lifecycle from development, to construction, to operation. The reduced cost of energy will be achieved by demonstrating a solar tracking technology that adds 20-40% more power over fixed tilt systems at a cost that is well below the cost of current solar trackers. The increases in energy supply reliability will be achieved by delivering additional power that occurs in the late afternoon to the grid.

CPUC Proceedings addressing issues related to this EPIC project:

California Solar Initiative: R.12-11-005

Applicable Metrics: CPUC Metrics- 2a, 3b, 4a

Lower Costs:

The PV solar tracking technology tested under this project will lower levelized cost of electricity (LCOE) by 40-50% of the levelized cost of electricity of currently available solar energy systems with trackers.

Greater Reliability:

The PV solar tracking technology tested in this project will result in greater energy supply reliability by increasing the energy efficiency by 20-40% over fixed tilt systems at a cost well below the cost of current solar energy systems with trackers.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $157,497
EPIC Funds Encumbered: $1,000,000	**EPIC Funds Spent:** $636,135
Match Partner and Funding Split: PV Evolution Labs: $265,000 (12.2 %) Sunfolding, Inc. : $906,565 (41.7 %)	**Match Funding:** $1,171,565
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	25 out of 27 bidders	Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The process of building and commissioning the air driven trackers led to the creation of additional installation tools to simplify that process, including a module installation toolkit. All trackers were instrumented with sensors, cameras, and data collection equipment to test and verify the 300 kW PV tracker in the field. Data on tracker performance, weather, and environmental conditions, such as wind, UV, and temperature data, is being collected. The distributed position sensors are gathering temporal positioning and providing tracker consistency data, and the air pressure sensors are deployed to assess pneumatic performance. The ongoing tests evaluate the environmental conditions, characterize the tracker performance, and evaluate different product configurations. Preliminary results have substantiated prior simulation work and enhanced the understanding of the system behavior.

29. EPC-14-026

Project Name:

Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment

[EPC-14-026]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 6/30/2017

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

Numerous studies have found that consumers are failing to adopt seemingly cost-effective investments in energy efficiency. Current energy efficiency programs and energy demand forecasts do not account for varying participation across social, cultural, and socioeconomic groups. Previous studies have been small scale or based on stated-choice surveys. The results of these studies can be unreliable due to low participation rates, recall bias, and other biases.

Project Description:

This project conducted a quasi-experimental, econometric study of energy efficiency adoption and energy savings with a focus on differences between social, cultural, and socio-economic groups. The study applied modern economic methods to Southern California Edison's Quality Installation Program, including regression-discontinuity and propensity score matching. The large data sets and rigorous methods resulted in estimates to improve demand forecasts, energy efficiency program design, and future energy studies concerning social, cultural, and socioeconomic groups.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (De Leon, 2015) set energy efficiency targets for 2030 and allowed for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project team recommended designing future residential energy efficiency programs that target low-income customers in hot climate zones, and account for time-of-use rates in California. Key findings that led to these recommendations were that hot climate zone was a huge factor in getting customers to participate in this HVAC program, low-income households experienced greater savings because existing household appliances were usually less efficient and more noticeably improved, and that energy savings, due to participating in the program, were the greatest between the hours of 3-9 pm in the months of August and September due to peak demand rates.

CPUC Proceedings addressing issues related to this EPIC project:

Long-Term Procurement Proceeding (LTPP): R.13-12-010 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 2a, 5c

Consumer Appeal:

The project team was able to break out participation by these characteristics to identify differences in program participation and recommend specific opportunities for improved program targeting that could increase electricity savings and decrease program costs.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $65,406
EPIC Funds Encumbered: $360,632	**EPIC Funds Spent:** $360,584
Match Partner and Funding Split: The Regents of the University of California, Berkeley: $150,784 (29.5 %)	**Match Funding:** $150,784
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 12 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team submitted its Final Report in March 2017, and had its final meeting in July 2017. Project findings suggest that: climate is the strongest variable for customer participation in t SCE's Quality Installation Program (participants in hot areas saved ~1100 kWh annually, compared to 300 kWh in warm areas and 0 in mild areas), savings were higher for lower income homes than for high income homes but lower income homes participated less frequently, the most significant hours for achieving energy savings were shown to be 3-9 pm, and that future energy efficiency programs should be focused on increasing participation of low-income homes in hot areas.

30. EPC-14-027

Project Name:

High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)

[EPC-14-027]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 11/30/2017

Program Area and Strategic Objective:

Applied Research and Development

S8: Integrate Grid Level Energy Storage Technologies and Determine Best Applications That Provide Locational Benefits

Issue:

Integrating renewable energy into the energy delivery system presents challenges, such as managing variable and intermittent generation from sources such as wind and solar. To address these challenges, the California Public Utilities Commission identified energy storage procurement targets for investor-owned utilities (IOUs). The U.S. Department of Energy and California Independent System Operator also identified a need for energy storage. However, there are significant barriers to energy storage use, including high capital costs, lack of information regarding performance, and limited operational experience.

Project Description:

This project designed a low-cost 74kW pilot High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES) system that can efficiently store grid-level energy and release that energy when it is needed to meet peak demand, particularly for ancillary services and load following use-cases. This project documented and reported on the design, anticipated performance and lessons learned of the HTH-CAES system to increase knowledge and understanding of how these storage systems perform and the barriers to siting and operations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Compressed air energy storage may be a viable solution for long-term and large-scale storage applications. HTH-CAES potentially has lower capital and maintenance cost and less geographic restrictions than other storage technologies. In the HTH-CAES technology, compressors are used to convert inexpensive off-peak electric power into compressed air and thermal reservoirs.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1c, 1i, 2a, 4a, 5b

Lower Costs:

The 74 kW system is designed to cost $938/kW and $156/kWh installed. Its designed to reach an efficiency goal of 85% and to last 15,000 cycles. At that level, cost could be 7 cents/kWh/cycle.

Environmental Benefits:

HTH-CAES produces no carbon emissions and utilizes a low-waste and environmentally friendly construction. This technology will reduce emissions of CO2, SO2, NOx, and CO by displacing natural gas fired peaker plants.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $206,222	
EPIC Funds Encumbered: $1,621,628		**EPIC Funds Spent:** $632,754	
Match Partner and Funding Split:		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 35 out of 38 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The design of a 74kW HTH-CAES system was completed and is ready for a future demonstration. The final report includes a description of the piping and instrumentation, the mechanical/thermal design of the energy storage, and the completed 3D layout of the plant. All major components for construction were purchased, several patents were developed and journal articles were published. The final report is being prepared for publishing on the Commission website.

31. EPC-14-028

Project Name:

Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions

[EPC-14-028]

Recipient/Contractor:

InnoSepra, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/1/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

Conventional biogas purification technologies used for biogas upgrading have high capital and operating costs, and have not been used commercially in power generation applications. Innovative technologies and physical sorbents to effectively remove multiple impurities from raw biogas in a single step prior to power generation would enable a significant reduction in the capital and operating costs and energy required for biogas purification. The use of purified biogas for power generation can provide significant cost, efficiency and environmental benefits in combined heat and power generation applications.

Project Description:

This project deploys a pre-commercial technology demonstrating a sorbent-based biogas purification process for combined heat and power generation at the pilot scale that removes multiple troublesome impurities from biogas, upgrading the fuel to near-pure methane for combustion in conventional prime movers. The pilot plant will be installed and tested at a brewery wastewater plant and at a landfill site to demonstrate the environmental and cost benefits of biogas purification prior to use in combined heat and power applications.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project is advancing an innovative gas cleanup system based on temperature swing adsorption concept that adsorbs carbon dioxide and other contaminants while letting methane pass through and that regenerates the adsorbent bed leading to lower cost of operation. Converting biogas to high purity biomethane enables its use in premium efficient devices for power generation thereby helping reduce the cost of electricity. This technological approach will help meet renewable electricity goals at a lower cost and will enable use of marginal biogas sources for power generation applications using conventional natural-gas fired prime movers.

CPUC Proceedings addressing issues related to this EPIC project:

Self-Generation Incentive Program: R.12-11-005 SB 1122 Bioenergy feed-in tariff: R.11-05-005 Combined heat and power: D.10-12-035., R.08-06-024.

Applicable Metrics: CPUC Metrics- 1a, 1b, 3g, 4a, 4b

Lower Costs:

This project is expected to lower costs by reducing the number of stages required to condition biogas to meet fuel specifications of most prime movers.

Environmental Benefits:

The project will reduce carbon dioxide emissions by increasing the use of renewable fuel and replacing fossil-derived methane for electricity generation. The project will also result in fewer methane emissions by reducing the flaring of biogas into the atmosphere.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $105,570
EPIC Funds Encumbered: $1,318,940	**EPIC Funds Spent:** $107,641
Match Partner and Funding Split: InnoSepra, LLC: $930,000 (40.8 %) ES Engineering, Inc. formerly Environ Strategy Consultants, Inc.: $11,000 (0.5 %) Waste Management of California, Inc.: $18,150 (0.8 %)	**Match Funding:** $959,150
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Pre-existing: U.S. Pat 8,591,627, 26 Nov 2013; U.S. Pat Appl 2014002675, 26 Sept 2013 Application number and date: Process for Upgrading Gases Containing Methane, to be filed in Feb 2015

Update:

One of the project host sites requested that Innosepra mount its gas conditioning skid on a trailer that could be parked at the facility so as to minimize permitting risk to the host. The scope of work did not preclude trailer mounting, however a budget reallocation to shift funds to equipment and materials to accomplish this was required. The amendment was executed in May, 2017. Since then, Innosepra has completed designs, released an RFP to California fabricators and is currently accepting bids from qualified vendors.

32. EPC-14-029

Project Name:

The West Star North Dairy Biogas-to -Electricity Project

[EPC-14-029]

Recipient/Contractor:

ABEC #2 LLC, dba West Star North Dairy Biogas

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Despite a regulatory environment encouraging renewable energy production and greenhouse gas reductions, dairy digester development has lagged in California. Fewer than twenty dairies in California have installed digesters and roughly half of these projects are operating. With dairy digesters having the potential to play an important role in providing renewable baseload electricity as well as reducing California's GHG emissions, California needs to demonstrate projects, which include design, operation and management strategies, that result in successful dairy digester-to-electricity projects.

Project Description:

This project advances digester design by building and demonstrating an innovative, double-cell covered lagoon digester and 1-megawatt (MW) generation system. The system will convert dairy manure into biogas and store the biogas above the primary and secondary lagoons under an inflatable cover. The biogas will be converted into renewable electricity and sold for export to the PG&E distribution grid. Further, dairy biogas systems qualify for participation in the CPUC's Assembly Bill (AB) 2514 electricity storage program. In a future phase, the biogas system may compete for an energy storage contract. The project will also improve groundwater protection by minimizing leaching of manure into the groundwater.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project demonstrates an improved digester design with the double cell lagoon for greater biogas storage and on-demand generation potential and, if successful, establishes dairies as competitors for storage contracts. The improved system will decrease dairy and digester operating costs while also enhancing the protection of groundwater. Other important benefits include: lowered manure handling costs and valuable co-products, such as nutrient rich, more absorbable irrigation water.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 3a, 4a, 4e

Lower Costs:

By advancing digester economics and design, through efficient manure management practices, the project will help lower dairy management and operation costs.

Environmental Benefits:

The project supports implementation of California's energy and GHG management goals and targets through the deployment of new renewable power generation capacity and the capture and destruction of methane currently vented into the atmosphere. The double-lined lagoon enhances groundwater protection by minimizing leaching of manure into groundwater. The project hired Climate Trust to estimate the Carbon Offsets that would likely be generated over the project's 10 year crediting period at 213,329 tonnes CO2e gross based on ARB's Livestock Protocol.

Consumer Appeal:

The project will improve odor control, through hydrogen sulfide removal, an issue important to the dairy employees and benefits the local community.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $32,107	
EPIC Funds Encumbered: $4,000,000		**EPIC Funds Spent:** $3,534,856	
Match Partner and Funding Split: ABEC #2 LLC, dba West Star North Dairy Biogas: $5,000,000 (55.6 %)		**Match Funding:** $5,000,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Bioenergy Storage and Management System and Method.

Lagoon Digester with Flexible Volume Capability.

California Bioenergy LLC Lagoon Digester Systems.

Update:

The project broke ground in fall 2016 and construction is complete. A TAC was held in October 2017, followed by a CPR in November 2017. The project accepted a 20-year PG&E BioMAT Power Purchase Agreement and will begin data collection and full operation commencing in the first quarter of 2018.

33. EPC-14-030

Project Name:

Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels

[EPC-14-030]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/15/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

There is a disconnect between studies that develop waste biomass utilization strategies and studies focused on identifying opportunities for distributed generation (DG), and specifically combined heat and power (CHP) or combined cooling, heat, and power (CCHP). No previous research has attempted to match local waste biomass sources in California with the variety of available conversion/power generation technologies and local demand for DG and waste heat applications to identify opportunities for efficient, cost-effective, and environmentally sustainable projects.

Project Description:

This project highlights locations where waste biomass can be used most efficiently and sustainably for distributed generation by developing scenarios through 2050 that identify the most promising opportunities for waste biomass DG, identify key technical and regulatory hurdles to waste biomass DG utilization, develop tools for matching available waste biomass resources with energy production opportunities, and suggest solutions for achieving cost parity with fossil fuels.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This analysis (1) identifies high-priority areas within California and feedstock types for further public deployment funding, (2) highlights promising geographic areas or available technologies to encourage increased investment in waste biomass DG by the private sector, and (3) improves efficiency and reduces environmental burdens by helping to minimize biomass transportation distances and maximize the efficiency of power production and waste heat utilization.

CPUC Proceedings addressing issues related to this EPIC project:

Combined heat and power: D.10-12-035., R.08-06-024.

Applicable Metrics: CPUC Metrics- 3c, 4a

Economic Development:

Integrated use of waste biomass (from municipal wastes, agricultural residues, and food processing wastes) for distributed generation applications in California has the potential to produce about 4.2 terawatt-hours of renewable electricity per year.

Environmental Benefits:

The use of waste biomass is expected to result in avoided fossil greenhouse gas emissions of about 2.5 million metric tons of carbon dioxide (CO2)-equivalent per year (of which 1.2 million tons is from avoided grid electricity, and 1.3 million tons is from avoided natural gas use for heating).

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $670,276
EPIC Funds Encumbered: $1,500,000	**EPIC Funds Spent:** $1,189,154
Match Partner and Funding Split: Energy Bioscience Institute: $50,000 (2.8 %) Allotrope Partners: $200,000 (11.2 %) PepsiCo R&D: $32,000 (1.8 %)	**Match Funding:** $282,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The researchers are developing 2020 (near term) and 2050 (long term) scenario projections for waste biomass supply in California. Four TAC meetings were held to identify the scope and scale of waste heat and waste heat-generated cooling for customers in the domestic, commercial, and industrial process markets. The project has developed a county-level monthly wet and dry California biomass inventory, assessed the energy generation potential from food waste in California and identified counties where new anaerobic digestion capacity is needed. The researchers estimated energy demand density and identified areas with district heating/cooling potential by using building stock turnover model along with energy use intensity factors. During next few months, the project will be matching biomass types and evaluating costs associated with relevant energy generation technologies.

34. EPC-14-031

Project Name:

Pollution Control and Power Generation for Low Quality Renewable Fuel Streams

[EPC-14-031]

Recipient/Contractor:

The Regents of the University of California on behalf of the Irvine Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2015 to 3/31/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Many potential renewable fuel streams cannot be used to generate electricity using current technology without considerable upgrading (i.e., increasing the heating value) and substantial clean up (e.g., cleaning contaminants such as hydrogen sulfide or siloxanes introduced by the feedstock). Prime examples include landfills that are approaching end of life that produce gases with some heating value, but the values are generally too low for commonly used combustion devices (e.g., reciprocating engines, gas turbines). Landfill biogases are also notoriously challenging due to the variability in level of contaminants.

Project Description:

The project is using a 250 kW gas turbine system that converts relatively dirty, low heating value fuels into heat using gradual oxidation. This gradual oxidation technology was developed by Ener-Core, a California company, and has been demonstrated in operating systems for well over 500 hours, but has not yet been commercially deployed in California. The site for the demonstration is a closed landfill producing low quality gas that is currently flared. This site is a good match for the 250 kW demonstration as it eliminates the flaring of the otherwise unusable gas while generating electricity for onsite use and use in other county-owned facilities as facilitated by SB 1122 or SB 43. The project is being carried out in collaboration with Orange County Waste & Recycling who is responsible for the test site.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will demonstrate and deploy a novel gradual oxidation system in conjunction with a gas turbine that is capable of converting low-grade, and otherwise unusable, landfill biogas into renewable electricity.

CPUC Proceedings addressing issues related to this EPIC project:

Self-Generation Incentive Program: R.12-11-005 Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011

Applicable Metrics: CPUC Metrics- 1a, 1c, 3a, 3h, 4a, 4b

Lower Costs:

This project will generate 250 kW of baseload power, reducing peak demand to the surrounding grid and saving the landfill $240,000 annually.

Greater Reliability:

The electricity generated on site will help offset grid draw of power during peak use times, thus helping with overall reliability of the electricity system.

Environmental Benefits:

Low-grade biogas produced by landfills is typically flared. By utilizing it to produce electricity instead, this project will reduce NOx produced at the landfill by nearly one ton annually.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $98,402
EPIC Funds Encumbered: $1,499,386	**EPIC Funds Spent:** $922,723
Match Partner and Funding Split: Ener-Core, Inc.: $384,856 (19.9 %) ES Engineering, Inc. formerly Environ Strategy Consultants, Inc.: $5,000 (0.3 %) Advanced Power and Energy Program (APEP) - University of California, Irvine: $48,489 (2.5 %)	**Match Funding:** $438,345
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was presented at the December 2015 EPIC Innovation Symposium in the "Bioenergy and High Fire Risk Areas" session. Site engineering, site drawings, and permitting requirements were completed in early 2016. An interconnection study with two supplemental reviews was completed by Southern California Edison in late 2016. The study identified the need for substation upgrades and an interconnection cost which far exceeded the budgeted amount. Consequently, the project sought a new landfill host site to demonstrate the novel gradual oxidation technology. A new site (with an existing interconnection agreement) was found and confirmed in mid-2017. The project is currently completing revised site engineering, site drawings, and permitting requirements at the new host site and plans to install and operate

the system in early 2018.

35. EPC-14-032

Project Name:

Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households

[EPC-14-032]

Recipient/Contractor:

Inova Energy Group, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 5/8/2018

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

An increasing proportion of California's population identifies as being Hispanic, but Hispanics have historically had low participation in energy efficiency programs. Due to cultural background, frequent linguistic isolation, and higher densities of rental, low-income, and multifamily households, Hispanics are considered hard-to-reach customers in California's energy efficiency landscape and are found to have disproportionately low participation in energy efficiency programs. As such, there is a significant energy efficiency potential that has not been realized from this hard-to-reach group.

Project Description:

This project focused on reaching Hispanic subpopulations in California to better understand the social, cultural, and behavioral aspects of their decisions to adopt energy efficient technologies and behaviors. The study combined data collected from participants via energy usage journals, in-home interviews, and energy meters to further the knowledge of Hispanic cultural associations and beliefs related to energy use decisions and choices. The information gathered in this study can be used to improve the metrics and assumptions underlying energy demand forecasting and energy efficiency potential and goals studies. In addition, the study provided information that can be used for targeted marketing of energy efficiency programs to the Hispanic population and improved levels of service to these households.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of the Hispanic subpopulation that discourage or prevent their participation.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Long-Term Procurement Proceeding (LTPP): R.13-12-010 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 5c

Greater Reliability:

New metrics on the impacts of utility energy efficiency programs for various subpopulations can increase the accuracy of energy demand forecasts used in Long Term Procurement Planning.

Consumer Appeal:

Energy efficiency programs that incorporate social, behavioral and cultural aspects into the program design are likely to have greater appeal to potential customers.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $10,681	
EPIC Funds Encumbered: $224,593		**EPIC Funds Spent:** $201,529	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 12 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was completed in 2017. Key findings show that participants' energy-related behaviors were heavily influenced by family and community. For example, extended family members living under the same roof lead to variances in energy behaviors. More subtle implications include the use of energy to prioritize comfort for elderly family members. The study also found that participants did not tend to focus on the technical capabilities of energy-efficiency equipment or home envelope improvements, instead the focus was on behavior. For example, participants reported manually turning on and off their air conditioners rather than relying on the thermostat.

The final report also contains recommendations for energy program administrators, policy- and decision-makers, and other researchers to increase Hispanic participation in energy efficiency programs.

36. EPC-14-033

Project Name: North Fork Community Power Forest Bioenergy Facility Demonstration [EPC-14-033]	
Recipient/Contractor: The Watershed Research and Training Center	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 5/15/2015 to 9/30/2018
Program Area and Strategic Objective: Technology Demonstration and Deployment S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies	
Issue: Forest biomass fueled bioenergy gasification projects have the potential to be more efficient and have cleaner electricity generation than direct combustion systems, and can reduce the risk of forest fires and pollutant emissions. The electricity generation is anticipated to be economical in the long-term, but is dependent on the ability of developers to achieve necessary operating hours. However, forest bioenergy demonstration facilities must collect additional scientific and technical data that will help demonstrate economic viability and attract private investment.	
Project Description: The North Fork Forest Bioenergy project is constructing and demonstrating a 1 megawatt (MW) forest waste bioenergy gasification-to-electricity facility in the foothills of the Sierra Mountains. The biomass gasification facility is targeted to be a commercial-scale, community-based facility capable of accepting and processing wood waste from forest management that would otherwise create wildfire and air quality challenges, and generating renewable grid-connected electricity. Critical to this gasification demonstration, the project is investigating the best practices and evaluating individual components and protocols to improve performance and reduce operating costs.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: The combination of a commercial-ready gasification technology that has not been previously demonstrated in California, along with the producer gas cleanup system, automation and control, and optimized operation will prove distributed, renewable, woody biomass fueled electricity as economically feasible and capable of operating for 7000 hours/year. The project will be grid-connected and will provide immediate benefits including increased renewable generation capacity, expanded technical resources, and community environmental, wildfire, and economic development benefits.	
CPUC Proceedings addressing issues related to this EPIC project: Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005	

Applicable Metrics: CPUC Metrics- 1a, 1c, 2a

Lower Costs:

Siting these plants near the forest reduces the cost of hauling biomass from the forest and reduces biomass electricity costs below those of larger, traditional biomass power plants.

Economic Development:

This plant will be built and operated by local contractors. In some cases, workers may even be trained to work on site. It is owned in part by a local Community Development Council, which will receive profits from the PPA and reinvest them in the community.

Environmental Benefits:

This project will be fueled by forest restoration by-product, which will increase air quality and reduce wildfire threat or intensity. Removing small, overstocked trees from the forest will release water into the watershed. Additionally, the power plant will anchor a biomass utilization campus, which will expand to include other forest products.

Public Health:

Disposing of biomass in controlled systems dramatically decreases emissions over pile and burn or wildfire. Placer County Air Pollution Control District published 60% CO2, 3% CH4, and 41% particulate emissions reductions over pile and burn in a direct combustion system. The system will reduce these even further by using gasification.

Consumer Appeal:

Providing jobs, protecting homes, and enhancing functioning forest ecosystems through water release, increased biodiversity, and decreased wildfire threat are all benefits that this power plant will be able to advertise to increase consumer appeal.

Energy Security:

This project will rely on California-grown fuel and operates as a baseload plant. Development will also require PG&E and plant owners to invest in the local substation, which will increase rural energy security.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $87,680
EPIC Funds Encumbered: $4,965,420	**EPIC Funds Spent:** $3,079,272
Match Partner and Funding Split: The Watershed Research and Training Center: $22,706 (0.4 %) Phoenix Energy: $684,144 (10.8 %) Yosemite Sequoia Resource Conservation and Development Council: $55,500 (0.9 %)	**Match Funding:** $1,361,360

<table>
<tr><td colspan="2">Western Energy Systems: $253,750 (4.0 %)
North Fork Community Development Council: $180,000 (2.8 %)
USDA Forest Service - Sierra National Forest: $150,000 (2.4 %)
TSS Consultants: $13,260 (0.2 %)
Kamalesh Doshi: $2,000 (0.0 %)</td><td colspan="2"></td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
19 out of 23 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 4: Ranked # 1</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-14-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
Permitting work is mostly completed and ground preparations and construction have started. The system was expected to be operational by June 2017 but equipment has not been delivered to the site and site preparations halted due to financing problems with project partners. A Stop Work Order was put in place on 9/18/2017 and will remain until the recipient provides documentation showing the financing is secured, the equipment is delivered on site and construction has resumed. As of 11/2017, Phoenix made public that they obtained a PPA with PG&E, however, they are still negotiating with the bank to secure the New Market Tax Credit grant of $800,000 which they plan to use for equipment delivery. Construction/installation is expected to resume in January 2018.</td></tr>
</table>

37. EPC-14-034

Project Name: Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy [EPC-14-034]	
Recipient/Contractor: Interra Energy, Inc.	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 5/15/2015 to 8/27/2017
Program Area and Strategic Objective: Applied Research and Development S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable	
Issue: Baseload bioenergy technologies have the potential to increase the reliability of California's energy supply, reduce the cost of renewable generation, reduce GHG emissions from the energy sector, and reduce the risk of forest fires. Current bioenergy technologies are not profitable at distributed scales. Further, the use of waste biomass resources in the state currently can have negative environmental impacts without appropriate technology and management strategy.	
Project Description: The purpose of this was to install and demonstrate an advanced modular bioenergy technology. The pilot-scale demonstration was intended to help determine if the performance of the technology, along with biomass co-product value creation enhancement strategy, was sufficiently powerful to overcome the affordability burdens that currently block the feasibility of distributed generation bioenergy projects in California.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: If successful, this project could help stabilize the grid, improve service reliability, and reduce the risk of forest fire. Advanced bioenergy systems that produce useful co-products can also reduce the cost of renewable energy procurement and mitigate the GHG impacts of energy generation.	
CPUC Proceedings addressing issues related to this EPIC project: Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005	
Applicable Metrics: CPUC Metrics- 1c, 4a, 4b	
Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $264,400
EPIC Funds Encumbered: $2,000,000	**EPIC Funds Spent:** $1,353,332

<table>
<tr><td colspan="2">Match Partner and Funding Split:
Interra Energy, Inc.: $4,627,400 (69.8 %)</td><td colspan="2">Match Funding:
$4,627,400</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
25 out of 27 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 1: Ranked # 2</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-14-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The project faced serious technological challenges and Interra Energy was unable to demonstrate progress towards meeting the project requirements. The Energy Commission determined that results from the bioenergy system are not satisfactory and the interim reports are technically deficient. As a result, the Energy Commission staff terminated the agreement at the August 2017 Business Meeting.</td></tr>
</table>

38. EPC-14-035

Project Name:

Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors

[EPC-14-035]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

Power distribution networks of today have limited visibility and diagnostic capabilities, and were designed to accommodate a limited number of rotating power generation plants. A future grid that incorporates large numbers of distributed PV systems will require different and more complex control mechanisms, which in turn will require coordinated control of both utility distribution equipment and solar inverters.

Project Description:

The research project is developing, demonstrating, and evaluating at the pilot scale, the ability of an integrated, advanced PV and storage system at a state-of-art test bed in the LBNL Facility for Low Energy Experiments (FLEXLAB). The system includes smart inverter control to enhance and optimize grid support and system performance. The strategy evaluates the use of distribution synchrophasor units data to support specific visualization and control applications on distribution circuits. The project includes a 13 to 15 kilowatt (kW) PV electric generating system and a 14 kW (56 kW-hour) battery storage installation at FLEXLAB.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will advance a breakthrough technology that is scalable across investor-owned utility territory leading to well-coordinated and managed high-density PV installations and ratepayer benefits of greater reliability, lower costs and increased safety.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 2a, 3c, 3d, 3f, 4a, 5b

Lower Costs:

The proposed installation includes 14 kW of PV and a 19 kWh battery that can provide 4.8 kW peak power for 4 hours (based on TOU high-peak pricing period). This will reduce energy costs to $139,500, and demand charges will be reduced to $53,000. The PV and battery combine for a maximum of 18.8 kW or 5 % of peak demand. The total monetary savings are 2.5%.

Greater Reliability:

Ratepayers will see electricity reliability improve as high-density PV installations are

coordinated and managed more efficiently.

Increase Safety:

This project will enhance grid safety by improving the ability for PV installations to detect and understand grid conditions and ensure safe operation in the event of grid failures.

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $375,000
EPIC Funds Encumbered: $1,000,000	**EPIC Funds Spent:** $844,424
Match Partner and Funding Split: Tesla Motors: $25,000 (2.4 %)	**Match Funding:** $25,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The PV array has been installed, energized and generating power. Different PV penetration scenarios were simulated. In mid-2016, the first micro synchro-phasor measurement unit (uPMU) was installed at the building feeder, and by August 2017 two other uPMUs were installed. Data for these units are being collected. Python scripts to download, query and analyze statistical data within the uPMU database were tested. The tasks of interfacing various hardware components of FLEXGRID (the facility encompassing solar PV, storage, uPMU, and load and grid simulators), and grid-event triggers were completed. A first test plan for baseline data collection was developed which will involve bi-weekly setup changes between no PV support, and standard PV support test cases.

39. EPC-14-036

Project Name:

Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage

[EPC-14-036]

Recipient/Contractor:

SunSpec Alliance

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

High PV penetration with legacy inverters on California grid feeder circuits can exacerbate problems associated with grid stability. While inverter power technology exists to address grid operating variability, a standard and cost-effective communication interface to monitor and control inverter operating functions has not been broadly deployed. It is currently both expensive and risky for grid operators to monitor and control diverse distributed energy resources (DER) assets. What is missing is the availability of a test framework for interoperability, empirical data to validate the effects of smart inverters on the grid, and market data to evaluate economic impacts.

Project Description:

The project is developing a complete solution of smart solar PV-based DER system that addresses key barriers impeding the progress towards high penetration of solar and DER. The work includes development of a CA Rule 21 test framework and test scripts; compliance testing of smart inverters with functionality as described in the CPUC CA Rule 21 Smart Inverter Working Group (SIWG) recommendations; monitor and control inverter operating functions including participation in ancillary service for diverse DER assets; increase of photovoltaic (PV) penetration and cost effectiveness while enhancing safety and reliability of the California grid. This agreement will deliver a smart inverter test framework and open source software tools to enable rapid product development and safety testing and will demonstrate the benefits to all stakeholders including ratepayers, utilities, manufacturers, investors and operators.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project addresses critical gaps impeding high penetration of solar PV and DER beyond current IEEE limits (15% total circuit penetration) while improving grid stability and increasing cost effectiveness though development of CA Rule 21 test framework, compliance testing of smart inverters, and deployment of integrated PV and energy storage systems, and helping create cost-effective and mass-produced smart inverters that can be integrated into diverse grid systems through standard communications.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Distribution Level Interconnection (Rule 21): R.11-09-011 Smart Inverter: D.14-12-035 (in R.11-09-011) Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 3d, 3f, 4a, 5b

Lower Costs:

Use of DERs- enabled by smart interoperable inverters – to mitigate grid conditions will result in cost avoidance for grid upgrades. Savings in IOU cost avoidance for circuit upgrades is estimated at $0.16 to $0.30 per installed watt based on an SCE study (http://www.energy.ca.gov/2013_energypolicy/documents/2013-08-22_workshop/SCE_Local_Energy_Resources_Study.pdf). Standardization could provide $0.05 per installed watt of savings in avoided switching costs; $0.02 of savings per watt due to decreased need for specialized labor, and reduced supply chain costs leading to plug and play compliant smart inverters that allow purchase of components from competing vendors.

Greater Reliability:

The project will help advance smart inverters, increase integration of energy storage with PV, and enable higher levels of renewable generation penetration providing greater flexibility to local capacity, increased reliability through improved capacity optimization, and obviating the need for conventional sources by providing distributed services that were previously provided by conventional bulk generating sources.

Environmental Benefits:

Enabling high penetration of solar PV and DER beyond the 15% IEEE limit and obviating conventional bulk generating sources will result in reduced GHG emissions, which will be quantified based on project results from field demonstrations. Distributed resources will also cost-effectively mitigate criteria pollutant emissions.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $162,005	
EPIC Funds Encumbered: $2,000,000		**EPIC Funds Spent:** $671,001	
Match Partner and Funding Split: SunSpec Alliance: $1,421,875 (35.0 %) Olivine, Inc.: $70,000 (1.7 %) Solar City Corporation: $575,000 (14.1 %)		**Match Funding:** $2,066,875	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 3; Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-14-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: Smart inverter testing is continuing and anticipated to conclude by December 2017. The participating inverter manufacturers are working with SunSpec to meet the new test standards specified in UL 1741 SA. SunSpec is also working directly with the developers at the inverter companies to bridge any gaps in understanding of the UL requirements for CA Rule 21 compliance to avoid any further delays. The planned start of the field test with SCE and Tesla (a.k.a. SolarCity) has been delayed until April/May 2018 due to design changes to the Tesla Powerwall and changing priorities in the Tesla business overall. However, Tesla has increased its activity and has promised a reevaluation of the schedule.

40.EPC-14-037

Project Name:

Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption

[EPC-14-037]

Recipient/Contractor:

Center for Sustainable Energy

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 3/31/2018

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

The current policy framework used to assess the adoption of residential energy efficiency measures is driven primarily by estimates of cost effectiveness. However, cost effectiveness calculations alone are inadequate to accurately predict adoption and market potential, as they do not capture the multitude of factors influencing the decision-making process of individual market sectors. Recent studies suggest that social, cultural and behavioral factors have a significant influence on the adoption of energy efficiency measures in residential households and should be considered in the decision-making process.

Project Description:

This project is conducting a multidisciplinary, data driven study to understand the role and interactions of various factors influencing the adoption and utilization of residential energy efficiency measures. The study will provide awareness into the stand alone and interactive effects of factors such as income, ethnicity, language, and political orientation on the adoption of energy efficient technologies, with a primary focus on the Latino population in the Fresno area. Knowledge gained from this study can be used to enhance energy policy and program design to account for social, cultural, and behavioral factors.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of the Hispanic subpopulation that discourage or prevent their participation.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 2a, 5c

Lower Costs:

Understanding social, cultural and behavioral aspects can help utilities more cost-effectively and efficiently market their energy efficiency programs to hard-to-reach customer groups.

Consumer Appeal:

Energy efficiency programs that incorporate social, behavioral and cultural aspects into the program design are likely to have greater appeal to potential customers.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $166,993	
EPIC Funds Encumbered: $599,924		**EPIC Funds Spent:** $414,838	
Match Partner and Funding Split: Renovate America: $214,000 (26.3 %)		**Match Funding:** $214,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 12 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

CSE's analysis of 704 records sample revealed that using brochures with imagery of modest houses and families that appeared Hispanic (as opposed to imagery of large homes and non-Hispanic, Caucasian families) had a positive impact on audit sign-up rates in census tracts with a high concentration of Hispanics. Despite this increased number of audit sign-ups, phone interviews with 30 self- identified Hispanic audit participants found few had completed or planned major upgrades based on the audit recommendations, though minor upgrades such as weather-stripping or light bulb replacements were more common. These results highlight the importance of tailoring outreach materials for energy efficiency programs, and the efficiency potential that can be accessed through improved program outreach.

41. EPC-14-038

Project Name:

Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design

[EPC-14-038]

Recipient/Contractor:

Indicia Consulting

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 1/31/2019

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

Technological innovation has been an impressive driver of efficiency gains; however, over time it has become clear that without a greater understanding of the human factors, potential energy savings will remain untapped. The goal of this research is to be able to recommend an alternative energy efficiency potential model. This new model would draw upon variables descriptive of culture and behavior among California sub-populations, and demonstrate the cost-effectiveness of programs designed to holistically address how different people experience and respond to technologies.

Project Description:

This project uses empirical research methods grounded in anthropology and other social and behavioral sciences to explore the factors affecting behavior beyond simple economic rationale. This practice is achieved by documenting and analyzing emerging attitudes, emotions, experience, habits, and practices around technology adoption for purposes of devising predictive indicators for on-going potential studies regarding energy consumption in California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of various subpopulations that discourage or prevent their participation.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 5c

Lower Costs:

Understanding social, cultural and behavioral aspects can help utilities more cost-effectively and efficiently market their energy efficiency programs to hard-to-reach customer groups, resulting in greater participation and lower program implementation costs per kilowatt-hour saved.

Greater Reliability:

New metrics on the impacts of utility energy efficiency programs for various subpopulations can increase the accuracy of energy demand forecasts used in Long Term Procurement Planning and Resource Adequacy proceedings.

Consumer Appeal:

Energy efficiency programs that incorporate social, behavioral and cultural aspects into the program design are likely to have greater appeal to potential customers. The research includes recommendations on utility program design elements that are likely to appeal to the cybersensitve market segment.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $40,208	
EPIC Funds Encumbered: $574,545		**EPIC Funds Spent:** $366,994	
Match Partner and Funding Split: Indicia Consulting: $52,500 (8.4 %) California State University San Marcos		**Match Funding:** $52,500	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 12 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project is proceeding on schedule. The project team has overcome initial difficulties in obtaining utility data and have been able to identify and collect data from survey recipients and interview participants in order to implement Task 2 (Document/Analyze emerging attitudes) and Task 3 (Identify drivers of cybersensitives). Deliverables have been completed on schedule and the team is working on the Task 5 (Develop Critical Insights for Supporting Residential Engagement) and Task 6 (Recommend an Alternative Energy Efficiency Potential Model).

42. EPC-14-039

Project Name:

Cultural Factors in the Energy Use Patterns of Multifamily Tenants

[EPC-14-039]

Recipient/Contractor:

TRC Engineers, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 12/22/2017

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

Currently, one third of all Californians live in multifamily housing. Multifamily units have represented 50 percent of all new housing constructions in the state continuously since 2009. However, energy patterns and cultural factors in multifamily settings have been understudied. Without evaluating of the energy usage patterns in multifamily settings it is difficult to assess the future energy consumption, and develop energy efficiency programs that target this increasingly common housing type, which is an essential component of future zero-net energy strategies.

Project Description:

This project examined the cultural and demographic factors that correlate with multifamily tenants' electric energy use patterns, before and after energy efficiency upgrades, and tenant engagement activities. Using multilevel tenant surveys and interval meter data analytics this study investigated the who, what, and why variations in multifamily energy use patterns. The large data sets will help to improve demand forecasts and energy efficiency program design by providing lessons learned and guidance for how social, cultural, and socioeconomic groups use energy differently in multifamily settings.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project provides program developers information on how social, cultural, and behavior aspects of multi-family building tenants impact participation in utility efficiency programs. The findings in the survey will help design utility efficiency programs to better engage customers in multifamily units to increase participation and achieve greater energy savings.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 2a, 5c

Lower Costs:

Understanding social, cultural, and behavioral aspects of can help utilities most cost-effectively and efficiently market their energy efficiency programs to hard-to-reach customer groups.

Consumer Appeal:

Energy efficiency programs that incorporate social, behavioral and cultural aspects into the program design are likely to have greater appeal to potential customers.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $107,714	
EPIC Funds Encumbered: $379,019		**EPIC Funds Spent:** $259,129	
Match Partner and Funding Split: Pacific Gas and Electric Company: $100,000 (20.9 %)		**Match Funding:** $100,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 12 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was completed in December 2017. The project surveyed energy use in multi-family units in the Bay Area and the Central Valley. The project found that the differences between load profiles are also correlated with demographic and cultural factors such as race/ethnicity of the occupants as well as the amount of plug loads they use. These are second order effects though to the weather-dependent energy use such as use of cooling energy in the hot Central Valley versus relatively mild coastal areas. The multivariate analysis shows that no single demographic or cultural factor (nor interactions with others) by themselves explain the differences more than or as much as the effects of location and climate. The initial finding of the TRC survey were presented at the BECC Conference on October 17, 2017 in Sacramento, CA.

43. EPC-14-040

Project Name:

Self-Tracking Concentrator Photovoltaics for Distributed Generation

[EPC-14-040]

Recipient/Contractor:

Glint Photonics, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

The highest efficiency PV cells are multijunction PV cells used in concentrator photovoltaic (CPV) systems, which offer about 40% conversion efficiency compared to about 16% for polycrystalline Silicon. However, concentrator photovoltaic systems require special mounting and precision tracking, and the resulting cost and complexity has prevented them from achieving significant market penetration.

Project Description:

This research is developing, testing, and demonstrating a self-tracking concentrator photovoltaic (ST-CPV) system, a new concentrator photovoltaic technology that does not require a precision mechanical tracker to keep it aligned to the sun. The ST-CPV panel contains a thin layer of fluids that passively responds to the changing solar angle, automatically adjusting optical pathways within the device to ensure that incident sunlight is captured and concentrated over a wide range of angles. The passive internal tracking allows ST-CPV panels to be mounted in a stationary configuration or with a simple single axis tracker. This makes the system highly economical, greatly reduces installation and maintenance complexity, and enables distributed generation with higher efficiency CPV modules.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Glint technology has the potential to capture 1% of the future potential rooftop solar market (153 MW). Glint Photonics anticipates a product introduction to the market in 2018, with penetration of the rooftop market to grow in the 2020s. If the anticipated performance can be realized, the company anticipates 1 MW of panels installed by the end of 2020, with significant potential for additional capacity and cost savings in future years.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 California Solar Initiative: R.12-11-005

Applicable Metrics: CPUC Metrics- 1a, 4a

Lower Costs:

This research is developing a novel self-tracking concentrator panel that does not require a precision mechanical tracker to maintain alignment of the sun. This technology can cut the installed system cost for distributed PV systems in half. This novel self-tracking concentrator panel have the potential of producing a LCOE below 3.5 ¢/kWh.

Economic Development:

The ST-CPV technology being developed under this project will help boost rooftop-installed solar energy that will produce renewable electricity, the equivalent worth of which will contribute to the state's economy. Additional benefits from successfully introducing ST-CPV products will accrue in job creation and improved peak demand management.

Environmental Benefits:

Greater adoption of PV power will reduce greenhouse gas emissions. Specifically, commercial adoption of ST-CPV systems on rooftops will help offset several millions of metric tons of carbon dioxide equivalent (CO2e) compared to conventional generation.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $67,377	
EPIC Funds Encumbered: $999,940		**EPIC Funds Spent:** $416,094	
Match Partner and Funding Split: United States Department of Energy: $1,000,000 (28.6 %) U.S. Department of Energy: $1,500,000 (42.9 %)		**Match Funding:** $2,500,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Researchers have completed the fabrication of the GEN 1 prototype module and prototype tracking mechanism. This improved prototype has been characterized in laboratory testing and direct sunlight. Laboratory testing indicated optical efficiency that closely matched simulations, indicating that there are not unexpected deficiencies in the optical components. Preliminary results have shown that the efficiency for stationary panels meet the target of a >15% power conversion efficiency. Additionally, a preliminary cost performance analysis identified that the modules can achieve the LCOE target of 3.5 ¢/kWh for high direct normal irradiance (DNI) locations. Research indicates that the CPV market is interested in the coarse single-axis

trackers, rather than on coarse two-axis trackers.

44. EPC-14-041

Project Name:

Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District

[EPC-14-041]

Recipient/Contractor:

Biogas & Electric, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2015 to 5/31/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Combustion of biogas in a low cost, lean burn combined heat and power (CHP) is vastly more economical than alternatives such as fuel cells, micro-turbines or conditioning biogas to pipeline quality. However, biogas fired internal combustion engines generate NOx and SOx, thus to obtain necessary air permits, biogas projects are required to deploy costly post-treatments such as selective catalytic reduction (SCR) to attain compliance. In addition to employing expensive catalysts, a downside of selective catalytic reduction -type systems is the need to maintain stocks of ammonia on hand to support the cleanup process.

Project Description:

This project aims to design, build and install a continuously operating commercial scale emissions reduction system for the lean burn biogas engine(s) at a municipal wastewater treatment plant in Palm Springs California. The project will enable lean burn biogas engines to comply with existing and future air quality regulations when deployed at wastewater treatment plants, resulting in reduced flaring and net reductions in emissions.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The technology being deployed is a low cost NOx and SOx reduction wet scrubbing technology called NOxRx (a registered trademark) which can be used in conjunction with all biogas engines and anaerobic digesters in the market today. NOxRx has a patented method of utilizing the effluent stream from an anaerobic digester to reduce emissions from biogas engines. Unlike SCR, it does not produce N2O and does not require H2S removal or biogas conditioning prior to combustion. Therefore, NOxRx represents a significant cost savings over competing NOx reduction solutions. The goal of this project is to demonstrate the commercial viability of NOxRx for biogas-fired lean burn engines to comply with CARB NOx and SOx standards, and SCAQMD Rule 1110.2.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1a, 1c, 1f, 3a, 3b, 4b, 4e

Lower Costs:

This technology will enable operators to deploy low-cost internal combustion engines for biogas generation by avoiding the need for pre-treatment and by replacing conventional selective catalytic reduction with a wet scrubber that uses the chemistry of the plant's available effluent rather than purchased or stored chemicals.

Environmental Benefits:

Cost-effective solutions for converting biogas to power will enable wastewater treatment facilities to reduce flaring to the atmosphere, and subject the products of combustion to post-processing that will reduce NOx and SOx emissions to tighter regulatory standards.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $2,249,322		**EPIC Funds Spent:** $11,858	
Match Partner and Funding Split: Anaergia Technologies, LLC: $450,000 (16.7 %)		**Match Funding:** $450,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Pre-existing: Patent number US 8, 012,746. Pending: 13/519,539 (7/27/12); US2010/61780 (12/22/10); 2,785,368 (12/22/10); 201080064956.8 (12/22/10); 10841589.4 (12/22/10); 5460/DELNP/2012 (12/22/10); 14/333,429 (7/16/14); US2014/046902 (7/16/14)

Update:

Biogas and Electric was unable to demonstrate its emission reduction system at the Palm Springs site, hence requested an amendment to the agreement to change the host site to a wastewater treatment facility in Escondido, San Diego County and extend the term. The amendment is pending approval.

45. EPC-14-044

Project Name:

Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy

[EPC-14-044]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/30/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Production of energy from waste biomass aligns with California's clean energy policies and diverts waste from landfills, reduces landfill methane and fossil carbon dioxide (CO2) emissions, reduces fossil fuel reliance, and improves grid reliability and resiliency. Using the organic fraction of California's municipal solid waste (MSW) for combined heat and power (CHP) generation would help the state meet its Renewable Portfolio Standard (RPS), diversify the mix of resources in the state's electric generation portfolio, and help municipal governments achieve sustainability goals.

Project Description:

The purpose of this project is to enable environmentally and economically sustainable deployment of technology that transforms organic municipal solid waste into heat, electricity, and compost via dry anaerobic digestion. A dry anaerobic digestion and composting facility processing the organic fraction of MSW will be scaled up from 40,000 tons/year to 90,000 tons/year, and will increase production of renewable electricity and heat.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will provide valuable insight to identify optimum pathways that overcome barriers for large-scale deployment of biomass conversion technologies. The research will focus on overcoming barriers for urban stakeholders, including odor, access to the utility grid, and improved utilization of waste heat.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Combined heat and power: D.10-12-035., R.08-06-024.

Applicable Metrics: CPUC Metrics- 2a, 3g, 4a

Lower Costs:

The renewable electricity and heat output has the potential to offset fossil fuel use, thus reducing fuel costs and helping to insulate ratepayers from future fluctuations in fossil fuel prices. It can produce up to 187.5 kwh electricity/tonne wet waste.

Economic Development:

It is estimated that 10 percent diversion of California's organic MSW for CHP generation has the potential to produce about 0.5 terawatt-hours (TWh) of renewable electricity per year, as

well as about 51 million therms of renewable heat energy per year. Zero Waste Energy Development Company (ZWEDC) will receive $178,482 to $464,486 under the biomass feed-in-tariff price in annual revenue from electricity sales.

Environmental Benefits:

The strategies to minimize odor-causing and other air emissions will improve increase the potential for bioenergy facilities that can be sited in or near cities throughout California to reduce transportation costs. Avoided GHG is estimated to be 298,651 metric tons CO2e per year.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $1,497,504	
EPIC Funds Encumbered: $4,300,000		**EPIC Funds Spent:** $2,987,486	
Match Partner and Funding Split: Zero Waste Energy Development Company: $1,500,000 (25.9 %)		**Match Funding:** $1,500,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Researchers measured NOx emissions during several flaring events to establish primary NOx formation pathways, which may include thermal, fuel, and prompt NOx formation. The team performed air emission measurements and modeling to minimize odors and greenhouse gases from anaerobic digestion and the composting facility. Researchers are updating the Life Cycle Assessment model to identify opportunities for improved economic and environmental performance by quantifying the life-cycle cost, energy demand, and the GHG impacts of the existing ZWEDC facility and paths to scale-up. ZWEDC has interconnected to PG&E grid and enrolled in CAISO to enable sale of net electricity.

46. EPC-14-045

Project Name:

Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation

[EPC-14-045]

Recipient/Contractor:

Taylor Energy

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

In California, 30-million tons of organic materials are added to landfills each year. There is a broad gap in available technology and scientific knowledge required for economic use of municipal solid waste as a gasification feed, particularly in the 1-MWe to 20-MWe power output range. There is a market need to address refuse derived biomass as an opportunity feedstock and to address the equipment size range needed for distributed power generation in California communities.

Project Description:

This project designs, develops and tests a waste-to-energy Process Development Unit (PDU), involving conversion of Refuse Derived Biomass into clean fuel gas by Thermal-Catalytic Gasification, Reforming and Pulse Detonation Technology. This is a two-stage process, with a primary gasification stage, followed by a reforming stage; and hot filtration, followed by wet scrubbing of the process gas. This project tests a 3-pound per minute PDU, evaluates the results, and provides engineering data to design a 30 ton/day plant generating 1-MW electric power.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project researches, develops, and verifies thermal catalytic gasification technology that will overcome technical and economic barriers preventing the use of refuse derived biomass (RDB) as an energy resource in California. Completion of the current gasification/reforming test program enables future scale-up to 30-ton/day RDB-to-energy (1-MWe scale), in preparation for commercial scale design at 300-ton/day, generating 10-MW of electricity with costs of less than $3,750/kWh of installed capacity.

CPUC Proceedings addressing issues related to this EPIC project:

Combined heat and power: D.10-12-035., R.08-06-024.

Applicable Metrics: CPUC Metrics- 2a, 4a, 4e

Lower Costs:

The Levelized Cost of Electricity is estimated at $118/MWh for 10-MW scale, which results in ratepayer savings of approximately $30/MWh compared to grid supplier power that will likely average $150/MWh through 2024.

Environmental Benefits:

The project will divert MSW from landfills and generate electricity, reducing NOx emissions from flaring or direct combustion by approximately 6.5 TCO2e/year.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $188,248
EPIC Funds Encumbered: $1,499,481	**EPIC Funds Spent:** $1,292,649
Match Partner and Funding Split: Taylor Energy: $46,616 (3.0 %)	**Match Funding:** $46,616
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Patent. Gasifying Carbon Materials: Jet Spouted bed Integrated with Draft-Tube Reformer, both powered by pulse-detonation -burner(s) and bed material optimum for the process.

Update:

Design and fabrication of the Process Development Unit and equipment layout work at the host site is complete. Major equipment, consisting of PDU, Reformer, gas-flare and gas conditioning equipment was installed. Testing of the gasification system has started. One TAC meeting and two CPR meetings were held to review project progress towards achieving goals and objectives. Initial startup of the gasification was performed using 8 lbs of wood pellets, and then refuse derived biomass. The pulse burner operated at 900 degrees C and produced 9.47% char by weight. Startup testing started in June 2017 and is scheduled to be completed during next four months, ahead of schedule. The rate of char conversion will be increased by a modification to the gasifier that allows char particles to stay in the gasification zone. This modification will also result in increased syngas production.

47. EPC-14-046

Project Name:

Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction

[EPC-14-046]

Recipient/Contractor:

Kennedy/Jenks Consultants, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Energy generation potential through the digestion of municipal sewage at wastewater treatment plants (WWTP) and the co-digestion of fats, oils and grease (FOG) and food wastes is estimated at more than 600 megawatts (MW). While combined heat and power generation systems using digester gas are highly beneficial, several barriers exist that impede the installation of these systems. Among the key barriers for food waste co-digestion are the challenges in pre-processing food wastes prior to their addition to the digesters.

Project Description:

The project demonstrates two complementary approaches to lower the overall cost of co-digestion: a new technology to lower preprocessing cost of food wastes, and a new strategy to lower the mass of cake solids requiring disposal. The new technology for the preprocessing of food wastes uses an organic waste preprocessing technique known as an organic extrusion press (OEP) for selective extrusion of organic materials and is capable of recovering 95% of organics. The project applies a new strategy in operating co-digestion systems that involves optimizing the organic waste loading in a way that will lower the mass of cake solids requiring disposal relative to the conventional process.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will result in reliable and cost effective energy production by producing bioenergy from waste water treatment plants (WWTP) through the addition of locally available food waste and restaurant fats, oil, and grease (FOG). Though there is some seasonal variation, the supply of wastewater, food waste and FOG are very reliable.

CPUC Proceedings addressing issues related to this EPIC project:

SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 3a, 4a, 4e

Greater Reliability:

Applying the results of this project to waste water treatment facilities will reduce grid imports and provide a reliable generation source for these facilities and the grid. With the technology advancement supported by this project, the estimated increase in annual energy production at the demonstration facility is approximately 7,400 MWh.

Environmental Benefits:

The technology from this project has the potential to reduce greenhouse gas emissions by 443,345 MTCO2e/year at a modest 10% market penetration. Furthermore, a lower volume of sludge requiring disposal will lower the emissions from trucks used for hauling sludge.

Public Health:

The project will help avoid manual handling and separation of decomposable waste materials and divert up to around 4,100 tons per day of food wastes out of landfills. Manual separation of food waste risks staff exposure to unsanitary conditions and potential inhalation of pollutants from purifying organic materials, resulting in sickness and other adverse health effects.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $323,906	
EPIC Funds Encumbered: $1,496,902		**EPIC Funds Spent:** $415,576	
Match Partner and Funding Split: Silicon Valley Clean Water (SVCW): $2,600,000 (63.0 %) Water Environment & Reuse Foundation: $30,000 (0.7 %)		**Match Funding:** $2,630,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The researchers completed benchmark digester performance for digester operations without the addition of food waste and Fats, Oils and Grease (FOG) at two sludge loading conditions. A FOG preprocessing unit is installed and is fully operational. The first test loading FOG to sludge is completed, and the second test is ongoing. Installation of the Organics Extrusion Press (OREX) for extracted food waste and polishing unit is completed, along with the initial characterization of OREX. The system is expected to be ready for operation by April 2018. Initial results from the study were presented at the Water Environment Federation's Residuals & Biosolids Conference in April 2017.

48. EPC-14-047

Project Name:

Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process

[EPC-14-047]

Recipient/Contractor:

Southern California Gas Company

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/15/2015 to 12/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

Because of the intermittent nature of many renewable energy sources, special attention must be taken when connecting them to the electrical grid. Energy storage technologies have the potential to increase the reliability of California's energy supply, as well as the ability to dispatch renewable energy sources on demand instead of upon production. Yet, traditional forms of energy storage are often prohibitively costly and lack mature mechanisms for participation in electricity markets.

Project Description:

This goal of the project is to integrate Concentrating Solar Power (CSP) and Hydrothermal Processing (HTP) into a single, integrated system; confirm that it can convert dairy manure into RNG and bio-crude; study the economics of integrated CSP-HTP systems sited at dairy farms; and confirm that the RNG produced meets pipeline-transmission and geological-storage quality standards. In this way, the project anticipates proving that it is possible to store the energy contained in dairy manure waste in a manner that enables California natural gas plants to produce readily dispatchable, ultra-low-emissions renewable electricity.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop and demonstrate a new bioenergy pathway which utilizes hydrothermal processing and concentrating solar power to convert dairy manure into bio-crude and renewable natural gas that will enable dispatchable and low emissions renewable electricity.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Energy storage: R.15-03-011 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1a, 1i, 2a, 3g, 4a, 4b, 4e

Lower Costs:

Cost-effective production of pipeline-quality renewable natural gas and bio-crude will offset use of fossil fuels and provide a pathway for low-cost energy storage, reducing peak electricity costs and lowering the price for ratepayers. The project team estimates a renewable electricity production cost of approximately $69 per MWh ($0.069 per kWh), much cheaper than comparable renewable resources.

Economic Development:

Commercialization of this technology would positively impact several markets including: dairies, fuel refineries, natural gas pipeline operators, and electricity producers. In addition, the project itself employs approximately 9 individuals in San Diego and Imperial County.

Environmental Benefits:

By converting dairy manure into renewable natural gas and bio-crude, greenhouse gas emissions typically associated with manure can be avoided. The project teams estimates that a commercial-scale facility using this technology would result in annual net greenhouse gas emission reductions of approximately 3,440 metric tons of carbon dioxide equivalent per year.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $98,501	
EPIC Funds Encumbered: $1,494,736		**EPIC Funds Spent:** $851,946	
Match Partner and Funding Split: Southern California Gas Company (SoCalGas): $600,000 (28.6 %)		**Match Funding:** $600,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project has made significant progress since its inception. Redesign of the CSP receiver was completed by NREL in early 2016, and fabrication of the receiver was completed in 2017. Design of the Genifuel hydrothermal processing (HTP) unit with input from the Pacific Northwest National Laboratories (PNNL) was completed in late 2016 and a fabricator was chosen in early 2017. As of late 2017, construction of the HTP system is near completion and the Hyperlight CSP facility is being expanded to a half acre in size using redesigned collectors and receivers. The system will be commissioned in early 2018 with testing will take place throughout the year.

49. EPC-14-050

Project Name:

City of Fremont Fire Stations Microgrid Project

[EPC-14-050]

Recipient/Contractor:

Gridscape Solutions

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

California needs to make better use of locally available renewable energy to increase resiliency and address climate change impacts, such as increased fires, severe storms, and heatwaves. Critical facilities are especially vulnerable to climate change impacts that disrupt the normal delivery of energy needed for their operation. Microgrids could help increase the resiliency of critical facilities through maximizing use of local renewable energy. Microgrid demonstrations at fire stations will develop a case study to assess their ability to support fire station operations and safely island from the grid.

Project Description:

This project will design and build low carbon-based microgrids at three fire stations in Fremont, California. Each microgrid consists of a microgrid energy management system, a parking lot canopy photovoltaic system, and a battery energy storage system. The automated microgrid control system will optimally manage local energy resources and loads. The microgrid will provide at least three hours a day of power for critical loads during a utility power outage.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The fire stations are vulnerable to earthquakes, so having local, renewable generation decreases their dependence on outside electricity sources. This is the first implementation of microgrids for several fire stations in the region which creates a great opportunity for proof of concept to overcome risk and knowledge barriers for adopting high penetration solar PV system. The microgrids will demonstrate their ability to improve energy efficiency by optimizing power generation and loads using advanced, automated microgrid control. Local, renewable photovoltaic generation and energy storage may provide increased energy security during utility power outages and reduce carbon dioxide emissions. The microgrids will help reduce grid congestion and increase grid reliability.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5a

Greater Reliability:

This project will reduce grid congestion and improve resiliency for the distribution system by using local photovoltaic generation, thus reducing the utility load where substations are near maximum capacity. The fire stations will have greater reliability by using local energy resources during a utility outage, at least three hours a day.

Environmental Benefits:

This project will reduce carbon dioxide emissions by using local clean power generation (solar photovoltaics) and energy storage when available. This emissions reduction will help the City of Fremont meet its greenhouse gas emission target and achieve its zero net energy goals for city government buildings.

Energy Security:

The fire station microgrids will provide at least three hours a day of electricity to critical loads during utility power outages. The fire stations are vulnerable to earthquakes from the nearby Hayward faults, so having local, renewable generation decreases their dependence on outside electricity sources.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $73,475	
EPIC Funds Encumbered: $1,817,925		**EPIC Funds Spent:** $1,003,605	
Match Partner and Funding Split: Delta Products Corporation: $71,691 (2.9 %) City of Fremont: $80,000 (3.2 %) Microgrid Energy: $10,000 (0.4 %) Gridscape Solutions, Inc.: $495,569 (20.0 %)		**Match Funding:** $657,260	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Gridscape has successfully completed design, procurement, construction, interconnection, and commissioning of the microgrid at the first fire station (#11). This microgrid has been operational since September 2017, and Gridscape has started the data collection process. The remaining two microgrids at the fire stations #6 and #7 are expected to be completed by March 2018. There were several barriers in this project involving liquefaction zones at the sites as well as utility interconnection issues. Those issues have been resolved; however, they resulted in a delay of 12 months. Gridscape was granted a 12 month time extension to complete the project. Gridscape has also presented this project at several conferences and is expected to commercialize this technology by end of 2018.

50. EPC-14-051

Project Name:

Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy

[EPC-14-051]

Recipient/Contractor:

All Power Labs, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/15/2015 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

California has an opportunity to help achieve the state's renewable energy goals using biomass from forest management, but it also faces conflicting challenges managing parched forests in a time of drought and climate change. Gasification is a key technology to forest biomass-to-energy conversion leading to reliable energy, reduced cost and greenhouse gas (GHG) emissions, and reduced risk of forest fires. Current related technologies are not profitable at distributed scales. Further, any negative environmental impacts from the use of forest waste and biomass resources in the state must be mitigated with appropriate technology and management strategy.

Project Description:

This project aims to design, deploy, and test a 150 kilowatt-electric (kWe) modular, mobile biomass gasification generator (the Powertainer) that converts forest slash biomass into on demand renewable energy and meets the California Air Emission Standards. The results of the demonstration will be analyzed to determine (1) optimal siting to enhance grid stability, (2) impact of monetizing current forest waste as fuel on ability to increase forest thinning and lower wildfire risk, and (3) impact of increased thinning on availability of hydrological resources.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project, built entirely of technology designed and manufactured in California, will develop and demonstrate a higher capacity, and currently unavailable in the market, mobile conversion system capable of cost-effectively converting forest biomass near where it is sourced into renewable, on-demand energy to help address a myriad of issues associated with climate change, including drought, fires, and the need for more renewable energy.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1a, 1c, 4a

Lower Costs:

The project uses increased forest thinning to produce renewable energy more economically via a low cost modular and mobile biomass gasification technology that is able to have a levelized cost of energy at or below SB1122 incentive target levels.

Greater Reliability:

This project analyzes and demonstrates how this technology could present CAISO and other regulatory bodies with a dynamic peak load shifting tool to address localized load and capacity constraints.

Environmental Benefits:

The project reduces about 95%+ in Carbon Monoxide, Volatile Organic Compounds, and PM-10 emissions compared to burning forest wastes.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $463,311	
EPIC Funds Encumbered: $1,990,071		**EPIC Funds Spent:** $1,292,604	
Match Partner and Funding Split: All Power Labs, Inc.: $686,038 (25.6 %)		**Match Funding:** $686,038	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

During the integration and assembly of subsystems into a fully assembled Powertainer (PT), researchers experienced technical challenges in some subsystems, such as the ash removal system, char candle filter performance, fuel flow from hopper, and layout and transportation. The gasifier and related components are being prepared for testing of the improved ash removal system. Preliminary tests on the gasifier measured a producer gas composition stable and within the expected range. The average composition of carbon monoxide and nitrogen was 28% and 20%, respectively, with a heat value equal to 7.0 MJ/m3. The ongoing activities are focused on the readiness of the fully assembled PT for performance and emission testing at the demonstration site. Data generated during those tests will be applied in market based models to determine the value and optimal locations for mass deployment.

51. EPC-14-052

Project Name:

Community Scale Digester with Advanced Interconnection to the Electrical Grid

[EPC-14-052]

Recipient/Contractor:

Organic Energy Solutions, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2015 to 5/31/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Digester systems have the potential to play an important role in providing renewable electricity while reducing California's GHG emissions. Despite a regulatory environment encouraging renewable energy production and greenhouse gas reductions, there is a need for technology to lower the system cost as traditional methods require high capital costs to remove organic materials from the wastewater stream to create good quality slurry for an anaerobic digester system.

Project Description:

The project's aim is to install and operate an innovative anaerobic digestion system using a high-rate biodigester technology that will process approximately 50 tons per day (TPD) of organic waste from a large supermarket (Albertsons) distribution center and 50 TPD (20,000 gallons) of high-strength slurry created by recovering and concentrating organics in wastewater streams. This project is co-located with the Co-West Commodities Wastewater Pre-Treatment Facility- an operation that collects wastewater (carbs, sugar, protein, and fat, grease, and oil known as FOG) from industrial businesses and pre-treats the material for disposal into the local sewer system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will demonstrate the use of electrical generation powered by digester gas to provide reliable power to a critical facility during outages on the grid. The electricity from this project will be exported to the SoCal Edison distribution grid through SB 1122 Bioenergy Feed-in Tariff. The system will also be equipped with islanding capability to support the critical facility during an interruption in the grid.

CPUC Proceedings addressing issues related to this EPIC project:

SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1b, 1c, 2a

Lower Costs:

The method developed by this project would lower the system cost, resulting in a significantly lower price of electricity compared to traditional or fossil generation. The estimated LCOE is $122/MWh.

Greater Reliability:

This project will provide reliable renewable electricity without the need for standby and backup power, capable of providing power during peak energy demand.

Economic Development:

The coproducts are 1,226 tons of residual solids for vermicomposting feedstock per year; and, 1.6M gallons per year of liquid effluent for fertilizer.

Environmental Benefits:

The project will divert and use food wastes to generate electricity that will yield reductions in GHG emissions. The net CHG offset is 4,125 MT CO2e/year. It will also improve environmental quality by providing clean energy while improving wastewater quality and reducing odor via anaerobic digestion.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $252,977	
EPIC Funds Encumbered: $5,000,000		**EPIC Funds Spent:** $1,845,252	
Match Partner and Funding Split: Organic Energy Solutions: $7,700,539 (60.3 %) CleanWorld: $75,400 (0.6 %)		**Match Funding:** $7,772,939	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Since the project kicked-off in August, 2016, OES has completed design and equipment specifications for the project and initiated procurement for long lead-time equipment. CleanWorld, a major subcontractor to this project is currently fabricating the anaerobic digestion processing skid in anticipation of its installation beginning in March 2018. CleanWorld has also completed the hot water skid for maintaining process temperatures and is currently holding it at its plant for delivery to the demonstration site when construction begins. Other

system components, including mechanical and electrical controls are also in the process of being assembled at CleanWorld. OES is currently seeking a 10 month no-cost time extension to ensure the project is completed during the grant term.

52. EPC-14-053

Project Name:

A Renewable Based Direct Current Building Scale Microgrid

[EPC-14-053]

Recipient/Contractor:

Robert Bosch LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/30/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

California needs to make better use of locally available renewable energy to increase resiliency and address climate change impacts, such as increased fires, severe storms, and heatwaves. Microgrids are able to disconnect from the grid and provide islands of stable, independent power that maximizes the use of local renewable energy. Microgrids can reliably integrate energy efficient demand-side resources, distributed clean energy generation, and smart grid components to enable energy smart community development.

Project Description:

This renewable-based direct current (DC) microgrid will connect on-site generation with loads and provide a low cost, energy-efficient solution to save costs. Solar PV will be directly connected to energy-efficient DC lighting, DC energy storage systems, and ventilation on a 380 V DC bus to form a DC building microgrid. This microgrid system proposed for the Honda Distribution Center in Chino, California reduces the need for inverters for PV and rectification equipment in the loads, thus improving the overall utilization of solar energy by 7-10% as compared to conventional AC systems, while lowering component complexity and costs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will demonstrate the feasibility and benefits of a commercial-scale DC building microgrid that uses multiple direct current technologies to provide reliable power to the loads on DC circuits, resilience during grid outages, increased energy efficiency and renewable energy utilization with lower losses.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5a, 5d

Lower Costs:

By operating advanced technologies such as LED lighting and energy storage systems on DC power as opposed to AC power, installation and operating costs will be reduced.

Environmental Benefits:

If adopted by 2-5 percent of commercial buildings in California, it can result in 128

gigawatt-hours per year of energy savings. This translates to avoided carbon dioxide emissions of 36,000 metric tons per year, and avoided NOx emissions of 343 metric tons per year.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $276,825
EPIC Funds Encumbered: $2,817,566	**EPIC Funds Spent:** $1,178,165
Match Partner and Funding Split: Regents of the University of California, Davis - California Lighting Technology Center: $9,183 (0.2 %) Maxwell Technologies: $56,393 (1.2 %) Imergy Power Systems: $45,000 (1.0 %) AMERICAN HONDA MOTOR COMPANY, INC.: $110,631 (2.4 %) Robert Bosch LLC: $1,576,337 (34.2 %)	**Match Funding:** $1,797,544
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	31 out of 40 bidders	Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The energy storage partner filed for bankruptcy and forfeited their contract. Bosch evaluated and brought on another storage vendor. Bosch then worked out the final battery design with the new partner to finalize the interconnection approval and provided revised construction drawings to obtain permits from the City of Chino and the Chino Fire District. Bosch worked to finalize the DC lighting fixture specifications with the lighting manufacturer. Information necessary for a training program curriculum is being collected and will include the ongoing work of installation and inspection of the solar, lighting, fans, and the fork lift charger system. Bosch continues to monitor the existing facility energy usage for future analysis.

53. EPC-14-054

Project Name:

Demonstrating a Community Microgrid at the Blue Lake Rancheria

[EPC-14-054]

Recipient/Contractor:

Humboldt State University Sponsored Programs Foundation

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	7/6/2015 to 3/30/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

California needs to make better use of locally available renewable energy to increase resiliency and address climate change impacts, such as increased fires, severe storms, and heatwaves. Microgrids are able to disconnect from the grid and provide islands of stable, independent power that maximizes the use of local renewable energy. Microgrids can reliably integrate energy efficient demand-side resources, distributed clean energy generation, and smart grid components to enable energy smart community development.

Project Description:

This project will demonstrate the ability of a community-scale microgrid to bolster the resiliency of an American Red Cross critical support facility and the capability of the microgrid to power itself with a high penetration of local renewable resources. The microgrid will be designed to island indefinitely.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will measure customer energy and cost savings benefits and demonstrate the benefits of microgrids using renewables for vulnerable communities. The microgrid will have the ability to disconnect from and operate without the larger electric grid by managing and balancing a portfolio of distributed energy resources.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5a, 5d

Lower Costs:

The solar PV array and battery storage system will lower annual energy purchases and also lower average peak demand by using onsite renewable energy resources.

Greater Reliability:

The proposed microgrid will be designed to be capable of supplying electric power indefinitely, even in the event of a utility grid outage. The microgrid controller will prevent uncontrolled export of energy to the electric grid which will increase grid reliability.

Increase Safety:

The microgrid as anticipated will increase the safety of the community by being able to provide electric power to the emergency response center if the electric grid goes down during a disaster.

Environmental Benefits:

The microgrid system will reduce power purchased from the electric grid by using onsite renewables and lower the amount of power generated by the on-site diesel generator.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $832,908
EPIC Funds Encumbered: $5,000,000	**EPIC Funds Spent:** $4,146,573
Match Partner and Funding Split: Serraga Energy, LLC at Blue Lake Rancheria: $715,935 (11.3 %) Humboldt State University Foundation, Schatz Energy Research Center: $82,221 (1.3 %) GHD, Inc.: $10,266 (0.2 %) Siemens Energy and Automation, Inc.: $250,000 (4.0 %) Tesla Motors: $210,000 (3.3 %) Pacific Gas and Electric Company: $50,000 (0.8 %)	**Match Funding:** $1,318,422
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In January 2017 the microgrid was operational, with the secondary SEL 700GT+ relay control system handling all transitions between grid-connected and islanded states. Offsite testing of the primary controller, the Siemens microgrid management system, was completed at Idaho National Laboratory in February of 2017 and microgrid operators participated in a control system training. In March 2017, onsite testing occurred along with a pre-parallel inspection. All protection and controls systems passed inspection except for seamless transitions events. PG&E granted Conditional Permission to Operate for Testing Purposes Only, which allowed the project team to fix the seamless transitions. Final Permission to Operate was granted on July 31, 2017. The primary microgrid control system has been fully operational since that time, and system monitoring is ongoing.

54. EPC-14-055

Project Name:

Las Positas Community College Microgrid

[EPC-14-055]

Recipient/Contractor:

Chabot-Las Positas Community College District

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/8/2015 to 1/18/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

California needs to make better use of locally available renewable energy to increase resiliency and address climate change impacts, such as increased fires, severe storms, and heatwaves. Microgrids are able to disconnect from the grid and provide islands of stable, independent power that maximizes the use of local renewable energy. Microgrids can reliably integrate energy efficient demand-side resources, distributed clean energy generation, and smart grid components to enable energy smart community development.

Project Description:

This project will demonstrate the ability of a commercial-scale microgrid to optimize distributed energy resources for customers, distribution utilities, and the California ISO by using advanced energy management tools to coordinate a high penetration of customer renewable energy assets with multiple energy storage technologies on a community college microgrid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project identifies and measures the benefits of microgrids for customers that shift peak energy use to coincide with peak solar production and for distribution utilities and the California ISO by demonstrating the resource capability of microgrids. This project will measure the microgrid's benefits by using existing retail rates as well as simulating a market in which all microgrid benefits can be monetized.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5a, 5d

Lower Costs:

The project will try to optimize renewable energy production and energy utilization to reduce maximum demand, peak demand, and part-peak demand with a goal of 400kW reduction. Based on the campus' current tariff this could reduce annual demand charges by approximately $100,000.

Greater Reliability:

The project may increase energy reliability on the campus by increasing the amount of solar energy that is used for campus operations instead of allowing uncontrolled export of solar energy to the local utility grid. Controlling the export of energy onto the grid will also increase reliability by reducing congestion.

Energy Security:

The project will attempt to increase energy security of the campus by enabling critical loads on the campus to island from the main distribution grid and operate for up to 10 hours with power generated from the campus solar PV system.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $260,719	
EPIC Funds Encumbered: $1,522,591		**EPIC Funds Spent:** $582,142	
Match Partner and Funding Split: Chabot-Las Positas Community College District: $450,000 (22.8 %)		**Match Funding:** $450,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The year's activities were the continuing development of the system by vendors with relatively new products: UniEnergy Technologies with their 100kW/500kWh vanadium flow battery, and GELI with their microgrid controls. These vendors worked together to integrate their products into a complete microgrid system. The infrastructure was designed and installed, including equipment pads, electrical switchgear, and power and data wiring. The system began operation and entered the measurement and verification project phase by year end. The team shared project information through presentations at national microgrid conferences at Boston in April, Washington DC in June, and a national Educational Public/Private Partnership conference in San Diego in October. The team will present at the annual California K-12 Facilities conference in February 2018.

55. EPC-14-056

Project Name:

Demonstration of Electric Vehicle Smart Charging and Storage Supporting Grid Operational Needs

[EPC-14-056]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/30/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

Plug-in electric vehicles (PEV) may offer a promising alternative to meet the state's transportation needs. However, the increase of PEVs on California's roads presents both an opportunity and a challenge. Specifically, PEVs can potentially be a resource to the grid but when charging PEVs, load patterns tend to spike, rather than remain at constant current. Therefore, research is needed to ensure that when using PEVs there are no negative impacts to the grid.

Project Description:

This project will install PEV charging equipment in five sites in Santa Monica to demonstrate scenarios that represent new power needs, including smart charging, peak shaving, addressing the "duck curve" when there's abundant solar energy, load management, and load smoothing while improving power quality and grid stability. The selected sites will reflect a variety of scenarios including public charging, fleet charging, integration of solar generation with charging, and integration of energy storage with fast charging. Further, the project will assess the usefulness of vehicle to grid and vehicle to building technologies for allowing bi-directional energy flow and using PEVs as distributed energy storage. The projects objective is to provide a model (using simulations to predict grid behavior and emulations using real-world power flows) that will be leveraged for grid planning, pricing, and incentive decisions and provide a deep understanding of the impact these technological changes will have on load and power quality.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Most current electric vehicle service equipment (EVSE) provide uncontrolled charging without using smart algorithms, software, or standard network technologies. This project is demonstrating a pre-commercial PEV infrastructure that uses a control center, communicating over a wireless communication network, to control the charging operations of the EVSEs using smart charging algorithms. The pre-commercial infrastructure (WINSmartEV TM) developed by UCLA will be advanced so that it is able to determine optimized charging and/or vehicle to grid services based on PEV profiles, user preferences, grid-related events, and grid capacities.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1h, 3f, 4b

Lower Costs:

The project attempts to provide grid services to smooth renewable over-generation, while generating a revenue stream for the vehicle user thus reducing the cost to own the vehicle. The researcher will also assess user incentives for V2G/V2B applications using data to understand the behavior of energy consumers and run simulations to understand the economic margin of these applications for grid services. Results will help better understand possible incentives that can encourage fleet owners or PEV drivers to participate in vehicle to grid/building and pricing models will be developed based on obtained analysis.

Greater Reliability:

The project will potentially increase reliability by implementing V2G to provide the equivalent of energy storage. This will be compared with the grid impacts of the surrounding area to determine the effectiveness of this approach.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $358,770
EPIC Funds Encumbered: $1,989,432	**EPIC Funds Spent:** $1,367,761
Match Partner and Funding Split: California Lithium Battery: $100,000 (4.0 %) Proximetry: $130,000 (5.2 %) City of Santa Monica: $146,000 (5.9 %) Korea Institute of Energy Research (KIER): $36,000 (1.4 %) The Regents of the University of California, Los Angeles: $88,000 (3.5 %)	**Match Funding:** $500,000
Leverage Contributors: City of Santa Monica : $146,000 Korea Institute of Energy Research (KIER) : $36,000 UCLA MAE : $218,000 California Lithium Battery : $100,000	**Leveraged Funds:** $500,000

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The UCLA team developed EV charging algorithms with demand response capability. The team also developed and tested a phone application and an EV user web application. The researchers are continuing development and integration of an IEC 61850 standard compliant gateway. Several EV chargers were installed in the City of Santa Monica Public Parking Building and on the UCLA campus. Possible solutions for control and V2G operations were explored, and the team also tested the bi-directional fast chargers during the past year.

56. EPC-14-057

Project Name:

Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets

[EPC-14-057]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/4/2015 to 3/30/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

Plug-in electric vehicle (PEV) charging presents new challenges for reliable grid operations and ratepayers. PEV charging can add substantial power draw to a facility, and when several PEV chargers are co-located, the ratepayer is likely to face substantial demand charges. For grid operators, PEV charging can add substantial loads during periods when the grid is already stressed. Currently, no commercially-available solutions exist for intelligently coordinating the charging of vehicles by either responding to automated demand response signals, by mitigating demand charges for a ratepayer, or by offering PEVs as a resource for the wholesale market.

Project Description:

This project is developing an aggregation system for smart charging PEVs to provide demand response, mitigate demand charges, leverage time-of-use rates, and offer wholesale market services. The demonstration is tapping into the inherent flexibility in the time and rate of PEV charging to participate in PG&E's automated demand response programs, and CAISO wholesale markets for demand response and ancillary services. A charging control system is being applied to a fleet of vehicles owned by Alameda County and to charging stations that are used by both county vehicles and the public. The project is adding systems for intelligent prediction of PEV loads and control algorithms to create a flexible, modular, and scalable solution for smart charging county fleet and public PEVs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project developed an aggregation system for smart charging PEV vehicles to provide demand response, mitigate demand charges, and leverage time of use rates. A charging control system was applied to a fleet of vehicles owned by Alameda County and to charging stations that are used by both county vehicles and the public. The project added systems for intelligent prediction of PEV loads and control algorithms to create a flexible, modular, and scalable solution for smart charging county fleet and public PEVs. The managed charging control system will enable growth in PEV adoption without straining current grid infrastructure.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1g, 1h, 2a, 3f, 4a, 4b, 5b

Lower Costs:

This project attempts to lower cost for energy users by allowing them to participate in energy markets which creates a revenue stream for vehicle users. This project is looking at plug-in vehicle participation in demand response, demand management, and demand charge mitigation.

Economic Development:

New revenues will be enabled by controlling PEV charging to offer grid services, including demand response and ancillary services.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $812,829
EPIC Funds Encumbered: $1,993,355	**EPIC Funds Spent:** $1,483,530
Match Partner and Funding Split: Kisensum: $416,800 (16.5 %) Bay Area Climate Collaborative: $25,000 (1.0 %) County of Alameda, General Services Agency: $27,711 (1.1 %) ChargePoint, Inc.: $45,743 (1.8 %) The Regents of the University of California, Berkeley: $21,507 (0.9 %)	**Match Funding:** $536,761
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project is successfully operating with the Alameda County fleet of vehicles in the Alameda County parking garage. Researchers have successfully recruited volunteers for public participation and will be incorporating information on public EV charging into the study. The EV drivers are using a phone application to communicate with the chargers in the garage for

scheduling their charging sessions. Researchers have begun quantifying the savings from smart charging and there is evidence of a reduction in demand due to the smart charging. Lawrence Berkeley National Laboratory participated in the last three Annual Vehicle-Grid Integration public workshops hosted by the CEC to share the progress, results, and findings of this project.

57. EPC-14-059

Project Name:

Laguna Subregional Wastewater Treatment Plant Microgrid

[EPC-14-059]

Recipient/Contractor:

Trane U.S., Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	8/27/2015 to 3/30/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

Critical facilities are vulnerable to climate change impacts, such as wildfires, that can disrupt the normal delivery of energy. Microgrid technologies are capable of improving a facility's energy resilience and providing additional value. This demonstration of a microgrid at a wastewater treatment plant will develop a case study on the plant's ability to provide sanitary services during times of emergency and to maximize on-site renewable energy use. The challenges involve integrating the energy storage, on-site generation, and control components to allow the facility to bid curtailable loads to the CAISO Proxy Demand Response market while improving resilience and earning revenue.

Project Description:

This project is upgrading a wastewater treatment plant to act as a microgrid with the ability to provide ancillary services to the grid. Once the components are installed and commissioned, the project team will monitor the plant as it operates and gather data on the microgrid operations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will demonstrate that a microgrid at a wastewater treatment plant can operate without compromising water quality or negatively affecting plant operations, can deliver reliable ancillary services to the grid, and can reduce the need for new peaker or load-following generation resources by providing ancillary services. The EPIC funds greatly accelerate the commercialization timeline by demonstrating a functional microgrid that addresses challenges with integrating energy storage, on-site generation, and control components to allow the wastewater treatment plant to bid curtailable loads to the CAISO market while improving resilience and earning revenue.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5a, 5d

Lower Costs:

This project will explore using on site renewables and demand response to lower the facility peak load, which will reduce operating costs.

Environmental Benefits:

This microgrid proposes to provide ancillary services by using renewables and demand-side resources instead of peaker plants.

Public Health:

If successful, this microgrid will support a critical facility that is vital to maintaining public health in an emergency.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $187,080	
EPIC Funds Encumbered: $4,999,804		**EPIC Funds Spent:** $211,444	
Match Partner and Funding Split: City of Santa Rosa: $750,000 (10.3 %) Nuvation Engineering: $1,200,000 (16.5 %) Parker Hannifin Corp: $340,000 (4.7 %)		**Match Funding:** $2,290,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The microgrid is in the construction phase. The project team also completed work on formal hardware/software specifications, methods of data storage and integration, and microgrid controller architecture. The project team successfully executed a City Agreement with Santa Rosa, allowing the team to perform construction activities. Permit applications and construction plans were developed for components, including on-site photovoltaics, energy storage, and selective catalytic reduction equipment.

58. EPC-14-060

Project Name:

Borrego Springs - A Renewable-Based Community Microgrid

[EPC-14-060]

Recipient/Contractor:

San Diego Gas & Electric Company

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/22/2015 to 6/30/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

California needs to make better use of locally available renewable energy to increase resiliency and address climate change impacts, such as increased fires, severe storms, and heatwaves. Microgrid demonstrations are needed to show if microgrids are able to disconnect from the grid and provide islands of stable, independent power using local renewable energy. Demonstrations of microgrids integrating energy efficient demand-side resources, distributed clean energy generation, and smart grid components are needed to encourage energy smart community development.

Project Description:

SDG&E and the project team will demonstrate a utility-owned community microgrid at Borrego Springs. The renewable based microgrid will be able to island the entire community with a peak load of approximately 14 MW, serving approximately 2,500 residential and 300 commercial and industrial customers. SDG&E will utilize two large PV systems, 14 rooftop PV systems, two substation batteries and three distributed batteries.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project proposes to demonstrate and measure improved grid resiliency from using a microgrid. The project will use a microgrid controller/energy management system to attempt to make greater use of locally available renewable energy while avoiding adverse grid impacts.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5a, 5d

Lower Costs:

Borrego Springs saw an average of four hours of outages per year between 2008 and 2012. If the microgrid in this project can avoid these outages, using Lawrence Berkeley National Lab's value of service estimates tool estimated a savings for customers that may top $600,000 per year.

Greater Reliability:

It is anticipated that the microgrid in this project may be able to achieve a 98 percent reduction

in the System Average Interruption Duration Index figure.

Environmental Benefits:

Once deployed for this project, a single 26 MW array could represent a reduction of as much as 21,000 metric tons of CO2.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $923,165
EPIC Funds Encumbered: $4,724,802	**EPIC Funds Spent:** $2,658,026
Match Partner and Funding Split: SMA America: $90,000 (1.4 %) San Diego Gas & Electric Company: $530,000 (8.2 %) OSISoft, LLC: $1,119,560 (17.3 %)	**Match Funding:** $1,739,560
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The focus for 2017 was on the testing and commissioning of the Spirae Distributed Energy Resource Management System (DERMS) software controller, upgrades to existing assets, upgrades to the system protection and automation settings, development of the Energy Education Center in Borrego Springs, and the preparation of the test plan for the oscillation mitigation controller. The team began testing the DERMS controller on all three circuits at the 69 kV bus with the NRG 26 MW solar array in December. The battery system was upgraded to 550 kW, and the system controller was updated to allow the battery system to be the island master and have black start capabilities. A new 250 kW ultra capacitor to assist with voltage and frequency regulation was installed and will be commissioned in Q1 2018. The project will undergo outage testing in early 2018 to assess how well the microgrid performs.

59. EPC-14-061

Project Name:

Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife [EPC-14-061]

Recipient/Contractor:

U.S. Geological Survey

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

There is a general lack of data to adequately determine some impacts of renewable generation on wildlife and habitat loss. This lack of understanding presents challenges to assessing, mitigating, and permitting new renewable energy development.

Project Description:

This research uses real-world data to understand renewable energy impacts to wildlife. The approach is to analyze observed wildlife fatalities and habitat loss to determine the significance of fatalities to population persistence; compare pre-construction predicted and post-construction actual impacts (fatalities) to sensitive species, as a foundation for improving predictive accuracy; and compare predicted and actual benefits of mitigation to sensitive species, as a foundation for improving predictive accuracy. The research goal is to produce a set of decision-making tools for renewable energy developers and permitting and regulatory agencies in California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop and apply a unique combination of stable isotope analysis and demographic modeling to characterize the wildlife population of interest affected by fatalities at renewable energy facilities in California and by novel application of techniques that evaluate statistical models to improve forecasting of wildlife fatality rates and mitigation outcomes. The approach will be high-tech, scientifically innovative and ultimately subject to peer-review via publication in scientific journals. Implementation of this set of tools will benefit ratepayers by streamlining permitting and reducing costs of energy development and electricity.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 3a, 4f, 4g

Lower Costs:

This project is expected to help streamline environmental permitting management (improving reliability and cost). Likewise, improved prediction of fatality and mitigation outcomes allows for the streamlining minimization of compliance efforts, which reduces costs.

Greater Reliability:

Having a better understanding of impacts and how to mitigate them could lead to more capacity via new renewable energy developments and longer operating time (e.g., reduced curtailments).

Environmental Benefits:

Refining predictions associated with infrastructure development will reduce impacts and improve mitigation effectiveness in future renewable energy development.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $262,924
EPIC Funds Encumbered: $1,000,000	**EPIC Funds Spent:** $62,947
Match Partner and Funding Split: US Geological Survey: $94,707 (3.6 %) University of Maryland Center for Environmental Studies Appalachian Laboratory: $22,470 (0.9 %) NextEra Energy: $1,500,000 (57.3 %)	**Match Funding:** $1,617,177
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

As of fall 2017, the project is transitioning from the data collection to the analysis phase. The research team has compiled close to 300 environmental impact and monitoring reports and about 3,000 carcasses that are being prepared for isotopic analysis to distinguish local resident birds from regional migrants. Together with experts, the research team developed a list of 34 species of five types on which to focus. Each type will be modeled with the most appropriate kind of demographic model using data from other parts of the project. The team has also shared sample material from carcasses found at renewable energy facilities with the team from EPC-15-043 to increase their database for genetic analyses.

60. EPC-14-062

Project Name:

Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems

[EPC-14-062]

Recipient/Contractor:

The Regents of the University of California on behalf of the Riverside campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	7/1/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Many water and wastewater treatment facilities in California have a variety of older energy consuming equipment from different vendors each having their own unique communication protocols. Upgrades, modernization and integration of control equipment of various vintages present serious communication challenges for optimizing energy efficiency and peak demand management.

Project Description:

This project involves setting up links using software and hardware at pumping stations for water delivery, storage or treatment that enable the integration and transmission of data from energy meters directly or indirectly into Supervisory Control and Data Acquisition (SCADA) systems that are traditionally set up to monitor water quality parameters in real time. Combined with historical energy use data on the platform operators can manage systems in real time to monitor and control peak demand.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will highlight a pathway for water and wastewater agencies in California to increase energy efficiency and reduce their peak energy consumption with no decrement in service or reliability by overcoming communication challenges with different vintages and vendors of control equipment. Better pump and other equipment management will reduce energy costs; especially during peak demand periods when energy costs are most expensive.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a

Lower Costs:

The project is expected to reduce energy costs for California water treatment facilities due to lower energy and demand costs. The estimated cost savings for the 3 water districts participating as host sites for this project is approximately 10 percent ($4.6 million) with a reduction in electricity consumption of 100 GWh.

Environmental Benefits:

By lowering peak demand, the project could reduce greenhouse gas emissions. Fast start peaker plants used during periods of peak demand; particularly on the hottest days of summer typically produce more emissions of GHG and criteria pollutants. The estimated reduction in GHG emissions is 28,300 metric tons equivalent.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $452,544
EPIC Funds Encumbered: $3,017,034	**EPIC Funds Spent:** $581,127
Match Partner and Funding Split: Opto 22: $94,198 (2.0 %) OSISoft, LLC: $1,081,469 (22.8 %) Regents of the University of California, Riverside Campus: $123,709 (2.6 %) Cucamonga Valley Water District: $198,896 (4.2 %) Inland Empire Utilities: $115,360 (2.4 %) Olivehain Municipal Water District: $109,100 (2.3 %)	**Match Funding:** $1,722,732
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The installation of and testing of software/hardware configurations for test sites to transmit energy data to SCADA operators is complete. These systems have been reviewed by the research team to insure their accuracy in transmitting energy use data in real time. Historical energy use at these sites has been customized in displays so that it can be used for operators to conduct peak load shaving to avoid historical peaks and thus lower energy demand charges. Discussions are taking place with M&V contractors to integrate their independent evaluation into the project design.

61. EPC-14-063

Project Name:

Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water [EPC-14-063]

Recipient/Contractor:

Porifera, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Industrial-scale wastewater treatment systems have the potential to save energy, reduce wastewater volumes, and generate pure water streams for on-site re-use. However, many industrial wastewaters are very difficult to treat, as they contain high levels of dissolved and suspended solids, making low cost treatment with membrane-based systems ineffectual.

Project Description:

This project is demonstrating an advanced wastewater treatment technology, the PFO Recycler that produces high quality water while reducing energy, chemicals and maintenance required for treatment of industrial wastewaters. Treatment of industrial wastewater is very challenging because of the high solids, pulps, free and emulsified oils and greases and their high chemical and biological oxygen demand. If the project is successful then this technology could be used to treat challenging wastewaters to achieve high purity and provide high temperature water for reuse while using less energy than other processes. Reclaiming water for onsite reuse will reduce the need for fresh water purchases.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project includes technological advancements in membrane development and module design in forward osmosis to address cost and performance issues. The demonstration projects are located at a winery, frozen food facility and a soap company. Each demonstration is documenting energy savings and potential for this technology to purify, concentrate and reuse challenging wastewaters that contains high levels of contaminants. This technology has the potential for application in the food and beverage, oil and gas, and other industrial sectors.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 4c

Lower Costs:

This technology treats challenging industrial wastewaters for water reuse and can result in energy and water saving benefits and cost savings. Preliminary results indicate an estimate 15-30 percent energy savings compared to competing technologies while also reusing about 50 percent of the wastewater for internal use. In the past all of the wastewater was disposed through the local wastewater treatment plant.

Environmental Benefits:

By reducing electricity use and water use, the project could reduce greenhouse gas emissions. With broad adoption, the technology could enable the reuse of industrial wastewaters rather than being disposed in the sewer system.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $964,131
EPIC Funds Encumbered: $3,230,420	**EPIC Funds Spent:** $1,569,463
Match Partner and Funding Split: CDM Smith, Inc. : $9,885 (0.3 %) Porifera, Inc.: $417,108 (10.8 %) Jackson Family Wines : $99,800 (2.6 %) Dr. Bronner's Magic Soaps : $69,700 (1.8 %) Wawona Frozen Foods : $50,000 (1.3 %)	**Match Funding:** $646,493
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-063 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Porifera has finished collecting the data from the Jackson Family Wines project site and is analyzing the data. They also have changed the Wawona Frozen Foods site to Ale Industries as they determined that the PFO Recycler will yield more savings and be better suited to meet Ale Industries' needs. They have started operations at Ale Industries and begun collecting data.

62. EPC-14-064

Project Name:

Aerosol Impacts on the Hydrology and Hydropower Generation in California

[EPC-14-064]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Riverside Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/13/2015 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Hydrologic forecasts for hydropower units can have substantial errors. This hampers the efficient management of hydropower units. Hydropower is a very important clean resource that provides peak generation in hot summer months and can provide electricity when wind and/or solar resources go down. Improving hydrologic forecasts could substantially increase these and other benefits obtained from hydropower units. Simulating the effect of aerosols (small particles in the air) into clouds and precipitation is a very promising option to improve weather/climate forecasts.

Project Description:

This research team is enhancing and using a fully coupled aerosol-meteorology-snowpack forecast model for hydropower applications, using observational datasets (precipitation, snowpack, stream inflow) for Southern California Edison's hydropower plant on Big Creek. The main goal is to demonstrate that the use of advanced forecasts can improve the management of hydropower units.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The results of this project are expected to improve the management of hydropower units which should reduce overall electricity generation costs and assist with adaptation under a changing climate.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 4a, 5c

Lower Costs:

The proposed research is intended to significantly advance our knowledge of aerosol impacts on the hydrology and hydropower generation in California. The improved forecast should maximize California ratepayer benefits by increasing the hydroelectric power plant's availability, flexibility and revenue in the wholesale electricity market.

Environmental Benefits:

Improved hydropower management will foster the use of a clean and flexible generation

resource during peak hours.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $92,951	
EPIC Funds Encumbered: $399,818		**EPIC Funds Spent:** $76,587	
Match Partner and Funding Split: University of California, Riverside: $56,262 (8.0 %) University of California Los Angeles: $249,975 (35.4 %)		**Match Funding:** $306,237	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team has set up the computer models and tested them against observed data to make sure their performance is adequate. The researchers are now working with Southern California Edison (SCE) and using a SCE model designed to optimize the operation of their hydropower units. The researchers are testing the hypothesis that using their forecasts can improve substantially the operation of the SCE hydropower units.

63. EPC-14-065

Project Name:

Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use

[EPC-14-065]

Recipient/Contractor:

Porifera, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

There is a need for energy efficient methods to concentrate food and beverage products and wastes under varying processing conditions and operations while preserving or improving product quality. Food and beverage industry operators are eager to implement new methods, but first need to be convinced of the effectiveness and efficiency of the technology without compromising the high quality standards of California's food and beverage products.

Project Description:

This project is demonstrating a new technology innovation, the PFO Concentrator, to reduce the energy, chemicals, and maintenance required for food and beverage processing and waste concentration. The PFO concentrator dewaters fruits and vegetables for production of food and beverage concentrates and purees and could replace energy intensive thermal evaporators. Additionally, water is extracted from the concentrated product for reuse on-site.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The technology uses forward osmosis and reverse osmosis in an energy efficient way to achieve the equipment performance of an evaporator and, in addition, generates purified water streams for reuse. When designed and implemented correctly, the technology can save energy and money.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 4c

Lower Costs:

This technology could lower energy use and costs for food processing and industrial operations through replacement of energy intensive thermal evaporators and reuse of wastewater streams onsite, rather than disposed through the municipal system. The PFO concentrator could save approximately 80 percent of thermal and electrical energy compared to conventional technologies and water reuse of greater than 50 percent. This results in additional cost savings and negates the need to purchase potable water from local jurisdictions.

Environmental Benefits:

Since this technology could lower energy use and eliminate the use of evaporators which burn natural gas, it could lower greenhouse gas emissions. Also the project has the potential to purify wastewater for on-site reuse, thereby lessening need for fresh water purchases, while reducing water disposed through the sewer system.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $621,536
EPIC Funds Encumbered: $2,499,289	**EPIC Funds Spent:** $1,473,278
Match Partner and Funding Split: CDM Smith, Inc. : $9,885 (0.3 %) Porifera, Inc.: $233,108 (7.5 %) Los Gatos Tomato: $385,575 (12.3 %)	**Match Funding:** $628,568
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 7

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Porifera is working on regulatory approval for food contact with the PFO Concentrator at Los Gatos Tomato and have begun testing at the facility. They are finalizing plans for installation at Anheuser-Busch and have prepared the M&V plan.

64. EPC-14-066

Project Name:

High-Performance Integrated Window and Facade Solutions for California Buildings

[EPC-14-066]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Windows have a significant impact on peak heating and cooling loads, and HVAC system sizing and layout. Windows can provide ventilation air and can offset electric use for lighting. While most envelope systems are static (insulation), windows can dynamically change their energy properties (switchable glass) in response to user, building owner, and grid demands. However, smart systems and controls infrastructure to optimize dynamic operations to reliably capture these energy advantages is unavailable.

Project Description:

This project develops, validates and quantifies energy impacts of a new generation of high performance facade systems and provides the design and management toolkits that will enable the building industry to meet challenging energy performance goals leading to zero net energy commercial buildings by 2030. This project considers cost-effective integrated system approaches to reduce energy-use associated with HVAC and lighting while improving occupant comfort.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Almost all fenestration products offered on the market today address a narrow, component-oriented set of performance goals often set by prescriptive codes, e.g. a U-value, with only a limited consideration of the broader tradeoffs possible in the context of whole-building performance. This project uses an integrated systems approach to technological advancement. The fenestration solutions include improvements to the cost and performance of highly insulating (Hi-R) windows, energy recovery-based envelope ventilation systems, and dynamic daylight redirecting systems. Supporting tools, data, and design methods are also being developed to enable widespread, reliable, cost-effective deployment throughout California.

These solutions could lower energy use and demand in buildings due to reduced HVAC and lighting loads while also reducing building owner operating costs.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a

Lower Costs:

The technologies in development are estimated to be capable of reducing statewide energy use by 5755 gigawatt-hours and peak electricity demand by 2250 megawatts resulting in lower electricity costs of $816 million/year (assuming 75 percent market penetration in new and existing commercial buildings).

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,308,746
EPIC Funds Encumbered: $3,000,000	**EPIC Funds Spent:** $1,875,000
Match Partner and Funding Split: United States Department of Energy: $450,000 (13.0 %)	**Match Funding:** $450,000
Leverage Contributors: United States Department of Energy : $450,000	**Leveraged Funds:** $450,000

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 10

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-066 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Design and prototypes are being evaluated for a light-weight, triple-pane window. Designing and early stage prototyping of a perimeter ventilation system that maximizes use of natural ventilation in mild California climates to offset mechanical cooling. Designing, prototyping, and initial field testing of a dynamic daylight-redirecting system that increases daylight up to 40 feet from the window. Improving tools for modeling innovative, optically-complex daylighting systems and prototyping/testing advanced model predictive control systems that will help optimize building electric loads.

65. EPC-14-067

Project Name:

Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems

[EPC-14-067]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/29/2015 to 12/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Next-generation hydrographic data networks are needed to better measure and predict critical snowpack levels that can help hydropower operators adjust to increased variability and precipitation consequences of climate change.

Project Description:

This project develops improved snowpack forecasts within a representative Sierra Nevada watershed to bolster the hydrographic data network that supports hydropower planning and operations. The project is expected to reduce uncertainty in water forecasts in a changing climate, and assist in the development of reliable and flexible operations of hydropower dams that will also bring economic benefits to utilities and ratepayers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project provides improved predictive planning and scheduling tools to manage hydroelectric resources that are needed to adapt to increasing vulnerabilities and uncertainties of a changing climate. This project specifically targets powerhouses operated by PG&E.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 2a, 3a, 5c

Lower Costs:

Increasing ability of hydropower to respond to fluctuations in demand and supply will result in lower costs of energy production.

Greater Reliability:

The improved snowpack data should allow for greater predictability and therefore increased reliability in hydropower generation.

Environmental Benefits:

Better, more-detailed, real-time predictions for water basin-runoffs will increase the hydropower availability and contribute to the mitigation of climate change effects.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $205,897
EPIC Funds Encumbered: $1,100,000	**EPIC Funds Spent:** $140,251
Match Partner and Funding Split: University of California Merced: $86,263 (6.5 %) California Department of Water Resources: $150,000 (11.2 %)	**Match Funding:** $236,263
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team completed hardware installations for three project sites in 2016: Grizzly Ridge, Kettle Rock, and Buck's Lake. Installations on the fourth project site at Humbug were completed in August 2017. The team got hydrologic data from three out of the four sites for water year 2016. The team will collect hydrologic data for the 2017 water year from all 4 project sites. Discussions with PG&E established a prioritized list of data to analyze. The research team will examine methods for extrapolating temperature measurements as well as the relationship between temperature and solar radiation, which is currently highly simplified in the Precipitation Runoff Modeling System. In January 2017, the team presented a poster on Water Sensor Networks at the California Climate Change Symposium. By January 2018, the team will prepare a first manuscript and submit it to a peer-review.

66. EPC-14-068

Project Name:

Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling

[EPC-14-068]

Recipient/Contractor:

Maulbetsch Consulting

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/13/2015 to 1/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

The needs for increasing amounts of electric power and clean water have sometimes come into conflict in California. Hybrid, wet/dry cooling systems enable significant water savings in comparison to wet cooling and improved plant efficiency and output in comparison to all-dry systems. To expedite the introduction of hybrid systems, a methodology and computational tool to provide regulators, planners and potential users with reliable, validated comparative performance and water use cost comparisons with optimized wet and dry cooling systems is needed.

Project Description:

This project analyzes the design, performance and cost of optimized hybrid cooling systems at utility power plant scale to illustrate the potential benefits of hybrid cooling in California. This project uses an existing Excel spreadsheet-based computational tool with the capability of specifying, at an "engineering-level", design parameters for optimized closed-cycle wet, direct dry, and parallel wet/dry hybrid cooling systems. The tool's output is checked against information from participating plants equipped with wet, dry, and hybrid cooling systems. The capability to make rigorous, reliable evaluations of hybrid cooling systems and the trade-offs between economic power production and water resource conservation enables the selection of preferred cooling systems for the economic and environmental benefit of California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Hybrid cooling systems for electric power plants provide an alternative cooling option for California power plants that can simultaneously achieve significant reduction in water consumed for power production compared to closed-cycle wet cooling, improve both peak load and annual average power production efficiency and output compared to all-dry cooling, and reduce the air emissions compared to all dry cooling systems at fossil-fired power plants. The tool has capabilities to make rigorous, reliable evaluations of hybrid cooling systems and the trade-offs between economic power production and water resource conservation enables the selection of preferred cooling systems for the economic and environmental benefit of California.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 2a, 3a, 4c

Lower Costs:

This project will be used to reduce plant capital costs below the cost of dry cooled plants of comparable output and to provide estimations of power output impacts of hybrid cooling systems compared to alternatives. Preliminary estimations performed using the tool show a power plant in Sacramento with an all-dry cooling system loses 20.8% (39.47 MW penalty) of output energy compared to 10.6% of output (20.11 MW penalty) for a plant with a hybrid cooling system.

Greater Reliability:

This project is expected to eliminate the significant efficiency penalties incurred by dry cooled plants during the hot periods of the year when power demand is the highest.

Environmental Benefits:

The project is expected to reduce the amount of water required to keep plants operating in comparison to traditional wet cooling. Estimations for the annual water use (in kgal/yr) for three hybrid systems show that water consumption decreases by 15% to 50% (depending on the site meteorology) compared to the all-wet cooling system. The tool can be useful in determining where hybrid cooling systems would result in optimizing plant performance, balancing power output and water consumption.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $581,580		**EPIC Funds Spent:** $355,250	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

The Recipient has identified an unregistered Spreadsheet Tool software as "project relevant pre-existing intellectual property" in agreement EPC-14-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The research team constructed the tool simulating characteristics for hybrid cooling systems in different climate zones in California as an Excel spreadsheet using the data sets obtained from 6 thermal generating plants using hybrid cooling: Gateway and Colusa (PG&E), Mountain View (SoCal Edison), Afton (Public Service New Mexico), Goldendale (Puget Sound Electric), Mountain View (SoCal Edison). The team obtained weather data from airports located in close proximity to the above-mentioned power plants. Final comparisons of spreadsheet tool estimates for hybrid cooling with actual plant data show a good agreement. The team finalized calibration of the spreadsheet tool and submitted a final tool descriptive report. The Recipient finalized the Case Studies and Statewide Benefits analysis in November-December 2017. Final report was submitted in December of 2017.

67. EPC-14-069

Project Name:

Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System

[EPC-14-069]

Recipient/Contractor:

Energy and Environmental Economics, Inc. (E3)

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/13/2015 to 1/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

If California is to achieve its long-term goal of reducing greenhouse gas emissions 80 percent below 1990 levels by 2050, the electricity system must play a pivotal role. Electricity generation must have significantly reduced carbon intensity and much of transportation and other end uses that are currently powered by direct fossil fuel combustion must be electrified. Prior research has identified "proof of concept" low carbon scenarios, but many aspects of the energy transition remain poorly understood.

Project Description:

This project advances the understanding of key parameters of long-term energy scenarios and greenhouse gas abatement options in the California energy system. Researchers will achieve this by further developing detailed scenarios and modeling capabilities of the California electricity sector, as well as interactions between the electricity sector and other sectors, and by exploring the implications of particular policy choices on the electricity system in the medium (2020-2030) and long term (2050). This project provides critical insight into some of the key challenges facing the low carbon transition in the electricity system, the options for addressing these challenges, and the dynamic interactions among these options, which are likely to grow more important over time.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project developed options for improving electricity planning methodologies, such that they better incorporate knowledge of how the electricity system will need to evolve over the next 15 to 30 years. The analysis includes a better understanding of how current policy choices will impact long-term climate outcomes, providing critical policy-relevant information to state energy agencies that will be implementing the Governor's energy and climate goals over the next 15 years.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 3f, 4a

Lower Costs:

This research provides information to policy makers about key choices that would lower the cost of meeting the state's environmental goals in the electricity sector. This project per se will not lower costs but it is providing information that can be used to develop and implement policies for the energy sector.

Greater Reliability:

This project provides information to policy makers about the key choices and decisions needed to maintain electric reliability of the future system with increased renewable and distributed generation. The scenarios explored by the research team have implications for prioritizing planning in technological development & demonstration and grid integration activities necessary to decarbonize the electricity system while improving resilience in a changing climate.

Environmental Benefits:

This project investigates the environmental and land use implications of different renewable development scenarios under a 50 percent renewable future in 2030 while reducing environmental impacts.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $286,936	
EPIC Funds Encumbered: $700,000		**EPIC Funds Spent:** $509,307	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The researchers improved their models and data sets, for example, improving the linkage between the E3 model of the electricity system and their PATHWAY model. E3 briefed Chair Weisenmiller and the Policy Advisory Committee in November 2017. The final project report is published on the Energy Commission website and available to the public. Key findings of the long-term energy scenarios research include: 1- renewable power generation needs to exceed the current RPS requirement of 50% set for 2030 if the 2030 emissions reductions goal is to be met; 2- to meet California's 2050 goal of 80% emissions reductions relative to 1990, the electricity system must comprise 85% to 95% zero-carbon electricity by 2050; 3- consumer behavior is the lynchpin to meeting 2030 targets; and 4- additional RD&D is needed to chart a path for hard-to-electrify end-uses (e.g., heavy-duty trucks, industry).

68. EPC-14-070

Project Name:

Wexus Energy and Water Management Mobile Software for the Agricultural Industry [EPC-14-070]

Recipient/Contractor:

GDRU Energy Solutions LLC (dba Wexus Technologies)

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

California's agricultural industry is one of the state's largest users of energy and water and has been historically underserved by a lack of effective efficiency technologies. The agriculture industry is also rapidly transitioning to the next generation of technology: mobile, cloud-based software, big data, and connected devices in the field. The combination of rising energy rates, increasing regulation and reporting, drought and changing weather patterns is driving demand for new agricultural energy efficiency solutions. Farmers currently cannot manage what they do not measure, leading to higher operational costs for farms.

Project Description:

This project deploys the Wexus (Water-Energy Nexus) mobile, cloud-based software platform in California's agricultural industry. The Wexus platform leverages existing utility meter infrastructure and helps agribusinesses to quickly assess energy (and water) usage and cost from virtually anywhere on any mobile device. Through customized alerts and reporting, the platform allows farms to quickly respond to changes in energy usage, adjust and optimize equipment in the field, and reduce operational expenses due to energy costs. Through collaboration with project partners, this project will further extend existing water-energy data analysis, visualization and remote controlling capabilities to the Wexus platform to further optimize water-energy resource management in the agribusiness sector.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The Wexus platform uses site data and electric and water utility data to estimate how energy is used on-farm. The data is translated into reports and informs the farmer when to turn off equipment in order to participate in demand response programs. The technology could save farmers about 10% in energy and water bills.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs:

The project could reduce energy costs (and water costs where possible) for California farmers who may use Wexus Software solution to monitor their onsite electricity and water use. The estimated savings over three years for the four demonstration farms: 2.4 million kWh, 4000 acre feet of water, 600 metric tons of GHG and more than $400,000

Greater Reliability:

The project could reduce the demand on the grid from California farms that may use the Wexus Software solution to make informed decisions on the cost/benefit of participating in utility sponsored demand response programs.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $571,397
EPIC Funds Encumbered: $4,000,000	**EPIC Funds Spent:** $2,456,363
Match Partner and Funding Split: Wexus Technologies, Incorporated: $1,000,000 (20.0 %)	**Match Funding:** $1,000,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has deployed the software and hardware solution to four sites and has started engaging the farmers in effective ways to manage on-site energy and water usage for their operations. Project team has started the baseline energy (and water where possible) use. Project team has completed the M&V report for the second quarter of 2017 (April - June), percent total change in energy (and related changes in GHG and cost) with respect to the baseline period for the Wexus farms include: a 3.2% decrease for the Berry Grower, a 75.7% increase for the Dairy Farmer, a 4.1% decrease for the Row Crop Grower, and a 9.8% decrease for the Winery.

69. EPC-14-071

Project Name:

Rotor-Mounted Bat Impact Deterrence System Design and Testing

[EPC-14-071]

Recipient/Contractor:

Frontier Wind

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Measures put in place to mitigate the impact of wind generation facilities on wildlife species, including bats, limit the achievement of key state objectives for renewable generation. These mitigation measures serve to limit the productivity and ability to develop and construct new wind energy projects. Developing more effective technology and methods to mitigate fatal interaction of bat species with wind turbine facilities could enable wider deployment of wind energy with less curtailment.

Project Description:

The project designs and test (in lab and field) a new bat deterrence system using ultrasound transmitters mounted in an array along the rotor blades, providing complete coverage over the entire rotor/nacelle envelope. A field test study using substantially similar methods to prior bat impact studies is being implemented post-installation at the test site to measure the effectiveness of the new ultrasound system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will create the wind industry's first bat impact deterrent system that can effectively prevent fatal bat interactions with wind turbines. Success of the project has potential to yield a transformational impact on the field of bat impact mitigation. An effective, practical, cost effective system design and test can enable commercialization and broad deployment of this technology. As a system that can be retrofitted into existing turbines and installed in new wind turbines, this technology could materially overcome a significant challenge of the wind power industry by reducing bat fatalities and injuries from turbine strikes.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 3a, 4g

Lower Costs:

Currently available mitigation measures can be costly to ratepayers through forced curtailments and limit pursuit of State renewable capacity expansion goals. As such, the project benefits ratepayers by providing a less costly alternative approach.

Environmental Benefits:

The project will develop new technology that could significantly reduce bat fatalities at wind energy facilities.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $29,547	
EPIC Funds Encumbered: $862,875		**EPIC Funds Spent:** $642,337	
Match Partner and Funding Split: Frontier Wind: $22,313 (2.5 %) Bruce Walker: $14,000 (1.6 %)		**Match Funding:** $36,313	
Leverage Contributors: United States Department of Energy : $249,000		**Leveraged Funds:** $249,000	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-071 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Patent for project-relevant independently funded intellectual property for an invention.

Update:

Researchers completed the design stage for the system and tested it in their lab. The full system was installed on twelve turbines at Hatchet Ridge in 2016. Bat fatality surveys were conducted on the test turbines and control turbines during the Fall 2016 bat migration season. Power supply problems disrupted the field testing, limiting the amount of useful data. Problems with the power supplies have been diagnosed and are being resolved. The system should be fully operational for the 2018 migration season, and it is anticipated that enough bat fatality data can be collected to give a statistically robust estimate of the effectiveness of the system to reduce fatalities.

70. EPC-14-072

Project Name:

Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California [EPC-14-072]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 12/30/2017

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

California has set an aggressive long-term climate goal of 80% GHG reduction by 2050 relative to the 1990 level. Several studies have been conducted on how to achieve this goal but they have not considered some important factors such as climate change impacts, aggressive demand response options, plug-in electric vehicle (PEV) adoption, and more realistic energy efficiency scenarios.

Project Description:

The researchers developed long-term energy scenarios for California that comply with GHG emission targets and goals. The scenarios provide new insights about technology options and by when some of this options should be implemented.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The researchers developed a stochastic version of their electricity model to explore issues such as path dependences. The preliminary final results indicates, among other things, that achieving the 2030 GHG target will be extremely difficult with a high percentage of natural gas appliances still in operation. However, this target can be met if California starts electrifying energy services and decarbonize power generation at a fast rate. The electrification of the industrial sector will be difficult even though the electrification technical potential is high. This is mostly due to the costs associated with electrification of the industrial sector. The use of PVs in disadvantages communities may not substantially improve local air quality or public health.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Long-Term Procurement Proceeding (LTPP): R.13-12-010 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 2a, 3f, 3h, 4a

Lower Costs:

The proposed analysis is providing guidance for future electricity investment that can meet carbon limits at the lowest cost. The CPUC using the results of the long-term energy scenario projects to inform their long-term procurement program.

Greater Reliability:

Energy system resilience analysis will help to ensure the electricity system is more robust to future external shocks.

Energy Security:

Studying the optimal paths for developing California's energy system to meet its GHG goals may prevent inefficiency in the energy system investments and potentially avert stranded investments.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $236,701	
EPIC Funds Encumbered: $700,000		**EPIC Funds Spent:** $700,000	
Match Partner and Funding Split: University of California, Berkeley: $65,000 (8.5 %)		**Match Funding:** $65,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-072 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

LBNL and UC Berkeley have developed several long-term energy scenarios for California. The team attempted to harmonize assumptions with E3 and UC Irvine. These two entities performed similar analyses (long-term energy scenarios) than LBNL/UCB, but using different tools. The LBNL/UCB team is modeling the entire Western Electric Coordinating Council (WECC) to investigate if a changing of geographical coverage can affect the long-term energy scenarios. They also used a more granular model of the electricity system both in space and time with, for example, several load centers in the WECC instead of representing California as one block.

71. EPC-14-073

Project Name:

Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures [EPC-14-073]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/29/2015 to 12/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

The prevalence of dark, dry surfaces and human-caused heat in cities creates Urban Heat Islands (UHIs) with elevated air temperatures. UHI countermeasures, such as reflective surfaces and urban vegetation, can save cooling energy, improve thermal comfort in summer, reduce pollutant emissions, and improve health. These measures may also help counter potential microclimate, emissions, and air-quality impacts of climate change. However, there has been little empirical validation of on-the-ground benefits of countermeasures. This study gathers high-resolution, real-world data to clarify determinants of UHI effects and sets the stage for improving quantification of countermeasures.

Project Description:

This project evaluates the distribution of air temperatures within urban heat islands in California and enhances the foundation for location-specific assessments of mitigation strategies. In collaboration with local governments and organizations in the Los Angeles Basin, the research team designed and implemented siting of fixed high-quality monitoring stations, supplemented with mobile monitoring and data from existing weather-station networks. This research assesses spatial and temporal variations in near-surface air temperature and recasts these observations for use in validating and calibrating the climate/meteorological models applied to assess potential benefits of urban heat island countermeasures throughout the state.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Research improves on-the-ground benefits from urban heat island (UHI) mitigation by verifying relationships between the UHI effect and land use/land cover; using these measurements to calibrate and validate models that estimate benefits of mitigation measures; establishing a baseline of today's UHI effect against which the efficacy of future UHI mitigation (cool community) programs can measured; and leaving in place a set of research-grade monitors that can be used to track changes in the UHI effect.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 4a

Greater Reliability:

Extensive prior research indicates that urban heat island (UHI) mitigation attainable through cool community strategies can save electricity, reduce peak power demand, lower strain on the electrical grid, and increase reliability. This research project will facilitate regionally optimized deployment of UHI mitigation technologies.

Public Health:

UHI mitigation can reduce air pollutant emissions and slow production of ground-level ozone, thus improving air quality and protecting public health. The research project will help ensure that future UHI mitigation efforts maximize public health benefits associated with reducing ground-level ozone concentrations and improving air quality.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $116,818	
EPIC Funds Encumbered: $500,000		**EPIC Funds Spent:** $500,000	
Match Partner and Funding Split: Altostratus, Inc.: $4,000 (0.8 %)		**Match Funding:** $4,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 7: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The team leveraged prior analyses of land-use, land-cover, and historical weather observation data and modeling efforts to identify good sites for urban heat island monitoring. The team selected sites in the Los Angeles air basin where the urban heat signal is conducive to research efforts, specifically, where the urban heat signal was sufficiently clear to enable new empirical understandings and model improvements. After extensive negotiation with the LAUSD, the team installed on-site weather stations. The team also developed a mobile monitoring platform and performed several mobile transects to collect data that assist in analysis of local determinants of the UHI effect as well as model calibration and validation. The

Advisory Committee continued to engage key stakeholders as well as scientists.

72. EPC-14-074

Project Name:

Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals

[EPC-14-074]

Recipient/Contractor:

The Regents of the University of California, Irvine Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 7/2/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

The energy system needs to respond to the impacts of climate change such as increased precipitation extremes, higher peak energy demand from hotter and more frequent temperature extremes, and damage to energy infrastructure. At the same time, the energy sector must comply with mandates to reduce greenhouse gas emissions. These two pressures (climate impacts and changes in energy policy) interact in complex ways on the existing grid. To support future planning, this project estimates how climate change would interact with efforts to reduce GHG emissions and to comply with renewable energy targets.

Project Description:

The project uses climate change simulations to produce modeled conditions that disrupt electricity system generation, renewable capacity potential, and demand for the years of 2030, 2040, and 2050. The combined effect of these impacts is then simulated on the electricity system using an integrated electric grid modeling platform.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project helps to define areas of technological need in order to fill future gaps in the electricity grid, created by climate impacts. Knowledge of those gaps can then be used by the Energy Commission and others to target funds for the most needed technologies to reach specific energy and climate goals.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 2a, 4a

Environmental Benefits:

The project will estimate the potential environmental benefits of different energy scenarios. This project is partnered with two other long term energy scenarios projects that will use a common base set of assumptions (based on prior work by E3 for the energy principals). This project is aimed at understanding climate impacts on hydropower and impacts associated with water consumption by solar thermal and geothermal power plants.

Energy Security:

The project includes analyses of robust energy systems. Robustness can be simulated and tested to produce results to inform which set of technologies in which places are the most protected from climate change, and therefore more energy secure.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $181,613
EPIC Funds Encumbered: $698,792	**EPIC Funds Spent:** $644,269
Match Partner and Funding Split: Southern California Edison: $150,000 (15.0 %) Southern California Gas Company (SoCalGas): $150,000 (15.0 %)	**Match Funding:** $300,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	12 out of 14 bidders	Group 5: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-074 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The modeling work for the research is complete as of Fall 2017 and the researchers are analyzing the results. The researchers have also met with a high level policy advisory committee led by Chairman Weisenmiller in Spring of 2016. They received feedback requesting an increased focus on environmental justice communities. In response throughout 2016 and 2017, the researchers connected with environmental justice advocates and area experts to highlight areas of importance to be attentive to in their analysis of project results. Throughout the life of the project, the research has also provided climate impact data for two other teams working on developing long-term energy scenarios for California's electricity sector.

73. EPC-14-075

Project Name:

Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems [EPC-14-075]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/15/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Historically, industrial facilities have paid little attention to electricity consumption. Many industrial customers are unaware of low-cost energy conservation and energy efficiency opportunities. Often the only electricity data available is at the whole facility level and cannot be easily analyzed to find energy-saving opportunities. Process-level sub-metering has been rare due to its historically high costs and it is typically not used to find ways to lower energy costs. Energy management systems that use real-time data and analysis to identify energy savings are not available in the market.

Project Description:

The University of California at Berkeley, Massachusetts Institute of Technology, and the University of Chicago, have partnered with Lightapp Technologies to demonstrate a pre-commercial, software-based, optimized energy management system in industrial facilities. Together, they will demonstrate Lightapp's energy-monitoring system on compressed air systems in 100 California industrial plants served by the state's investor-owned utilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The Lightapp technology takes an innovative approach by relating electricity use and operating measurements to the production outputs of specific facility systems. This project will monitor the compressed air systems over time, looking at both the supply side (the compressor) and the demand side (production). The software tool then identifies anomalies and makes recommendations to lower the overall energy intensity of production and save energy and money. This project demonstrates the operational effectiveness and financial viability of deploying a more developed version of the technology in California industries. This project focuses on optimizing electricity consumption in compressed air systems, a common system in many industries.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The project could lower energy use and costs by optimizing industrial processes in a variety of manufacturing sectors. Market assessments and technology deployed to date have estimated savings of 15% to 17% in compressed air system energy use with paybacks of less than 2 to 3

years.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $451,253	
EPIC Funds Encumbered: $4,981,729		**EPIC Funds Spent:** $2,318,208	
Match Partner and Funding Split: University of California, Berkeley: $1,530,590 (23.5 %)		**Match Funding:** $1,530,590	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 8
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-14-075 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: As of October 16, 2017 the recipient has released 592 facility names for recruitment and has signed 68 facilities to participate. To date, 33 software installations were completed and energy savings data continues to be gathered.			

74. EPC-14-076

Project Name:

Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings

[EPC-14-076]

Recipient/Contractor:

Kennedy/Jenks Consultants, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

The secondary biological wastewater treatment process is usually the most energy intensive process of a wastewater treatment plant (WWTP). The most common secondary biological treatment method is called the "activated sludge process", and is accomplished by aerating wastewater. On average the activated sludge process accounts for 40 to 60 percent of total WWTP electricity consumption. The electricity used for aeration is proportional to the organic load entering the aerated activated sludge process. Achieving a higher degree of removal of the organic load before the aerated activated sludge process provides a breakthrough opportunity to reduce electricity consumption.

Project Description:

This project is extending the application of Cloth Depth Filters (CDF) to raw wastewater filtration at three wastewater treatment plants in California. The CDF concept replaces the current technology of primary clarification by offering the following advantages: (1) substantially higher removal of organic load resulting in significantly lower aeration electrical power demand, and (2) smaller footprint requirements both for primary and secondary treatment steps. CDF employs established principles of gravitational forces which results in minimal operational and maintenance complexities. The unique attribute which offers promise for CDF technology in raw wastewater is the vertical placement of the filter medium and flow direction of this filtration process. Unlike prevailing filtration systems, the vertical orientation of the filter medium permits heavy solids to settle within the tank.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project uses cloth depth filtration (CDF) for raw wastewater filtration to reduce the organic load on the secondary wastewater treatment step, which is the most energy intensive step in the treatment process. This breakthrough treatment using CDF has never been tested nor implemented at wastewater treatment plants. The technological breakthrough is proving the effectiveness and technical and economic feasibility of filtering raw wastewater for removal of biosolids before any other wastewater treatment step occurs. A reduction in biosolids loading before the primary and secondary treatment can lead to 35 percent reduction in secondary aeration energy use that will help these plants meet the state's SB 350 goals. The project team includes engineers, consultants end users and others who will work collaboratively to overcome barriers for market acceptance of the CDF technology.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The project could reduce the cost of wastewater plant operations within California by reducing wastewater treatment plant electricity consumption (CPUC Metrics 1f and 1h). Assuming 10 percent market implementation by the wastewater treatment sector, this could result in annual savings of 34 million kWh and $3.6 million in reduced operating costs.

Assignment to Value Chain:	**Total Budgeted Project Admin and Overhead Costs:** $1,184,735
Demand-side Management	
EPIC Funds Encumbered:	**EPIC Funds Spent:**
$3,476,085	$1,830,831
Match Partner and Funding Split:	**Match Funding:**
Kennedy/Jenks Consultants: $38,400 (0.8 %) Aqua-Aerobic Systems, Inc.: $631,000 (13.2 %) Process Wastewater Technologies LLC: $552,300 (11.6 %) Linda County Water District: $29,640 (0.6 %) Water Environment Research Foundation: $25,000 (0.5 %) Regents of the University of California (University of California, Davis): $12,000 (0.3 %)	$1,288,340
Leverage Contributors:	**Leveraged Funds:**
None	$0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-076 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has finalized the design for the first deployment site and anticipates construction to be completed and startup of the full system by the fourth quarter 2017.

75. EPC-14-077

Project Name:

Enable Standardized Vehicle-Grid Integration through Development of Universal Standard [EPC-14-077]

Recipient/Contractor:

Center for Sustainable Energy

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Technologies and Strategies That Optimize the Benefits of Plug in Electric Vehicles to the Electricity System

Issue:

California utilities are currently working to meet the State's Renewables Portfolio Standard of 33% by 2020, while simultaneously planning for the 1.5 million zero-emission vehicles that will be deployed by 2025, with over 130,000 plug-in vehicles (PEVs) sold since 2011. The State's vision to achieve cross-cutting benefits from these two separate yet interconnected efforts, however, requires new thinking on precisely how electric system operators can leverage and utilize PEVs as beneficial Distributed Energy Resources without compromising safety, data security, consumer simplicity or the mobility needs of the PEV owner.

Project Description:

The project was intended to design and develop a Demand Clearing House (DCH) to monitor published energy pricing from the California Independent System Operator's Fifteen-Minute Energy Market as well as load forecasts from San Diego Gas & Electric and other participating utilities through an Application Programming Interface translation from Open ADR 2.0b, a Demand Response protocol used by all California Investor Owned Utilities. The DCH would have then used algorithms that convert grid conditions into ISO/IEC 15118 "grid profiles," or Tariff Tables, which in turn would be communicated to 15118-capable charging stations and vehicles. A fully developed DCH would allow utilities to respond to supplemental energy market prices, proving a viable and scalable pathway toward using plug-in electric vehicles to manage variable grid conditions, solar oversupply, and other system wide challenges. This project was terminated early and will not complete.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Had the project been successful, this project would have advanced the adoption of an open protocol that enables large amounts of new, low cost flexible capacity on the grid. The open protocol could potentially minimize stranded investments in less cost effective forms of flexible grid resources, maximize renewable and PEV integration, and promote a safer, more reliable low carbon future.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Smart grid: R.08-12-009

Applicable Metrics: CPUC Metrics- 2a, 4a, 4b			
Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $193,033	
EPIC Funds Encumbered: $1,499,999		**EPIC Funds Spent:** $356,872	
Match Partner and Funding Split: KnGrid: $31,312 (1.9 %) Center for Sustainable Energy: $47,514 (2.9 %) Broadband Telcom Power Inc.: $81,128 (4.9 %) Energy Solutions: $2,520 (0.2 %)		**Match Funding:** $162,474	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 25 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-14-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions. Pre-'Demand Clearing House' intellectual property delivered 'energy limits' based on inputs from a local grid operator. A building energy management (BEM) system was linked to a cluster of local charging stations. RWE's 'Demand Energy Management' system connected to the BEM system via SFTP and received a forecast of available power limits to the local charging stations.			
Update: CSE was unsuccessful in completing this project to develop, test and demonstrate an open-source Demand Clearing House (DCH). CSE experienced numerous project delays due to the loss of a major subcontractor and subsequently their demonstration site. CSE and the Energy Commission determined that the project could not satisfactorily complete before the grant funds expired. These delays ultimately led to the termination of this grant agreement. The only deliverable brought to completion was the DCH Server Specifications, which detail the design capabilities and functionality of the DCH. Work progressed on the DCH software, but was only completed up to 25%. The Server Specifications and "work in progress" software are			

available to the public for use and continued development.

76. EPC-14-078

Project Name:

Next-Generation Grid Communication for Residential PEVs

[EPC-14-078]

Recipient/Contractor:

ChargePoint, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Technologies and Strategies That Optimize the Benefits of Plug in Electric Vehicles to the Electricity System

Issue:

Currently there are no adequate communication interfaces that allow communication between utilities, charging stations, and residential plug-in electric vehicle (PEV) customers. While there is some capability for aggregated commercial charging applications to provide grid stability, residential PEV participation in grid stabilization requires significantly more fine-grained data collected by advanced charging station-PEV communication protocols, coordination of charging at stations owned by different parties, and sensitivity to the driver's needs and preferences and a real-time understanding of each vehicle's state of charge or charge needed to make the next vehicle trip before departure.

Project Description:

The project develops communication interfaces between PEV customers and utilities using cloud-to-cloud OpenADR 2.0b communication with a vehicle charging network and will leverage emerging means for retrieving vehicle information via the ISO/IEC 15118 standard for consideration in the decision process. The communication will be able to gather customer data and receive signals from a third party (utility) for the purpose of optimizing PEV charging in a mutually beneficial manner to the customer and the utility. In addition to investigation and implementation of the ISO/IEC 15118 standard, the project will also investigate using control methods that do not require having vehicle charging information. This may be done through statistical estimation, rate of charge output from charging stations or driver opt-in based on maximum charge needed.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lower or defer costs in upgrading local distribution infrastructure by providing a mechanism for demand management for local distribution networks, specifically managing PEV charging with input from PEV customers, vehicles, and utility signals. The results from this project would allow the utility to optimize a residential customers night time charging while still satisfying the driver mobility needs. The driver will have the same driving experience, generation and transmission resources can be optimized, and the grid costs and emissions can be reduced. Quantitative benefits are being determined through the pilot study data.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Smart grid: R.08-12-009

Applicable Metrics: CPUC Metrics- 1g, 1h, 2a, 3f, 4a, 5b

Lower Costs:

This project will result in lower costs for customers and utilities as customers will be able to optimize their PEV charging through demand management.

Greater Reliability:

The methodology developed under this project will assess and test the real time potential for residential smart chargers to respond to utility signaling to support grid stabilization.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $139,418	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $541,482	
Match Partner and Funding Split: ChargePoint, Inc.: $142,500 (8.7 %)		**Match Funding:** $142,500	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 25 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-078 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

ChargePoint completed 15118 testing on the Daimler vehicle to send charging schedules to the vehicle and receive them back from the station. The 3 month pilot demonstration with 30 residential customers was completed and ChargePoint will analyze the results of the pilot to analyze how the residential customers behaved in the controlled charging schedules. ChargePoint will also work with LBNL to analyze the grid impacts of this kind of controlled charging. The project will continue to implement the 15118 standard into a charging station and test communication between that station and a vehicle.

77. EPC-14-079

Project Name:

Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy

[EPC-14-079]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

One of the most prominent limiting factors for solar generation on California distribution systems occurs when multiple PV systems are installed behind a single distribution transformer. Limitations have already occurred in which consumers were not permitted to add solar, or inverters experienced shutdown due to local overvoltage conditions. It is not known whether multiple inverters can operate side-by-side in stable conditions when each one is performing smart-inverter functions. High PV penetration on the feeder and the voltage profile may be fine, but local over-voltage, variability, and equipment stress occurs on the customer side, limiting PV deployments and production.

Project Description:

The purpose of this project is to resolve the limiting conditions that occur on California distribution systems when many PV systems are installed behind a single residential distribution transformer by evaluating advanced inverter functionality with specific goal of enabling higher penetration of photovoltaic on the grid. The project is identifying, implementing, and testing (both in lab and field) optimal methods by which smart inverters can mitigate the issues that otherwise would limit local high penetrations of residential PV. The process will identify how California Rule 21 functions can be used and configured so that multiple smart inverters work in harmony and will also identify how other naturally-occurring consumer devices, such as electric vehicle chargers and other smart loads, can serve to further enable high-levels of solar PV.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

A key benefit of this project to California IOU ratepayers is to find the upper limits of solar PV hosting that may be achieved using smart inverters and naturally occurring products, thereby providing insight into the necessity and timing in which such additional DER devices may be required in addition to lower costs and greater electricity reliability.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Distribution Level Interconnection (Rule 21): R.11-09-011 Smart Inverter: D.14-12-035 (in R.11-09-011) Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 3d, 4a, 5a, 5b

Lower Costs:

The use of smart inverter functions, together with smart (PV-optimized) behavior of loads, can increase production (KWh) of residential systems by 15%. For an affected consumer on a constrained distribution circuit, this means more annual savings.

Greater Reliability:

The multi-inverter interaction testing and evaluation of smart inverter functions and smart management of consumer loads under this projects can minimize stress on grid equipment and will further improve reliability.

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $400,537
EPIC Funds Encumbered: $1,705,478	**EPIC Funds Spent:** $338,382
Match Partner and Funding Split: Electric Power Research Institute, Inc.: $149,452 (5.8 %) Underwriters Laboratories, Inc.: $78,174 (3.0 %) Southern California Edison Advanced Technology Organization: $260,000 (10.0 %) Intwine Connect: $107,758 (4.1 %) ClipperCreek, INC.: $66,480 (2.6 %) Sacramento Municipal Utility District: $156,000 (6.0 %) Pentair: $50,000 (1.9 %) Emerson Climate Technologies: $8,550 (0.3 %) A. O. Smith Corporate Technology Center: $15,000 (0.6 %)	**Match Funding:** $891,414
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 27 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement

Terms and Conditions.
Update: All of the controllable load devices have been identified and some have been procured. The lab test setups have been designed and are partially complete. The control devices and initial algorithms were developed and implemented. Field test sites are being identified and recruited. Delays in the availability of UL-certified remotely controllable PV inverters have delayed the project progress. A CPR meeting was held on September 21, 2017 to mitigate the impacts of these delays and the Energy Commission decided to adopt the Recipient's proposal to split the project into two parallel tracks. The revised plan will retain the original project end date and budget, fully achieve all project objectives that do not require reliable remote control of inverters, and incorporate reliable full function inverters into the project as they become available.

78. EPC-14-080

Project Name: Renewable Microgrid for a Medical Center [EPC-14-080]	
Recipient/Contractor: Charge Bliss, Inc.	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 6/17/2015 to 12/28/2018
Program Area and Strategic Objective: Technology Demonstration and Deployment S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development	
Issue: California needs to make better use of locally available renewable energy to increase resiliency and address climate change impacts such as increased fires, severe storms, and heatwaves. Critical facilities are especially vulnerable to climate change impacts that disrupt the normal delivery of energy needed for their operation. A demonstration of a renewable-based microgrid at a hospital will develop a case study to assess their ability to support hospital operations and convince the Office of Statewide Health Planning and Development to allow microgrids for hospitals.	
Project Description: This project will demonstrate a full-scale renewable-based microgrid for a hospital. The microgrid consists of a solar photovoltaic array, battery energy storage, and a microgrid controller integrated with an existing combined heat and power system. The microgrid will provide at least three hours of power during a utility outage and will also use automated demand response to reduce electrical demand.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: This microgrid will demonstrate reduction of utility energy usage by greater than 350,000 kWh per year, decreased peak monthly site demand by 100kW, regulation and improvement of site power quality to achieve greater load item efficiencies, and the ability to "island" to support life and safety functions for three hours or longer to supplement existing backup generation tools and improve the energy reliability of hospitals in crisis situations. In collaboration with the governing agency Office of Statewide Health Planning and Development (OSHPD), the CEC and Charge Bliss are forging new methods and standards to support the resiliency and autonomy of critical healthcare facilities. This will lead all healthcare stakeholders to reconsider current policies and procedures for energy supply and to evaluate additional redundancies to protect hospital operations.	
CPUC Proceedings addressing issues related to this EPIC project: Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003	

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5a

Lower Costs:

This project expects to save $141,000 per year in direct energy costs for the site owner (997,000 kWh/yr x $0.1418/kWh) and create efficiencies in both usage and demand (automated demand response).

Greater Reliability:

This microgrid plans to increase electric reliability by participating in the CA Independent System Operator's fast power quality regulation to mitigate large power quality fluctuations.

Environmental Benefits:

The microgrid plans to provide environmental benefits by attempting to reduce greenhouse gas emissions by 263 tons of carbon dioxide per year (997,000 kWh/yr x 0.5888 lbs/kWh) through the use of renewables.

Public Health:

The microgrid is designed to provide at least three hours of power during a utility outage for critical hospital facilities that are essential during mass casualties or illnesses.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $729,842	
EPIC Funds Encumbered: $4,776,171		**EPIC Funds Spent:** $3,849,024	
Match Partner and Funding Split: OSISoft, LLC: $1,119,560 (16.3 %) Kaiser Permanente Medical Center: $576,275 (8.4 %) Princeton Power Systems, Inc.: $400,000 (5.8 %)		**Match Funding:** $2,095,835	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 40 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-080 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement

Terms and Conditions.
Update: This project is demonstrating the ability of a microgrid to support and sustain the functions of a healthcare facility and to overcome barriers to its deployment. The Charge Bliss team successfully designed, engineered, procured, constructed, and commissioned the microgrid systems and began operations in the summer. The Team overcame diverse obstacles including hospital operations constraints for shutdowns, while meeting the requirements for regulatory oversight (OSHPD) and interconnection with the PG&E. The Team developed a novel microgrid controller to execute demand management and power quality regulation, which has been deployed. Ground-breaking interconnection to hospital Life and Safety systems was completed in November, 2017. Data collection for validation of system performance is ongoing and will be completed by the summer of 2018.

79. EPC-14-081

Project Name:

Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption [EPC-14-081]

Recipient/Contractor:

PowWow Energy, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/15/2015 to 4/1/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Annual electricity used to supply water to farms is estimated to be 10 TWh per year, or about 4% of California's total electricity usage. This usage increases significantly in drought years due to the need to pump water from increasingly deeper wells. In 2014, California growers extracted an estimated additional 5 million acre-feet of groundwater from aquifers to compensate for the lack of surface water and rain, resulting in an additional $454 million of energy costs for water pumping. This usage of groundwater is not sustainable, and resulted in the Governor signing a law (SB1168) to require growers to monitor groundwater extraction.

Project Description:

This project is demonstrating a software tool that links groundwater extraction with smart meter data to provide growers with automated information on energy and water consumption. This data is augmented by weather data and optional soil moisture data from local sensors to provide information to growers regarding irrigation needs. Use of the software program could help inform growers and reduce irrigation while maintaining or optimizing yield. This technology is being applied over 1,000 acres of farms owned by several growers of alfalfa, tomato, pistachios and almonds.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Reduced irrigation techniques have not been adopted by growers because of perceived risks associated with lower crop yield and quality, and lack of equipment and labor to measure water consumption. This project is developing a unique software tool for measuring groundwater extraction and water application, by leveraging smart meter data, as well as existing water data in the cloud and at the farm sites. The tool is unique because it uses smartmeter data to measure water volumes from pumps without installing hardware devices on site. The tool also communicates with the farmer and irrigator to optimize crop yields and water applications.

CPUC Proceedings addressing issues related to this EPIC project:

Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11
Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 4c

Lower Costs:

Supplying water for on-farm irrigation is an energy intensive task (especially for groundwater pumped from wells) that results in a large expense for growers. This technology could lower electricity costs associated with water pumping for farms. Additionally, optimized irrigation may

reduce water use and could increase crop yield .For the affected demonstration farms, this could annually save approximately 400,000 kWh and 1,000 Acre-feet of water, or about $60,000 annually in energy cost..

Environmental Benefits:

Reduction in energy use will result in reductions in greenhouse gas emissions. Reduction in water use will lessen the impact on ground water pumping and issues associated with subsidence, especially in the Central Valley.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $332,162
EPIC Funds Encumbered: $2,292,829	**EPIC Funds Spent:** $1,960,956
Match Partner and Funding Split: UC Santa Barbara: $83,401 (2.9 %) UC Davis: $83,469 (3.0 %) PowWow Energy, Inc.: $368,698 (13.0 %)	**Match Funding:** $535,568
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-081 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The Recipient has begun deploying the software (and hardware) at each deployment site and engaging the growers to optimize their irrigation plans for the year based on crop needs. Project team is working to finalize the results of the 2017 growing season and has begun to write the final report for this project.

80. EPC-14-082

Project Name:

Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid

[EPC-14-082]

Recipient/Contractor:

Sierra Institute for Community and Environment

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	7/10/2015 to 12/31/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Communities in the colder high Sierra regions of California often experience peak electrical loads during the winter due to a reliance on electric resistance heating, heat pumps with poor performance, and fuel switching from oil and propane to electricity when fossil fuel prices spike. These regions are also prone to catastrophic wildfires due to overstocked forests that exacerbate drought conditions. Electric and thermal energy from forest biomass clearing operations offer a unique opportunity to reduce peak loads using local renewable resources.

Project Description:

This project is deploying a biomass-fired combined heat and power system to provide heat and power to Plumas County health facilities. Biomass from local forest clearing operations will be used by a new biomass boiler to supply heat to an Organic Rankine Cycle (ORC) power unit. Waste heat from the ORC will be used to as a heat source for heat pumps, improving their performance for the winter heating season.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will link emerging technology with new, innovative opportunities to advance renewable energy, distributed generation, and create clean energy jobs. The first-of-its-kind project combines a biomass-fired boiler with an Organic Rankine Cycle electric generator that diverts waste heat to source heat pumps supplying economical heat and power to a community-scale entity currently experiencing high energy costs. The project will help sustain a market for locally-sourced, sustainable forest biomass, providing jobs to the community and helping to reduce the risk of catastrophic wildfires that threaten transmission infrastructure and public safety. The project will serve as a template for other rural communities as how to combine emerging technologies in unique ways to address local energy needs using local fuels and reducing their need for grid electricity and fossil fuels.

CPUC Proceedings addressing issues related to this EPIC project:

SB 1122 Bioenergy feed-in tariff: R.11-05-005 Combined heat and power: D.10-12-035., R.08-06-024.

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 4b

Lower Costs:

By generating up to 35 kilowatts electricity and using 400 kilowatts (thermal) to supply heat pumps, the Plumas County Health and Human Services center will reduce its energy costs (electricity plus propane) by $50,000 per year.

Greater Reliability:

Electricity reliability will be enhanced by decreasing consumption of grid electricity during winter peak periods.

Increase Safety:

Safety will be improved by reducing both the risk and destructiveness of wildfires in forest communities by removing up to 815 tons of forest waste/biomass per year.

Environmental Benefits:

Burning biomass in a controlled setting rather than in the field will result in fewer pollutants (CO2, NOx, VOC and CO) being released into the environment.

Energy Security:

Energy security is enhanced by deploying 35 kilowatts of distributed electricity with waste heat utilization that will reduce load on the local grid and decrease peak demand by as much as 205 kilowatts.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $262,813	
EPIC Funds Encumbered: $2,385,261		**EPIC Funds Spent:** $1,852,118	
Match Partner and Funding Split: Plumas County: $400,000 (13.4 %) Sierra Institute for Community and Environment: $193,316 (6.5 %)		**Match Funding:** $593,316	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 16 out of 22 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project scope and budget were decreased as of September, 2017. Feather River College, formerly a project partner, will no longer be taking waste heat from the project's organic Rankine cycle power plant, hence the scope and budget were reduced accordingly. In the new configuration, the system will generate 35 kW electrical and 400 kW thermal to serve load at the Plumas County Health and Human Services Center. Construction is currently underway, with system start-up anticipated for the first quarter of 2018.

81. EPC-14-083

Project Name:

College of San Mateo Internet of Energy

[EPC-14-083]

Recipient/Contractor:

Prospect Silicon Valley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/29/2015 to 10/11/2017

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

As the California grid continues to increase intermittent renewable generation, approaches are needed to solve critical issues of grid stability and efficient utilization of distributed energy resources. Batteries can provide dispatchable load-following power to address some of these issues. However, current battery storage technologies are not cost competitive with conventional generation sources and have limited deployment, which leads to potential risks. Other mitigation strategies, such as demand response and load shifting, are growing but still limited and largely uncoordinated across assets, limiting the effectiveness thus far.

Project Description:

This project was initiated to demonstrate an integrated solar PV, energy storage, and advanced power electronics within a single module to significantly increase overall efficiencies by minimizing conversion losses. The demonstration was to include the integration of a 250 kW pre-commercial high-yield PV system from Flex, a 500 kWh stationary battery energy storage system, and advanced HVAC system and controls, with an advanced energy management system that uses the Internet of Energy concept to optimize performance of distributed energy resources and the local grid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

If successful, this project was projected to result in a 10% reduction in utility demand charges for the College of San Mateo campus in addition to saving another 8% in energy charges from peak demand reduction and efficient energy management measures. In addition, the PV and energy storage system was to be designed in a modular fashion by housing the Energy Storage System and Power Conversion System in a standard 20-foot container enclosure that was being produced to dramatically reduce balance of system costs.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1a, 1b, 1e, 1f, 1h, 1i, 2a, 3a, 3e, 4a

<table>
<tr><td colspan="2">Assignment to Value Chain:
Generation</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $411,350</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$2,999,601</td><td colspan="2">EPIC Funds Spent:
$402,626</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
San Mateo County Community College District: $1,200,000 (28.3 %)
Growing Energy Labs, Inc.: $35,000 (0.8 %)</td><td colspan="2">Match Funding:
$1,235,000</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
16 out of 22 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 2: Ranked # 4</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-14-083 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The College of San Mateo released an RFP for construction and installation of the project in February 2017 and selected Opterra in April 2017, but the project experienced several delays related to equipment sourcing and legal requirements.

In late July 2017, the College of San Mateo decided to withdraw from the project, because the perceived risks were too great, and they did not believe that the full scope of the agreement could be completed within the agreement term. As the College of San Mateo was providing the demonstration site for the project as well as the majority of the match funds, Energy Commission staff and PSV decided to mutually terminate the project. The Energy Commission issued a Stop Work Order to PSV on August 7, 2017, and the Commission formally terminated the agreement at the October 11, 2017, business meeting.</td></tr>
</table>

82. EPC-14-084

Project Name: ABEC #4 Renewable Combined Heat and Power Project [EPC-14-084]	
Recipient/Contractor: ABEC #4 LLC	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 6/30/2015 to 3/29/2019
Program Area and Strategic Objective: Technology Demonstration and Deployment S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies	
Issue: California has had a lack of success in the dairy biogas industry. Issues include permitting obstacles and complexities, high environmental compliance costs, lack of long-term economical power purchase agreements, high financing risk and costs, and little commercialization of the industry. Further, dairy farmers typically are not experienced in building and operating digesters and generation systems. Combined Heat and Power (CHP) has the potential to increase dairy farm energy efficiency and reduce peak demand and dairy operation electricity costs. Projects demonstrating how dairies can benefit from CHP are critical to the success of future dairy digester-to-electricity projects.	
Project Description: The project uses biogas derived from on-site dairy manure to generate low-carbon, renewable electricity and achieve high overall efficiency by capturing waste heat from the power generation system, and uses it to drive an absorption chiller. The absorption chiller is designed to convert waste heat into chilling capacity, which will be used to chill milk produced by the dairy cows. New absorption chiller capacity directly offsets electricity consumption from existing electric chillers. Combining renewable generation with waste heat collection and cooling, the project increases energy efficiency of the existing dairy by an estimated 10% or more, while also reducing peak grid power demand.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: The project represents a significant advance in dairy energy management by combining renewable generation with waste heat collection and cooling to increase energy efficiency of the existing dairy by an estimated 10% or more, while also reducing peak grid power demand. The project benefits include substantial reductions in greenhouse gas emissions, lower manure handling costs, and generation and distribution of technical and economic data on community scale power production.	
CPUC Proceedings addressing issues related to this EPIC project: Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005	

Applicable Metrics: CPUC Metrics- 3a, 4a, 4e

Lower Costs:

By advancing digester economics and design, through efficient manure management practices, the project will help lower dairy management and operation costs.

Environmental Benefits:

The project supports implementation of California's energy and GHG management goals and targets through the deployment of new renewable power generation capacity and the capture and destruction of methane currently vented into the atmosphere. The double-lined lagoon enhances groundwater protection by minimizing leaching of manure into groundwater. The project hired Climate Trust to estimate the Carbon Offsets that would likely be generated over the project's 10 year crediting period at 206,060 tonnes CO2e gross based on ARB's Livestock Protocol.

Consumer Appeal:

The project will improve odor control, through hydrogen sulfide removal, an issue important to the dairy employees and benefits the local community.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $32,107	
EPIC Funds Encumbered: $3,000,000		**EPIC Funds Spent:** $1,756,927	
Match Partner and Funding Split: ABEC #4 LLC CE&S Dairy Biogas: $4,983,619 (62.4 %)		**Match Funding:** $4,983,619	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 16 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-084 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Bioenergy Storage and Management System and Method.

Lagoon Digester with Flexible Volume Capability.

California Bioenergy LLC Lagoon Digester Systems.
Update: The project broke ground in fall, 2016 and construction is complete. A TAC was held in October, 2017 followed by a CPR in November. The project accepted a PG&E BioMAT Power Purchase Agreement and began testing in fourth quarter 2017 with full operation and data collection beginning in first quarter 2018. Monthly invoicing and progress reports are being submitted and the project is expected to complete as planned.

83. EPC-14-085

Project Name:

Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System

[EPC-14-085]

Recipient/Contractor:

The Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2015 to 9/28/2018

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

The intermittent nature of solar energy generation requires special attention when connecting to the grid. Critical issues include the grid instability of the distributed energy resources, and imbalance between energy demand and production, especially during periods of overgeneration. Although energy storage has the potential to serve multiple valuable functions in a microgrid setting, it is currently a very expensive resource because it is generally in the early stages of technology development. Renewable-based microgrids also require a reliable control system since they have insufficient inertia to dampen disturbances from distributed generation.

Project Description:

This project is demonstrating that the combination of advanced PV generation and an energy management system can reduce the community's average daily power and daily peak energy demand by more than 10%. The project includes a smart electrical energy storage system that integrates retired electric vehicle batteries. The generator and storage system are controlled by a commercial-grade microgrid controller, with the three levels of hierarchy. The demonstration site is located in the Robert Mondavi Institute at the UC Davis campus.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The combination of advanced PV and energy management systems will result in significant reduction in annual grid electricity consumption - estimated at over 80% or a cost savings of roughly $29,000 per year with associated greenhouse gas reductions of about 250 tons per year. Furthermore, the success of this project will provide follow-on benefits to California's large wine industry by proving that winemaking can be an environmentally-friendly process.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Smart grid: R.08-12-009 Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 1e, 1f, 1h, 2a, 3b, 4a

Lower Costs:

The project aims to reduce the high costs of energy storage by using second-life electric vehicle batteries and an advanced energy management system.

Economic Development:

Proving the concept of a high-penetration renewable microgrid at the Robert Mondavi Institute is expected to lead to adoption of similar concepts at a number of vineyards and breweries across California.

Consumer Appeal:

California's wine and brewery market represents a significant market. The Robert Mondavi institute is generally considered a leader in this area, and if this concept is demonstrated successfully at this site, it is expected to be adopted elsewhere.

Energy Security:

This project will increase energy security on the UC Davis campus by enabling a microgrid with the potential to function during outages of the larger grid.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $124,883	
EPIC Funds Encumbered: $1,238,491		**EPIC Funds Spent:** $18,284	
Match Partner and Funding Split: Solexel: $12,000 (0.6 %) UC Davis: $167,262 (8.8 %) OSISoft, LLC: $479,467 (25.3 %)		**Match Funding:** $658,729	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 16 out of 22 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Due to the hazards associated with lithium ion batteries, battery storage was moved to a container outside the building where it was supposed to be installed. Moving the battery storage resulted in a delay due to redesign of the power distribution and control layout, and the plan of the new installations of conduit and concrete pads. The new location of the batteries drives the space conditioning and fire suppression requirements of the storage container.

Additional delays were encountered after the loss of the key PV supplier (Solexel Inc.). Although the project suffered from construction delays as result of the change in location and redesign efforts, the project is now back on track.

84. EPC-14-086

Project Name:

Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability [EPC-14-086]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	8/1/2015 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Technologies and Strategies That Optimize the Benefits of Plug in Electric Vehicles to the Electricity System

Issue:

Several barriers must be overcome for plug-in electric vehicles (PEVs) to become viable distributed energy resources, including inconsistent data communication approaches among PEVs, a lack of situational awareness of the PEVs relative to grid state, fragmented technology and standards preventing interoperability and inclusion of vehicle-to-grid (V2G) resources into applicable distribution and independent system operator grid services related programs. In addition, there is limited availability of on- or off-vehicle V2G systems on scale from original equipment manufacturers (OEMs) because OEMs do not see their value to end customers.

Project Description:

The project develops an integrated vehicle-to-grid (V2G) system that can be tested and demonstrated to be distribution-aware, self-regulating, interoperable, secure and open as well as scalable and flexible. These real-world tests and demonstrations will provide confidence in the V2G systems that provide grid support functions and possibly influence investor owned utilities (IOUs) to add them to their Assembly Bill 2514 Storage Mandate compliance plans. The data gathered will also enable validation of cost effectiveness models through direct engagement with the IOUs' existing infrastructure and distribution networks, combined with simulated independent system operator interaction.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

PEVs with integrated V2G systems have the potential to simultaneously improve air quality, reduce vehicle operational costs and to reduce grid stress and increase grid reliability and stability. Monitoring at the transformer level with control of V2G provides enhanced local situational awareness and real-time responsiveness to distribution grid conditions. The developed management and monitoring system will have awareness of load, power, temperature, current, voltage, frequency, and PEV customer constraints – information to be utilized to determine need for V2G resource. This approach provides a potentially significant solution for integration of a viable energy efficient energy storage technology into a decentralized grid structure, and with the ability to operate as a unified distributed energy resource aggregation system.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Smart grid: R.08-12-009

Applicable Metrics: CPUC Metrics- 1c, 1e, 2a, 3f

Lower Costs:

Analysis showed that PEVs can provide a net ratepayer benefit of ~$2,500 per vehicle and a statewide economic benefit of over $5,000 per vehicle. Using TOU rates to shift charging loads off-peak reduces distribution upgrade costs by over 60%. Further analysis of a dynamic hourly VGI rate shows that it can reduce present value of charging costs per vehicle under 40% RPS scenarios from around $1,400 to under $600 - a net benefit of $850 per PEV.

Greater Reliability:

Vehicle to grid technologies provide ancillary support to the grid during gaps in service and when addressing renewable generation intermittency. With increasing penetrations of PV, its marginal capacity value will decline from ~0.5 kW per kW of PV today to less than 0.1 kW. V2G capability of EVs can counteract this effect, providing a dispatchable capacity resource that can reliably reduce peak loads. In capacity constrained areas such as the LA basin, the local capacity value can be over $200/kW-Yr.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $666,988	
EPIC Funds Encumbered: $1,499,977		**EPIC Funds Spent:** $659,091	
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $795,754 (34.7 %)		**Match Funding:** $795,754	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 25 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-086 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

EPRI is developing an end-to-end capable V2G system that demonstrates grid condition awareness in a safe and outage-immune method. Aerovironment and Kitu have completed integration and assembly of J3072 and SEP 2.0b software into the 10 demonstration EVSEs. The research team is currently developing the on-board V2G communication module for the PEV that will be demonstrated at UCSD. EPRI is preparing the UCSD demonstration site for

testing in late 2017/early 2018.

85. EPC-14-088

Project Name:

Demonstration of Low-Cost Liquid Cooling Technology for Data Centers

[EPC-14-088]

Recipient/Contractor:

Asetek USA, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/13/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Data centers consume a disproportionate amount of electricity in California. As traditional building efficiency improves, data centers continue to grow in size and power. Approximately 40% of the electricity used in data centers is used for cooling. Since California is home to many data centers, improving data center cooling efficiency represents one of the major energy efficiency measures for this sector.

Project Description:

This project is validating the performance, reliability, cost savings and payback of a data center efficiency technology that uses direct-to-chip liquid-cooling to cut data center cooling energy use. The technology is being demonstrated at two full scale data centers and the deployment is occurring with minimal operational disruptions during installation. Energy consumption, load, reliability and server performance are being monitored. The results of the demonstrations, along with "lessons learned", will be made broadly available to the data center community and public-policy makers to stimulate adoption of this technology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

If successful, the project will validate the performance, reliability, cost savings and payback of a data center efficiency technology that could reduce cooling costs while being able to be installed as a retrofit. This could lead to overcoming barriers to adoption by minimizing operational disruptions and costs compared with conventional installations and retrofits.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

This technology could reduce electricity use and cost for cooling data centers. The lifecycle energy cost savings is projected to be approximately 30% compared to standard cooling technologies used for existing data centers.

Assignment to Value Chain:	**Total Budgeted Project Admin and Overhead Costs:** $1,038,931
Demand-side Management	

<table>
<tr><td colspan="2">EPIC Funds Encumbered:
$3,552,678</td><td colspan="2">EPIC Funds Spent:
$2,448,921</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
Asetek USA, Inc.: $303,726 (6.0 %)
Lawrence Livermore National Laboratory: $1,216,012 (24.0 %)</td><td colspan="2">Match Funding:
$1,519,738</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders</td><td>Rank of Selected Applicant/ Bidder:
Ranked # 3</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-14-088 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
At one of the demonstration sites, Lawrence Livermore National Lab, Phase 2 testing is being conducted after completing the demonstration and the M&V plan. At the second demonstration site, Lawrence Berkeley National Laboratory, site designs have been completed, and now the bidding for the installation is being conducted.</td></tr>
</table>

86. EPC-15-003

Project Name:

Demonstration of Community Scale Generation System at the Chemehuevi Community Center [EPC-15-003]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Riverside Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	10/29/2015 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

California's electricity grid is undergoing significant changes. With major reductions in the cost of solar, customers are choosing distributed generation to meet their electricity needs. All these developments are crucial for California to meet its AB 32 goals, but they come with a number of challenges such as supply uncertainty, changing demand patterns, continual increase in energy consumption and ramping demands. New solutions will be required for the future electricity grid to continue providing reliable and cost effective electricity.

Project Description:

This project deploys and demonstrates a community energy generation system at the Chemehuevi Indian Tribe Community Center. The energy system incorporates two pre-commercial solar technologies with flow-battery energy storage integrated with energy management system. The integration of the energy management system components will reduce peak energy demand for the center by utilizing battery storage to shift building and community loads and provides an uninterruptable power for the center when it is used as an Emergency Response Center for the tribe.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This system will result in greater electricity reliability, lower electricity costs, reduced peak energy demand and avoidance of failures and outages. The project is scalable in both size and quantity. Therefore, this effort will demonstrate the commercial feasibility to deploy many megawatt hours of dispatchable energy integrated in a photovoltaic/battery storage configuration.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1g, 1h, 2a, 3f, 4a, 5a

Lower Costs:

The system is designed to lower the kW demand by more than 10 percent of the daily average energy demand during peak times. This will result in a reduction of costs associated with procuring additional energy during periods of peak demand. Researchers estimate over $670,744 in energy savings from the solar PV system, $74,463 from energy storage revenue streams, and $38,910 in preventing costs due to sustained interruptions over a 20 year period.

Greater Reliability:

Greater electricity reliability is achieved by managing energy use and local generation supported by PV generation and battery storage in daily energy use profiles. This will help reduce failures and outages associated with demand response.

Environmental Benefits:

Researchers estimate a carbon reduction of 1038 tons over the life of the project.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $525,157
EPIC Funds Encumbered: $2,588,906	**EPIC Funds Spent:** $752,331
Match Partner and Funding Split: The Regents of the University of California - Riverside: $77,451 (2.4 %) OSISoft, LLC: $479,467 (14.5 %) Primus Power: $21,780 (0.7 %) Chemehuevi Indian Tribe: $91,000 (2.8 %) Solexel: $12,000 (0.4 %) SunPower Systems: $25,000 (0.8 %)	**Match Funding:** $706,698
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	16 out of 22 bidders	Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

UCR continued to work on finalizing a purchase order for 30 kW SunPower P-Series Modules (SPR-P17-340-COM) and 60 kW SunPower E-Series Modules (E20-435-COM). UCR also assisted the Chemehuevi Realty Department in preparing subcontracts with the different industry partners, contractors, and vendors. The carport construction subcontractor EcoForce Solutions has completed carport structure design, ordered fabrication steel and received building permit to complete construction in 2017. A ribbon cutting ceremony is being planned

for January 22, 2017. The interconnection agreement is expected to be completed before the ribbon-cutting ceremony.

The project was also featured in UCR Today at the link below:
https://www.solarpowerworldonline.com/2017/04/ensync-chemehuevi-solar-installation/

87. EPC-15-004

Project Name:

Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand

[EPC-15-004]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	8/3/2015 to 12/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Cooling and heating buildings contribute to a large portion of the electricity bills for California ratepayers. Traditional heating, ventilating and air conditioning (HVAC) systems waste energy. Innovations in HVAC systems, such as variable refrigerant flow and advanced indirect evaporative cooling systems are well suited for California climates. However the full potential of these innovations has not been realized.

Project Description:

This project is developing and demonstrating a Climate Appropriate Air Conditioning system for commercial buildings that optimizes occupant comfort and can reduce energy use and peak demand. The project will apply a combination of Variable Refrigerant Flow (VRF) technology with Indirect Evaporative Cooling (IEC) integrated and operationally optimized through the building control system. The project will also investigate alternative non- Ozone Depleting Potential (ODP) refrigerants and HVAC system designs that could enable their usage in commercial buildings. This project will benefit small and medium commercial buildings, such as retail stores, offices buildings and food service and could be implemented in existing and new commercial buildings through direct replacement of rooftop packaged air conditioners. It is estimated that the HVAC systems for these sectors use 7,000 GWh and contributes 5 GW of peak demand. This project could reduce HVAC energy consumption and peak demand.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The technology advancement is the intelligent HVAC controller that processes signals from building sensors and system feed-back to maximize system efficiency while also synchronizing operation of the VRF and IEC to reduce energy use and peak energy demand and maximize occupant comfort. The innovative control system utilizes cloud based optimization using weather, grid conditions and occupancy (CO_2) as inputs to optimally operate a VRF and the IEC system to reduce both energy and water use. The IEC will be set up as a dedicated outdoor air system and incorporate variable speed blower and heat recovery ventilation. These subsystems will also be intelligently controlled by the building controller. For commercial HVAC equipment, this project will also evaluate and provide systems designs that use alternative refrigerants that have zero ODP or low GWP.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

This project could reduce electricity use for HVAC systems up to 40 percent . This could mean lower energy costs for commercial building owners or occupants that pay utility bills.

Environmental Benefits:

This project could reduce electricity use in HVAC systems and identify potential alternative refrigerants that could reduce greenhouse gas emissions.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,088,673
EPIC Funds Encumbered: $2,834,721	**EPIC Funds Spent:** $748,658
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $440,509 (13.4 %)	**Match Funding:** $440,509
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 9

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Three test sites have been approved. The test sites are located in Davis, Mission Viejo and San Diego. The Davis and Mission Viejo sites will add indirect evaporative cooling and the San Diego site will add a new variable refrigerant flow loop. The recipient is collecting data at each test site to establish baseline conditions prior to equipment installation. The alternative refrigerant work is underway and the Recipient continues to work on the EnergyPlus model and control system.

88. EPC-15-005

Project Name:

Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.

[EPC-15-005]

Recipient/Contractor:

ICF Incorporated, L.L.C.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	12/4/2015 to 5/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Sea-level rise (SLR) presents a critical threat to California's low-lying coastal areas and the energy infrastructure located there. The reliability of California's electricity service could be threatened by either permanent inundation from SLR or temporary coastal flooding events that cause disruptions to generation, transmission, and distribution.

Project Description:

The project evaluates SLR vulnerability and adaptation options in the SDG&E service area at a level of detail appropriate for informing electricity sector policy and planning. ICF International is partnering with SDG&E to conduct a detailed and robust sea level rise vulnerability assessment and to identify and evaluate appropriate adaptation measures. This project identifies adaptation measures for the electrical system that are actionable and aligned with existing policies, based on a comprehensive understanding of the vulnerabilities of specific assets, how these combine at a system level, and significant feedback from the utilities. The results were formed with significant input from the IOU to ensure the adaptation measures are actionable.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Detailed SLR inundation modeling that builds on previous studies is used to identify the SDG&E infrastructure that will be exposed to coastal flooding and assess how the electricity system could be affected. Impacts of coastal inundation and possible adaptation measures are determined using literature reviews, interviews with key experts, modeling, and workshop elicitation. Potential direct and indirect impacts are used at an asset-by-asset level and through system-wide assessment, including power flow modeling to support a "value of lost load" analysis.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 5a, 5d

Greater Reliability:

This project is expected to result in the greater electricity reliability and lower costs by establishing a better understanding of vulnerabilities for the electrical system and by focusing utility adaptation efforts in a way that benefits San Diego ratepayers.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $240,425	
EPIC Funds Encumbered: $499,929		**EPIC Funds Spent:** $225,966	
Match Partner and Funding Split: San Diego Gas & Electric Company: $166,200 (25.0 %)		**Match Funding:** $166,200	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: Working closely with SDG&E, the research team first collected information on specific infrastructure assets and operations, and identified potential climate impacts. The climate impact vulnerabilities of the electricity system were then identified and discussed with the utilities. A matrix of assets and electricity service categories was developed in 2016. The research team collected information on electricity system adaptation measures and presented them to the utilities at a series of workshops to obtain feedback in summer and fall of 2017. The utilities are using some of the results from this study for adaptation planning.			

89. EPC-15-006

Project Name:

Modeling the Impact of Wildfires on California's Transmission and Distribution Grid

[EPC-15-006]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	11/1/2015 to 6/1/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Climate projections indicate longer, warmer dry seasons in California, thus increasing the risk of large wildfires. Previous research funded by the Energy Commission established that some climate change scenarios could cause a substantial increase in exposure of major existing transmission lines to wildfire, but the vulnerability of distribution circuits has yet to be investigated. Research is needed to extend this previous assessment of vulnerability of the transmission system in California to include the distribution system.

Project Description:

This study is advancing scientific knowledge by combining and enhancing several state-of-the-art models to produce the most detailed analysis to-date of California's future electric grid and fire risk under alternative conditions of climate change and grid evolution, including changes in the use of demand response, renewables, and distributed generation.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will lead to maintenance of grid reliability and safety while adapting to the challenge of changing climate and wildfire risk. Researchers will apply a unique methodology to measure wildfire risk, allowing them to relate an evolving wildfire probability over time with an evolving electricity grid. The methodology will reveal grid adaptations for minimizing the risk and cost associated with future wildfires.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 2a, 5a, 5d

Lower Costs:

The study will use modeling to minimize the cost of maintaining a reliable electricity supply in the face of increased wildfire risk.

Greater Reliability:

The study is designed to increase reliability and the capacity of the electricity system to respond to increasing climate change-related wildfire risk. The project will explore adaptation strategies for minimizing impacts of wildfire, including well-designed transmission and

distribution system paths and better located generation assets.

Increase Safety:

Greater ratepayer safety follows from improved electricity system reliability because that reduces the potential hazards associated with power outages, such as public health and operations of critical facilities.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $169,786	
EPIC Funds Encumbered: $500,000		**EPIC Funds Spent:** $500,000	
Match Partner and Funding Split: University of Hawaii at Manoa: $17,157 (3.3 %)		**Match Funding:** $17,157	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The researchers obtained the maps of future burned area being used for California's Fourth Climate Change Assessment as the basis for their study of future risk to the transmission and distribution system. They mapped current and future exposure of operationally significant segments of transmission paths to wildfire. They used land use projections of urban expansion from the Fourth Assessment as a proxy for the extension of the distribution grid for modeling its wildfire risk. Then they used the PLEXOS model to estimate the cost of fire-caused outages with and without wildfire forecasts, such as the change in generation costs as other power plants are dispatched to replace the stranded generators during the outage. The team is drafting the paper to be included in California's Fourth Climate Change Assessment in 2018.

90. EPC-15-007

Project Name:

Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat

[EPC-15-007]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	12/1/2015 to 9/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Because Los Angeles County is such a geographically diverse region, the impacts of climate change will be experienced differently across neighborhoods. Understanding the localized effects of climate change and the impacts on communities has been difficult to assess. Research predicts the Los Angeles region will be warmer by 3-5 degrees F annually by mid-century, and will have an increase in the number of "extreme heat days" varying regionally, with some cities experiencing up to 5-6 times their current levels. What is still unknown however, is how and where these increases in temperature will impact the electric grid.

Project Description:

This project is developing a sophisticated and in depth description of future electric grid demand, response, and vulnerability due to increased (and prolonged) heat events in Southern California Edison territory under current and future climate scenarios. It will enable innovative grid management and operation strategies and will identify adaptation guidance. Ultimately, researchers will provide the information to local governments, regional and state agencies, utilities, and the general public in tangible, easy-to-understand formats to enhance local and state capacity to respond to potential disruptions in transmission due to climate change.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project is integrating a set of models in a novel way to link new results on extreme heat events in Los Angeles County with electricity demand projections that respond to these events and then to model how these climate impacts would affect the vulnerability of electricity supply and of transmission and distribution networks. Doing so will create a greater level of understanding on where the grid is most vulnerable, which neighborhoods each circuit serves, and what types of adaptation measures need to be taken by the utility as well as state, regional, and local actors. The project can equally help guide investments in distributed generation that could alleviate pressure on the conventional electricity generation system.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 1e, 2a, 5a, 5d

Lower Costs:

The study will provide information to support decisions that would result in lowered costs for ratepayers, by providing utilities and policymakers with further information on where and how they can prioritize investments in the grid moving forward.

Greater Reliability:

By evaluating the vulnerability of critical substations and transmission lines during future projected heat scenarios, the study will identify problem spots in the grid in Los Angeles County. This in turn will provide a greater understanding to the utilities of localized risk, such that they can plan for a more reliable energy system.

Increase Safety:

Identifying grid vulnerabilities can help utilities and decision-makers better plan for potential outages, and resultant ratepayer safety risks. As this analysis will be mapped out geographically, it will facilitate the identification of and planning for those ratepayer communities at greatest risk.

Public Health:

Extreme heat events can worsen numerous health problems, which can be exacerbated by grid outages. This project will identify vulnerable segments of the grid to guide decisions about adaptation measures to minimize these health risks.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $500,000		**EPIC Funds Spent:** $13,311	
Match Partner and Funding Split: The Regents of the University of California, Los Angeles: $168,753 (24.7 %) County of Los Angeles: $15,000 (2.2 %)		**Match Funding:** $183,753	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The research team has modeled temperature projections to the end of the century for Los Angeles County and extracted data on the increased number of extreme heat days for each 2km grid cell. They developed a model relating monthly energy usage at the building level to temperature and building characteristics. They are completing the projections of peak demand in response to increased air conditioning load due to climate change under a range of assumptions. They are also working on modeling the vulnerability of distribution grid circuits to the projected increases in demand. The team is planning an extensive outreach effort to inform utilities, local governments, and ratepayers. The report will be part of California's Fourth Climate Change Assessment due in 2018.

91. EPC-15-008

Project Name:

Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt

[EPC-15-008]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	11/16/2015 to 6/28/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

California's electricity system is vulnerable to a variety of weather- and climate-related events, and stakeholders involved in electricity system management, operations, and planning must have timely access to relevant, best available, peer-reviewed data in a form that is easy to understand and useful for timely decision-support. As part of California's Fourth Climate Change Assessment, a suite of energy sector research projects are probing vulnerabilities and resilience options for the electricity system. Cal-Adapt 2.0, developed and launched under EPIC funds, is the platform through which underlying climate scenarios are rendered accessible to energy sector stakeholders.

Project Description:

This project develops a suite of analytical and outreach approaches to provide electricity system stakeholders with actionable data pertaining to local climate risks. The project is organized around three imperatives. The first is developing interactive, visually compelling, and useful web-based visualization applications depicting climate-related risks to the electricity infrastructure. The second is to build focused toolsets to support planning to protect energy infrastructure. Finally, the project includes outreach and training with energy stakeholders, climate practitioners, planners, managers, educators and ratepayers in the state through targeted workshops, webinars, and presentations. As articulated by electricity sector IOUs in the 2017 IEPR Adaptation Workshop, Cal-Adapt 2.0 is an instrumental tool for developing and implementing locally appropriate adaptation options in the electricity sector.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Cal-Adapt provides integrated tools that directly support electricity sector decision making with regard to infrastructure planning and management. Moreover, Cal-Adapt 2.0 coheres with the Governor's Office of Planning and Research's adaptation guidelines and is a key resource for accessing the data prescribed by those guidelines. Use of Cal-Adapt 2.0 to plan for climate resilience contributes multiple benefits to California's electricity ratepayers by helping to stabilize the grid, improve service reliability, and reduce financial losses associated with power outages.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 5a, 5d

Greater Reliability:

Integrated planning supported by this project will help improve service reliability and reduce financial losses associated with power outages. For example, as discussed at the 2017 IEPR Adaptation Workshop, SDG&E is using Cal-Adapt to support a review of transmission line design standards.

Energy Security:

Integrated planning supported by this project will help stabilize the grid and reduce system outages.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $74,324	
EPIC Funds Encumbered: $400,000		**EPIC Funds Spent:** $259,692	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 12 out of 13 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team released version 2.0 of Cal-Adapt, which includes more powerful visualization tools, new datasets, improved access to data, and a public platform for development of custom tools. New data include higher-resolution projections of temperature and precipitation designed to capture extremes as well as a hydrodynamical dataset for exploring potential inundation associated with sea level rise along the entire California coast, and the Bay Area and Sacramento/San Joaquin Delta. The Cal-Adapt team also developed several aggregation and data download options, as requested by the Technical Advisory Committee, which includes utilities and CAISO. Pursuant to a User Needs Assessment Workshop to capture electricity sector needs, Cal-Adapt launched a stream flow tool and improved existing tools (e.g., "quick stats" and historical modeled data download) to support

IOU analyses.

92. EPC-15-009

Project Name:

Workforce Instruction for Standards and Efficiency (WISE)

[EPC-15-009]

Recipient/Contractor:

California Homebuilding Foundation (CHF)

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	11/30/2015 to 3/31/2020

Program Area and Strategic Objective:

Market Facilitation

S17: Strengthen the Clean Energy Workforce by Creating Tools and Resources that Connect the Clean Energy Industry to the Labor Market

Issue:

California's homebuilding market emerged from the recession to find that many skilled tradespeople have permanently left the residential construction market. Meanwhile, techniques for constructing high performance attics, walls, and roof assemblies that were once considered "advanced practices" employed by few builders are now code requirements for new residential construction. The lack of skilled labor, coupled with increased demand for high-performance insulation techniques, could disrupt the rate of adoption of these measures or lead to poor installation of them. This may result in lower than expected energy savings and construction defects that impose safety risks.

Project Description:

This project is providing education, tools and on-the-job training to homebuilders in California's new residential construction market on High Performance Attics (HPAs) and High Performance Walls (HPWs), two new requirements in California's Building Energy Efficiency Standards for 2016. The project helps homebuilders better understand the new requirements and options for compliance, and provides them with technical support to enable the transition to the new requirements. Additionally, the project team provides on-the-job training to homebuilders, installing trades, subcontractors, and field crews on the proper installation of insulation and changes to other building systems that will be necessary to meet the new requirements.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The California Energy Code now requires new homes to be constructed with high performance walls and attics to meet energy efficiency standards. This project helps overcome market barriers for high-performance walls and attics by providing the construction industry with access to on-the-job training and tools on the best available technologies, techniques, and practices for complying with the new requirements.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1c, 1e, 1f, 1h, 2a, 3c, 4a, 4b

Lower Costs:

As builders become more familiar with proper installation practices and products are more widely deployed, the costs for installing HPAs and HPWs will be reduced. Additionally, proper installation will lead to energy savings, further reducing costs for ratepayers.

Increase Safety:

Training will improve safety by ensuring builders follow code-compliant manufacturers' installation guidelines to reduce the risk of construction and structural defects.

Public Health:

Supplemental ventilation training will ensure indoor air quality is unaffected or improved by changes to construction practices.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,667,291
EPIC Funds Encumbered: $4,431,918	**EPIC Funds Spent:** $1,641,157
Match Partner and Funding Split: APA - Engineered Wood Association: $473,710 (2.4 %) BASF: $990,000 (4.9 %) Bayer Material Science: $1,230,290 (6.1 %) California Building Industry Association (CBIA): $58,110 (0.3 %) Ensoltis Green Hybrid Roofing: $631,600 (3.1 %) KB Home: $3,043,501 (15.1 %) Owens Corning: $2,327,444 (11.6 %) Panasonic Eco Solutions North America: $265,200 (1.3 %) PCBC: $151,200 (0.8 %) QC Manufacturing: $335,220 (1.7 %) Shea Homes: $2,248,622 (11.2 %) SIPA - Structural Insulated Panel Association: $303,000 (1.5 %) SPFA - Spray Polyurethane Foam Alliance: $239,000 (1.2 %) Taylor Morrison Homes of California, LLC: $1,929,494 (9.6 %) Tru Team of California: $1,008,684 (5.0 %) ConSol: $450,000 (2.2 %)	**Match Funding:** $15,685,075
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	Funding Mechanism:	No. of Initial Passing Applicants/ Bidders:	Rank of Selected Applicant/ Bidder:
Competitive	Grant	4 out of 4 bidders	Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The team continues to actively engage with the building industry giving training and technical support for the new HPA/HPW code requirements. Builder participation in hands-on trainings was slow so the team focused on subcontractor trades and building officials but will continue to pursue builders. Resources such as product guidelines, short videos, and other materials were developed to share success stories, lessons learned, and options for code compliance. These materials are posted on the project's online public clearinghouse: www.wisewarehouse.org. A curriculum on the new HPA/HPW requirements is being developed for a statewide high school building and technology program, as well as third-party verification requirements and training certification for insulation installers. Finally, independent measurement and verification activities will assess forthcoming installation trainings.

93. EPC-15-010

Project Name:

Increasing Workforce Development Opportunities in Disadvantaged Communities through Automated Demand Response Communication Equipment Training

[EPC-15-010]

Recipient/Contractor:

Center for Sustainable Energy

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	12/8/2015 to 3/31/2020

Program Area and Strategic Objective:

Market Facilitation

S17: Strengthen the Clean Energy Workforce by Creating Tools and Resources that Connect the Clean Energy Industry to the Labor Market

Issue:

Automated demand response (AutoDR) equipment and communications standards have evolved significantly over the past decade. However, these advances and standards have not been adequately translated into training programs to help facilitate the widespread deployment of AutoDR communication equipment. Lack of an adequately trained workforce could limit the benefits provided by demand response to electric customers and the larger grid.

Project Description:

The project is recruiting workers from disadvantaged communities into apprenticeship programs at California Joint Apprentice Training Centers (JATCs), providing them with comprehensive classroom and on-the-job training on the installation and maintenance of AutoDR communications equipment. By addressing the acute skills gap by producing a workforce qualified to install and maintain cutting-edge AutoDR communications equipment, the project is enabling demand response to be deployed in the market at scale.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The California Energy Code was updated in 2013 to require lighting systems in large buildings to be capable of receiving and automatically responding to at least one standards-based messaging protocol which enables demand response. This project is helping ensure a workforce that is trained in the proper installation and maintenance of AutoDR communications equipment exists to meet California Energy Code requirements for commercial buildings.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1g, 1h, 2a, 3f

Lower Costs:

Proper installation of AutoDR communications equipment will facilitate greater levels of demand response by reducing the transaction costs for participating customers.

Greater Reliability:

Compared to manual response, properly installed AutoDR communications equipment increases customer response to utility or system operator messages about a demand

response event.

Economic Development:

Training on the proper installation and maintenance of AutoDR communications can provide increased employment opportunities for workers in disadvantaged communities.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $863,874	
EPIC Funds Encumbered: $4,476,189		**EPIC Funds Spent:** $1,249,547	
Match Partner and Funding Split: California LMCC IBEW-NECA: $16,165,080 (78.3 %)		**Match Funding:** $16,165,080	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 4 out of 4 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Subcontractors ASWB and UC Davis's CLTC finalized the academic workbook, lab workbook, and instructors' guide to start development of online coursework for the… course. The online version of the course was launched by the Joint Apprenticeship Training Centers in early November of 2017. In an effort to assist in reaching new apprentices (?), the project has established a project website where facilities and contractors can explore resources, incentives, and more at: http://energycenter.org/demand-response

94. EPC-15-012

Project Name:

Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants

[EPC-15-012]

Recipient/Contractor:

Kennedy/Jenks Consultants, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/30/2016 to 3/29/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Membrane treatment processes are highly energy intensive due to the fouling of the membranes over time. The high energy demand of low pressure membranes is caused by the accumulation of colloidal particles in the feedwater inside the membrane pores which increases the transmembrane pressure. There are no techniques to measure the levels of colloidal particles directly in wastewater, and minimize their deposition in membrane pores. As a result, many utilities do not pretreat the entering wastewater prior to membrane treatment. This results in membrane fouling and high energy use.

Project Description:

The project is demonstrating an on-line monitoring technology to directly measure colloidal particle monitoring technique. Direct detection of colloidal particles will help administration of optimal amount of pretreatment to remove colloidal particles and render membrane treatment energy efficient.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Nationwide there are over 100 microfiltration/ultrafiltration treatment plants and there are over 100 reverse osmosis facilities in California using membranes. Membrane treatment for wastewater treatment is very energy intensive due to fouling of membranes over time. This project could overcome the barriers to use of membrane treatment by demonstrating a technology that can detect colloidal particles in membrane feed water. This can facilitate an optimal pretreatment process for their removal and reduce membrane fouling and energy costs.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4c

Lower Costs:

The project could reduce the frequency of cleaning and membrane replacement, reduce energy use and reduce wastewater treatment plant operating costs by reducing the build-up in membrane pores and removing colloidal particles in the feed water. Assuming 50 percent improvement in microfiltration membrane energy and 20 percent improvement in reverse osmosis efficiency using the proposed technology and a 50 percent market penetration, could

result in annual energy savings of 47,500,000 kWh or about savings of $5 million.

Economic Development:

If the project is successful, Malvern Instruments, the owner of the technology will directly market this technology to water clients worldwide. Malvern is located in the United Kingdom. The technology could lower the overall cost of water reclamation due to improvement in energy efficiency, reduction in membrane cleaning frequency, and reduction in membrane replacement frequency. Therefore, this will help to provide a reliable local source of water.

Environmental Benefits:

By reducing energy use, the project could reduce greenhouse gas emissions.

<table>
<tr><td colspan="2">Assignment to Value Chain:
Demand-side Management</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $429,784</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$1,167,034</td><td colspan="2">EPIC Funds Spent:
$252,066</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
Orange County Water District: $60,000 (4.0 %)
West Basin Municipal Water District: $50,000 (3.3 %)
Evoqua Water Technologies: $126,000 (8.4 %)
Malvern: $100,000 (6.7 %)</td><td colspan="2">Match Funding:
$336,000</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders</td><td>Rank of Selected Applicant/ Bidder:
Ranked # 9</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-15-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
</table>

Update:

Bench scale studies have been performed at Orange County Water District to develop preliminary relationship between coagulant dose and colloidal particle removal. The Recipient has started coordination with Malvern Instruments. Both the microfiltration and reverse osmosis pilot units have been refurbished at the demonstration site. On-site safety training was completed and the health and safety plan and chemical handling plans were developed. Instruments and chemicals for initial testing have been procured. The recipient has completed feedback loop for coagulant dosing in response to colloidal particle count in the feed water, and also started testing and optimizing activities.

95. EPC-15-013

Project Name:

Open Source Platform For Plug-in Electric Vehicle Smart Charging in California

[EPC-15-013]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	2/1/2016 to 1/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Technologies and Strategies That Optimize the Benefits of Plug in Electric Vehicles to the Electricity System

Issue:

Plug-in electric vehicles (PEVs) represent a rapidly proliferating new vehicle technology and source of utility grid load. Currently only pilot concepts exist for actively managing PEV charge control for the benefit of California's grid and ratepayers. Meanwhile California's electrical grid is evolving to rely more on intermittent renewable power sources, with different "grid acceptance" issues than more traditional generation sources, driven by the state Renewable Portfolio Standard (RPS), creating a unique opportunity for PEV charging and the "greening of the grid" to go hand-in-hand.

Project Description:

The project develops a one-way charging concept for PEVs that maximizes accommodation of intermittent renewable generation and minimizes impacts to the distribution grid. The project focuses on controlling the charging of PEVs in residential and small commercial settings using a novel and flexible open-source, open-software architecture charge communication and control platform. This software-based platform will be embedded in the context of overall utility and residential/business electrical and building automation systems, lending itself to potential broad implementation by commercial interests due to its flexible architecture and "agnostic" approach to communications standards. Control strategies and applications will be guided by an assessment of user needs and grid operation and ratepayer benefits, and the potential for one-way PEV charge control to lead to increased ability to accept intermittent renewable energy for California's electrical grid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project focuses on controlling the charging of plug-in electric vehicles PEVs at residential and small commercial settings using a novel and flexible open-source, open-architecture charge communication and control platform. This XBOS-V platform is embedded in the context of overall utility and residential/business electrical and building automation systems, lending itself to potential broad implementation by commercial interests.

This integrated project also focuses on the development of the open-source platform including assessment of user needs and grid operation and ratepayer benefits, grid security considerations, and the potential for PEV charge control to lead to increased ability to accept intermittent renewable energy for California's electrical grid. The platform is flexible to adoption/inclusion of several communication protocols.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Smart grid: R.08-12-009

Applicable Metrics: CPUC Metrics- 2a, 3h, 4a

Lower Costs:

This project is estimated to result in $176 million per year reduction in electricity costs for ratepayers in 2024 from lower electric distribution system upgrade and operating costs, increased electric distribution system energy efficiency, increased PEV charging energy efficiency, and lower electricity generation costs.

Greater Reliability:

This project is expected to increase reliability of the electric distribution grid, reducing frequency of outages by 25% in residential areas. Coordinated charging of PEVs in distribution networks could reduce impacts from sudden surges in charging (e.g., PEV owners in large groups set the timing of the charge to coincide with reductions in TOU rates after the evening peak). By coordinating the charge more carefully across utility distribution level nodes, these grid impacts can be greatly minimized based on initial project findings. Managed charging also has the potential to curtail about 500 GWh of renewable overgeneration.

Environmental Benefits:

This project could reduce carbon dioxide emissions of 340,000 metric tons per year in 2024 from increased electric distribution system energy efficiency, increased PEV charging efficiency, increased fraction of intermittent operationally GHG-free renewable electricity generation, and the decreased need for GHG-intensive supplemental peaking generation.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $549,477
EPIC Funds Encumbered: $1,500,000	**EPIC Funds Spent:** $463,102
Match Partner and Funding Split: BMW of North America: $90,000 (5.7 %)	**Match Funding:** $90,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 25 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team completed the participant focus groups to assess market drivers and decision points for adopting PEVs. The team also interviewed building energy managers to assess their needs and barriers to implementing a building management system with integrated vehicle charging. The project team also installed the Wi-Fi enabled smart-charger and completed initial integration of the software/code to communicate with the charger through the XBOS-V platform. Project work is currently focusing on simulation of added PEV charging loads in the context of a simulated distribution feeder that is based on an actual multi-nodal grid section of the PG&E network. The research team continues to extend the current grid load projects to better understand larger VGI grid benefits of aggregating building loads with PEV charging.

96. EPC-15-015

Project Name:

Grid Communication Interface for Smart Electric Vehicle Services Research and Development [EPC-15-015]

Recipient/Contractor:

Andromeda Power, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	2/1/2016 to 1/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Technologies and Strategies That Optimize the Benefits of Plug in Electric Vehicles to the Electricity System

Issue:

The increase of distributed energy resources, including intermitting renewables and storage in plug-in electric vehicles (PEVs), makes the coordination of supply and demand to maintain the reliability of the distribution network challenging. PEVs are rapidly expanding in California and this will proportionally increase the installation of bidirectional stations, creating additional demand and stress on the grid. In order to effectively implement vehicle-to-grid (V2G) services, the grid has to be capable of effective machine-to-machine and user-to-machine communication.

Project Description:

Andromeda Power will develop an advanced smart grid communication interface that allows utilities to send dispatch signals to PEVs in real-time to optimize the bidirectional power flow of PEV battery packs depending on local power conditions such as congestion, power quality, voltage and frequency, while maintaining the driver's mobility needs. The grid communication interface operates with a virtual machine able to interface PEVs of any standard. The real time monitoring and control of the stations will provide to the California Electrical Investor Owned Utilities a means of quick Automated Demand Response.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project enables the harmonization of V2G services, removing the communication barrier between PEVs of different standards and the grid. The communication interface enables Smart Demand Side Management with the possibility of using PEVs as distributed energy storage and controllable load. Local PEVs can be used to store onsite renewable energy and deliver to the grid on demand. The additional smart charging incentive can accelerate PEV adoption to achieve the targeted 1.5 million ZEVs on the road by 2025. Using PEVs as an energy storage resource can reduce energy demand and stress of the grid, making the load predictable and more manageable.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1g, 2a, 4a, 5b

Lower Costs:

The annual energy shift capacity introduced by InCISIVE is about 8.2 MWh/year (= 22.5 kWh x 365) toward the end of On-Peak period and in the following Mid-Peak period when marginal electricity is produced by natural gas peaker plants.

Environmental Benefits:

Each PEV used for energy storage is estimated to result in more than 1.3 metric tons per year of additional GHG reductions. Additional GHG reduction can be achieved using PEV batteries to store excess renewable energy to flatten the electric grid duck curve.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $304,177
EPIC Funds Encumbered: $681,693	**EPIC Funds Spent:** $377,046
Match Partner and Funding Split: Verdek: $125,000 (10.9 %) Suncharge: $340,000 (29.7 %)	**Match Funding:** $465,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 25 out of 25 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team designed and prototyped two models of Level 2 chargers (ORCA InCISIVE, Strada and Zen) capable of demand response according to the V1G (managed charging) use cases defined by SCE and PG&E. The Andromeda VGI EVSE design includes smart inverter designs to accommodate Rule 21. The EVSEs will be installed in the field for durability tests. The EVSEs (Level 2 and Level 3) will also be integrated in a microgrid with 110 kW solar panels to demonstrate the feasibility of the InCISIVE system in mitigating renewable energy overgeneration.

97. EPC-15-016

Project Name:

A Transformative Flywheel R&D Project

[EPC-15-016]

Recipient/Contractor:

Amber Kinetics, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	1/27/2016 to 3/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S8: Integrate Grid Level Energy Storage Technologies and Determine Best Applications That Provide Locational Benefits

Issue:

Many of the promising energy storage solutions - those with the potential to dramatically reduce cost - are still in the early stages of development. Amber Kinetics is working to advance flywheel energy storage technology to provide safety, reliability, fast response, long cycle life, long discharge duration, and most importantly, low cost.

Project Description:

This project will fully develop advanced manufacturing processes and improve the flywheel rotor geometries. The project will seek to build on developments that the Amber Kinetics flywheel engineering team made in the areas of improved materials processing for better strength, longer life, and improved rotor geometries to maximize energy storage density and reduce costs. Amber Kinetics' projected flywheel manufacturing cost targets are below $150/kWh, inclusive of power electronics.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is building on developments that the Amber Kinetics flywheel engineering team has made in the areas of improved materials processing for better strength and longer life, as well as improved rotor geometries to maximize energy storage density, thus reducing the cost of the system.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011

Applicable Metrics: CPUC Metrics- 1c, 1i, 2a, 4a, 5b

Lower Costs:

Develop a low-cost flywheel energy storage system to demonstrate the commercial readiness of flywheel systems utilizing the most advanced design and manufacturing techniques available to drive down the cost of flywheel energy storage systems for less than $150 kWh when compared with other existing energy storage technologies (e.g., Li-ion, sodium sulfur (NaS), etc.)

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $388,000	
EPIC Funds Encumbered: $2,000,000		**EPIC Funds Spent:** $1,215,133	
Match Partner and Funding Split: Amber Kinetics, Inc.: $12,000,000 (85.7 %)		**Match Funding:** $12,000,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 35 out of 38 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 7
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: Amber kinetics completed their commercial readiness tests of more than 25,000 operating hours. Also, they are continuously performing the safety validation with burst tests that are used to analyze and improve the flywheel containment design. For grid connection using multi-unit arrays, Amber Kinetics developed communication protocols, multi-array connectivity, charge and discharge operations, and control algorithms for coordination of multiple flywheels. This information was documented in a delivered technical report. They continue to collect flywheel operational data under real world conditions to prove the design robustness, reliability, round trip efficiency, and the ability to balanced power and control the state of charge.			

98. EPC-15-018

Project Name:

Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems [EPC-15-018]

Recipient/Contractor:

Eos Energy Storage, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	3/22/2016 to 3/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S8: Integrate Grid Level Energy Storage Technologies and Determine Best Applications That Provide Locational Benefits

Issue:

Utilities are looking for alternative solutions to address load growth. Customer rates are increasing rapidly as a result of the utilities' increasing costs of service. Distributed energy storage can provide fast-responding grid services and much needed locational capacity to integrate high penetration of renewables while helping utilities during 4-6 hour system peaks. Current commercial energy storage technologies are uneconomical because of their high cost and short life. Also, safety and energy density limitations have prevented wide-spread deployment of energy storage on a distributed basis or at the point of consumption.

Project Description:

The goal of this project is to develop and test behind-the-meter residential and commercial battery storage applications, each on both a stand-alone basis and integrated with solar PV. This project is utilizing several kW-scale, AC-integrated Znyth (Trademark) battery technology storage systems. The residential and commercial systems are located at the University of California, San Diego (UCSD) campus. The project team is developing, modeling, and testing experimental rate designs and evaluating the impact on customer load profiles; developing control algorithms and demonstrating aggregation of multiple storage units to create virtual power plants that maximize the value of behind-the-meter storage to the utilities; and modeling, simulating, and extrapolating the economic impacts of installed systems and quantifying the benefits to CA utilities and ratepayers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project aims to validate the safety, reliability, and performance of a new aqueous, zinc-based battery technology to support customer adoption in behind-the-meter energy storage markets and applications. Behind the meter DER application of energy storage has been identified as a major commercial market for energy storage. Detailed field performance data on the application of energy storage in these behind the meter DER opportunities is critical to the state to open up this market for new and emerging energy storage technologies.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1c, 1i, 2a, 4a, 5b

Lower Costs:

This project will help lower energy costs for residential and commercial customers by providing behind-the-meter energy storage options that may help offset peak use rates and lower demand charge costs.

Increase Safety:

Eos is the only company offering a Zinc Hybrid Cathode Battery, under the trademark name Znyth. This is an aqueous, zinc-based battery technology that is inherently safer than competing technologies. This technology is non-flammable and non-toxic. In addition to being backed by UL- and ISO-certified quality assurance and control, the manufacturing process involves no toxic or hazardous materials.

Environmental Benefits:

Greenhouse gas, NOx, and SO2 reductions will be calculated from measured battery performance based on peak loads shifted.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $218,866	
EPIC Funds Encumbered: $1,894,866		**EPIC Funds Spent:** $75,546	
Match Partner and Funding Split: Eos Energy Storage, LLC: $1,436,801 (43.1 %)		**Match Funding:** $1,436,801	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 35 out of 38 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Eos submitted the Site License Agreement and Payment to UC San Diego for battery storage system installation and testing. The test plans and the engineering designs for both the commercial as well as the residential systems were completed. Battery production has begun. The inline design for the residential system integration with AC inverter has begun. Fully

integrated batteries will be delivered to the UC San Diego campus in January 2018 for installation and the residential storage system testing will begin.

99. EPC-15-019

Project Name:

Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps

[EPC-15-019]

Recipient/Contractor:

The Regents of the University of California on behalf of the Davis campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 9/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Ground-coupled heat pumps (GCHPs) have been proven to deliver heating and cooling at much higher levels of efficiency than air-source air conditioners and heat pumps. However, their application in relatively mild climates, like California, is limited by the very high cost of conventional ground heat exchangers (GHE).

Project Description:

This project is addressing the high cost of GHEs for water-to-water and water-to-air heat pumps to facilitate increased implementation of efficient ground-coupled heat pumps in California. The project focuses on shallow (20-30 feet deep) and large diameter (2-3 feet diameter) ground heat exchanger designs using helical coil heat exchangers. The project team is developing models, validating them with field data from three existing sites, identifying optimal designs, and developing modeling methods that can be adapted for use with Title 24 standards compliance tools. The project is also producing typical design specifications that will support future Title 24 eligibility criteria. A design guide is being developed for use by the industry as a training aid, and a position paper is being prepared for the Department of Water Resources' California Geothermal Heat Exchange Well Standards Stakeholder Advisory Group.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project facilitates the market for high efficiency GCHPs by evaluating and testing an innovative method to reduce the cost of GHE, whose cost has been a barrier to more GCHP installations. Cost savings are associated with use of common, locally available drilling equipment for shallow bores as compared to deep drilling rigs that often must be transported from out of state, and the use of the helical coil GHE technology. In addition, this technology will be made ready for commercialization by developing tools needed to properly design, size and evaluate energy savings and to facilitate use with California Title 24 standards compliance tools.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)
Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs:

Ground coupled heat pumps (GCHPs) could result in lower utility costs for heating and cooling, lower maintenance costs, and improved system reliability when compared to conventional forced air systems. Estimated annual energy savings to be over 67 billion BTU, assuming 40,000 single family homes built annually and 10% of new homes equipped with GCHPs. Annual electricity savings from improved cooling efficiency in new homes estimated to be 1.2 million kWh. For a 2,100 square feet home and a 2 ton system, and comparing the incremental cost for a GCHP system with conventional HVAC system, the annual cost savings per home is $173, when amortized over 30 years with federal tax credits.

Environmental Benefits:

Assuming a 10 percent market penetration on new homes, estimated greenhouse gas emissions would be reduced by 8 million pounds per year.

Consumer Appeal:

Increased use of ground coupled heat pumps would eliminate noisy and visually unappealing outdoor condensing units. Also, GCHPs could improve comfort for residents when compared to conventional forced air systems.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $361,292	
EPIC Funds Encumbered: $1,212,186		**EPIC Funds Spent:** $356,706	
Match Partner and Funding Split: Davis Energy Group, Inc.: $18,826 (1.5 %)		**Match Funding:** $18,826	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 12

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In 2017 the team collaborated with the author of an existing capacitance resistance model to study the optimization of the GHE design. The team developed a new computational fluid dynamics model that was used to validate the existing capacitance resistance model which will enable the study of variable soil properties. The existing model for a conventional U-tube GHE was validated by comparing ground thermal response generated by the model with those reported in literature. Three residential field sites were instrumented and field monitoring was completed. The results were used to validate the helical GHE model and a new model was developed to calculate the thermal behavior of helical GHE designs for use in building energy simulation software. A TAC meeting was held in December 2017. The project is on schedule and on budget.

100. EPC-15-020

Project Name:

Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization

[EPC-15-020]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	3/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

In low income housing, HVAC energy use, in many cases is the largest component of energy use. However, the efficiency issues associated with HVAC units are largely unaddressed due to cost, ownership and complexity of the systems. By targeting the so called "low hanging fruit", such as control mechanisms, energy savings could be realized with minimal cost to the tenant. However, monitoring and verification of energy savings is needed before building owners/operators are convinced of the benefits and savings.

Project Description:

This project is developing a low-cost smart thermostat with a simplified user interface. It is being tested in low-income and senior housing, but can be readily adapted to other building sectors, including small commercial. The smart thermostat will track user preferences and manage indoor conditions to optimize energy use. Internet connectivity is not required. By automatically optimizing thermostat settings, this project determines if smart thermostats can be a cost-effective method to address HVAC energy use in sectors where it does not make sense for building owner or tenant to make HVAC system upgrades.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project bridges a technology connectivity gap in low-income and senior communities. Current smart thermostats are expensive, and a lack of broadband internet access makes these devices a bad fit for the low-income market. Developing a low-cost, internet-independent device creates opportunities to expand smart grid infrastructure and capture energy savings associated with automated controls in hard to reach building sectors.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1g, 1h, 3a, 4a

Lower Costs:

This project will leverage lower-cost hardware and software platforms to develop a cost-effective smart thermostat option ~ 40% lower cost than the current market price of ~$60. By providing a more cost-effective thermostat, this project could leverage utility and other

incentives for a no-cost option for homeowners. By increasing adoption of smart thermostats this project will help lower energy use and costs from a generation and end-use level. At the end use level, smart thermostats have the potential to reduce HVAC energy use and costs by 10 to 15%.

Environmental Benefits:

Development of a smart thermostat has the potential to reduce HVAC energy use. Energy saved at a building level means less energy required at a generation level, therefore reducing the need to burn fossil fuels which generate greenhouse gasses at a power generation facility. The aggregate reduction in carbon dioxide (CO2) emissions imparted by the proposed thermostat just from low-income customers translates to 175,000 tons. Including small commercial, emissions can be reduced by 218,000 tons.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $903,766	
EPIC Funds Encumbered: $2,705,759		**EPIC Funds Spent:** $221,572	
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $427,072 (13.6 %)		**Match Funding:** $427,072	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 11

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The team recently conducted interviews and surveys with property managers and residents to inform outreach and education strategies. Surveys were completed in Q4 of 2017. The recipient has hosted several connected devices working council sessions to gain feedback from manufacturers and other industry stakeholders. Hardware for the thermostat has been procured and software development is well underway. Currently the team is working on embedded software for Bluetooth connectivity for the thermostat.

101. EPC-15-021

Project Name:

Mobile Efficiency for Plug Load Devices

[EPC-15-021]

Recipient/Contractor:

AGGIOS, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/1/2016 to 12/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Typical smartphones consume 0.03 W when idle and less than 1W when in use. In comparison, typical set top devices, like satellite, cable or IP devices or home and office computers, use 100-1000 times more power when idle and 5-50 times more power when in use. From end user's perspective those devices are converging and increasingly offer similar information, video, audio and other services. Therefore, research is needed to improve power management on the major types of plug load devices so that they can approach the efficiency equivalent of mobile devices.

Project Description:

This project is designing a methodology guideline for plug load manufacturers to use in developing energy efficient plug load devices. In developing the guideline, the recipient will evaluate mobile design practices, hardware components, and power management software kernels to prove their effectiveness. The results will be used to develop the first virtual prototypes and reference designs for energy optimized hardware and software that can guide plug load device manufacturers to reach mobile energy efficiency levels. Manufacturers will use these reference designs to develop and mass deploy energy efficient plug load devices into the marketplace. The project will show a reduction of energy consumption of residential and commercial plug load devices, such as set-top boxes, TVs, computers, and game consoles. The project will also define and introduce a widely accepted industry standard through the Institute of Electrical and Electronics Engineers (IEEE) to support the newly developed unified design methodology and secure its long-term adoption and further evolution.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is advancing a methodology guideline to help plug load manufactures develop energy efficient plug load devices. The recipient is conducting detailed technical analysis on new software, hardware and power management design and verification methodology, conducting tests on virtual prototypes, verifying energy savings, and developing reference designs, in the form of design guidelines. This information will be made available to the plug load device manufacturers and their suppliers to help accelerate the adoption of mobile efficiency practices across multiple product categories in the shortest time and the lowest costs. As many current plug load devices in the market lack any power management capabilities, similar to those in smart phones, this project will pave the way for plug load manufacturers to advance those capabilities into other plug load devices.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

This project has the potential to impact reduce energy use and costs across a broad array of plug load devices. If successful, the estimated potential energy savings beyond today's average unit energy consumption range from 20% to 50% per plug load device.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $136,800
EPIC Funds Encumbered: $1,996,999	**EPIC Funds Spent:** $1,338,814
Match Partner and Funding Split: AGGIOS, Inc.: $225,000 (2.8 %) Freescale: $20,000 (0.2 %) International Rectifier: $225,000 (2.8 %) Keysight: $65,000 (0.8 %) Mentor Graphics: $4,350,300 (54.2 %) Synopsys: $1,145,150 (14.3 %)	**Match Funding:** $6,030,450
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

- Functional Specification Document Architecture Specification Document
- Automatic Energy Design and Management System
- SEED - Software Defined Power Manager
- EnergyLab - Software Toolkit for Energy Analysis and Software Generation
- UHAL - Unified Hardware Abstraction Language
- Functional Specification Document Architect

Update:

The recipient has completed the development of virtual prototypes for each plug load device that is being tested such as gaming console, computer, television, and set-top box. These virtual prototypes represent all of the components and power states defined in the specification of each device. These prototypes help identify the methodology for design space exploration and optimize energy efficiency before developing hardware and software components. The recipient completed the IEEE P2415 standard to support the newly developed unified design methodology. This standard is being reviewed for adoption. The recipient participated in the Energy Commission's Plug Load Collaborative in which they shared their current progress, results, and findings to other plug load projects. Staff conducted a site visit in early 2017 of the recipient's headquarters to evaluate the testing facility.

102. EPC-15-022

Project Name:

Power Management User Interface

[EPC-15-022]

Recipient/Contractor:

The Regents of the University of California, Irvine Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/1/2016 to 4/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Personal computers typically do not employ existing power management capabilities and are left on idle mode. This practice results in an increasingly large proportion of energy consumption in homes and businesses.

Project Description:

This project seeks to reduce computers' energy consumption by improving how users employ existing power management capabilities. Although all computers have the capacity to enter low-power modes such as sleep, and can be shut down when not in use, this potential for energy savings has not been realized in the majority of desktop computers. These computers remain on at full power when they are not used. The problem is one of user behavior. The project uses a software solution to change user behavior by changing the tool they are using. This approach is firmly based in behavior theory and human-computer interaction research, which have long demonstrated that the interface of a device can change users' behavior.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The Recipient will develop and test a new user interface designed to facilitate and encourage greater utilization of low-power modes by computer users. The interface design will incorporate lessons from the fields of human-computer interaction and behavior theory. The field test will provide data that will improve understanding of user behavior toward computer power management.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

Lower energy use results in reducing operating costs for consumers. The energy savings is estimated to be as high as 50 percent per computer, between 139 and 321 kWh per year or up to approximately $58 per year.

Environmental Benefits:

Reducing energy use will result in greenhouse gas emission reductions.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $300,159	
EPIC Funds Encumbered: $785,124		**EPIC Funds Spent:** $310,060	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

UCI has produced a fully functional draft of the software prototype. They have conducted pretests of the software and selected survey questions and made revisions to the questionnaires and software based on pretesting results. They are conducting the field test of the software on university staff desktops, and have more than 300 participants so far.

103. EPC-15-023

Project Name:

Gaming System Energy Efficiency without Performance Compromises

[EPC-15-023]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 12/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

More than 1 billion people around the world engage in digital gaming. The approximately 20 million gaming platforms in use in California include 7 million mainstream personal computers used partly for gaming, 1.5 million specialized high-power PCs known as Gaming PCs (GPCs), and 12 million Video Game Consoles (VGCs). It is estimated that these platforms collectively consume 5% of total residential electricity and 18% of residential miscellaneous plug loads in California (and an unknown share of non-residential plug loads).

Project Description:

This project provides a detailed market segmentation and baseline energy demand assessment of the gaming market, including development of measurement and benchmarking protocols for gaming software and hardware. Top-selling gaming PCs and games are then cross-benchmarked and retrofitted to achieve maximum energy savings beyond what commercialized products currently can attain.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will advance the design of energy efficient of video gaming computers and consoles by demonstrating system designs that are significantly more efficient than current market offerings. The research results could spur component and integrated system manufacturers and game developers to bring more energy efficient video game computers and consoles into the market without sacrificing the gaming experience. The project could also identify potential opportunities for codes and standards improvements and/or utility incentives. California ratepayers could benefit by having lower energy use and costs associated with their gaming systems without compromising their video game choices and experience.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

If successful, this project could reduce the energy "bill" for a typical gaming personal computer by $236/year (assuming a 75% savings potential), which is more than any other miscellaneous plug load.

Environmental Benefits:

By reducing energy use, the project will also reduce greenhouse gas emissions.

Consumer Appeal:

Gamers are intently focused on noise, heat management, and thermal comfort. Energy efficiency improvements will not impact these elements but could result in less heat and increased thermal comfort.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $658,250	
EPIC Funds Encumbered: $1,386,530		**EPIC Funds Spent:** $1,386,530	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team has built all the video gaming computers and procured the video gaming consoles. Each video game device was evaluated with baseline testing of energy use and different power states. The team has recruited beta testers to come and record their video gaming playing time. The team evaluated the energy use for each device as testers are playing different games. The testing team implemented different efficiency measures on the gaming computers and evaluated the energy savings potential. The testers were surveyed on whether or not the game quality has differed once the measures have been implemented. The goal of the project is to demonstrate efficiency measures without compromising the game quality. Staff conducted two site visits in 2017. The first site visit was to participate in the Technical Advisory Committee meeting. The second visit was to evaluate the testing lab.

104. EPC-15-024

Project Name:

Efficient and ZNE-Ready Plug Loads

[EPC-15-024]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/11/2016 to 4/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Plug load devices require the conversion of grid power from alternating current (AC) to direct current (DC) and these devices spend long periods of time in standby mode, creating inefficiency in current plug load devices. There is a need for energy efficient plug load technologies and strategies to reduce electrical consumption.

Project Description:

This project researches and develops new technologies and strategies to eliminate or significantly reduce energy use in standby mode by redesigning the power supply for plug load devices. This research project develops and demonstrates strategies to remove plug load devices from grid AC power by redesigning these devices to use DC power from photovoltaic power sources.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Standby power use is the electricity consumed by almost every electrical consumer device plugged in to an electrical outlet. Standby power is responsible for roughly 5% of California's residential electricity use. This project will develop an innovative family of zero-standby technology solutions and will enable the next generation of electrical devices to draw zero standby power while providing the full range of functionality that are desired by consumers.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The project could lower the cost of electricity to the consumer through the elimination of standby power and electrical losses from converting DC to AC by an estimated $750 million per year.

Environmental Benefits:

The project has the potential of reducing energy use up to 5,100 GWh/ year, which is equivalent to the reduction of approximately 3,000 metric tons of greenhouse gas based on EPA's emission calculator.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $634,531	
EPIC Funds Encumbered: $1,600,000		**EPIC Funds Spent:** $541,352	
Match Partner and Funding Split: EMerge Alliance: $50,000 (2.4 %) Power Integrations: $75,000 (3.6 %) Delta Electronics: $100,000 (4.8 %) United States Environmental Protection Agency: $270,000 (12.9 %)		**Match Funding:** $495,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The project is on track to meet all its deliverables. The researchers are reviewing technologies for energy harvesting and energy storage in order to identify those most suitable for pairing with a power supply. They are also working on identifying energy efficiency technologies to integrate into selected plug loads that take into account human behaviors and device functionalities. The first TAC meeting was conducted in October of 2017. An abstract paper by Alan Meier, the principal investigator of the project on "Zero Standby Power Supply" was submitted to ACEEE for consideration, and was also presented at the 2017 EEDAL International Conference on Energy Efficiency in Domestic Appliances and Lighting.			

105. EPC-15-025

Project Name:

Plug Load Reduction App: RYPL

[EPC-15-025]

Recipient/Contractor:

Home Energy Analytics

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	4/11/2016 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Plug loads or miscellaneous electrical loads (MELs) are the fastest growing category of residential electricity consumption and the idle load represents a surprisingly large percentage of the electricity used in California homes - on average 218 Watts across 70,000 homes. In addition, there is no accurate and reliable way to guide residents in choosing actions to reduce the idle load and no accurate way to track their progress if actions are taken to reduce the idle load.

Project Description:

This project researches methods to reduce home idle loads by utilizing smart meter analytics, an engaging smart phone app, a new online crowd-sourced database of miscellaneous electric loads, and an online efficient product marketplace to educate California residents about the idle load of their home and ways to reduce it. The system is to be piloted within all three electric investor owned utility territories and measure actual energy savings through smart meter data.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Idle load is a new concept to most residential energy users and includes appliances and equipment in the off or standby mode but still drawing power. The recipient has developed an innovative smart phone app called Dr. Power which provides residents with information about their idle loads, provides ideas and a plan to reduce the idle loads, and correlates any energy saving actions with smart meter data. This simple to use app tests the theory that if accurate information about energy use is provided to consumers, they will be more likely to engage and take action. This technology has the potential to advance consumer knowledge and overcome barriers to reducing idle loads that could hinder the State's goal of doubling energy efficiency by 2030 and/or achieving zero net energy buildings in the future.

CPUC Proceedings addressing issues related to this EPIC project:

Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

Project could lower energy bills by an estimated 10 percent due to reducing idle loads in homes.

Environmental Benefits:

Reduced GHG emissions through reduced energy usage.

Consumer Appeal:

Due to the number of smart phones, a mobile app could provide information on energy use, actionable recommendations and follow-up to show energy saving results through links with the Green Button Connect features. This easy to use application could increase consumer uptake.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $884,100	**EPIC Funds Spent:** $666,292
Match Partner and Funding Split: Enervee Corporation: $300,000 (24.3 %) Home Energy Analytics: $50,000 (4.1 %)	**Match Funding:** $350,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project is on track to meet or exceed all its deliverables on time and on budget. The research team is continuing development of the iPhone application version, and continuing work on the Plug Load Data Base (PLDB) interface and the Reduce Your Plug Load (RYPL) server for the text-based inventory of home devices. The application, Dr. Power, was launched successfully for both Apple and Android mobile operating systems. Feedback on the application is being collected to ensure accuracy; early feedback is very encouraging. The

team is also working with Southern California Edison to resolve issues with the Green Button Connect features.

106. EPC-15-026

Project Name:

Unlocking Plug Load Energy Savings through Energy Reporting

[EPC-15-026]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/1/2016 to 4/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Plug loads account for an increasing portion of electricity consumption in both residential and commercial buildings. Recent surveys indicate that plug loads are responsible for at least 25 percent of building electricity use nationally, and even more in California.

Project Description:

This project will develop an interoperable protocol that can be implemented in all plug-load devices, unhampered by proprietary restrictions which will implement energy reporting to enable plug-load devices to transmit operating information - such as identity, power consumption, and functional state - through a communications network to a central entity. After a communication infrastructure is established for plug-load devices, the data flow can be reversed to send control signals to individual devices. The central management system that this project will demonstrate is well positioned to provide comprehensive control over diverse plug-load devices.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Building operators and end users do not have a clear or accurate tally of the plug load devices in their buildings, how much energy is used or how they could be better controlled to save energy. The Recipient is developing inexpensive, proprietary-free technologies that can acquire energy use data for networked plug load devices and make them available to building owners. The technologies will be able to identify abnormally large plug load energy use and enable building owners to react to its energy use. The technology could be incorporated directly into California's building codes and other energy efficiency standards.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 4a

Lower Costs:

In California, energy savings could exceed 5 TWh/year in residential and commercial buildings. More savings should result from applying the technology to other plug load devices such as appliances. The technology could result in a demand reduction of more than 700 megawatts.

The energy savings could result in lower energy costs for consumers.

Environmental Benefits:

The project could reduce energy consumption and greenhouse gas emissions by more than 1.7 gigatons per year.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $123,700
EPIC Funds Encumbered: $1,630,699	**EPIC Funds Spent:** $848,910
Match Partner and Funding Split: Energy Solutions: $94,318 (4.4 %) The Watt Stopper: $50,000 (2.4 %) Lawrence Berkeley National Laboratory: $350,000 (16.5 %)	**Match Funding:** $494,318
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

List of device types created by LBNL with funding from Northwest Energy Efficiency Alliance. Made available for use by UPnP (Universal Plug and Play) which has been since merged into OIC (Open Interconnect Consortium). This list will be recommended for incorporation into other technology standards. A report on this at: http://nordman.lbl.gov/docs/lbnl-classification-v1.pdf.

Update:

The project team has identified several devices and protocols, and have demonstrated energy reporting capabilities. The project team held a TAC on October 27, 2017 and received positive feedback. The team will continue to identify more devices and protocols for testing. The project is on budget and schedule.

107. EPC-15-027

Project Name:

Electric Plug Load Savings Potential of Commercial Foodservice Equipment

[EPC-15-027]

Recipient/Contractor:

Fisher-Nickel, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/16/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

The main barriers preventing adoption of advanced appliances in commercial food service has been a combination of the industry's lack of knowledge and energy data. An equally important barrier to the adoption of optimized energy mode technologies is the operator's apprehension that the appliance will not be ready to use when needed; that the amount of time required to heat the appliance will delay product delivery and hinder the "speed of service" to the customer. Another operator concern is that that product quality will suffer when this type of technology is applied to appliances that are designed to maintain food-safe temperatures.

Project Description:

This project assesses the energy reduction potential of electric commercial plug load foodservice equipment at five different commercial kitchens and hopes to demonstrate reduced energy consumption through the use of pre-commercial appliance designs and control technologies.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project advancement is to bridge the knowledge gap and support the accelerated adoption of advanced appliances and controls by better understanding operator behavior and operational changes that can be made to successfully use new lower energy appliances. The results of this effort will be used to develop real world case studies of successful implementation of next generation plug load appliances, and provide training to food service operators to maximize energy reduction potential for food service equipment. In addition to food service operators, the research results will assist equipment manufacturers in further product development of energy efficient food service equipment and help justify development of utility incentives for purchasing and installing energy efficient foodservice equipment.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs:

This project could lower energy costs by encouraging the adoption and implementation of advanced design and controls for commercial food service plug load appliances that use less energy than conventional systems. On a per-appliance basis, amounts would range from $71/year for a single hot plate to $950/yr for a single espresso machine. Savings on the

equipment could total up to $2,643 annually if energy saving controls were optimized for each appliance and the site has a combination of a vertical toaster, food warmer, hot plate, rice cooker, and soup warmer in its kitchen.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $392,763
EPIC Funds Encumbered: $937,469	**EPIC Funds Spent:** $6,421
Match Partner and Funding Split: Fisher-Nickel, Inc.: $1,377 (0.1 %) Pacific Gas and Electric Company: $148,623 (13.0 %) Dalla Corte: $20,000 (1.8 %) Nuova Simonelli: $18,350 (1.6 %) Hatco: $4,100 (0.4 %) NAFEM: $10,000 (0.9 %)	**Match Funding:** $202,450
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient has collected baseline data and installed new equipment at several restaurants in California. Plug load meters were installed at each of the test sites to determine baseline electrical consumption. Depending on logistics and site flexibility, between two weeks and three months of baseline data was collected.

The field data thus far showed that commercial foodservice plug load equipment has a wide range of energy intensity, based on the operation type and hours. Cumulative energy savings for all plug load equipment can be substantial.

The appliance with the highest average daily energy use, the conveyor toaster, used more than 20 times the energy on average than the appliance with the lowest average daily energy use, the soup warmer.

108. EPC-15-028

Project Name:

Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations

[EPC-15-028]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/13/2016 to 5/13/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Electrification of customer energy technologies and services can create a number of benefits for California ratepayers and residents, including improved air quality, reduced greenhouse gas emissions, and significant cost savings. However, not all electric technologies are automatically beneficial. The cost-to-benefit ratio varies widely with each application, and there are many different technologies and hundreds of applications. Understanding how each electric technology contributes to a significant electrification scenario is critical to both an understanding of the societal benefits and real world implementation of programs designed to achieve electrification objectives.

Project Description:

The research team is conducting a statewide assessment - at the zip code level - of the potential for electrification (e.g., use of electricity for space heating) to generate benefits to customer cost savings, statewide economy, climate, and air quality. The assessment will feed a comprehensive climate and energy model and a subsequent air quality analysis that will help determine public health benefits, with a focus on the South Coast and the San Joaquin Valley air basins.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The analysis of health and air quality benefits alongside costs of electrification under this agreement is forming the basis for new cost-benefit metrics that can be used to assess the economic viability of breakthrough technologies. Cost-benefit analyses of this sort can be used to make evidence-based decisions regarding technology financing and deployment.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 4a, 4b

Lower Costs:

Electrification of customer energy technologies and services can create a number of benefits for California ratepayers and residents, including improved air quality, reduced greenhouse gas emissions, and significant cost savings. The project will show cost and benefits to utility customers of specific electrification technologies like off-road vehicles and efficient heat pumps.

Environmental Benefits:

The benefits from this research are predicate to achieving wider-spread benefits of electrification for public health and the environment. Electrification of customer energy technologies, including homes, businesses, industry, and mobile sources can reduce greenhouse gas emissions. Initial research suggests that peak ozone concentrations in the South Coast Air Basin could be reduced by up to 5 parts per billion by 2030 and transportation greenhouse gas emissions reduced by up to 65% by 2050 through electrification. The research in this project will evaluate potential benefits of as well as how to best target geographic areas with specific electrification technologies to achieve state goals.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $234,351	
EPIC Funds Encumbered: $799,444		**EPIC Funds Spent:** $90,374	
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $609,213 (39.1 %) South Coast Air Quality Management District: $150,000 (9.6 %)		**Match Funding:** $759,213	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The researchers for this project met with the three research teams (UC Berkeley with LBNL, E3, and UC Irvine) that are developing the long-term energy scenarios for the electricity sector in Spring 2016. Those scenarios are informing this research by providing electrification pathways. The researchers from EPRI are also involved as Technical Advisory Committee members on the long-term energy scenarios in order to facilitate integration between results and include salient metrics for environmental justice benefits in this project and the long-term energy scenario work. EPRI is also coordinating work by Ramboll, its subcontractor, to model air quality changes from switching fuels to electricity.

109. EPC-15-029

Project Name:

Distributed Generation Environmental Planner

[EPC-15-029]

Recipient/Contractor:

Black & Veatch Corporation

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 1/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Site information required for project siting and permitting of solar photovoltaic (PV), in particular environmental and distribution system interconnection data, are not widely available or accessible to project developers, local planners, utilities, landowners, and other stakeholders in an organized, centralized location. Having this information early in the siting process could reduce project development costs and reduce uncertainty of lengthy and complicated environmental permitting processes. Tools exist to perform similar functions for landscape scale planning, but it is not known whether they can be successfully adapted for local distributed PV planning.

Project Description:

This project developed a tool to identify environmentally preferred areas for distributed solar generation (DG). The project demonstrated how disparate spatial information, such as solar capacity, environmental data and utility infrastructure, can be combined in a site screening tool for effective local DG planning. The project aimed to expand energy planning tools at the local level by leveraging the ongoing development of the statewide planning tools. The existing statewide tool (prototype currently called the "RE Infrastructure Planning Assistant") focuses primarily on environmental screening for utility scale renewable energy development. This project adds more detailed energy and economic information appropriate for distribution-scale solar siting and most importantly incorporates distributed generation into the prototype interactive mapping tool and tests it in Lancaster, California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This agreement created a prototype, public tool (http://dg-solar.org/) that enables DG PV site selection by providing users both environmental and engineering geospatial data. Having proven the concept in Lancaster, CA, the tool may be expanded to other areas of California with similar data. Making information more comprehensive and accessible at the DG level will improve market functioning, while also enabling better DG infrastructure planning that incorporates environmental conservation.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 4f

Lower Costs:

Benefits include reduced siting and permitting risk, reduced development risk, and time and cost savings in the development cycle. Cost savings will accrue to permitting agencies, utilities, ratepayers, and other stakeholders, especially in regions vulnerable to environmental conflict.

Environmental Benefits:

The tool helps to identify areas with low conservation value for species and habitats that could be suitable for renewable energy with least impact or conflict.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $44,350	
EPIC Funds Encumbered: $199,976		**EPIC Funds Spent:** $179,582	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team designed the technical specifications of the planning tool, developed the web-based application, and compiled and processed spatial data. They revised the tool in response to TAC feedback. The tool combines solar resource, environmental sensitivity, cost, and interconnection spatial data layers in a single GIS application. The format of the tool allows user-entered values for a variety of screening parameters that may be of interest to developers, local planners, and government officials. The tool returns maps and lists of parcels that match the user-entered criteria and then generates reports. The completed tool at http://dg-solar.org/ went live in 2017. Members of the TAC from Los Angeles County and sPower are interested in incorporating the tool's functionality into their own planning process and using the tool to guide future development in Lancaster, respectively.

110. EPC-15-030

Project Name:

San Diego Regional Energy Innovation Cluster

[EPC-15-030]

Recipient/Contractor:

Cleantech San Diego Association

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan 2015-2017 Triennial Investment Plan	7/15/2016 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

Clean energy startups face difficulties in making use of the existing programs and resources available in the area, and accessing technology validation facilities, business training, market intelligence, and capital. They also experience increasing challenges navigating regulatory barriers to development and commercialization of entrepreneur's innovations. In order to facilitate the development of new energy innovations and their entry into the market, the various entrepreneurial support services available in the region must be coordinated under one directive, optimizing key services to meet the needs of individual businesses.

Project Description:

This project will develop a collaboration of clean energy organizations in the San Diego Region to provide and coordinate key services, resources, and infrastructure needed by entrepreneurs and researchers in the region. The project aims to accelerate the successful market entry of energy innovations that can benefit Investor Owned Utility (IOU) electric ratepayers. This project will also work with businesses, local jurisdictions and other organizations in the region to connect emerging technologies to region specific-needs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help advanced the goals of SB 350 (2015) by accelerating the commercialization of new smart grid technologies that can enable the integration of high-penetrations of renewables and distributed energy resources. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project will help shorten technology development time and costs by providing a one-stop shop for entrepreneurs to quickly find and access the right services and resources.

Economic Development:

This project will help facilitate successful clean energy entrepreneurship, leading to increased private sector investment and local job creation.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $880,681
EPIC Funds Encumbered: 2012-2014 Plan: $3,000,000 2015-2017 Plan: $2,000,000 Total: $5,000,000	**EPIC Funds Spent:** $580,210
Match Partner and Funding Split: Cleantech San Diego Association: $2,876,060 (35.5 %) CONNECT: $221,874 (2.7 %)	**Match Funding:** $3,097,934
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 6 out of 12 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Cleantech San Diego has accepted over 15 companies in the San Diego Regional Energy Innovation Network (SD-REIN).

111. EPC-15-031

Project Name:

Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response

[EPC-15-031]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/2/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Consumer power consumption from electronic and miscellaneous plug loads pose large load profiles. Plug loads are not typically targeted by utility energy efficiency nor demand response programs. Consequently, plug load energy consumption and integrated plug load control strategies are not well-understood or developed. However, California's policies drive the need to better manage the growth.

Project Description:

This agreement develops integrated plug load control strategies for different spaces within multiple types of commercial buildings. The project implements a flexible energy management system (FEMS) to demonstrate the integrated control strategies for plug loads at pilot sites. This includes the installation of smart power outlets and integration of various plug load control strategies with building energy management and/or lighting control systems. The project demonstrates and measures the degree of effectiveness of the flexible control strategies developed for integrally managing operation of plug loads to achieve energy efficiency and demand reductions.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

In order to reduce plug load energy use and increase the energy efficiency of buildings, this project advances flexible energy management systems coupled with smart power outlet technology to control plug load use. The project will also enhance integrated strategies for operating different plug load types to achieve energy efficiency and demand response. The results of this project can potentially reduce electricity use in commercial buildings, particularly during low-occupancy times and in user-assigned spaces, thereby achieving lower electricity costs for the ratepayer.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs:

The developed cost-saving plug load control strategies will clarify display designs, control settings and incorporated behavioral considerations. The identified strategies could potentially reduce electricity use by 10% from plug loads, particularly during low-occupancy times and in user-assigned spaces. This would lead to a reduction in electricity cost of commercial ratepayers..

Greater Reliability:

The developed technology will identify potential demand response strategies through coordinated operation of plug loads in an integrated building system environment. This could help support power and market systems, particularly during critical periods when the grid is stressed or prices are high.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $366,082	
EPIC Funds Encumbered: $1,050,022		**EPIC Funds Spent:** $133,542	
Match Partner and Funding Split: Enmetrics Systems: $24,120 (1.7 %) Ibis Networks: $51,000 (3.7 %) SkyCentrics: $10,000 (0.7 %) San Diego Gas & Electric Company: $30,000 (2.2 %) To Be Determined: $30,000 (2.2 %) TBD - Technical Writer: $25,000 (1.8 %) Electric Power Research Institute (EPRI): $165,000 (11.9 %)		**Match Funding:** $335,120	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team holds regular Technical Advisory Committee (TAC) meetings to seek input and evaluate the plug loads that are being monitored at their Stanford and AP+ Design test sites. The project team and the TAC continue to evaluate the effectiveness of the measures for reducing impacts from plug loads. The most recent TAC was held in December 2017.

112. EPC-15-032

Project Name:

Bay Area Regional Energy Innovation Cluster

[EPC-15-032]

Recipient/Contractor:

Activation Energy, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan 2015-2017 Triennial Investment Plan	5/12/2016 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

Long development times, high capital requirements, and long sales cycles for hard energy technologies have all contributed to an extremely difficult financing environment for hard energy innovators. In particular, venture capital (VC) investment, the main source of private sector support for early stage technology companies, has declined sharply for hard energy technology in the past several years. Unfortunately, no reliable, alternate source of private capital has emerged, due to the high risks associated with early stage energy technology development.

Project Description:

This project will establish a Bay Area Regional Energy Innovation Cluster by expanding the Cyclotron Road program to provide commercialization support services to Bay Area entrepreneurs developing breakthrough materials and hardware devices in energy efficiency, energy storage, distribution, grid management, and power generation. This project will provide key services, infrastructure, expertise, and resources to energy entrepreneurs in the Bay Area region to successfully deploy and commercialize their innovations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help advance the goals of Senate Bill 350 (De Leon, 2015) by accelerating the commercialization of clean energy technologies, including energy efficiency, demand response, renewable generation, energy storage, and smart-grid integration. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project will decrease the time and costs for new technology development by providing entrepreneurs with the services and facilities they need to commercialize their technology.

Economic Development:

This project will help facilitate successful clean energy entrepreneurship, leading to increased private sector investment and local job creation.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $282,411
EPIC Funds Encumbered: 2012-2014 Plan: $2,000,000 2015-2017 Plan: 2,980,000 Total: $4,980,000	**EPIC Funds Spent:** $589,372
Match Partner and Funding Split: DLA Piper LLP: $90,000 (0.6 %) Lawrence Berkeley National Laboratory: $4,150,000 (29.7 %) Activation Energy, Inc.: $260,000 (1.9 %) Autodesk, Inc.: $4,500,000 (32.2 %)	**Match Funding:** $9,000,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	6 out of 12 bidders	Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In 2017, Activation Energy launched the Energy Commission funded track of the Cyclotron Road program. Up to seven clean energy entrepreneurs will be selected to receive access to Lawrence Berkeley National Lab to develop their innovations, as well as a suite of support services including business model development, customer discovery, and investor matchmaking. Activation Energy also developed a resource library for use by the public that

provides resources and examples of best-practices on technology development, team building and management, and attracting capital. Activation Energy also received two DOE grants - one will develop a simple standardized partnership agreement that reduces the time and complexity of forming partnerships between large industry corporations and early-stage technology developers; the other will build a fund that provides early investors with technology testing data rather than company equity.

113. EPC-15-033

Project Name:

Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC

[EPC-15-033]

Recipient/Contractor:

Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 9/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Research indicates that many California classrooms are under-ventilated relative to rates specified in Title 24 and ASHRAE 62.1. Simply increasing outdoor air ventilation rates in classrooms has pitfalls: it will increase energy use, and it can have the unintended negative consequence of increasing student exposures to outdoor air pollutants. As California looks ahead to achieving 50% energy use reductions in existing and future ZNE schools, there is a need to demonstrate ventilation approaches that are substantially more energy efficient than current, minimally code-compliant systems.

Project Description:

Several technologies that deliver HVAC services and energy savings are being field tested at several schools in California. The technologies currently identified included in this study include heat recovery ventilators, air economizers, demand control ventilation, displacement ventilation, high performance filtration, and learning thermostats. These are advancements that are over and above the technologies typically used in California schools, and can greatly improve the energy efficiency of providing heating, cooling, and ventilation in classrooms.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The agreement provides information on indoor air quality and energy usage in classrooms with current HVAC systems throughout different parts of California. The project then evaluates next generation HVAC system retrofits with regards to energy efficiency and indoor air quality performance. The results will enable energy savings without impacting indoor air quality in classrooms. The study is the first large field study to examine the energy efficiency upgrade and indoor air quality impacts after the implementation of Prop. 39.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 4b, 5d

Lower Costs:

By field testing several HVAC technologies that provide significant savings over existing systems, this project will result in energy savings from improved equipment performance and lower costs associated with delivering thermal comfort and improved indoor air quality in classrooms.

Environmental Benefits:

By field testing the performance of several HVAC technologies implemented in California's schools, this project will provide real-world information on energy savings resulting from improved equipment performance, lower costs associated with delivering thermal comfort, and improved indoor air quality in the classrooms.

Public Health:

This project will provide data on indoor air quality in classrooms that have both current and state-of-the-art HVAC systems. The results will enable future HVAC deployment in California that provides both energy savings and improved indoor air quality, improving the health of students at schools throughout California.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $439,287	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $584,980	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement

Terms and Conditions.
Update: By fall of 2017, the research team collected indoor air quality monitoring date, ventilation and energy usage data from 104 classrooms in 11 schools that use current HVAC systems. The characteristics of the classrooms and schools include locations, district sizes, grades, free/reduced lunch percentage, and equipment types. A teacher survey on usage of the HVAC system in classrooms was also completed with an excellent response rate. In November, the technical report was submitted to the Energy Commission and the technical advisory committee for review. As of December 2017, the research team is working on installing and commissioning two next generation HVAC systems on two demonstration schools.

114. EPC-15-034

Project Name: Emerging Energy Public Health Research Roadmap [EPC-15-034]	
Recipient/Contractor: Public Health Institute	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 6/1/2016 to 7/31/2017
Program Area and Strategic Objective: Applied Research and Development S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts	
Issue: The energy system is rapidly evolving under efforts to reduce greenhouse gas emissions and develop resilience to climate impacts. The rapid evolution of the energy system may yield unexpected public health impacts unless proactive measures are taken to identify potential health risks and develop strategies to avoid undesirable impacts.	
Project Description: This research develops a research needs assessment that focuses on the known and potential public health impacts of emerging energy systems. The needs assessment is based on consultation with experts in emerging energy systems and occupational and environmental health (OEH) and with stakeholder representatives from labor, business, government, and community-based organizations.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: This report establishes a public health research roadmap aimed at anticipating and preventing potential unintended health impacts of emerging electricity generating, storing, and distributing systems (EES). Research recommendations were prioritized and presented in this roadmap.	

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 4b, 5d

Public Health:

The public health research roadmap identifies potential health effects from renewable generation, electricity storage, and distribution systems that are already being implemented or are likely to be part of the California's electricity grid by 2030. It prioritizes research needed to avoid or mitigate health effects from these emerging technologies.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $151,000	**EPIC Funds Spent:** $135,899
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In 2017, the research team held 22 meetings with 34 experts throughout the energy, life cycle assessment, health, labor, and environmental justice field for total for over 30 hours. The team also created a growing database of peer-reviewed and grey literature. As of December 2017, the database houses 165 documents on Emerging Electricity-Generating Systems and related health and equity topics. Workshops were conducted in spring and summer of 2017 to obtain inputs. The research roadmap was published in fall 2017.

115. EPC-15-035

Project Name:

Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability

[EPC-15-035]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 6/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

The current lack of empirical research aimed at characterizing the relationship between energy use and groundwater pumping prevents accurate resource planning. Previous studies show that the water sector represents at least 7.7 percent of statewide electricity needs. The actual percentage of energy used for groundwater pumping is unknown. Similarly, the social barriers to decreasing pumping related energy use are poorly understood, as are options for overcoming those barriers.

Project Description:

The project is quantifying current statewide energy use and costs attributable to groundwater pumping and developing near-term projections of energy use and statewide costs. The projections will factor in groundwater demand, groundwater levels, climate change scenarios, energy prices, and obstacles to implementing energy-efficient pumping and groundwater conservation measures. By expanding knowledge of the relationship between groundwater pumping and energy use, the proposed project will enhance the ability of the State of California and other stakeholders to coordinate water and energy resources planning. In addition, the project is providing key insights on how to improve groundwater use and pumping efficiency.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This study is producing needed fundamental information about the type and quantity of energy used for pumping groundwater. That information can be used to increase the efficiency of the energy used in the water sector, inform demand side management strategies, and decrease greenhouse gas emissions.

Although previous estimates have been made for energy in groundwater pumping, both studies by the Energy Commission and contracted by the California Public Utilities Commission note that they likely grossly underestimate the amount of energy used for pumping. Because of changes in data disclosure regulation for water resources, LBNL is able to combine a new methodology with better data to produce more accurate estimates of energy used for groundwater pumping.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 2a, 4c

Environmental Benefits:

This study will produce information necessary to develop tools and techniques (technology) to increase energy efficiency and decrease greenhouse gas emissions from pumping groundwater.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $260,000
EPIC Funds Encumbered: $625,000	**EPIC Funds Spent:** $483,112
Match Partner and Funding Split: Michael Hanneman: $22,550 (3.5 %)	**Match Funding:** $22,550
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 7: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The kick-off meeting for this project occurred on October 13, 2016. Although some data collection was delayed due to lengthy negotiations between LBNL and PG&E, the team has obtained a significant portion of the spatial and temporal data needed to develop geographical and time-varying relationships between groundwater pumping and energy use. With this information, the team has been building its model and is investigating options to test the skill of the model. The options will be selected in early 2018. Results are anticipated in 2019. The first technical advisory committee meeting was held in December 2017. Members of the Water-Energy Team of the Climate Action Team ("WET CAT") have expressed interest in this study and are supporting it through representation in the technical advisory committee.

116. EPC-15-036

Project Name:

Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling

[EPC-15-036]

Recipient/Contractor:

Eagle Rock Analytics

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/13/2016 to 9/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

As California moves towards a diverse energy future, with a focus on renewables, the need for improved weather/climate forecasts will increase. These forecasts/scenarios are needed at the seasonal and decadal scales to address operational and planning issues.

Project Description:

The research team developed and tested new forecast methods for temperature and humidity and extensive testing is taking place. The forecasts will be provided in the format used by energy planners and managers. The researchers are exploring the forecasting utility of parameters such as sea surface temperatures in the middle of the Pacific Ocean that can influence summer conditions in California months in advance. The decadal forecasts will be done using forecasts of large-scale predictor variables of climate from different research centers downscaled to the California region.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is unique in its use of sea surface temperatures to create a probabilistic forecast of long-term weather conditions in California. The project aims to determine, for example, the likelihood of California experiencing consecutive days above 105 degrees F in a given year.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 5c

Greater Reliability:

Improved information about potential weather conditions in the next few months (probabilistic seasonal forecasts) can help plan for unusual weather conditions such as summers with much higher than average high temperatures. The CaISO uses climatology (average weather conditions) to estimate the generating capacity that will be needed for the summer. Improved seasonal forecasts have the potential to anticipate summers with very hot days and ensure enough generation is secured to handle high peak demand.

<table>
<tr><td colspan="2">Assignment to Value Chain:
Grid Operations/Market Design</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $53,531</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$400,000</td><td colspan="2">EPIC Funds Spent:
$151,154</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
None</td><td colspan="2">Match Funding:
$0</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
45 out of 45 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 10: Ranked # 1</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-15-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The research team has successfully developed a seasonal forecast model using Linear Inverse Modeling. The model now predicts monthly minimum and maximum temperatures across California, 1-9 months in advance. The team has also performed experiments demonstrating the maximum potential predictability of the Pacific Ocean upon California’s seasonal climate. As part of this effort, the team is presently performing sensitivity analyses to understand how the choice of model domain, time steps and datasets play in the success or failures of the model. The team has also engaged with IOU stakeholders to learn what specific climate variables and the forecast lead times will have the greatest impacts on operations.</td></tr>
</table>

117. EPC-15-037

Project Name:

Smart Ventilation for Advanced California Homes

[EPC-15-037]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/13/2016 to 9/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

As California approaches zero net energy (ZNE) homes, heating and cooling loads and systems get smaller, but the need to provide acceptable indoor air quality (IAQ) remains unchanged. Business as usual will result in ventilation contributing a larger fractional load, which counters ZNE goals. In addition, current approaches that specify ventilation per hour are not responsive to occupant needs or contaminants of concern (COC) levels.

Project Description:

This project develops approaches and tools to enable smart ventilation techniques suitable for new and existing advanced and ZNE homes. Smart ventilation systems use information about current thermal, occupancy, system, and air quality conditions to optimize performance of ventilation-related equipment.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This work builds on efforts of the past decade that have facilitated dynamic ventilation approaches. The project uses informed simulation approaches to determine how energy, IAQ, demand, and comfort can be optimized using smart ventilation. The results from the project will help consumers identify effective smart ventilation strategies and provide important information that advise the development of ventilation standards.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 4b, 5d

Lower Costs:

The project will result in reduced electricity consumption by using smart ventilation strategies to optimize the ventilation system performance. The system will collect indoor and outdoor air quality and environmental data to adjust ventilation strategies to minimize electricity consumption and maintain adequate indoor air quality.

Public Health:

The project recommends smart ventilation technologies to benefit ratepayers to obtain energy efficiency saving and maintain proper ventilation for their homes.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $649,037	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $621,240	
Match Partner and Funding Split: United States Department of Energy: $1,000,000 (35.7 %) Aereco S.A.: $200,000 (7.1 %) Lawrence Berkeley National Laboratory: $100,000 (3.6 %)		**Match Funding:** $1,300,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: In summer 2017, the research team completed building energy simulation test plan and a literature review for smart ventilation. The literature review was submitted for journal publication. In November 2017, the team conducted the critical project review. As of December 2017, the simulation of single-zone technology evaluation is underway.			

118. EPC-15-038

Project Name:

Central Valley Energy Innovation Cluster: BlueTechValley Energy Cluster

[EPC-15-038]

Recipient/Contractor:

California State University, Fresno Foundation

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan 2015-2017 Triennial Investment Plan	5/16/2016 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

While the region's entrepreneurs are helping to drive new and effective energy and water innovations, many are still limited by technical and non-technical hurdles on the road to commercialization. On their own, many do not have sufficient resources to fully test their technologies, develop fundable business plans, grow entrepreneurial networks, or transition technologies from trial or demonstration scale to real-world deployment and commercialization. The need to help such entrepreneurs is magnified by the recent drought conditions in the Central Valley that have critically reduced available surface water supplies and increased electricity demand due to increased groundwater pumping.

Project Description:

This project expands access for clean energy entrepreneurs to a region-wide energy-water-food nexus incubator and commercialization services in California's Central Valley and North State regions. The Central Valley Energy Innovation Cluster (a.k.a. BlueTech Valley Energy Cluster) provides entrepreneurs with a variety of services, including technology evaluation, proof-of-concept validation and advisory support as well as opportunities to connect with investors, industry leaders and potential customers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help lead to technology advancements by providing and coordinating key services, assistance, resources, and infrastructure needed by entrepreneurs and researchers to create and develop advanced energy technologies that will help the state meet the targets set by Senate Bill 350 to increase both renewable electricity generation and energy efficiency to 50 percent by 2030.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 2a, 3e

Economic Development:

This project helps facilitate successful clean energy entrepreneurship, leading to increased private sector investment and local job creation.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $718,347
EPIC Funds Encumbered: 2012-2014 Plan: $3,000,000 2015-2017 Plan: $2,000,000 Total: $5,000,000	**EPIC Funds Spent:** $502,453
Match Partner and Funding Split: California State University, Fresno Foundation: $2,350,112 (30.7 %) Child Family Institute for Innovation and Entrepreneurship - UC Davis: $200,000 (2.6 %) Schatz Energy Research Center: $35,772 (0.5 %) Los Angeles Cleantech Incubator: $19,900 (0.3 %) Kern Economic Development Corporation: $49,900 (0.7 %)	**Match Funding:** $2,655,684
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 6 out of 12 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Overall, BlueTech Valley (BTV) has accepted and supported 56 companies into their program (49 companies in 2017), has received $2,995,000 in additional private capital funding in 2017, and has received a $500,000 grant through the Regional Innovation Strategies i6 Challenge and Seed Fund Support Grants competition.

In May 2017, for the first time BTV joined UC Davis in putting on the UC Davis Big Bang! Business Competition (UCD BBBC) event, which allowed the event to expand and reach a broader audience. This competition awarded over $50,000 in funds to promising startups (https://gsm.ucdavis.edu/news/2016BigBangWinners).

The second UCD BBBC, with BTV, was kicked off in October 2017.

In November 2017, BTV with UC Berkeley Law's New Business Practicum, hosted a Legal Advice Workshop webinar on intellectual property, as part of a series focused on legal aspects of operating a business.

119. EPC-15-039

Project Name:

Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle

[EPC-15-039]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/24/2016 to 8/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Deserts are impacted by both the development of large scale solar installations, and by the temperature changes associated with human induced climate change. The effect of these impacts on the soil organic (biomass) and inorganic (calcium carbonate) carbon budget is unknown. It is crucial to gain quantitative understanding whether desert ecosystems will lose carbon as a result of both solar field installations and climate change, as well as to identify the environmental costs and benefits of renewable energy development in terms of GHG emissions.

Project Description:

This project quantifies the impacts of large-scale solar arrays and long-term climate change on desert soil conditions (i.e. vegetation, microclimate, hydrology, and biogeochemistry) using coupled *in-* and *ex-situ* monitoring and analytical techniques, and determines the soil carbon budget response to these perturbations using climosequence analysis and advanced biogeochemical modeling. Data gathered in the course of this investigation provides the most comprehensive information to date on the influence of local soil surface and regional climate conditions on arid soil carbon storage and on soil biogeochemical processes more generally. The modeling and analytical work is at the forefront of studies on the desert soil carbon cycle and promises to yield fundamental insights into the terrestrial carbon budget in arid environments.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The proposed research is determining the impact of large solar arrays on the carbon storage of desert soil ecosystems. Results provide data and modeling results that give insights into the most effective ways to design and manage solar production facilities for maximum net carbon benefits.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 2a, 4f

Lower Costs:

The proposed research estimates the mass (and market-based value) of net carbon change in desert soils due to solar sites development and climate change. These metrics for soil carbon gains and losses could be incorporated into renewable energy credits (RECs) and would constitute a direct monetary benefit to California IOU ratepayers.

Environmental Benefits:

The proposed research estimates GHG emissions arising from net changes to the natural soil carbon cycle caused by utility scale solar installations, reduces regulatory uncertainty, facilitates more efficient environmental approval procedures for solar energy companies, and helps to meet the state's renewable energy goals.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $80,312	
EPIC Funds Encumbered: $499,181		**EPIC Funds Spent:** $31,720	
Match Partner and Funding Split: SunPower Corporation: $72,000 (12.6 %)		**Match Funding:** $72,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Sensor installation has been completed at the six desert sites in Mojave Desert. Real-time meteorological data and CO2 flux data are being collected. Soil sampling was conducted in soil trenches excavated at each of the six sites. Completed physical and chemical soil analyses will include: soil water retention curves, soil porosity, soil water permeability functions, organic C/N content and isotopic composition, carbonate content and isotopic composition, radiocarbon dates. In November 2017, the team finalized an agreement allowing access to a solar PV facility and evaluated short- and long-term impacts of land use and climate change on the soil carbon cycle. The team also prepared a first project manuscript in November 2017. In addition,

the team presented results from the first year of the project at the American Geophysical Union annual meeting in New Orleans in December 2017.

120. EPC-15-040

Project Name:

Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy [EPC-15-040]

Recipient/Contractor:

Zoological Society of San Diego dba San Diego Zoo Global

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 9/2/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

In California, western burrowing owls (*Athene cunicularia hypugaea*) have been designated with the conservation status of Species of Special Concern, mainly due to habitat loss. With planned facility expansions in burrowing owl habitat, renewable energy projects potentially represent a major contributing factor in the continued decline of the species. Translocation away from project sites is an important mitigation method for owls impacted by development, but there is significant uncertainty around the effectiveness of the main two approaches (active and passive translocation) due to the difficulty of tracking owls long enough to determine post-translocation fates.

Project Description:

The project studies and tests the consequences of both passive and active relocation methods for burrowing owls (a California Species of Special Concern), and fills an existing need for robust scientific data on the relative effectiveness of relocation as a conservation method. Secondary goals are to provide data on owl movements and habitat use that will inform collision risk models and site selection decisions for renewable energy-generating facilities. The project team is fitting 50 owls with GPS tracking devices and dividing them into three study groups--active translocation, passive relocation, and a control group. Frequent site visits are providing information on mortality rates and reproductive output.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will increase the effectiveness of conservation actions designed to mitigate renewable energy impacts on burrowing owls. This will be achieved by evaluating the relative effectiveness of primary translocation methods in an experimental framework. Improvements to the effectiveness of existing translocation methods will also be tested experimentally. Long-term GPS tracking of individuals in the active and passive relocation groups and a control group will provide the critical, previously missing, information to judge the effectiveness of each method.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 4f, 4g

Environmental Benefits:

The project will identify the most effective method for translocation of burrowing owls that are displaced from renewable energy development areas. This may lead to better guidelines for mitigating impacts on this California Species of Special Concern.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $54,425
EPIC Funds Encumbered: $598,671	**EPIC Funds Spent:** $126,193
Match Partner and Funding Split: Western Riverside County Regional Conservation Authority: $127,315 (10.6 %) United States Department Fish and Wildlife Service: $35,022 (2.9 %) Zoological Society of San Diego dba San Diego Zoo Global: $407,161 (33.9 %) Coachella Valley Conservation Commission: $33,438 (2.8 %)	**Match Funding:** $602,936
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team has captured the first year's set of burrowing owls at development sites and released the active translocation group of owls at conservation areas. They have conducted the tracking and monitoring of the first year's set of owls during 2017. In collaboration with their technical advisory committee, they have refined the study design and research protocols. In addition, they have tested GPS units and modified their design for use with burrowing owls. In Fall 2017, they identified new sites for owls in the next non-breeding season. They have shared sample material from captured owls with researchers in EPC-14-061 and EPC-15-043 to extend the data used for isotopic and genetic analyses in those projects.

121. EPC-15-041

Project Name:

MarketZero: Taking an existing grocery store to scalable near-ZNE

[EPC-15-041]

Recipient/Contractor:

Prospect Silicon Valley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Supermarkets and grocery stores have the highest energy use indices of commercial building types. They are also the most challenging cases to achieve zero net energy among commercial buildings. This is due to the high process energy use of refrigeration and commercial kitchen systems. The 2006 California Commercial End-Use Survey (CEUS) indicated a statewide average of approximately 210 Kbtu/SF/yr in existing grocery stores.

Project Description:

This project demonstrates a cost-effective pathway to achieving maximum energy efficiency in a grocery store. The project results in the identification and installation of a comprehensive cost-effective energy efficiency upgrade package that utilizes innovative strategies such as advanced heating, ventilating and air conditioning systems, refrigerants, fans, occupancy sensing measures and advanced lighting and controls. The project provides new design approaches that allow for rapid technology discovery and incorporation to ensure the most current technologies are implemented into the design.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project implements a cost-effective energy efficiency upgrade strategy that uses existing and new technologies. The project includes extensive refrigeration system improvements, such as re-piping and re-configuring of the refrigerant lines to increase energy efficiency, changing to a lower global warming potential refrigerant, and installing a high-efficiency variable frequency drive compressor. These types of improvements pose challenges to grocery stores due to limited space and existing configurations. However, documenting cost, savings and benefits could influence the grocery market to make similar future upgrades. The project also includes variable air volume air distribution system, a solar air preheat (to preheat outside air) and an electric heat pump water heater. These solutions and design approaches hope to achieve near zero net energy for a grocery store.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 4a

Lower Costs:

Implementing the energy efficiency upgrade package could lower future energy costs for building owners and operators and is applicable to other grocery stores. Estimated state-wide reduction of about $400 million (based on savings of 2,400 GWh and 15 million therms) across California grocery stores.

Environmental Benefits:

Implementing the measures could reduce resource consumption (energy, water), reduced greenhouse gas emissions, while improving indoor air and environmental quality.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $846,723	
EPIC Funds Encumbered: $2,999,591		**EPIC Funds Spent:** $515,848	
Match Partner and Funding Split: Whole Foods Market: $650,000 (17.8 %)		**Match Funding:** $650,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The overall project remains on track. The recipient is developing construction drawings.

The recipient has calibrated the model and conducted comprehensive energy analysis of the energy systems in the grocery store and developed a final list of efficiency measures. Additionally, the technical advisory committee met in June and in September concurred with the recommendations.

122. EPC-15-042

Project Name:

Zero Energy Residential Optimization - Community Achievement (ZERO-CA)

[EPC-15-042]

Recipient/Contractor:

California Homebuilding Foundation (CHF)

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

Although the construction of a number of single (one-off) Zero Net Energy (ZNE) homes has established that this is a technically feasible goal, it is less clear whether ZNE construction can cost-effectively be brought to scale, especially within the context of the Title 24 Building Energy Efficiency Standards. There is a need for significant increase in the efficiency of California new construction - without significant increases in cost. Additionally, the State will need improved methods for estimating and controlling the unregulated loads, which have grown and will continue to grow over the coming decades.

Project Description:

The project serves as proof of concept for large-scale deployment of Zero Net Energy (ZNE) single-family homes in California. The objective is to construct ZNE homes without creating undue cost burdens on builders, businesses or consumers, while assuring that changes to home design do not pose health, safety or other risks to occupants. The project also provides industry and regulators with a better understanding of site energy use and renewable energy generation.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Working closely with the builder and subcontractors, technology costs will be evaluated and will include a real-world perspective by providing actual time and labor spent to install and commission each of the new technologies versus only the technology cost. By providing this data and analysis on the approximate 50 homes being constructed, this project will serve as a roadmap toward the most effective ways to implement ZNE homes. The information gathered will be disseminated through various project participants such as California Building Industry Association (CBIA) events and member newsletters in efforts to promote the potential for cost-effective ZNE to the builder community.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 3b, 4a

Lower Costs:

The project will focus on cost control for ZNE construction by developing numerous cost-effective packages of Building Energy Efficiency Standards (Title 24, Part 6) "regulated" measures, as well as presently unregulated measures, such as appliances, plug loads, and lighting. In addition to builder cost savings passed to consumers in sales price, the project will assess and optimize actual consumer utility cost savings from ownership of ZNE homes.

Environmental Benefits:

This project is estimated to reduce greenhouse gas (GHG) emissions by integrating renewable energy and other energy efficiency measures into approximately 40-50 homes within a community development project. This offset of end-use demand will result in an avoided capacity needed at the generation level and the reduction of GHG emissions associated with that demand.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $1,488,701	
EPIC Funds Encumbered: $4,819,805		**EPIC Funds Spent:** $530,175	
Match Partner and Funding Split: California Homebuilding Foundation (CHF): $2,611,014 (35.1 %)		**Match Funding:** $2,611,014	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The new project site is located in Marina, CA. The project has started construction on the first phase of ZNE Homes. Draft reports addressing ZNE market acceptance and prioritization of energy features to be used during phase 1 construction have been complete. Work is ongoing with HVAC consultants to address challenges with heat recovery ventilation (HRV) and HVAC duct design strategies. Additional measures are still being explored for energy savings such as home energy management systems and battery storage. These additional measures present

the unique challenge of there being no existing modeling capabilities available in the existing CBECC (California Building Energy Code Compliance) software.

123. EPC-15-043

Project Name:

Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California

[EPC-15-043]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 9/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

While renewable energy facilities offer clean alternatives to our growing energy needs, they have recently come under scrutiny for their impacts on native wildlife. In particular, tens of thousands of protected birds are killed at solar and wind facilities each year. Assessment of the overall impact of these facilities has been hampered because 1) population-level distributions are poorly understood (i.e. do killed individuals come from vulnerable populations?) and 2) current methods for identifying migration routes have low resolution and are extremely costly.

Project Description:

This project develops a low-cost method that capitalizes on genomic data to create high-resolution spatial maps of bird populations and migration routes. This technology will be extended to identify migration routes for additional vulnerable and endangered species, assess population-level impacts of fatalities at renewable energy facilities, and map migration hotspots. This information will help with siting decisions of new facilities as well as operational decisions, such as when to turn off wind turbines to avoid vulnerable population fatalities, reducing the overall number of bird losses at renewable energy facilities. Accurate understanding of the distributions of vulnerable populations in space and time will lead to more effective siting, monitoring, and operation, ultimately lowering costs to California ratepayers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project harnesses the power of genomic data to develop genetic assays for quick, low cost screening of thousands of individuals. Researchers are creating high-resolution maps of population structure and migration routes and applying this information to assess population-level impacts by screening carcasses collected from renewable energy facilities. Genoscape maps can be merged with existing spatial data of energy potential to make siting recommendations for new facilities in areas with minimal impact on wildlife.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 4g

Environmental Benefits:

Improved mapping of migration routes of bird populations of concern and their timing will inform renewable energy siting decisions and target mitigation strategies.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $114,850
EPIC Funds Encumbered: $599,236	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Regents of the University of California, Los Angeles: $888,250 (59.7 %)	**Match Funding:** $888,250
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team collected samples from the selected set of birds (Common Yellowthroats, Burrowing Owls, and American Kestrel plus others being studied with match funds) and completed genetic analysis to identify populations. Some of the Burrowing Owl samples were shared from EPC-15-040, "Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy." In Fall 2017, they developed maps and schedules of the migration routes (genoscape maps) relative to renewable energy sites. They collected samples from bird carcasses from solar and wind facilities (some shared from EPC-14-061, "Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings") to use the genetic methods to determine which population the dead birds belonged to. They developed their approach for prioritizing migratory hotspots with input from the TAC and others.

124. EPC-15-044

Project Name:

Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources

[EPC-15-044]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	8/15/2016 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Operational Tools, Models, and Simulations to Improve Grid Resource Planning

Issue:

Revisions being made to Rule 21 require grid-supportive functionality and communication interfaces, and specify the IEEE 2030.5 communication protocol for monitoring and managing distributed energy resources (DER). This protocol is complex, making the development of products difficult and putting interoperability at risk. The application of the IEEE 2030.5 protocol to DER is new, and certification procedures and test software for this application do not exist. These challenges translate to reduced value to owners of DERs and delay in the availability of products and programs that provide grid support opportunities.

Project Description:

This project is developing two key open-source software technologies: 1) Implementation of a complete, certified IEEE 2030.5 communication protocol that manufacturers can freely take and incorporate into their products. This reduces the cost and complexity of bringing systems to market, streamlines the certification process, and helps ensure that products can successfully connect and participate in grid programs; and 2) A certification procedure and associated test software by which any system or device can be checked for compliance to the standard. Independent evaluation provides manufacturers with an unbiased assessment of their products and provides both business and individual consumers with assurance that their purchases will work as expected. The project will validate the completeness and quality of these technologies by implementing the open-source client in a commercial DER system and performing field testing.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will accelerate availability of products and systems that allow California ratepayers to install and operate as much grid-tied solar generation as they wish and to ensure their purchases remain compatible with value-added opportunities over their service life. The open-source software will enable $1-2 million of cost savings per DER manufacturer by eliminating the need to develop, test, integrate and certify proprietary software.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1a, 1h, 1i, 2a, 3a, 5a

Lower Costs:

The cost of product development and system integration is reduced through the availability of free open source software. These cost savings are reflected in retail costs and program incentives that directly benefit California ratepayers.

Consumer Appeal:

Customers of all types require their investments to be compatible with utility communication systems to enable more solar energy on the grid and to maximize the range of value-added services that their products can provide.

Energy Security:

Emergency backup power and smart home systems that aid consumers during disasters become practical because of the accessibility and interoperability of systems provided by a successful open communication protocol.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $203,973
EPIC Funds Encumbered: $816,539	**EPIC Funds Spent:** $169,696
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $92,153 (8.7 %) Enphase Energy: $24,000 (2.3 %) QualityLogic: $32,519 (3.1 %) SunSpec Alliance: $65,050 (6.1 %) Xanthus Consulting International: $30,000 (2.8 %)	**Match Funding:** $243,722
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 23 out of 29 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Work on the IEEE 2030.5 software and certification procedure is well underway. The delayed approval schedule for the IEEE 2030.5 standard revision has affected the project timeline, but the team has taken action to mitigate the impacts. Additionally, a report "Standard Communication Interface and Certification Test Program for Smart Inverters" was recently published, and elements of this project will build upon the report's findings.

125. EPC-15-045

Project Name:

Transactive Incentive Signals to Manage Electricity Consumption for Demand Response [EPC-15-045]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/18/2016 to 6/28/2019

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Demand response (DR) has substantial potential to act as either a demand-side or a supply-side resource. However, existing programs and rates do not provide a participation incentive structure that accurately reflects system conditions or system costs, a suboptimal situation that results in higher ratepayer costs, low DR participation and an inability for system operators to regularly utilize demand-side resources. As the state moves toward more distributed generation and intermittent renewable energy generation, integration of those generation resources will further increase costs in the absence of significantly expanded DR resources responding to actual system needs in real time.

Project Description:

This project develops Transactive Load Management (TLM) signals, expressed in the form of proxy prices reflective of current and future grid conditions, and develops and implements software to calculate such signals. These signals are being designed to provide customers sufficient information to optimize their energy costs by managing their demand in response to system needs. The signals are transported via proven and available protocols and networks for use by projects that will test the efficacy of the TLM signals using the demand response projects awarded under GFO-15-311, Advancing Solutions that allow Customers to Manage Their Energy Demand.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project demonstrates the potential for a variety of different loads and customer types to respond automatically to a real-time proxy pricing signal. This could advance the potential of DR being a demand side or a supply side resource for the State.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Smart grid: R.08-12-009 Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11 Distribution Level Interconnection (Rule 21): R.11-09-011 Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002 Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 3c, 3e, 3f, 3h, 4a, 5a, 5b

Lower Costs:

Demand response lowers costs for both the system and individual customers. Procurement costs are reduced when wholesale energy prices are attenuated by price-responsive demand; customer costs are reduced when they either shift consumption to lower-priced times or receive payment for participating load reduction.

Greater Reliability:

High levels of demand can stress grid assets, and increased stress could lead to outages if left unchecked. To the extent that a TLM signal and smart management of consumer loads can minimize stress on grid equipment, reliability is improved.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $126,585	
EPIC Funds Encumbered: $498,054		**EPIC Funds Spent:** $259,071	
Match Partner and Funding Split: Greenlots: $110,450 (18.2 %)		**Match Funding:** $110,450	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient conducted the first Technical Advisory Board (TAB) meeting on October 10 and solicited feedback from the members on the work completed to date. Based on comments from Energy Commission staff, the recipient is making revisions to the draft report on the Transactive Load Management (TLM) System, Price, and Signal Design. After review by Energy Commission staff, the draft will be sent to technical advisory committee and TAB members for comments. The reference design for the TLM signal is being finalized for implementation in early 2018.

126. EPC-15-046

Project Name:

Developing a Distribution Substation Management System

[EPC-15-046]

Recipient/Contractor:

Siemens Corporation

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/24/2016 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020

Issue:

As the electric distribution system becomes increasingly complex with the integration of more distributed energy resources, existing distribution automation systems need to be enhanced with functions to manage increasing amounts of renewable energy connected at the distribution level and to provide greater control over the operation of distributed energy resources. Distribution management systems need to automate more monitoring and control operations at substations using standard communication protocols to quickly respond to changes and problems to reduce outage times.

Project Description:

This project will develop an operational display for electrical distribution substations. This display along with the supporting software will show the current state of the distribution system, detect problems, and automatically suggest potential solutions to reduce outage times. The software will also automate routine and non-routine engineering and maintenance tasks that are performed on substation equipment.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Highly automated and efficient grid operation is required to achieve California's energy goals, in particular with respect to the Clean Energy and Pollution Reduction Act of 2015 (Senate Bill 350) that strives to reach 50 percent renewable energy resources. This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating the potential of semantic technologies for increasing electrical grid automation. This will allow control interventions to happen at much faster speed and further automate routine and non-routine engineering and maintenance tasks that are performed on substations. By making the complex smart grid more accessible for operators, it will permit faster resolution of outages, thereby making the grid more maintainable and resilient.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 3a, 3d, 5f, 5h

Lower Costs:

A greater degree of automation for grid operation processes will lead to reduced grid operation costs that potentially translate into lower rates for California ratepayers.

Greater Reliability:

The main benefit of this project is that it will allow grid problems to be resolved automatically, thus averting power outages.

Energy Security:

A greater degree of grid automation enables faster reactions to shifts in electricity production, thereby permitting a higher percentage of distributed renewable energy resources.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $171,526	
EPIC Funds Encumbered: $500,000		**EPIC Funds Spent:** $110,409	
Match Partner and Funding Split: Siemens Corporation, Corporate Technology: $455,000 (47.6 %)		**Match Funding:** $455,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 23 out of 29 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient created an intuitive dashboard for easy visual classification of data. This allows operators to apply a statistical classifier to the data to categorize the incoming data streams. The categorized data will be analyzed by software in charge of monitoring anomalies and undesired behavior on the grid. This software consists of knowledge models that are continuously enhanced and updated during the project.

127. EPC-15-047

Project Name:

Powernet - A Cloud Based Method for Managing Distribution Resources

[EPC-15-047]

Recipient/Contractor:

SLAC National Accelerator Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/18/2016 to 2/26/2019

Program Area and Strategic Objective:

Applied Research and Development

S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020

Issue:

The power grid is changing rapidly. In California, renewables on the utility side of the meter are expected to provide 50% or more of load by 2030, requiring significant distributed energy resources (DERs) to help integrate those renewables. Additionally, greatly expanded numbers of DERs, such as distributed solar, storage, and EVs, are expected on the customer side of the meter and on the utility side of the distribution grid. There is an urgent need to coordinate all these resources to: (i) minimize costs, (ii) increase consumer quality of service, (iii) preserve grid stability and (iv) offer services to the grid.

Project Description:

This project will further develop Powernet, a cloud-based method to manage energy resources in homes and businesses. Powernet will control and coordinate energy resources both behind the meter and at the distribution system for residential and commercial ratepayers to: (i) minimize costs, (ii) increase consumer quality of service, (iii) preserve grid stability and (iv) offer services to the grid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Several significant Powernet system innovations would be developed under this proposal: (i) the integration of control, optimization and power electronics would enable novel functionality – stable connect/disconnect from the grid, local and global power sharing and grid services including demand response; (ii) the layered structure of the system will enable the operator to utilize Powernet for a variety of different grid purposes or service offerings with the assurance that those are always done on top of an economically optimal operating point every second; (iii) the system would be robust and secure by design; and (iv) the system would adopt open source standards and establish an open protocol (OpenDER) for the platform to enable scalable engagement of devices in the future.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1g, 2a, 3a, 3d, 3f, 5f, 5h

Lower Costs:

The economic savings of using Powernet are significant. Every home and business will need to pay only once for installation of the Powernet and can then progressively add DERs on its own. While balance of systems cost of storage and solar can reach 65% of the total ownership cost, this may be reduced to 50% to 55% using Powernet depending on the total number of DERs

installed.			
Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $865,939	
EPIC Funds Encumbered: $2,210,720		**EPIC Funds Spent:** $961,931	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: United States Department of Energy : $3,500,000		**Leveraged Funds:** $3,500,000	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 23 out of 29 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 4
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The project team made progress in the following areas: 1) the site location was finalized at Vista Ridge Housing Unit in San Diego; 2) equipment (batteries, appliances, etc.) was installed at the Lab in Stanford and the solar and storage components were built at SLAC; and 3) the architecture and the components for testing were developed by SLAC and testing was initiated at the Lab in Stanford. SLAC is working with Lincoln Military Housing group to start final recruitment of the individual homes and installation of measurement devices as well as thermostats. Two labs are being prepared for the project: one at Stanford and the other at SLAC. The two labs will act like two different housing units and the technology being developed will focus on optimization of the individual units as well as the optimization of the neighborhood. A demonstration at the Stanford Lab began in November.			

128. EPC-15-048

Project Name:

Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources

[EPC-15-048]

Recipient/Contractor:

Alternative Energy Systems Consulting, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Renewable energy generation, such as solar, creates a very challenging situation for grid operators (e.g. Cal ISO) due to the steep ramp-up needed after the sun goes down. Until there is a better way to manage intermittent renewable resources and peak energy demand, a significant contribution from renewable energy cannot be realized. Intelligent building energy management systems that can shift energy loads and manage more complex and robust resources are needed to transition from a few centralized energy resources into millions of distributed energy resources (DER) such as rooftop solar, and energy storage.

Project Description:

This project tests and validates an intelligent residential energy management system that communicates with a variety of DER such as solar PV, and energy storage in in 100 residences in San Diego, CA. The project integrates the use of pilot time-of-use utility rates in conjunction with simulated dynamic pricing signals to optimize cost savings. In addition, modeling and measuring the energy implications and costs without affecting occupant comfort is also being explored.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The key advancement in this project will be the knowledge gained from testing this innovative residential energy management system in actual homes. If proven successful through field testing, this system could achieve widespread deployment throughout the state which could significantly reduce peak demand, reduce annual energy costs, and improve grid operations.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1h, 2a, 4a

Lower Costs:

Based on initial estimates, the proposed solution could reduce annual electricity costs by 36 to 41 percent.

Greater Reliability:

The integration and communication of distributed energy resources across millions of homes

can provide greater electricity grid flexibility.

Environmental Benefits:

Contributes to California's goal of 50 percent renewable energy by 2030 by intelligently using the residential market to absorb additional renewable electricity. Production of 50 percent renewable energy will greatly contribute to reduced GHG emissions.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $938,190
EPIC Funds Encumbered: $3,996,560	**EPIC Funds Spent:** $231,632
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Progress to-date includes development of Technical Advisory Committee (TAC), coordination with San Diego Gas and Electric to select test homes and explore potential incentive structures, DER energy management system optimization, and exploring specific DERs to include in project.

129. EPC-15-049

Project Name:

Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System

[EPC-15-049]

Recipient/Contractor:

Antelope Valley Water Storage, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 9/29/2017

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

In recent years, incorporation of renewable energy into the electric grid has increased the importance of developing energy storage. Conventional pumped hydroelectric storage has been the dominant energy storage technology in the United States. The technology is limited by topography, environmental concerns, high cost, and the large size requirements needed to make conventional pumped hydroelectric storage practical. The primary limit to pumped storage is lack of adequate siting, as most of the best sites for surface reservoirs have already been taken. Sites with the requisite elevation difference and existing facilities limit the wider use of pumped storage in California.

Project Description:

The project conducts a feasibility study that determines the value of energy storage and associated grid support benefits provided by Peak Hour Pumped Storage and Aquifer Pumped Hydro applications at an existing water bank. The feasibility study also identifies critical parameters for success for both technologies and identifies other water banking sites in the state where these technologies are likely to be successful.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project conducts feasibility analyses of Aquifer Pumped Hydro and Peak Hour Pumped Storage for energy storage purposes, hydropower generation, and demand response potential if implemented at a groundwater bank. Potential barriers are identified and economic analysis conducted to identify types of implementation with the highest value. The project is developing a set of tools other water banks can use to conduct similar assessments. Based on preliminary review, these tools could be very useful for all water banks in California.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011

Applicable Metrics: CPUC Metrics- 1e, 3f

Greater Reliability:

This project assessed two promising energy storage technologies that can be used to firm up variable renewable energy generation and other fluctuations on the electric grid.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $15,276	
EPIC Funds Encumbered: $197,300		**EPIC Funds Spent:** $123,116	
Match Partner and Funding Split: CIM Group: $199,353 (50.3 %)		**Match Funding:** $199,353	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 11: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The research team conducted technical feasibility analysis and preliminary field testing of two pumped storage systems: Peak Hour Pumped Storage (PHPS) and Aquifer Pumped Hydro (APH) storage at Willow Spring Water Bank. Hydropower generation and demand response potential of groundwater banking projects were assessed. The results show low efficiency and revealed water quality issues as a potential barrier for implementation for the APH system. The demand response during a dry hydrologic year has the highest value based on analysis. The project also created tools for other groundwater banks in California to conduct similar analysis. The project was completed as planned in September 2017 and the final report is published.			

130. EPC-15-050

Project Name:

Winery Water and Energy Savings

[EPC-15-050]

Recipient/Contractor:

Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 12/31/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

California is the fourth largest producer of wine in the world. The California wine industry is a significant water consumer and is the second largest consumer of electricity among the food and beverage industry. As the wine industry and its associated water and energy use continue to expand, efficiency technologies will become increasingly important. Water supply is limited and energy bills will become a larger portion of operating costs if not contained. Water reuse and novel heat recovery can significantly decrease fresh water use in wine production while decreasing energy use, but data on technical and economic feasibility is limited.

Project Description:

This project is testing two energy and water saving technologies at a winery facility in northern California. The first technology is a water treatment and reuse system to recycle wastewater for indoor barrel washing. The second is a wine-to-wine heat exchanger for the cold-stabilization of white wines. Both technologies have been installed on a single skid at the project location in Sonoma County, along with monitoring and verification equipment. Jackson Family Wines owns the bottling facility where the technologies are being tested.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project focuses on full-scale technology demonstrations of two water and energy saving technologies for the wine industry. The water treatment and reuse system uses reverse osmosis to treat water to potable standards for barrel washing. It's estimated to reduce water use at the facility by 90 percent. The second technology reduces the amount of energy used to stabilize the white wine.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 4a, 4c

Lower Costs:

The water and energy savings are expected to result in bill savings, leading to lower operating costs for winemakers and owners of bottling plants. Treating and reusing barrel wash water results to additional energy savings and greenhouse gas emission reductions, due to the embedded energy savings in the fresh water supply that is being offset by the use of the recycled water. Furthermore, the wine-to-wine heat exchanger technology for the

cold-stabilization offers significant electricity and natural gas savings. The estimated overall annual cost savings for this project is $54,418.

Environmental Benefits:

This project is estimated to reduce the amount of fresh groundwater used for barrel washing by 90 percent annually. Reuse of the treated wastewater for barrel washing is expected to save 1.4 million gallons of fresh water annually. In addition, the wine-to-wine heat exchanger technology can result in substantial energy savings and greenhouse gas emissions reduction. The annual greenhouse gas emissions reduction for the overall project is estimated to be 504,111 pounds of CO2e, based on electricity, natural gas, and water savings.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $157,088
EPIC Funds Encumbered: $1,989,201	**EPIC Funds Spent:** $90,870
Match Partner and Funding Split: Jackson Family Wines: $404,625 (16.9 %)	**Match Funding:** $404,625
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Name: Vibratory Shear Enhanced Processing (VSEP). **Type:** Project-relevant pre-existing IP - Technology, Design, Drawing. The proprietary technology was fully developed and patented by the owner, New Logic Research Inc., prior to the start of this Agreement. Name and date of Copyright and Patent to be provided.

Update:

This project is in the water quality testing and monitoring phase, prior to installation of the water reuse equipment. Jackson Family Wines is in the process of obtaining the installation permit from the City of Windsor. The team is also finalizing the design of the wine-to-wine heat exchanger equipment.

131. EPC-15-051

Project Name:

The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings

[EPC-15-051]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 6/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Advanced lighting controls are among the rapidly evolving technologies that utilize wireless communications, embedded sensors, data analytics and controls to optimize building systems in real time. Energy benefits due to lighting controls are becoming a smaller piece of the technology overall value proposition. This project seeks to quantify the demand response (DR) value (energy and non-energy benefits/costs) for networked lighting systems in addition to their energy-efficiency benefits, and integrate this DR value into a broader advanced lighting controls value proposition framework that can be employed as a tool for the future.

Project Description:

This project identifies, quantifies and evaluates the incremental costs and benefits of demand responsive (DR) lighting controls system requirements in the California Energy Code across existing, non-residential building stock. The project focuses on the incremental costs and benefits associated with adding the DR functionality to enhance general lighting upgrades in existing, non-residential buildings to enable them to act as DR resources.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will advance intelligent, network controls to become dynamically controlled, dispatchable grid resources. The advanced controls developed will ease building participation in Auto-Demand Response (DR) programs and improve grid reliability and resiliency, improve user interfaces for lighting systems to reduce energy waste and cost, and enable IOUs and others to geographically target DR deployments as a cost effective means to transmission and distribution infrastructure upgrades.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 5b

Lower Costs:

Demand response enabled, advanced lighting controls can significantly reduce customer energy consumption (50% - 70% in offices) and costs by optimizing light output when and where it is needed, and by minimizing its use when not needed through the deployment of highly granular networked sensors and efficient light sources.

Greater Reliability:

Increased customer participation in demand response programs especially for lighting resources, can increase grid reliability and reduce utilities' need for purchasing expensive electricity during periods of high demand.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $130,529
EPIC Funds Encumbered: $500,000	**EPIC Funds Spent:** $412,875
Match Partner and Funding Split: Energy Solutions: $138,648 (21.7 %)	**Match Funding:** $138,648
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project is on track to successfully complete all deliverables on or before March 2018. A critical project review meeting and a technical advisory committee meeting were held in October 2017. The research team has developed commercial lighting load profiles, and continues to work on quantifying the costs and benefits from automated demand response enabled systems such as initial installation cost, operating costs, financing costs, energy cost savings, revenue savings, and how Title 24 requirements impact these costs. None Energy Benefits (NEB's) are identified with all supporting methodologies versus quantification metrics and values. Preliminary results of the research project were presented at the Emerging Technologies Coordinating Council, Quarter 1 meeting in Ontario, CA.

132. EPC-15-052

Project Name:

ZipPower San Leandro

[EPC-15-052]

Recipient/Contractor:

ZipPower, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Traditionally, renewable energy in communities has been implemented one rooftop at a time without basing investment decisions on an assessment of the community's energy system as a whole or the integration and automation of all required components. The absence of an integrated, community-wide energy planning and implementation process results in a lost opportunity to increase distributed renewable energy output in a more efficient, scalable, and strategic manner.

Project Description:

This project will develop and pilot a platform that optimizes distributed energy resource planning by integrating and automating all the data required to target optimal sites across city areas, and streamline pre-approval of the permitting and interconnection at those sites. The project will also use aggregated customer financing as an option to design, finance, deploy, scale, and replicate Advanced Energy Communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

SB 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings in existing buildings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project will reduce the time and costs needed to bring community-scale IDER projects to a shovel-ready state.

Economic Development:

This project will pilot new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Consumer Appeal:

Greater deployment of advanced energy technologies at a community scale will increase consumer familiarity and comfort with ZNE homes and communities, increasing the likelihood of consumers choosing to live in communities deploying advanced energy technologies.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $158,370
EPIC Funds Encumbered: $1,495,338	**EPIC Funds Spent:** $0
Match Partner and Funding Split: ZipPower, LLC: $486,000 (24.5 %)	**Match Funding:** $486,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was approved at a Business Meeting on May 17, 2016. Work is expected to begin June 2016.

133. EPC-15-053

Project Name:

Customer-Centric Approach to Scaling IDSM Retrofits

[EPC-15-053]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

The California retrofit goal is to reduce 50% of existing buildings' energy use by 2030. Disadvantaged, low-income, multifamily communities are one of the most important retrofit targets, yet have no cost-effective pathways to achieve these goals. Multifamily housing is a very difficult market segment to address due to split incentives as retrofits are the responsibility of a property owner but he/she does not pay the energy bill. Limited technical and financial knowledge for owners also plays a role.

Project Description:

This project develops and demonstrates an approach to scale residential retrofits for disadvantaged communities that will focus on customer-centric solutions. This project develops and demonstrates an innovative approach, focusing on energy efficient retrofit packages that are non-intrusive to occupants and have the potential of reducing energy use by 30 to 40 percent.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project provides new data, analysis, and designs for cost-effective integrated demand side management retrofits such as advanced HVAC, smart thermostats, plug load controls, LED lighting, and heat pump water heats for residential communities.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 5b

Lower Costs:

These integrated retrofits could reduce energy use by 30 to 40% in multifamily buildings. The project could result in significant savings in energy and operating costs to building owners and residents.

Greater Reliability:

Improve the reliability with the integration of energy efficiency, demand control, and renewable power with buildings and the Smart Grid.

Increase Safety:

IDSM retrofits have the potential to increase safety due to the improved ability to control and integrate buildings' use of renewable power, storage, electric vehicle charging, and the Smart Grid. In addition, many of the networked IDSM technologies have additional monitoring and safety features.

Environmental Benefits:

This project has the potential to reduce greenhouse gas emissions due to the reduction in energy use by demonstrating a combination of energy efficient technologies in multi-family buildings.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $1,316,714	
EPIC Funds Encumbered: $3,894,721		**EPIC Funds Spent:** $229,608	
Match Partner and Funding Split: BIRA Energy: $25,000 (0.5 %) Southern California Edison: $312,572 (6.7 %) LINC Housing Corporation: $461,987 (9.8 %)		**Match Funding:** $799,559	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team has begun to install the efficiency measures at each site. The team has hired a subcontractor to be in charge of installing new appliances, lighting, HVAC, and envelope measures. Project measures selected include: hand-sealing for air leakage, insulation, LED interior lighting, LED exterior lighting, mini-split heat pump, smart thermostat, and low-flow showerheads and faucets. All measures provided by the agreement are all electric. Installations of these measures will be made at each site and monitoring and verification to follow. Staff has conducted 2 site visits in 2017. The first site visit was to evaluate

the current technologies installed at the sites. The second site visit was to tour the facility and view the existing and proposed retrofit technologies during the 2017 ET Summit.

134. EPC-15-054

Project Name: Complete and Low Cost Retail Automated Transactive Energy System (RATES) [EPC-15-054]	
Recipient/Contractor: Universal Devices, Inc.	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 6/30/2016 to 3/29/2019
Program Area and Strategic Objective: Applied Research and Development S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices	
Issue: Existing Demand Response programs, tariffs and wholesale markets in California are focused primarily on reliability and peak load reduction. The end-use loads enrolled in these programs tend to have high opportunity costs so participation in these programs is low. Participation logistics - including metering, telemetry, baseline estimation, verification and settlement - still serve as a barrier to wider participation. Substantial research and technology development over the past decade have pointed toward a vast untapped potential for balancing electricity supply and demand in near-real time through better management of customer loads and distributed energy assets.	
Project Description: This project will develop and pilot-tests a complete, low cost, and standards based Retail Automated Transactive Energy System (RATES), and behind the meter energy management solution. The purpose is to minimize the cost and complexity of customer participation in energy efficiency programs, maximize the potential of small loads to improve system load factor, shave peaks, integrate renewable generation, and provide low opportunity-cost resources to the grid. This project will work with Southern California Edison to facilitate customer participation and expand Demand Response Participation in the area served the Moorpark substation.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: This project will advance the ability of customers to participate in Demand Response (DR) markets. The technology developed will apply customer preferences to automate energy management and response to energy market and rate variations using off-the-shelf equipment and a simple technology platform and two-way subscription tariff design that is retail price responsive, simplifies settlement activities, and facilitates integration of behind-the-meter Distributed Energy Resources, without the need for complicated measurement, verification, and baselines. This technology will reduce barriers to low cost, anytime responsiveness from millions of customers and their devices by solving the significant cost and complexity of current DR participation options.	
CPUC Proceedings addressing issues related to this EPIC project: Demand Response (DR): R.13-09-011 Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Integration of Distributed Energy Resources (IDER): R. 14-10-003	

Applicable Metrics: CPUC Metrics- 1c, 1e, 1f, 1g, 1h, 3f, 4a

Lower Costs:

The primary goal of the project is to reduce the cost of customer participation in energy efficiency and demand response programs. Expanded participation will lower ratepayer costs by reducing procurement and grid capacity expansion costs as well as reducing carbon emissions and helping integrate renewables.

Greater Reliability:

Greater resiliency of demand will increase reliability as additional variable renewable generation resources are added to the grid. Variable renewables require procurement of additional "firming" resources to provide both ancillary services and generation resources when renewable production drops. Successful expansion of the ability of loads to respond to supply variation allows grid operators an additional tool to balance demand and supply.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $3,187,370		**EPIC Funds Spent:** $1,535,107	
Match Partner and Funding Split: TeMix, Inc.: $919,325 (21.5 %) TBD Electrical Contractor: $7,000 (0.2 %) TBD - Controls: $1,150 (0.0 %) Universal Devices, Inc.: $160,235 (3.7 %)		**Match Funding:** $1,087,710	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project is on schedule, required deliverables have been provided, and the level of engagement by utilities and other partners is expanding the project impacts beyond what was initially anticipated in the agreement. SCE has provided additional funding to support expansion of the research in the Moorpark substation area (a Disadvantaged Community also

at risk for reliability issues). In addition, Amazon has been working with the team to evaluate its Echo technology as a platform for hosting the transactive client and Google has been in talks with the team to do the same with its Google Home technology.

135. EPC-15-055

Project Name:

The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community

[EPC-15-055]

Recipient/Contractor:

Charge Bliss, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Disadvantaged communities, especially those with low air quality, may seek to incorporate electric vehicles and photovoltaics (PV) to meet their clean energy goals. However, planning the locations and amounts of community scale PV, electric vehicle charging, and storage can be complicated and costly – and many disadvantaged communities do not have the resources to design the community. Cities need examples of how other disadvantaged communities planned, permitted, and designed community scale systems that incorporate energy storage, electric vehicle charging networks, and distributed generation in a way that minimizes the need for additional grid upgrades.

Project Description:

This project demonstrates how the City of Carson's disadvantaged downtown community worked with Chargebliss and its team to plan and design an advanced energy community that included an extensive electric vehicle charging network, high penetrations of photovoltaic (PV) generation, and stationary battery storage in their municipal parks and city-owned facilities. The project team is using transportation and utility data to best place EV charging stations in high utilization areas and how the increased energy demand will be balanced with solar and storage to minimize grid impacts. The team is conducting planning, permitting, financial modeling, and engineering design for over three megawatts of PVs and 40+ charging stations for a disadvantaged public sector and commercial area in the City of Carson. Charge Bliss is collaborating with two local government entities, South Bay Cities Council of Governments, and Southern California Association of Governments, as well as a collection of universities and private companies on this effort.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

SB 350 (2015) sets a 50 percent renewable energy standard by 2030 and a doubling of energy efficiency savings in buildings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting financing, and engineering approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 3b, 3e

Lower Costs:

This project will reduce the time and costs needed to bring community-scale IDER projects to a shovel-ready state.

Economic Development:

This project will pilot new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Consumer Appeal:

Greater deployment of advanced energy technologies at a community scale will increase consumer familiarity and comfort with ZNE homes and communities, increasing the likelihood that consumers will choose to live in communities deploying advanced energy technologies.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $197,815
EPIC Funds Encumbered: $1,500,000	**EPIC Funds Spent:** $400,991
Match Partner and Funding Split: Efacec: $20,000 (1.3 %) Ji Min: $25,000 (1.6 %) Edward Kjaer: $8,325 (0.5 %) Tanner Engineering: $43,612 (2.7 %)	**Match Funding:** $96,937
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has worked with the City of Carson, SCE, and other stakeholders to select the best public buildings and parks to install energy storage, an extensive electric vehicle charging network, photovoltaic, and smart control technology. They further established the amount of PV to place at each site, as well as the quantity and level of charging that would be available at each site – keeping in mind impacts to the grid, ZNE status, and cost. The next step for the project is to conduct engineering design and present a final package to the City for approval.

136. EPC-15-056

Project Name:

Peninsula Advanced Energy Community (PAEC)

[EPC-15-056]

Recipient/Contractor:

Natural Capitalism Solutions, dba Clean Coalition

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/27/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Solar Emergency Microgrid (SEM) projects often struggle to establish a clear payback period, as payback periods are largely site-specific, requiring intensive analysis to determine which sites will provide the best value proposition. This analysis can drive up the soft costs associated with microgrid projects. SEM projects also struggle to demonstrate acceptable pay-back periods needed to secure project financing. This is partly due to putting a monetary value on resiliency benefits provided by the microgrid.

Project Description:

This project is planning and designing Solar Emergency Microgrid (SEM) within the southern portion of San Mateo County. The project is developing several case studies to guide SEM site selection based on which services will be included and their implicit or minimum loads, facility type, interconnection options, the resources available, and the proximity of the site to local hazards, in addition to available financing options. The project team is using these case studies to inform their work with the local planning and building departments to streamline zoning and engineering permitting for optimal SEM sites. To help incentivize microgrid investments, including for the project's SEM, the project team is working to establish a backup power valuation methodology to use in commercial applications.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments are playing a critical role in achieving this goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project is piloting innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

Streamlined planning and permitting, as well as new financial models will lower the time and capital costs associated with the AEC developments. This will make AECs more affordable for both developers and consumers.

Economic Development:

This project is piloting new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Consumer Appeal:

Greater deployment of AECs will increase consumer familiarity and comfort with Zero Net Energy homes and communities, increasing the likelihood of consumers choosing to live in an AEC.

Energy Security:

Microgrids using renewable energy generation, coupled with storage systems, allows consumers to generate their own energy locally.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $312,711	
EPIC Funds Encumbered: $1,318,997		**EPIC Funds Spent:** $738,937	
Match Partner and Funding Split: Natural Capitalism Solutions, dba Clean Coalition: $330,000 (20.0 %)		**Match Funding:** $330,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			

Update:

This project is finalizing a scalable suite of tools, policies, and programs to enable communities to accelerate their progress towards affordable, resilient power systems that combine energy efficiency, local renewables, electric vehicle charging stations, energy storage, and monitoring, communications, and controls. The project has finalized an electric vehicle master plan for Redwood City, and has submitted a draft proposal for an interconnection pilot with PG&E in the San Mateo region. The project team have created a project-specific page on their website, which can be seen at:
http://www.clean-coalition.org/our-work/peninsula-advanced-energy-community/.

137. EPC-15-057

Project Name:

Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings [EPC-15-057]

Recipient/Contractor:

The Regents of the University of California on behalf of the California Institute for Energy and Environment

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

The services demanded of commercial building customers require significant energy and contribute to peak energy demand. Few demand response (DR) solutions address the complexity and heterogeneity for commercial customers. Large commercial customers typically have a building management system (BMS) that controls HVAC and lighting in order to respond to price signals. Small commercial customers do not have BMS, and thus cannot easily participate in DR. This problem has not been addressed because an open source and open architecture enabling platform runs counter to the business model of many companies, who want to maintain a single vendor, proprietary solution.

Project Description:

The purpose of this project is to improve small and large commercial customer participation in demand response programs by providing a cost-effective energy management system that allows a wide range of service offerings as well as effective and automated price-based management. The project is providing a holistic solution and provides the demand response manager at each site with the following: 1) receive price signals and evaluate energy demand; 2) enable heterogeneous customers to adapt to DR with individual preferences; 3) track, evaluate and control multiple devices; 4) interoperate with various building systems; 5) retain the electrical usage history of connected devices; 6) provide pricing based load management algorithms; 7) coordinate to maintain load diversity; 8) provide security and 9) provide customer value in addition to DR.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project could overcome the cost of installing energy efficient equipment by providing a software solution that is open source with an open architecture enabling platform. The eXtensible Building Operating System (XBOS/DR) can interface with multiple hardware devices from different vendors as well as include software applications from various vendors. With its ability to create a virtual building management system for small commercial buildings by networking thermostats and other controllers, XBOS/DR can provide large and small commercial customers with a variety of choices for DR capability. The open architecture can foster technical innovation by third-party vendors and other manufacturers in providing energy services.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1c, 1e, 1g, 1h, 4a

Lower Costs:

The recipients estimates that the software is estimated to reduce energy costs for ratepayers by $260 million per year in 2024 - due to lower demand charges, increased electric grid energy efficiency, reduced energy end-use from persistent efficiency in parallel with DR, and lower generation costs.

Greater Reliability:

450 MW of avoided or shifted peak electric demand in 2024. This is a 150% increase beyond the 293 MW of DR from a combination of nonevent-based programs, critical peak pricing, and peak-time rebates estimated by the California Energy Demand 2016-2026 Revised Forecast.

Environmental Benefits:

The project can reduce 930,000 metric tons of CO2e and 130 metric tons of NOx emissions per year avoided in 2024 from: increased electric grid energy efficiency, increased end-use energy efficiency in parallel with demand-management, and increased fraction of intermittent operationally GHG-free renewable electricity generation.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,373,762
EPIC Funds Encumbered: $4,000,000	**EPIC Funds Spent:** $260,711
Match Partner and Funding Split: Siemens Corporation, Corporate Technology: $400,000 (9.0 %) Quantum Energy Services & Technologies, Inc. (DBA: QuEST): $24,000 (0.5 %)	**Match Funding:** $424,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

There are several open source IP being used, including: the eXtensible Building Operating System, the Monitoring and Actuation Profile, the Building Operating System Services Wide Area Verified Exchange, the Berkeley Tree Database, Giles, and OpenBAS.

Other IP include: Semantic Integration of Wearable Sensors into Professional Healthcare, EnergyOP, and OWL implementation of SPC201.

Update:

The Pilot Test Plan for Large Commercial Buildings, which describes how to integrate the XBOS software with existing building automation systems, was prepared in May of 2017, as well as the Software Architecture Memo, which describes the XBOS software and includes interfaces to hardware devices, security, and integration of the user interface. The project team continues to build out and implement the XBOS platform in small-medium commercial buildings and developing control algorithms. A CPR was held in November of 2017. The project is on time and on budget.

138. EPC-15-058

Project Name:

The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project

[EPC-15-058]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/27/2016 to 3/23/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

In order for California to meet its ambitious energy goals, cost-effective retrofit strategies must be found for the state's existing housing stock. Advanced Energy Community (AEC) developments that deploy a wide mix of clean energy technologies on a medium-to-large scale offer a way to retrofit entire communities, rather than on a building-by-building scale. However, community-scale energy retrofits are untested and models for governing and financing the energy systems are not established. Additionally, local governments, developers, and other stakeholders do not have standards for planning, permitting, and funding these types of developments, making their realization difficult.

Project Description:

This project is developing a model for a residential block-scale retrofit development of an integrated energy system combining energy efficiency, renewable generation, and water conservation technologies, called the EcoBlock. The development of the energy and water system components of the model serves as a case study to analyze different owner-operator, and financing structures that may be applicable to a residential community. This case study can help transform the EcoBlock model from a one-off demonstration to a sustainable and replicable model for the entire state. The City of Oakland will also use the EcoBlock model to develop new planning and permitting processes that can lower the time and cost of similar block-scale developments throughout the city.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

SB 350 (De Leon, 2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Deploying customer-side of the meter technologies at scale will help meet this goal, but will require new innovations to how local jurisdictions design, plan, finance, and manage energy upgrades at the community level. This project is developing sustainable financing structures, clear owner-operator responsibilities, and streamlined planning and permitting processes, which are critical to successfully deploying community-scale energy retrofits throughout the state.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Water-Energy Nexus: R.13-12-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action

Plan (June 2015)

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

Streamlined planning and permitting, as well as new financial models will lower the time and capital costs associated with AEC developments. This will make AECs more affordable for both developers and consumers.

Economic Development:

Increased AEC deployments can lead to increased demand in clean energy technologies and services resulting in broad economic benefits to the clean energy sector.

Consumer Appeal:

Greater deployment of AECs will increase consumer familiarity and comfort with ZNE homes and communities, increasing the likelihood of consumers choosing to live in an AEC.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $117,432	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $119,752	
Match Partner and Funding Split: Rexel Foundation: $140,000 (6.2 %) Morgan, Lewis & Bockius LLP: $412,300 (18.2 %) Arnold & Porter LLP: $150,000 (6.6 %) Perkins Coie: $41,250 (1.8 %) The Regents of the University of California on behalf of the Berkeley campus: $26,296 (1.2 %)		**Match Funding:** $769,846	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In 2017, the project team completed an EcoBlock design that includes 27 houses and 2 multi-family buildings in Oakland, CA. The project team completed their analysis on the existing energy and water infrastructure of the block, and developed scenarios for potential energy generation and water conservation systems. The energy system plan combines efficiency upgrades at the building-scale with a flywheel storage system to create a AC/DC microgrid. The water conservation plan proposes different methods to utilize, recycle, and conserve potable, sewer, storm and rain water. In 2018, the project team will synthesize their research results and add an analysis on different owner-operator and finance models that may be applied to the EcoBlock, as well as provide the City of Oakland with recommendations on ways to streamline their planning and permitting processes for block-scale developments.

139. EPC-15-059

Project Name:

UniGen Smart System for Renewable Integration

[EPC-15-059]

Recipient/Contractor:

Onset, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/24/2016 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020

Issue:

The electric grid was designed on the presumption of a predictable and slow-moving load and the generation scheduled to serve it. Grid managers rely on an Energy Management System to identify deviations from the scheduled generation, after which operators make adjustments manually to wait for the adjustment to take effect. While it takes 10 to 30 minutes by which time disruptions caused by the volatility of wind and solar has most likely changed the operation of the grid. This variability results in increased threats to electricity reliability and costs to California ratepayers or limits in the amount of renewable electricity generation that can be accepted by the grid operations.

Project Description:

This project is developing the UniGen Smart Software System to smooth energy output from a combination of variable energy resources (VERs). VERs generation often deviates from forecasts and schedules because of variations in weather. This can be alleviated by a fast-acting control system that automatically compensates for deviations from projected generation using a dedicated mix of energy resources (e.g., a photovoltaic system and an energy storage system). Onset's UniGen control system couples these resources with a primary power plant using proprietary algorithms in a software application in real time so that the combined output corresponds to the committed output. Any deviation is solved at the project or distributed level, making it easier for the ISO to manage grid performance.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

A commercial version of UniGen would be an important tool to integrate the large amounts of VERs envisioned by California's energy policy (i.e., 33 to 50 percent) along with current generation to create a balanced system. Modeling this approach strongly suggests that the software has the potential to simplify CAISO's energy balancing efforts.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1a, 1h, 2a, 3a, 5a

Lower Costs:

The cost of using UniGen to couple a VER with a dedicated power plant can be substantial, up to $1M to $2M for every 100 MW of VERs, and over 12,000 MW of renewable available in California. Preliminary results indicate that when using UniGen market participants have financial incentives to schedule VERs and thereby enhancing the integration of a larger amount of renewables. The UniGen Smart System has the potential to save California ratepayers an estimated $100 M.

Greater Reliability:

The software could help the California ISO maintain grid reliability and avoid non-compliance with NERC standards. If the controllable generation is insufficient or not timely during the afternoon peak, there is the threat that system frequency will fall below levels required by NERC. This system assists the CAISO in real-time balancing, which should reduce the likelihood of over or under supply.

Environmental Benefits:

The software helps enable achievement of California's aggressive climate change goals by accelerating the penetration of higher levels of renewable energy sources.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $638,993		**EPIC Funds Spent:** $196,330	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 23 out of 29 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The team developed and modeled their algorithms, demonstrating the versatility of the UniGen Smart System to mitigate the consequences of renewable over supply conditions. The analysis shows that deployment of UniGen throughout CA would result in flattening the steep afternoon ramps. The team also modeled and analyzed the improvement in the frequency response capability of a Balancing Authority like CAISO after the UniGen Smart System has been introduced onto the system. The study concluded that the use of UniGen would add primary frequency response capability to CAISO. The team also developed their laboratory test plan, which included full software programming and trial testing.

140. EPC-15-060

Project Name:

Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions

[EPC-15-060]

Recipient/Contractor:

Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 9/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Habitat variation and changes to species interactions within and adjacent to energy installations may regulate impacts to species of concern, including rare and invasive species. Typical management planning for both rare and invasive species takes a single-species approach, and may overlook how species' responses change over the variation in micro-environmental conditions within energy facilities and mitigation areas. In addition, altered species-interactions may drive long-term failure or success of species in landscapes modified by renewable energy development and operation.

Project Description:

This research quantifies how microhabitat conditions that affect rare plants, invasive plants, and sensitive insects vary across a gradient of solar energy configuration, including sites within a solar field, mitigation areas within a solar field, sites on the margin of a solar field, and similar undisturbed locations. Experiments are being used to determine how habitat variation affects target plant species and their essential species interactions, including herbivory, predation, and pathogens.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will provide methods to decrease adverse environmental impacts of solar energy facilities and enhance the ability to predict and overcome costly invasions of non-native plants in early stages. This research will also advance the effectiveness of mitigation measures, reduce impacts, and overcome barriers to facility siting and design by studying species responses in different conditions within a solar array and the changes in species interactions.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 3a, 4f

Lower Costs:

This research will reduce costs in the siting and deployment of renewable energy by assessing the benefits or ecological costs of different facility configurations, providing guidance for the design of future solar facilities and the cost-effective management of native and invasive species in existing facilities.

Environmental Benefits:

This research will benefit ratepayers by providing effective, efficient strategies for the management of state and federally listed species within and adjacent to energy facilities.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $104,801	
EPIC Funds Encumbered: $597,865		**EPIC Funds Spent:** $247,622	
Match Partner and Funding Split: The Regents of the University of California, Santa Cruz: $54,940 (7.8 %) Regents of the University of California (University of California, Davis): $48,357 (6.9 %)		**Match Funding:** $103,297	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has refined the study design and set up the field experimental sites. They completed the first year of data collection on microhabitat factors and experimental results in 2017 and are analyzing these data for the interim task reports.

141. EPC-15-061

Project Name:

Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings [EPC-15-061]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/13/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Upgrading existing buildings in support of state energy and environmental goals is a monumental challenge. The limitations are greatest in disadvantaged communities (DACs) because of insufficient community involvement, a high percentage of renters, a lack of energy data supporting energy retrofit financial support programs, and a lack of knowledge transfer due to education and/or language barriers. Furthermore, inadequate financing strategies for promoting clean energy solutions are amplified in DACs where financial risks can have more impact. A replicable approach is needed to overcome these barriers and deploy Advanced Energy Communities (AECs) throughout the state.

Project Description:

This project is funding the planning, permitting, and preliminary engineering needed for the integration of advanced energy technologies in a disadvantaged community. The design will provide locally generated, GHG-free electricity from community solar and storage to offset electricity consumption of participants who opt in to the AEC. The design will also enable participants to benefit from savings resulting from various onsite Integrated Demand Side Management (IDSM) actions at no up-front cost, including energy efficiency retrofits, demand response, energy management systems, and an energy education and support program. Participants will pay back retrofit costs and cost of capital for solar and storage assets through an on-bill financing mechanism, including a first-of-its-kind virtual net metering (VNEM) tariff across multiple county-owned sites and residential buildings piloted by Los Angeles Community Choice Energy (LACCE). The project has a strong focus on local outreach and engagement to promote community participation in the AEC, as well as robust data evaluation methods facilitated through the LA County Energy Atlas to ensure design and financing features are optimized.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Local governments can play a critical role in achieving the State's SB 350 (2015) building energy efficiency goals by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) for energy efficiency. This project is piloting innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project will reduce the time, costs, and resources needed to bring community-scale integrated distributed energy resource (IDER) projects to a shovel-ready state.

Economic Development:

Increased demand for AEC deployments can result in broad economic benefits to the clean energy sector. This project is also serving to build community capacity around energy issues, which could increase support for local clean energy and economic initiatives.

Consumer Appeal:

This project is increasing consumer familiarity with ZNE homes and communities, which should increase support from the local community for greater deployment of advanced energy technologies at a community scale.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $449,666	
EPIC Funds Encumbered: $1,497,996		**EPIC Funds Spent:** $61,580	
Match Partner and Funding Split: Regents of the University of California, Los Angeles: $118,014 (6.5 %) Los Angeles County Office of Sustainability: $198,793 (11.0 %)		**Match Funding:** $316,807	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement

Terms and Conditions.
Update: The project team has proposed an AEC system design that will include 5.9MW of solar PV and 4.7MWh of energy storage capacity. The project team is currently working with Los Angeles County and Bassett Unified School District to evaluate county sites and school campuses for siting of solar PV generation and storage. LACCE will begin delivering retail electricity the first quarter of 2018, and the project team is working to secure approval from LACCE to act as the Load Serving Entity since they will have the authority to create and administer their own VNEM tariff. The project team is also focused on the recruitment of local Energy Ambassadors, who will agree to opt in to the AEC and receive training on the project. The idea is these Energy Ambassadors will become a trusted source of knowledge and provide transparency to the local community in order to promote participation in the AEC.

142. EPC-15-062

Project Name:

Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems

[EPC-15-062]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Irvine campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 4/18/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Low emission distributed generation technologies, such as microturbines and reciprocating engines, can improve onsite resiliency and reduce peak demand. However, assuring that these systems produce minimal emissions is paramount. As a result, there is a need for a low cost approach to monitor emissions performance.

Project Description:

The project is testing several recently developed sensors with the capability to detect low NOx levels generated by dispatchable generation systems, such as internal combustion engines and/or micro-turbines. Deploying clean, efficient, distributed generation systems directly addresses goals stated in AB 32, SB 350, and the Clean Energy Jobs Plan. While reducing greenhouse gases and improving efficiency are vital, maintaining strict air emission standards is also important. DG systems often suffer performance degradation over time once deployed. As a result, it is critical that system performance be monitored and maintained. The proposed solution offers a cost effective means to monitor real time emissions performance of the system and information that can be used to optimize system performance and actually maintain low emission performance.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The NOx sensor is based on ceramic solid-state electrochemical sensor technology, similar to the automotive oxygen sensor. Solid-state NOx sensors have been developed for direct in-situ measurement of exhaust to meet stringent on-board diagnostic requirements for self-diagnosis and reporting, including required sensitivities down to parts-per-million. The NOx sensor combines existing commercial NOx sensors with newly developed electronics for use in applications including dispatchable distributed generation like micro-turbines. Compared to other NOx sensors, the sensor is a simple solid state device, with a single cell and no internal diffusion chambers (electrodes directly in the flow). This gives it faster responsiveness, making it more robust and easier to manufacture.

CPUC Proceedings addressing issues related to this EPIC project:

Combined heat and power: D.10-12-035., R.08-06-024.

Applicable Metrics: CPUC Metrics- 2a, 3f, 4b

Lower Costs:

Compared to other NOx sensors, the NOx sensor to be tested is a simple solid state device, with a single cell and no internal diffusion chambers (electrodes directly in the flow). This gives it faster response time, makes it more robust and easier to manufacture. The co-fired multi-layer zirconium and aluminum oxide sensor is less expensive to manufacture.

Environmental Benefits:

Based on the current microturbine generator fleet in CA, approximately 13,000 lbs/NOx per year could be avoided with the technology demonstrated. The primary benefit is associated with lower cost to help achieve good air quality and reduced greenhouse gas emissions from electricity generation.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $53,531	
EPIC Funds Encumbered: $200,000		**EPIC Funds Spent:** $87,607	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 11: Ranked # 8

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In summer 2017, the research team completed sensor robustness testing. Two types of NOx sensors were tested. Based on the result from the test, the team made a selection. In the fall of 2017, the team worked on integrating the selected sensor information into the engine system.

143. EPC-15-064

Project Name:

Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing [EPC-15-064]

Recipient/Contractor:

Prospect Silicon Valley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

The State of California has set ambitious net-zero energy targets, including that 50% of existing commercial buildings achieve net-zero by 2030. This aggressive target is especially challenging for buildings under 50,000 square feet. Challenges include significant capital costs (labor and equipment); building conditions (conflicting infrastructure energy effects, aging physical conditions which do not easily accommodate state-of-the-art technology); operational considerations (occupant behavior, transaction timing and lack of maintenance expertise); and legal and policy factors (split incentives).

Project Description:

This project demonstrates the installation of innovative technologies to retrofit an existing, low-income, mixed-use multi-unit building in a dense urban setting to become zero net energy (ZNE). Innovative strategies include a rapid new technology discovery and assessment approach, to ensure the most current emerging technologies are incorporated, as well as innovative measurement and verification. These approaches and other ZNE design process innovations are to be packaged into an advanced ZNE design methodology for use in the demonstration project as well as broad dissemination to the design and innovation community. Numerous technical innovations and pre-commercial technologies are planned for inclusion including dynamic chromatic glass, heat recovery ventilators, variable refrigerant flow, occupancy based plug-load management, and advanced light emitting diode lighting systems.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project site represents a test case for many of the complex challenges facing zero net energy retrofits of multi-unit, mixed-use buildings and is relevant to a state-wide greenhouse gas emission and energy efficiency goals such as AB 32, AB 758 and SB 350. The approaches and other zero net energy design process innovations are to be packaged for broad dissemination to the design community.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The implementation of energy efficiency measures can lower electricity costs for building owners. The recipient estimates that implementation of the measures would reduce building energy use by 40 percent for both electricity and natural gas.

Environmental Benefits:

With a 5% adoption rate, the project hopes to reduce carbon emission by 580,000,000 metric tons per year.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $408,130
EPIC Funds Encumbered: $2,995,653	**EPIC Funds Spent:** $386,230
Match Partner and Funding Split: Chinatown Community Development Center: $800,000 (21.1 %)	**Match Funding:** $800,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

On July 23, 2017, the recipient informed staff that a significant construction obstacle was encountered and would require a major electrical service upgrade. This was not taken into account when the original budget was submitted, and may impact the energy efficiency measures selected for upgrades. A Critical Project Review (CPR) meeting was held on September 22, 2017 where the recipient presented a new energy efficiency package strategy that took into consideration the service upgrade. A CPR report was submitted to the Energy Commission on November 15, 2017 with new project recommendations and the report is undergoing review.

144. EPC-15-065

Project Name:

Berkeley Energy Assurance Transformation (BEAT) Project

[EPC-15-065]

Recipient/Contractor:

City of Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/31/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Multi-user microgrids (MUCs) improve project economics and performance through the aggregation of multiple, complimentary loads. However, MUCs come at a higher cost than single-user microgrids, as they result in more transaction costs for securing participation and managing agreements across multiple parties. MUCs also face a lack of industry standard business models, a lack of regulatory or statutory support to realize revenue streams, and MUCs projects often lack municipal government or district scale stakeholder engagement in the planning process.

Project Description:

The City of Berkeley is designing a clean energy microgrid community anchored around a public parking garage in the Downtown Berkeley area. The financing and regulatory models resulting from this project provide pathways for dense urban communities to develop microgrids that cross the public right-of-way (ROW) to maximize the resiliency and efficiency of distributed energy resources while reducing the city's carbon footprint. The financial and regulatory analyses from this project will help minimize the soft costs associated with the development of future community microgrid projects by proposing optimized owner-operator structures. Using this analysis, other dense, urban, microgrid projects looking to cross the public ROW will be able to accelerate the non-technical planning, modeling, and then deployment of their microgrids.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments are playing a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project is piloting innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

Streamlined planning and permitting, as well as new financial models will lower the time and capital costs associated with Advanced Energy Community (AEC) developments. This will make Advanced Energy Communities more affordable for both developers and consumers.

Greater Reliability:

The project will increase energy reliability by enabling districts in downtown Berkeley to localize power generation and distribution.

Economic Development:

Increased AEC deployments can lead to increased demand in clean energy technologies and services resulting in broad economic benefits to the clean energy sector.

Energy Security:

Microgrids using renewable energy generation, coupled with storage systems, allows consumers to generate their own energy locally.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $500,070	
EPIC Funds Encumbered: $1,499,214		**EPIC Funds Spent:** $90,872	
Match Partner and Funding Split: Office of Energy and Sustainable Development, City of Berkeley: $106,475 (6.1 %) Bay Area Regional Energy Network: $54,000 (3.1 %) Center for Sustainable Energy: $11,200 (0.6 %) NHA Advisors: $7,500 (0.4 %) URS Corporation: $60,946 (3.5 %) West Coast Code Consultants Inc.: $10,000 (0.6 %)		**Match Funding:** $250,121	
Leverage Contributors: City of Berkeley : $248,009		**Leveraged Funds:** $248,009	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: In 2017, the project team synthesized their research to develop a viable business model, implementation roadmap, and model design of the microgrid in Downtown Berkeley, creating a roadmap for future projects looking to develop AECs in dense urban areas, and for those projects looking to develop microgrids that cross the public right of way. The project has so far identified that ownership of the generation and storage assets would be the most beneficial option of local governments, while optimal microgrid operation structure involves utility and municipal or private operations, supported by CCE tariffs and special rates. The team has also identified a need to better calculate the monetary value of community resilience for determining the cost-benefit of microgrid deployment. <a href="https://building-microgrid.lbl.gov/projects/berkeley-energy-a

145. EPC-15-066

Project Name:

Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego [EPC-15-066]

Recipient/Contractor:

Groundwork San Diego-Chollas Creek

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	7/26/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Low income communities are disproportionately affected by climate change, and have limited access to the economic, environmental, and health benefits of many low and no carbon energy technologies. Disadvantaged communities have not been fully engaged in the energy aspects of their communities.

Project Description:

This project will develop a prototype plan called the Encanto Social-Economic Education Development (EnSEED), designed to transform an existing disadvantaged community in Southeastern San Diego into a community of near-zero net energy (ZNE) buildings. This project will include close engagement with the local community, and development of a final system design, financing plan, and plan to obtain all required government review and approvals. A permitting plan will be developed to document the necessary permit processes and prepare permit applications to the point deemed complete by the responsible permitting agency. Upon completion of the permit review process, Groundwork will initiate the environmental review process with the City of San Diego. This process will determine the level of anticipated impact and type of environmental document needed.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

Streamlined planning and permitting, as well as new financial models will lower the time and capital costs associated with AEC developments. This will make AECs more affordable for both developers and consumers.

Economic Development:

This project will pilot new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Consumer Appeal:

Greater deployment of AECs will increase consumer familiarity and comfort with ZNE homes and communities, increasing the likelihood of consumers choosing to live in an AEC.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $129,898	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $780,641	
Match Partner and Funding Split: Blue Flame Energy Finance: $520,000 (25.7 %)		**Match Funding:** $520,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-066 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Staff attended an EPIC Community Launch and Media Event sponsored by Groundwork San Diego- Chollas Creek at the Groundwork San Diego-Earth Lab Station. Regional Stakeholders were present and spoke on behalf of the "Chollas Eco-Village" which will be created into a Zero Net Energy Community.

146. EPC-15-067

Project Name: Integrated Community Resource Marketplace [EPC-15-067]	
Recipient/Contractor: The Local Government Commission	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 6/1/2016 to 3/30/2018
Program Area and Strategic Objective: Market Facilitation S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure	
Issue: Most community upgrades happen by degrees, with different branches of a local government approving and financing smaller projects that address their jurisdictions. Lowering administrative and buying costs through aggregated purchasing, larger, community-scale projects is often considered too difficult, requiring more complex planning and financing mechanisms. Additionally, community upgrade projects often look at introducing advanced energy technologies after building designs are completed, requiring more planning and increasing costs.	
Project Description: This project pilots an innovative process for local governments and developers to aggregate community upgrade projects, helping lower costs by increasing buying power and reducing administrative costs. The Local Government Commission's process enables decision makers to prioritize community goals, review active building construction plans for the community, and connect local building projects with additional sources of capital that can help bring advanced energy technologies into the community. The system helps communities optimize available financing, and streamline planning and permitting for community projects. The system is currently being piloted for Fresno's Blackstone Corridor and Downtown Specific Plan.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: SB 350 (2015) sets a 50 percent renewable energy standard by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and energy storage. This project will pilot innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	
CPUC Proceedings addressing issues related to this EPIC project: Integration of Distributed Energy Resources (IDER): R. 14-10-003	

Applicable Metrics: CPUC Metrics- 3b, 3e

Lower Costs:

This project will reduce the time and costs needed to bring community-scale IDER projects to a shovel-ready state.

Economic Development:

This project pilots new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Consumer Appeal:

Greater deployment of AECs will increase consumer familiarity and comfort with ZNE homes and communities, increasing the likelihood of consumers choosing to live in an AEC.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $432,890
EPIC Funds Encumbered: $1,500,000	**EPIC Funds Spent:** $444,152
Match Partner and Funding Split: Local Government Commission: $12,445 (0.8 %)	**Match Funding:** $12,445
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has worked with the City of Fresno and other stakeholders including builders and financers to develop a portfolio of projects that can be built out in a way that integrates advanced energy technologies such as energy storage, renewable energy, and building energy management systems. The recipient collected information from developers, advanced energy technology providers, financers, and city officials and used the information to create a tool that dynamically organizes and prioritizes projects based on the projects attributes and the user's preferences. The tool also includes information on how each site can be financed by

stacking eligible grants, loans, bonds, incentives, and many other sources of capital.

147. EPC-15-068

Project Name:

Understanding and Mitigating Barriers to Wind Energy Expansion in California

[EPC-15-068]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/30/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

The need to transition from traditional hydrocarbon-based sources of energy becomes ever more compelling as energy demand rises in tandem with the necessity to reduce greenhouse gas emissions. Wind energy already plays a key role in diversifying and greening many energy portfolios. However, wind speeds vary across space and time, which affects where wind farms should be sited, as well as their reliability. Accurate projections of wind energy potential and investment in the industry depend on the stability and predictability of wind resources and the operating environment, which are not well understood in a changing climate.

Project Description:

The research uses a combination of global re-analysis datasets, a unique set of observations, and high-resolution global climate model simulations to help identify and characterize the extent to which regions in California may exhibit vulnerability or new opportunity in terms of changes to wind resource magnitude, spatial and temporal variability, and/or operating conditions of sufficient magnitude to alter their viability for wind energy development. The unique strength and theme of this research lies in the use of a next generation variable resolution global climate model that has the ability to simulate climate change over a limited area region, i.e. California, in a computationally cost effective manner.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help overcome a key barrier to long-term wind energy investment that can help California meet its 50% renewable energy goal and climate change mitigation goals. Improving the characterization of uncertainty in wind resource magnitude and variability in the context of climate change can help reduce risk in future wind energy investments in California. Technological advancement will be realized through use of a next-generation variable-resolution coupled atmosphere-ocean global climate model that is capable of simulating climate and climate change at relatively high spatial resolution (7km to 14km) over California. This is the first time that a variable-resolution climate modeling system will be utilized for a specific energy application.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 2a, 5c

Lower Costs:

Better understanding of potential changes in the operating environment of wind turbine installations would help lower operating and maintenance costs.

Greater Reliability:

The project will improve the characterization of uncertainty around the magnitude and variability in space and time of California's wind resource in the near and mid-term. Projections of potential changes to the operating environment will reduce downtime.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $74,830
EPIC Funds Encumbered: $200,000	**EPIC Funds Spent:** $175,374
Match Partner and Funding Split: UC Davis: $54,000 (20.0 %) DNV GL: $16,000 (5.9 %)	**Match Funding:** $70,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 11: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team has developed its modeling product for the variable-resolution community earth system model and validated it with historical wind observations and reanalysis data for California. Based on the analysis of future wind projections, the team has predicted that the majority of the state will experience an increase in wind power during summer, and a decrease during fall and winter, based on significant changes at several wind farm sites. This study improves the characterization of uncertainty around the magnitude and variability in space and time of California's wind resources in the near future. The rest of the analyses are nearing completion as of late 2017. Two journal articles are in preparation, and the team will be drafting the final project report in early 2018.

148. EPC-15-069

Project Name:

Lancaster Advanced Energy Community (AEC) Project

[EPC-15-069]

Recipient/Contractor:

Zero Net Energy Alliance, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	7/13/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

In 2011, the city of Lancaster set a goal to become the first Zero Net Energy (ZNE) City. Regulatory and pricing issues, including high up-front costs, burdensome interconnection applications, and unproven business models continue to be significant barriers to deployment of advanced energy technologies at the scale Lancaster needs to achieve its goal. This project seeks to address (1) how to enable ZNE residential communities from both a financial and technical perspective, and (2) how to capture the value of DERs in a standardized manner to develop viable business models and attract the financial investment needed to support widespread deployment of clean energy resources.

Project Description:

In collaboration with the City of Lancaster and Lancaster Choice Energy (LCE), this project will plan and permit a ZNE microgrid connected to a medium-density affordable housing project that enables the cost-effective deployment of advanced technologies. The microgrid design approach minimizes the impact of ZNE buildings and increasing renewables on the grid, increases DER design flexibility, and enables local control of energy management through LCE, all while exploiting the plummeting cost of islanding capability to provide valuable resiliency benefits to the community. The project team is also developing a community DER valuation framework that assesses the value of DERs on an aggregated and integrated network basis from multiple stakeholder perspectives by combining various value streams and evaluating evolving revenue and market participation opportunities. This framework is being used to inform the shared services model behind LCE's "Green District" program that integrates storage, solar, and smart building technology as a service for large commercial and industrial customers to reduce their demand charges while allowing LCE to save on procurement costs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Local governments can play a role in achieving California's demand reduction goals by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project is outlining how ZNE residential subdivisions can use municipal bonds to finance DER infrastructure with lower interest rates than commercially available third party financing. The project is also working on streamlining the interconnection process for new ZNE communities, which will reduce costs and resources needed to establish a ZNE community.

Greater Reliability:

The tools and resources developed under this project will assist in identifying citywide optimal microgrid sites that will have the most local generation potential and minimize impacts on grid reliability.

Economic Development:

By providing tools to overcome some obstacles to DER deployment and DER programs, this project could spur the development of these sectors in other communities. When deployed properly, DERs can provide energy savings, and their installation and maintenance creates a variety of jobs. This development also leads to new investment in the community.

Consumer Appeal:

This project will increase consumer familiarity with ZNE homes and communities, which should increase support from the local community for greater deployment of advanced energy technologies at a community scale. The project is also developing an innovative stationary storage program that minimizes up-front capital costs through innovative ownership and value sharing models.

Energy Security:

Microgrids using renewable energy generation, coupled with storage systems, allows consumers to generate and manage their own energy locally.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $507,982
EPIC Funds Encumbered: $1,469,779	**EPIC Funds Spent:** $744,075
Match Partner and Funding Split: City of Lancaster: $1,500,000 (50.5 %)	**Match Funding:** $1,500,000

Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: This project is in the final stretches of creating a scalable suite of tools, policies, and programs to enable communities to accelerate their progress towards ZNE. The team is currently in talks with potential technology vendors, and plans to have finalized partnerships and signed agreements with initial customers in the next few months. The project team has also evaluated the various use cases for the microgrid planned in connection with the Avenue I affordable housing project. Once the tract map is approved, they will recommend microgrid component sizing, technical schematics, and controls that will be incorporated into the architectural and construction documentation.			

149. EPC-15-070

Project Name:

Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System [EPC-15-070]

Recipient/Contractor:

Altostratus, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 5/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Probabilistic seasonal and decadal climate forecasts for the electricity system are typically done at coarse-resolution regional scales and do not incorporate impacts from urban areas in models. Intra-urban variations in temperature are on average between 1 and 4 degrees C in most urban areas in California and can be as large as 10 degrees C. It is important to explicitly account for them in the seasonal, decadal, and short-term forecasts of the electric system that serve as a basis for planning by the CEC and the utilities.

Project Description:

This project develops and applies methodology to improve the representation of urban effects in probabilistic and short term forecasts for the electricity system. It quantifies intra-urban climate variability in California for inclusion into forecasts used by the Energy Commission and the utilities. The characterizations are based on state-of-science highly-urbanized atmospheric modeling supplemented by analysis of observational weather data. Detailed statistical correlations and analysis are being undertaken, focusing on summertime conditions, and transfer functions are being developed to facilitate use of results by the Energy Commission and utilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will add fine-resolution, intra-urban climate detail to coarse-scale, regional-level probabilistic or deterministic forecasting, thus allowing for more accurate, area-specific characterizations and forecasts for the electricity system and better apportionment of electricity generation.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 1e

Greater Reliability:

This project is expected to improve electric system reliability by reducing uncertainty in seasonal and decadal probabilistic weather forecasts as well as short-term forecasts used by the Energy Commission and utilities for management of the electric system.

<table>
<tr><td colspan="2">Assignment to Value Chain:
Grid Operations/Market Design</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $14,035</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$193,326</td><td colspan="2">EPIC Funds Spent:
$95,017</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
Altostratus, Inc.: $5,000 (2.5 %)</td><td colspan="2">Match Funding:
$5,000</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
45 out of 45 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 11: Ranked # 6</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-15-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
In spring 2017, the researcher identified target databases and downloaded a large amount of weather data. During summer 2017, several scripts and codes were written to handle the analysis of large observational datasets. Hourly data was read and analyzed at each monitoring area (Greater San Francisco Bay Area, Fresno-Bakersfield region, and the Los Angeles Region). In fall 2017, the researcher configured the Weather Research and Forecasting (WRF) atmospheric model, so the fine-resolution simulation results generated by the model can be compared with the observational data.</td></tr>
</table>

150. EPC-15-071

Project Name:

Zero Net Energy Farms

[EPC-15-071]

Recipient/Contractor:

Biodico, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/1/2016 to 3/31/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Farms depend on the electricity grid and fossil fuels for everyday operations. These demands continue to increase and expand as new farming technologies are introduced and as ground water pumping demands increase. Many farms lack the tools and knowledge necessary to deploy distributed renewable technologies to meet these demands in place of conventional energy systems or increased reliance on the electricity grid. Furthermore, farms need guidance to effectively address permitting requirements and find competitive funding alternatives that will allow them to become leaders in California's distributed and renewable energy future.

Project Description:

This project is developing and piloting a Project Management Application tool for farms and agricultural communities. Included in this tool is information gathered from a trade study of available equipment vendors that will compare cost effectiveness and reliability of technologies for solar, wind, anaerobic digestion, and gasification. A unique feature about this project is that it integrates Net Energy Metering Aggregation (NEMA), a program through the California Public Utilities Commission (CPUC) that enables agricultural communities to aggregate meters in a continuous property, with various other strategies to maximize the effectiveness of the Project Management Application. Development and testing will be done in collaboration with four local jurisdictions in the Central Valley, the San Joaquin Valley Air Pollution Control District, and the US Navy.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

SB 350 (2015) sets a 50 percent renewable energy standard and a doubling of energy efficiency savings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, and demand response. This project will pilot innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project will reduce the time and costs needed to bring community-scale IDER projects to a shovel-ready state.

Economic Development:

This project will pilot new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Public Health:

Establishing a replicable model for the adoption of renewable energy generating technologies in the Central Valley can lead to an increase in air quality for not just that region, but all of California.

Consumer Appeal:

This project will conduct a case study documenting the steps required to deploy IDER solutions in farms and agricultural communities, creating a roadmap making it easier for similar communities to follow and adopt.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $122,540
EPIC Funds Encumbered: $1,175,919	**EPIC Funds Spent:** $434,622
Match Partner and Funding Split: City of San Joaquin: $25,000 (1.1 %) Fresno Council of Governments: $25,000 (1.1 %) PondelWilkinson: $25,000 (1.1 %) Red Rock Ranch, Inc.: $25,000 (1.1 %) San Joaquin Valley Air Pollution Control District: $47,500 (2.1 %) Office of Community and Economic Development - CSU Fresno: $25,000 (1.1 %) San Joaquin Valley Clean Energy Organization : $25,000 (1.1 %) West Hills Community College District: $25,000 (1.1 %) 18Thirty Entertainment, LLC: $15,000 (0.6 %) City of Huron: $25,000 (1.1 %) Larry Alberg: $16,000 (0.7 %) Dr. Stephen Kaffka: $16,000 (0.7 %) Chelsea Teall, PE: $16,000 (0.7 %) Leon Woods III: $16,000 (0.7 %) Biodico, Inc.: $813,919 (35.1 %)	**Match Funding:** $1,140,419

Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-071 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The draft Master Community Design has been completed that identifies resources available at the selected farm and advanced energy technologies (for energy generation, storage, etc.) that can help make the site a Zero Net Energy Farm, which includes solar, wind, anaerobic digestion, gasification, vehicle to grid (V2G) systems, energy storage with smart batteries, and smart street lamps. This Master Community Design describes the associated planning, permitting, and financing mechanisms that can be used to build out the site, which are supported by the Project Management Application (PMA) that uses a Geographic Information System (GIS). The PMA enables one to estimate the cost and energy generation of various advanced energy technologies for a given farm in California This draft plan was presented to the public at the Zero Net Energy Farms (ZNEFs) Summit on November 3, 2017.			

151. EPC-15-072

Project Name:

New Chemical Compounds for Cost-Effective Carbon Capture

[EPC-15-072]

Recipient/Contractor:

The Regents of the University of California, Davis Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 7/1/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Carbon dioxide (CO2) is one of the major contributors to climate change and the result of activities such as combustion of fossil fuels (coal, natural gas, and oil) for energy, transportation, certain industrial processes, and land-use. Carbon dioxide capture and sequestration (CCS) could play an important role in reducing greenhouse gas emissions, while enabling low-carbon electricity generation from power plants. The current CO2 capturing compounds have a number of shortcomings. This project is developing new carbon capture solvents that are more efficient and will cost less.

Project Description:

Many technologies for capturing carbon dioxide from fossil fuel energy conversion facilities use amines as solvents for carbon dioxide capture. Many practical shortcomings of amines could possibly be avoided, if a newly discovered naturally-occurring phosphoenol compounds featuring suitable combination of reaction enthalpy, solubility, viscosity and reaction rate would be further characterized and developed to be an inexpensive, non-toxic substitute for amines in carbon capture. The grant recipients are building upon their previous efforts by using sophisticated ab-initio quantum mechanical and molecular dynamics simulations to optimize and design a molecule from the class of phosphoenols by adding and removing different functional groups to make it more reactive with carbon dioxide (CO2) and more water soluble.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Although recent regulations will dramatically reduce greenhouse gas emissions, fossil fuels will remain fundamental to the California energy infrastructure for decades. Carbon capture can reduce the greenhouse gas emissions from power production facilities and other large industrial processes that rely on combustion of fossil fuels as an energy source.

CPUC Proceedings addressing issues related to this EPIC project:

Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 2a, 4a

Lower Costs:

Improved solubility of potential carbon capturing molecule in water instead of expensive organic solvents would result in significant cost savings if applied in large-scale carbon capture process.

Environmental Benefits:

A path for a drastic reduction of greenhouse gas emissions from fossil fuel burning energy systems could be developed upon completion of this agreement.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $40,000
EPIC Funds Encumbered: $200,000	**EPIC Funds Spent:** $10,778
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 11: Ranked # 9

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-072 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was kicked-off and the Technical Advisory Committee was formed in August 2016. The researchers initiated simulation and optimization of candidate carbon capturing molecules in Chem3D Pro and completed a demo of computational chemistry software packages. The recipient purchased software for computations, Aspen Plus. In November 2017, the Recipient began studying plant process modeling using Aspen Plus and continued building the database of candidate molecules using Chem3D Pro. In the first quarter of 2018, the recipient will purchase Gaussian software to start running computational chemistry on candidate molecules.

152. EPC-15-073

Project Name:

Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation

[EPC-15-073]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

As the state moves toward more distributed generation and intermittent renewable energy generation, there is a need for smaller resources to play larger roles in distribution and transmission grid management. The end-use loads enrolled in Existing Demand Response (DR) programs have high opportunity costs and participation is low. Some newly-developed market options, such as aggregation programs, could enable large numbers of small loads across multiple customers to participate in wholesale markets. However, participation logistics, including metering, verification and settlement, are barriers to wider participation.

Project Description:

This project is testing the effectiveness of innovative designs for demand response programs for residential customers using a behind-the-meter customer engagement platform developed by Chai Energy. Each of these innovative demand response strategies integrates a recent approach that energy researchers have shown to be effective in reducing customer consumption. These strategies include providing households with a) tailored energy-analytic feedback, b) aggregated versus single-period incentive information, c) non-financial environmental health benefit frames and d) social comparisons. An additional strategy is exploring how the timing of the delivered demand response information affects the magnitude of household participation and response.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will test the effectiveness of innovative design strategies for residential demand response providers and analyze different segments of the residential population including various socioeconomic groups and residential customers with photovoltaics and electric vehicles to see what incentives, messages and energy use information motivates reliable participation in utility demand response programs. This information will expand knowledge in this area so that utility companies and regulators can build new and modify existing demand response programs to increase effectiveness. Accurate and reliable forecasts of participation in these programs will enable better utilization of existing generation resources and deferral of system capacity upgrades thereby lowering consumer electricity costs.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1h

Lower Costs:

This project could lower ratepayer costs through better utilization of existing electricity generation resources by having residential customers participate in demand response (DR) programs. System-wide this could reduce the need for high cost peaker plants during extreme climate events. Participants in the DR programs could be rewarded with incentives that would result in lower energy bills. One of the project goals is to learn what potential demand reduction could be achieved by optimizing the metrics of residential DR programs.

Greater Reliability:

Greater electric system reliability could be achieved through increased residential demand response program participation and having this contribute towards greater grid optimization, flexibility and lowering imbalances on the grid.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $203,115	
EPIC Funds Encumbered: $2,007,875		**EPIC Funds Spent:** $181,556	
Match Partner and Funding Split: Chai Energy: $288,853 (11.2 %) University of California Los Angeles: $273,780 (10.7 %)		**Match Funding:** $562,633	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Work is ongoing to recruit participants in the study by Chai Energy and early generation treatments are being analyzed for their effect on customer/participant behavior(s). About 3,200 customers have been signed up for participating in the project which is less than the ultimate target of at least 7,000. A video has recently been produced, and supplemented strategies to enhance recruitment are being considered . UCLA has randomly assigned participants to one

of 6 test groups to compare with the control group. 6 treatments have been delivered to the 3,200 customers based on the assigned group they are in and the data is being analyzed.

153. EPC-15-074

Project Name:

Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems

[EPC-15-074]

Recipient/Contractor:

Center for Sustainable Energy

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/18/2016 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

The State of California has established aggressive goals for incorporating behind-the-meter, customer-sited distributed energy resources (DERs) into the California wholesale energy markets, managed by the California Independent System Operator (California ISO). However, with only limited testing performed to date, the ability of DERs to simultaneously and cost-effectively meet onsite customer electrical needs while providing energy services into the California ISO market is largely unproven.

Project Description:

This project develops co-optimization strategies for distributed energy resources (DERs). The purpose is to maximize customer and system value under existing CPUC-approved retail and California Independent System Operator (California ISO) wholesale tariff structures, future market structures and pricing, and the transactive energy pricing signals developed under agreement EPC-15-054. The project tests and configures two DER portfolios: a) one consisting of large retail customers and schools using battery energy storage, solar photovoltaics, and integrated load management, and b) the other consisting of hotels using passive thermal energy storage and energy efficiency. Both will be included as part of an integrated load management strategy, to respond to price signals as well as develop operational strategies that provide best practices for wholesale integration subject to the identified retail and wholesale tariffs and operational constraints.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project could lead to technological advancement and innovation by developing and testing strategies that customers, demand response (DR) aggregators, scheduling coordinators, and policy makers can implement to expand both participation in and the benefits of DR markets. The project provides comprehensive recommendations on how to overcome technical, institutional and regulatory barriers to facilitating DER participation in supply-side markets.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Energy storage: R.15-03-011 Smart grid: R.08-12-009 Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11 Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding.

LTPP (2016) cycle: R.16-02-007: R.16-02-007 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 3e, 3f

Lower Costs:

This project has the potential to lower energy costs for individual customers, as well as system costs for all ratepayers California ISO market participants. On the distribution circuit, storage devices may defer cost of expensive capital upgrade projects such as transformer or line upgrades.

Greater Reliability:

As the penetration of intermittent resources increases in California, energy balancing requirements increase as well. Behind-the-meter storage on the distribution system can increase distribution system reliability issues through services such as local overload relief, power quality and ramp-rate mitigation on circuits with high penetration of photovoltaics.

Increase Safety:

By deploying, testing, and validating system integration, metering, and telemetry, the project will contribute to the safe operation of DER systems in customer-sited locations while maximizing value for these systems to both customers and wholesale market activities.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $746,794	
EPIC Funds Encumbered: $3,960,805		**EPIC Funds Spent:** $613,409	
Match Partner and Funding Split: Solar City Corporation: $1,449,262 (24.4 %) DNV GL: $2,000 (0.0 %) Conectric Networks, LLC: $530,000 (8.9 %)		**Match Funding:** $1,981,262	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-074 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement

Terms and Conditions. Subcontractor Conectric, LLC will employ patented and unregistered IP in the operation of control systems being used to evaluate different load management strategies and customer impacts in this project.
Update: The project is on schedule. Agreements with Tesla (formerly Solar City) to engage and operate the K-12 school sites equipped with solar PV, storage, and load management control capabilities have been finalized and operational testing in preparation for market participation is proceeding on schedule. Installation of monitoring and control equipment at the hotel sites has been completed and audits, data collection, and operational testing are already yielding recommendations for efficiency improvements. The data are being analyzed for the purpose of developing effective DR strategies

154. EPC-15-075

Project Name:

Customer-centric Demand Management using Load Aggregation and Data Analytics [EPC-15-075]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/18/2016 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Load management in buildings has been lagging for decades due to lack of customer acceptance of load control, and of technology that can reliably provide reductions. As the State moves toward high penetration of customer-sited renewables, and an evolving transmission market, it is imperative that load management become mainstream, and include the customer in the transaction. Connectivity of all end use systems is growing, but there is no open standard requirement in Title 24. Incorporating these technology advances is essential to achieve a flexible, reliable, and affordable grid for California.

Project Description:

This project demonstrates how a large number of small electric loads, each impacted by and tuned to individual customer preferences can provide load management for both utilities and the California Independent System Operator (California ISO). The recipient works with an extensive spectrum of leading product providers covering all major distributed energy resources (DERs), such as Nest (thermostats), ThinkEco (plug loads), Honda and BMW (Vehicle Grid Integration), EGuana (smart Inverter) and Ice Energy (Thermal Storage). A variety of price signals are being tested for Time-of-Use customers such as Critical Peak Pricing and Demand Rate. The project is using deep analytics to evaluate individual customer preferences for demand management using microdata from devices and aggregate the responses to meet grid needs at different distribution and transmission levels.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project could provide California ratepayers methods to control their energy cost using low cost off-the-shelf technologies, and to adopt PV by providing a platform to manage their energy cost as the tariff structures evolve to account for grid costs of distributed generation. This platform enables the technology innovation without additional and expensive requirements of hardware for grid integration.

CPUC Proceedings addressing issues related to this EPIC project:

Self-Generation Incentive Program: R.12-11-005 Energy storage: R.15-03-011 Smart grid: R.08-12-009 Distribution Level Interconnection (Rule 21): R.11-09-011 Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Long-Term Procurement Proceeding (LTPP): R.13-12-010 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 5c

Lower Costs:

Benefits include statewide residential electricity savings of approximately 1040 GWh per year and small commercial of 53 GWh per year for a total of 1093 GWh per year, which translates to estimated statewide CO2 reductions of 397,631 tons per year. The total annual bill reduction is approximately $8.21M for commercial facilities and $185M for residential buildings.

Greater Reliability:

The project could increase adoption of demand response programs from the current 15 percent to 60 percent, managing air-conditioning loads, and newer loads such as plug loads, and electric vehicles could provide up to 12 GW of peak capacity, almost the capacity of the older power plants in the state. This 12 GW of capacity could provide greater grid flexibility.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,163,894
EPIC Funds Encumbered: $3,998,587	**EPIC Funds Spent:** $118,850
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $979,860 (18.6 %) InTech Energy, Inc.: $280,452 (5.3 %) Pedagogy World, Inc.: $10,000 (0.2 %)	**Match Funding:** $1,270,312
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	19 out of 21 bidders	Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-075 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

"Energy360 Power Monitoring, Analytics & Controls" software is pre-existing intellectual property trademarked by InTech Energy.

The Chai Energy Logo is trademarked project-relevant pre-existing intellectual property.

The Olivine DER Platform and the EPRI Smart Thermostat Collaborative Data are project-relevant, unregistered pre-existing intellectual property.

Update:

The project is on track. The team is continuing to fulfill the requirement of Task 2, *Developing Project Requirements* by working with their key development partners to leverage the demand response scheduling interface with the CAISO market. The recipient continues to make progress on the Task 3 *Energy Data Warehouse* and customer user interface requirements in anticipation of beginning testing of the messaging across all platforms in early 2018.

155. EPC-15-076

Project Name:

Richmond Advanced Energy Community Project

[EPC-15-076]

Recipient/Contractor:

Zero Net Energy Alliance, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/13/2016 to 3/30/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Due largely to limitations and challenges in design, financing, available professional expertise, and scale-up strategies, zero net energy (ZNE) communities have not yet been developed at a large scale, or applied to infill development. The majority of ZNE buildings have been deployed in more affluent areas that can afford the initially steep ZNE learning curve and higher-cost early-stage technologies. Streamlining the regulatory and financing aspects of ZNE deployment can lead to significant increases in similar developments throughout California.

Project Description:

The City of Richmond Advanced Energy Community project will facilitate adoption of a comprehensive integrated policy, planning, program, and financing framework to transform the City of Richmond into a Zero Net Energy Community, using forward-looking policies that integrate energy, land use, and transportation planning, and progressive municipal financing mechanisms. As part of the project, ZNE Alliance will also facilitate the planning and permitting of approximately 20 abandoned homes to be converted into affordable ZNE homes available to working families via the First-time Home Buyers' Program. This redevelopment project will be accomplished by a Social Impact Bond administered by the Richmond City Council.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

Streamlined planning and permitting, as well as new financial models will lower the time and capital costs associated with AEC developments. This will make AECs more affordable for both developers and consumers.

Increase Safety:

Increased safety will be achieved by: identification of hazards and ventilation defects during energy assessments conducted as a result of adoption of the Building Energy Saving Ordinance, (BESO).

Economic Development:

This project will pilot new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Consumer Appeal:

Greater deployment of AECs will increase consumer familiarity and comfort with ZNE homes and communities, increasing the likelihood of consumers choosing to live in an AEC.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $370,990	
EPIC Funds Encumbered: $1,480,111		**EPIC Funds Spent:** $593,860	
Match Partner and Funding Split: Energy Solutions: $500,084 (12.3 %) City of Richmond: $550,000 (13.5 %) Olivine, Inc.: $40,050 (1.0 %) Richmond Community Foundation: $1,500,000 (36.9 %)		**Match Funding:** $2,590,134	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-076 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: This agreement was adopted at an Energy Commission Business Meeting on May 17, 2016. This agreement was signed and executed on June 8th, 2016. A group kick-off meeting with all Advanced Energy Community award recipients was held in September 2016.

156. EPC-15-077

Project Name:

Huntington Beach Advanced Energy Community Blueprint

[EPC-15-077]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Irvine campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/15/2016 to 7/31/2018

Program Area and Strategic Objective:

Market Facilitation

S16: Collaborate With Local Jurisdictions and Stakeholder Groups in IOU Territories to Establish Strategies for Enhancing Current Regulatory Assistance and Permit Streamlining Efforts That Facilitate Coordinated Investments and Widespread Deployment of Clean Energy Infrastructure

Issue:

Electrical utilities face challenges with aging infrastructure and load capacity constraints that limit where certain technologies can be installed. Disadvantaged communities face their own set of challenges that often prevent their clean energy needs from being met. While integrated, community-scale systems that combine local renewable energy sources, energy storage, and control technologies could provide benefits to help the utility and community, new tools and approaches are needed to design these systems in a manner that meets the needs of both groups.

Project Description:

This project is designing an integrated energy system to transform the disadvantaged Huntington Beach community of Oak View, into an advanced energy community (AEC). UCI is working closely with ComUNIDAD, a community organization, to ensure the community needs are factored into modeling scenarios. The project team is developing new design tools that simulate an integrated energy infrastructure on a community-scale, expanding the capability from the existing single-building design tools. Multiple case studies will be evaluated for the most optimal energy technologies and business and financial models that align the community's various energy needs within the constraints of the existing electricity infrastructure.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving this goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project will reduce the time and costs needed to bring community-scale IDER projects to a shovel-ready state.

Economic Development:

This project will pilot new approaches and develop new planning tools that can increase the financial attractiveness and overcome some of the common obstacles of deploying community-scale IDER projects, especially in disadvantaged communities. Combined, these can lead to increased investment energy savings and investment in the community.

Consumer Appeal:

Greater deployment of advanced energy technologies at a community scale will increase consumer familiarity and comfort with Zero Net Energy homes and communities. This will increase the likelihood of consumers choosing to live in communities deploying advanced energy technologies.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $508,226	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $337,423	
Match Partner and Funding Split: Southern California Edison: $200,000 (8.7 %) County of Orange/City of Huntington Beach: $152,900 (6.6 %) Altura Associates, Inc.: $62,000 (2.7 %) National Renewable Energy Laboratory (NREL): $200,000 (8.7 %) Southern California Gas Company (SoCalGas): $150,000 (6.5 %) The Regents of the University of California, Irvine Advanced Power and Energy Program: $46,098 (2.0 %)		**Match Funding:** $810,998	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 4
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The project team completed the development of two new tools: the Smart Community Microgrid Energy Management Model as well as the AEC Design and Planning Tool, used to simulate and evaluate impact and performance characteristics of a suite of clean energy technologies in order to determine the most optimal measures and technologies for the Oak View AEC. The team is currently exploring different innovative financing models and working with the city of Huntington Beach to develop a streamlined permitting plan and continues to actively engage with the community on outreach activities. Additionally, the project team is working with the local community college organization to develop a workforce development program to recruit residents of Oak View to help install solar PV in the community.

157. EPC-15-078

Project Name:

Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector

[EPC-15-078]

Recipient/Contractor:

The Regents of the University of California, Berkeley

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	5/30/2016 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Adaptation to climate change is critical to ensure a robust electricity system for California. However, little is known regarding system-wide effectiveness of current electricity sector approaches to managing climate change-related risks. Similarly, little is known regarding barriers faced by electricity sector stakeholders' implementation of adaptation measures. This research develops a framework for systematically identifying barriers to climate adaptation and develops a metric to evaluate the performance of California's electricity sector in terms of adaptation to climate change.

Project Description:

Researchers are developing a framework for assessing climate change risk and adaptation practices in the electricity sector, identifying perceived barriers to execution of resilience strategies, and delineating practices that are currently being implemented in the electricity sector. These initial activities form a basis for developing a dynamic model for long-term resilience planning that can identify optimal strategies to hedge against climate risks associated with future climate scenarios for California. The analysis also considers how independently initiated adaptation efforts perform relative to a system-wide strategy, with an eye toward identifying lingering electricity sector vulnerabilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Researchers are developing methods to account for risks, plan for resulting adaptation, and account for the barriers that might exist in the system. The results of research are intended to improve on the general knowledge of framing climate-related policies under uncertainty and to examine all aspects of the adaptation planning process: decision-makers involved, stages of decision processes, and the institutional contexts where the decision-makers develop the decision processes. The results can inform technology choice investment and deployment, to the extent that those choices are made with consideration of climate risks.

CPUC Proceedings addressing issues related to this EPIC project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 1e, 2a, 3e, 3h

Lower Costs:

The research results may be used to improve on policies by ensuring the affordability of electricity production. The financial and operational-risk minimization method developed for this study is focused on eliminating barriers to climate change adaptation, ensuring affordability of the production and supply side due to better planning and accounting for extreme events.

Greater Reliability:

The proposed work is providing a better understanding on how and where adaptation is needed, as a function of uncertain climate change predictions, and barriers that are likely to arise and thus will ensure the resilience and greater reliability of the power sector in the face of extreme events.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $350,000		**EPIC Funds Spent:** $48,202	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 8: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-078 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team's efforts to interview and survey key stakeholders in California's electricity sector has been challenging due to active involvement of key IOU stakeholders in developing institutional positions coupled with ongoing regulatory work in the area of electricity sector adaptation. However, review of administrative documents filed with the State of California has proven a rich source of material for providing input to model development related to adaptation barriers, metrics to gauge resilience, and system-wide performance of adaptation measures. Additionally, ongoing surveys of ratepayers' impressions of climate adaptation measures and costs are providing data to the research team for use in the modeling effort.

158. EPC-15-079]

Project Name:

Advanced Renewable Energy Storage and Recycled Water Project

[EPC-15-079]

Recipient/Contractor:

Victor Valley Wastewater Reclamation Authority (VVWRA)

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/13/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Several California wastewater treatment plants have on-site power generation systems fueled by biogas. However, many of these systems are unable to respond to variable onsite electrical loads and this can result in tripping off a facility's wastewater treatment equipment. This results in shut downs of the onsite power generation system resulting in increased power costs and reliance on non-renewable power and a corresponding reduced ability to produce recycled water. An effective power control system is needed to demonstrate that it can reliably collect and store excess renewable electricity generated on site and reduce the cost and increase the availability of producing recycled water.

Project Description:

The Victor Valley Wastewater Reclamation Authority (VVWRA), in partnership with Primus Power, University of California Riverside (UCR), and Anaergia, is demonstrating an advanced, pre-commercial flow battery storage and control system at VVWRA's existing Regional Wastewater Treatment Plant, located in a disadvantaged community outside of Victorville. The project deploys Primus Power's ENERGYPOD flow battery system in a 240 kW/1,200 kWh configuration, managed by a UCR-designed controller system that is optimized specifically for management, generation and storage of renewable energy power. The project hopes to alleviate rapid fluctuations in the wastewater treatment plant's power demand that causes disruption of the disinfection system used to treat recycled water to California standards, resulting in the disposal of approximately 2.5 million gallons of water annually.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project demonstrates an advanced battery storage and control system coupled with on-site renewable energy generation and its ability to control rapid changes in on site power demands. If successful, this project could reduce grid power demand and reduce energy costs to wastewater treatment plants and alleviate disruptions in recycled water production due to high variability of on-site power loads which can cause partial treatment shutdowns. The project results could be applicable to other wastewater treatment and industrial plants in California.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1h, 3c, 4c

Lower Costs:

This project uses a battery storage system combined with an advanced controller to enable the wastewater treatment plant to accommodate variable loads, increase onsite renewable power production, and substantially reduce its reliance on grid power. This project could reduce annual grid power demand by 4.2 million kWh or nearly $473,000 in cost savings to the treatment plant.

Economic Development:

Stored power will be used to meet peak demand on site with 100% renewable energy, reducing grid power consumption by 4,213,416 kWh/yr.

Environmental Benefits:

Under the project, equipment tripping off due to power fluctuations would be curtailed, enabling reuse and water savings of approximately 2.5 million gallons per year. This water could be used by the community in place of fresh water sources.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $220,423	
EPIC Funds Encumbered: $1,734,059		**EPIC Funds Spent:** $127,244	
Match Partner and Funding Split: Victor Valley Wastewater Reclamation Authority (VVWRA): $773,014 (29.3 %) Primus Power Corporation: $129,201 (4.9 %)		**Match Funding:** $902,215	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			

Update:

As of October 16, 2017, the recipient is designing the control system and awaiting delivery of the flow battery storage system. Current issues being evaluated include design of proper control modes to accommodate for battery maintenance cycles and the data transmissions systems regarding the power control software.

159. EPC-15-080

Project Name:

Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies

[EPC-15-080]

Recipient/Contractor:

Thalassa Research & Consulting, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 1/17/2018

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Climate vulnerability assessments in the energy system by utilities have thus far only examined hazards that the utilities are familiar with and that are proximate to their assets. However, what is known from natural disaster research is that hazards can have cascading impacts across sectors. To protect the energy sector from climate disruption, it is crucial to develop tools and methodologies to investigate non-proximate catastrophic and cascading risks in a geographically and context specific manner. This research is a first step in developing such methodologies and tools for the greater Los Angeles region.

Project Description:

This pilot study for electricity sector climate adaptation involves vigorous stakeholder engagement and systems analysis to identify and systematically account for cascading impacts internal to and outside of the electricity sector as well as resilience options. These cascading impacts include climate impacts to supply chains for electricity generation and distribution, disruption to telecommunications that the electricity sector relies on in emergencies, and other impacts that may be initially felt far away but have consequences for California's electricity system. One example of supply chain interruption is that manufacturing facilities in East Asia that produce 500kV transformers, which the California distribution system relies on, are susceptible to flooding and other extreme events linked to climate change. This study pilots a systematic framework for assessing such long-distance linkages that can disrupt electricity services and cause ripple or cascading effects on critical infrastructure in the Greater Los Angeles region. Findings from this project, which includes many diverse stakeholders, could be used to inform planning in other areas of the state.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The research will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by addressing challenges in the state's largest metropolitan area -- the study of societal teleconnections. Societal teleconnections are human-created linkages that connect activities, trends, and disruptions across large distances such that locations can experience negative impacts from faraway places. This study is producing new tools and techniques to assist communities to incorporate climate impacts that are non-local in origin into their traditional climate adaptation and hazard planning. This is the first time that a systematic approach to exogenous risks is being taken for an urban area.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 2a, 3a, 3e, 3g, 4a

Increase Safety:

The tools created in this study, which are being pilot tested in the greater Los Angeles area, can be used to protect the safety of electricity infrastructure from cascading impacts of climate change related events across sectors.

Public Health:

Public health benefits from this study come from mapping the consequences of interlinked hazardous events across sectors to critical infrastructure that protects public health and safety.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $128,188		**EPIC Funds Spent:** $20,240	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 11: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-080 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project held its first multi-stakeholder workshop in late 2016 to assess the vulnerabilities of multiple interconnected sectors. It conducted individual interviews with area experts and energy managers; collected data from those interviews, conducted in spring and summer 2017, and the first workshops were then used in summer 2017 to create a complex map modeling the interconnections, vulnerabilities, and adaptive capacity across the energy, water, transportation, telecommunications, and emergency response sectors in the Los Angeles

region. Based on this model, further analysis of resilience options is ongoing.

160. EPC-15-081

Project Name:

Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity

[EPC-15-081]

Recipient/Contractor:

Ghoulem Research

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/13/2016 to 6/28/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Energy and climate change planning depend on anticipated changes in actual use of technology. Energy sector planning to meet challenges of climate change must incorporate lessons from historical technology transitions. One area in which an ahistorical perspective of energy planning prevails is in demand forecasting models. DFMs provide rough approximations of future household energy use and carbon emissions, but do not treat the dynamism and diversity of residential demand in any detail. Climate change policy requires dynamic, flexible simulation tools to address a range of questions about complex social-technological-environmental system dynamics in uncertain conditions.

Project Description:

Analysis of quantitative and qualitative data sheds light on histories of key energy technology changes, planned and unplanned. Interpretation of these histories will provide examples, principles and insights that can be used in future planning. The research team is producing example scenarios that illustrate the differences that these insights can make in planning and technology design. This research pays particular attention to developing and disseminating this information in usable ways, via dialogue with policy makers and planners, and through communications with other stakeholders. Leveraging insights from historical technology transitions, the research team is designing, deploying and testing a flexible modeling platform with which researchers, utilities, and Energy Commission demand modeling and forecasting staff can draw upon the best available empirical data to simulate dynamic residential demands for AC. This model serves as a proof of concept that might later be broadened to other energy uses and demand sectors.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Results improve the state's ability to estimate timing of technology penetration and accrual of benefits, and costs of desirable residential sector technologies. These results are key to improving the performance of efficiency measures outlined in AB 758 and the California Energy Code. They also support goals of CPUC's Energy Efficiency Strategic Plan, and inform updated estimates of timing and benefits as appropriate. Results portraying penetration and performance of key technologies (e.g., A/C) are expected to be of direct use in the scenario development and demand forecasts used in the Integrated Energy Policy Report.

CPUC Proceedings addressing issues related to this EPIC project:

Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11
Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 5c

Greater Reliability:

This project improves energy demand forecasting, which will lead to greater electricity reliability and lower long-run costs by offering more accurate dynamic models that will result in more effective programs and policies, fostering beneficial technology transitions.

Environmental Benefits:

The study will result in a rigorous model that enables exploration of the human dimensions that could hinder or enable the technologies that are essential in the transition to a deeply decarbonized electricity system.

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $400,000	**EPIC Funds Spent:** $0
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 11: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-081 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team convened in-depth discussions with members from the Energy Commission's Demand Analysis Office, Supply Analysis Office, Building Standards Office, and Research Division to ensure that their modeling and historical energy transitions efforts address needs in those areas. The research team also developed a first-cut implementation of a "Simulation Sandbox", or prototype model to enable exploration of impacts of a number of

human dimensions (e.g., behavior, policy, trends in AC adoption) on residential air conditioning demand. Finally, the team has been in conversation with two utilities regarding possible partnerships involving data sharing.

161. EPC-15-082

Project Name:

Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation

[EPC-15-082]

Recipient/Contractor:

The Regents of the University of California on behalf of the Merced Campus

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/1/2016 to 6/24/2019

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

With the growing concern about greenhouse gases and the resulting effects on the environment and public health, including long-term effects such as climate change, there is an emphasis on clean fuels that do not generate harmful pollutants to produce energy. Therefore, low-cost efficient hydrogen production from renewable sources such as biogas is an important challenge that needs to be addressed if it is going to play a major role in satisfying our future clean energy needs.

Project Description:

The project demonstrates operation of a microplasma array reactor converting a mixture of carbon dioxide and methane (two potent greenhouse gases) to synthesis gas, which could be combusted in gas turbines to produce electricity with very low emissions. The effort builds and characterizes a microplasma reactor ignited by high voltage nanosecond pulses to determine dependence of conversion rate, selectivity, and energy efficiency on plasma operating parameters. A performance model will be developed to optimize the conversion process and design an array reactor comprised of several individual reactors to demonstrate scale-up.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project provides an improved understanding of how various operating parameters affect the conversion efficiency of microplasma array reactors for conversion of biogas to synthesis gas. The production of hydrogen from biogas will advance California's ability to produce clean energy from renewable resources by consuming greenhouse gases, thereby reducing the impact of electricity generation on climate change, the environment, and public health.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 4a

Environmental Benefits:

The production of syngas from a biogas using a low-temperature microplasma is more energy-efficient compared to a syngas production by gasification or pyrolysis and would allow for energy savings. Furthermore, syngas produced from renewable resources produced very low emissions and reduces the carbon footprint from electricity generation.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $35,171	
EPIC Funds Encumbered: $200,000		**EPIC Funds Spent:** $38,380	
Match Partner and Funding Split: The Regents of the University of California, Merced: $47,199 (19.1 %)		**Match Funding:** $47,199	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 45 out of 45 bidders	**Rank of Selected Applicant/ Bidder:** Group 11: Ranked # 5
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The low temperature microplasma reactor was installed and tested using a mixture of inert gases, such as Argon and Nitrogen. In November 2017, the reactor was tested using a mixture of carbon dioxide and methane. Staff conducted a site visit to evaluate the performance of the reactor on November 9, 2017.			

162. EPC-15-083

Project Name: Empowering Proactive Consumers to Participate in Demand Response Programs [EPC-15-083]	
Recipient/Contractor: OhmConnect, Inc.	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 5/18/2016 to 6/28/2019
Program Area and Strategic Objective: Applied Research and Development S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices	
Issue: The market for third-party demand response (DR) is constrained, severely limiting non-utility resources from contributing to the electricity grid. Although a bi-directional grid is now technically possible, neither prosumers (customers who both draw from and contribute to the grid) nor their devices can be integrated into the energy markets. A chicken and egg situation exists where policymakers and regulators will not open up the market for non-utility energy sources, citing a lack of customer interest, while customers remain unaware of how to contribute to the grid.	
Project Description: This project contains three elements to provide data for policymakers and businesses to explore this new market. First, this project determines prosumer (producer/consumer) interest in a third-party demand response market by testing user acquisition via direct and non-direct engagement strategies. Second, experimentation with behavioral and automated users allows analysis of user yield under a variety of conditions and extract a set of shadow curves that can inform how much energy load shifting can be expected under various price incentives. Finally, this project creates a novel solution for using residential telemetry to connect prosumers and their Internet of Things (IoT) devices to the market operators.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: This project provides policymakers and regulators with information to develop the policies and limitations for a third-party demand response market. In addition, a solution for residential telemetry is proposed to empower prosumers to interact effectively with the grid, allowing them to supply electricity and save money.	
CPUC Proceedings addressing issues related to this EPIC project: Smart grid: R.08-12-009 Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11 Distribution Level Interconnection (Rule 21): R.11-09-011 Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002 California Solar Initiative: R.12-11-005 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs	

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 3e

Lower Costs:

This project could reduce electricity costs for participants, permanently reduce the economic overhead associated with interfacing with new grid edge technologies, reduce peak demand on California's energy generation facilities, avoid peak demand energy costs, and provide crowdsourced grid services to meet increased demand, rather than relying on construction of new fossil generators.

Greater Reliability:

This project could reduce the complexity for grid-edge resources (including renewables and storage) to be grid assets, thereby increasing the pool of accessible grid resources, stabilizing the grid by more effectively coordinating demand and supply resources, and enabling grid services to be crowdsourced to balance increased demand.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $33,903
EPIC Funds Encumbered: $3,995,028	**EPIC Funds Spent:** $1,789,516
Match Partner and Funding Split: Schneider Electric USA Inc.: $120,000 (2.0 %) Honeywell, Inc.: $164,000 (2.8 %) OhmConnect, Inc.: $1,593,378 (27.1 %)	**Match Funding:** $1,877,378
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-083 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

OhmConnect has built a user experience when registering, engaging, and interacting with the OhmConnect product. This user experience will be modified in ways to incorporate this project's goals for a subset of users. Those modifications are not covered in this Intellectual Property. During this project, certain portions of this user experience will be exposed in various contexts to the CEC.

Update:

This project is on track. The recipient completed the work to incorporate numerous different transactive signals, including the utility, the CAISO, and EPRI. The recipient has completed the preliminary data modeling process to be used for testing and has successfully completed testing the transmission of telemetry data to EPRI's ftp site at 5-minute intervals. The team also began building the automation required to participate in the CAISO's day-ahead markets. UC Berkeley, the evaluation subcontractor, published results of their initial analysis of customer participation showing that reductions in the program were reliable, had little rebound effect, and were greater for participants using automation than those not using automation.

163. EPC-15-084

Project Name:

Total Charge Management: Advanced Charge Management for Renewable Integration [EPC-15-084]

Recipient/Contractor:

Bayerische Motoren Werke of North America, LLC

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Smart charging is a means of managing charging within a particular charging or parking event, usually at work during the day or at home during the night. The future electricity grid will face new balancing needs that change throughout the day and night as utilities and grid operators attempt to align renewable generation with customer load. As the grid becomes more dynamic, optimizing vehicle charging will require moving charging from night to day, from hour to hour, or from one grid location to another. California's steadily increasing electric vehicle population with larger capacity batteries combined with the mandates for more renewables require more means for managed vehicle charging.

Project Description:

This project explores the benefits and opportunities of Total Charge Management, where electric vehicle charging is managed across multiple charging events to maximize vehicle load flexibility. The project tests how flexible electric vehicle load can be if managed across a driver's daily or weekly charge events. This flexibility utilizes several pricing mechanisms to estimate the benefits of the Total Charge Management approach. The research develops and evaluates advanced vehicle telematics for utilities and grid operators to align vehicle battery status, driver mobility needs and grid conditions. Collaboration between the grid and the driver can yield a charging load profile that minimizes energy costs by aligning daily and weekly charging events to best meet grid needs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help the state advance the flexibility of electric vehicle charging as a flexible grid resource and vehicle charging cost savings to the driver. Optimal charging load patterns will be identified that can capture grid benefits using a variety of grid price signals. The project will pioneer technology advancement of not only the temporal benefits of controlled charging, but also the possible benefits that can be derived from being able to influence the location of charging.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1g

Lower Costs:

The cost of Plug-in Electric Vehicle (PEV) ownership is estimated to fall by $500 per year through grid service payments and reduced electricity bills for PEV drivers through managed charging. In total, this would provide $4,000 in savings over the 8-year ownership life of a typical vehicle.

Greater Reliability:

Total Charge Management would represent a resource of over 10,000 MWh per day. If 40 percent of that load could be flexibly managed, the following benefits would be realized every day: 3,000 MWh of solar-following load (enough to accommodate 4 million additional solar panels on the grid), and 1,200 MWh of wind-following nighttime load.

Environmental Benefits:

Aligning vehicle charging with renewable energy generation has the potential to reduce carbon emissions associated with vehicle charging by as much as 660,000 metric tons per year, at a scale of 1.5 million vehicles.

Energy Security:

Greater energy security comes from having more diverse distributed resources able to respond to grid needs. The Total Charge Management approach helps utilities and CAISO get more functionality out of electric vehicle load as a grid resource, which contributes to energy security.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $207,398	
EPIC Funds Encumbered: $3,999,900		**EPIC Funds Spent:** $250,374	
Match Partner and Funding Split: Kevala, Inc.: $33,545 (0.8 %) BMW of North America, LLC: $378,386 (8.6 %)		**Match Funding:** $411,931	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 21 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-084 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

The existing iCharge Forward program developed trade secrets related to the vehicle telematics system and software used to administer grid service functionality between BMW's software backend and BMW electric vehicles. These trade secrets will be applied in this CEC project.

Update:

BMW identified seven use cases to test during their pilot demonstration project. 383 participants were enrolled into their pilot and received home area network devices to collect their vehicle charging and meter data. The team has also engaged in discussions with EPRI to implement the transactive energy signal into this pilot. Kevala (subcontractor) completed the analysis of the Locational Marginal Price data to identify grid efficiency improvement opportunities. The analysis was used in a developed tool to estimate cost savings from shifting charging times at night, during the day, or over multiple days.

164. EPC-15-085

Project Name:

San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project

[EPC-15-085]

Recipient/Contractor:

Center for Sustainable Energy

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

California has set goals for 50% of existing publicly-owned municipal buildings to be Zero Net Energy (ZNE) by 2025, and for 50% of existing commercial buildings to be ZNE by 2030. Public agencies are in a unique position to demonstrate ZNE and integrated demand side management solutions, and to share lessons learned with other public agencies and the private sector to spur continued growth in these markets. Cost-effective pathways to achieving ZNE through maximum energy efficiency paired with integrated approaches are not widely proven. Further demonstration and analysis is needed to determine market viability and long-term sustainable savings, particularly in the municipal sector.

Project Description:

This project integrates pre-commercial energy efficiency measures, building automation and control systems, and behind the meter solar photovoltaic in three existing public libraries in San Diego. The project also evaluates the addition of energy storage. In addition, the project engages in a multiyear, flexible, and transparent collaboration to uncover, test, verify and publicize strategies for integrating energy efficiency, energy storage, solar photovoltaics, and other demand side resources to achieve near zero net energy and cost-effectiveness.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Combining energy efficiency and building automation with solar photovoltaics and storage systems can result in an integrated approach capable of meeting the State's energy efficiency goals and providing demand response to provide grid flexibility. As the commercial sector, and local governments in particular, are risk averse, being able to demonstrate an integrated approach and document performance and benefits and costs without disrupting municipal operations is key to encouraging greater adoption of the technologies. The successful implementation of the technology will help other local governments and the commercial building industry budget, plan and prioritize these types of projects for existing building ZNE upgrades ahead of the state's 2030 requirements.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs:

The project could reduce energy and demand costs by integrating a package of energy efficiency and demand reducing technologies. CSE estimates that the project will save the City of San Diego approximately $75,000 annually.

Greater Reliability:

The presence of onsite renewable energy generation coupled with integrated efficiency and management technologies will allow commercial and municipal buildings to reduce grid consumption and shift load usage during peak energy demand. Results of the project will allow the commercial sector to increasingly participate in demand response programs that increase grid reliability and provide additional revenue for participating customers.

Environmental Benefits:

The project could potentially reduce building electricity consumption by approximately 932,000 kWh and reduce utility requirements to meet peak demand with fossil fuel powered peaker plants. This can potentially offset approximately 531,000 pounds of CO2e per year.

Public Health:

The reduced energy consumption from the libraries will offset 186 lbs of NOx per year and help mitigate the energy impacts of providing "cool zone" services to the community during extreme temperature days in the summer months.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $313,516	
EPIC Funds Encumbered: $2,715,516		**EPIC Funds Spent:** $208,635	
Match Partner and Funding Split: San Diego Gas & Electric Company: $60,000 (1.8 %) City of San Diego: $482,000 (14.8 %) San Diego Green Building Council: $1,568 (0.0 %)		**Match Funding:** $543,568	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The recipient (CSE) was awarded a Master Services Agreement with the City of San Diego at their August 2017 City Council Meeting. CSE has also finalized their agreement with the subcontractor, Sustainability Matters. CSE continues to evaluate the libraries and develop a preliminary list of efficiency measures. They anticipate baseline monitoring to begin in Spring of 2018 with installation of the efficiency measures to follow.

165. EPC-15-086

Project Name:

Substation Automation and Optimization of Distribution Circuit Operations

[EPC-15-086]

Recipient/Contractor:

The Regents of the University of California, Irvine

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/22/2016 to 2/28/2019

Program Area and Strategic Objective:

Applied Research and Development

S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020

Issue:

Distributed and renewable energy are being introduced and integrated into the grid and controllable loads are controlled and operated individually by the owners under an interconnection agreement with the utility. As the number of these resources increases, it becomes necessary to manage and control these resources as a single entity for grid reliability and to meet performance targets.

Project Description:

This project will provide enhanced electrical substation control over grid assets, including generation resources, energy storage and controllable loads. This will improve grid management at the distribution level through the modification, implementation, and simulation of a Generic Microgrid Controller (GMC). Different tariffs and interconnection agreements will be assessed for a portfolio of scenarios to address the participation of DERs in the market. In addition, a fictitious retail/distribution market will be developed and assessed.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs by developing a control strategy to manage high penetrations of distributed energy assets (including generating resources, energy storage and controllable loads) as a single unit through the modification, implementation and simulation of a Generic Microgrid Controller (GMC) at a substation. The GMC will manage dispatchable loads and generation, reducing stress on the grid by shedding unnecessary loads and dispatching generation as required. The GMC also includes an economic dispatch feature that determines the least expensive solution to serve all the loads.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1g, 3a, 3f, 5f

Lower Costs:

The controller will optimize dispatch of the available resources on the distribution system, which will lower operation costs by dispatching and utilizing available assets so they will neither be stranded nor under-utilized.

Greater Reliability:

The controller provides visibility into the distribution system and will enable the operators to identify any issues quickly and respond to maintain system reliability.

Increase Safety:

Enhancing automation and control capabilities of a substation allows for quick resolution of safety issues. Controlling load further allows for ensuring that the critical loads are being served in case of an emergency.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $124,021	
EPIC Funds Encumbered: $932,718		**EPIC Funds Spent:** $331,241	
Match Partner and Funding Split: OPAL-RT Corporation: $35,978 (3.4 %) The Regents of the University of California, Irvine Advanced Power and Energy Program: $76,303 (7.3 %)		**Match Funding:** $112,281	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 23 out of 29 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-086 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient purchased and commissioned OPAL-RT hardware and software to model a substation and two 12kv distribution circuits feeding homes previously part of the Irvine Smart Grid Demonstration (ISGD) project. Models of the two circuits were developed and load flows were run. Additionally, the development of more detailed residential distribution energy resources were modeled for integration into the 12kv distribution circuit models. The recipient documented the approach and lessons learned from setting up the OPAL-RT hardware and software and developing and verifying the model (including the substation and circuits).

166. EPC-15-087

Project Name:

Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings

[EPC-15-087]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 12/31/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Chemical water treatment systems used to reduce scaling and inhibit biological degradation have typically been used in large central plants, industrial refrigeration plants, and other large cooling systems. Non-chemical treatment systems have the potential to reduce consumption of water by allowing more cycles of concentration in this equipment, as well as reducing the quantity and toxicity of discharge to wastewater treatment plants. The Vortex Process Technology has the potential to increase energy efficiency and reduce water use but there are uncertainties associated with long term performance, effectiveness, energy savings and cost effectiveness.

Project Description:

This agreement is funding the full-scale deployment demonstration of the Vortex Process Technology in cooling towers of commercial buildings. This technology has been used successfully in Europe and will be testing in California to address state specific goals for water and energy savings.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Non-chemical water treatment has the potential to reduce water use, improve quality of water discharged to wastewater stream, reduce scaling in condenser water piping, and increase energy efficiency of chilled water plants. The Vortex technology removes calcium carbonate from recycled cooling water and improves viscosity. By removing calcium carbonate physically it reduces the amount of chemicals used in calcium removal methods.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 1h, 4c, 4d, 4e

Lower Costs:

This project has the potential to reduce energy and water costs in commercial buildings. The energy savings is due to improved cooling tower efficiency and heat transfer in cooling equipment. This project is estimated to reduce electricity use by 3 to 5 percent, excluding embedded energy savings from reduced water pumping and water treatment. The water savings is due to allowing higher cycles of concentration and supply water usage.

Increase Safety:

Reduces use of hazardous chemicals, thereby reducing exposure of maintenance personnel.

Environmental Benefits:

As less chemical are used in the treatment of the water in cooling towers, this could reduce discharge of toxic materials into wastewater stream.

Public Health:

Reduces exposure to toxic chemicals related to their manufacture, transport, handling, and disposal or use.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $485,121	
EPIC Funds Encumbered: $1,999,995		**EPIC Funds Spent:** $382,981	
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $324,990 (13.3 %) Cypress LTD: $125,000 (5.1 %)		**Match Funding:** $449,990	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 6
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-087 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			

Update:

Staff met with the recipient and conducted a site visit to AMGEN, one of the demonstration sites, on November 8, 2017. The recipient provided cooling tower drawings and utility data for the demonstration sites. Upcoming tasks include preparing site specific equipment designs.

167. EPC-15-088

Project Name: Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings [EPC-15-088]	
Recipient/Contractor: Kennedy/Jenks Consultants, Inc.	
Investment Plan: 2012-2014 Triennial Investment Plan	**Project Term:** 6/30/2016 to 3/31/2020
Program Area and Strategic Objective: Technology Demonstration and Deployment S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies	
Issue: The secondary biological wastewater treatment process method is accomplished by aerating wastewater and is very energy intensive, typically accounting for 40 to 60 percent of the total wastewater treatment plant (WWTP) electricity consumption. Achieving a higher amount of removal of organic material before the aerated activated sludge process provides a breakthrough opportunity to reduce electrical power demand. However, biofiltration as an advanced primary treatment method is an emerging technology for removal of total organic load, both soluble and particulate material, and has never been implemented full scale at WWTPs.	
Project Description: The project is demonstrating that Biofiltration is a technically viable and commercially attractive approach to achieve significant electrical energy savings at wastewater treatment plants. This project is quantifying the electrical energy reduction and water savings that can be achieved by Biofiltration based on demonstration results at the Linda County Water District plant. This project will provide the cost and performance data to evaluate the benefits from a sustained, full scale validation testing, including quantification of electrical energy savings, determination of water savings, organic solids removal efficiencies, operation and maintenance and design criteria, independent monitoring and verification and technology transfer.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: Biofiltration as an advanced primary treatment method could reduce the aeration electrical energy needed for secondary treatment, increase energy production in the anaerobic digester from the removed organic material and increase existing secondary treatment capacity and forestall the need for future treatment plants. Based on pilot studies outside of California, Biofiltration has shown the potential to decrease aeration power by 45 to 60 percent, increase gas production from 25 to 40 percent and increase treatment capacity by 50 percent.	
CPUC Proceedings addressing issues related to this EPIC project: Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs	

Applicable Metrics: CPUC Metrics- 1f, 1h, 4c

Lower Costs:

Aeration power requirements are estimated to decrease by approximately 45 to 60 percent compared to conventional treatment methods. Assuming 25% implementation of the technology, it is estimated that the annual electrical energy and cost savings for the ratepayers in California will be 110,000,000 kWh and $12,900,000 per year, respectively.

Economic Development:

Biofiltration is an emerging technology that would avoid/minimize the considerable capital costs and land usage of conventional primary and secondary treatment units (compared to Biofiltration as an APT).

Environmental Benefits:

Biofiltration will provide improved environmental sustainability of wastewater treatment through reduced energy demand and carbon footprint, as well as improvements to recycled water quantity and quality. Reduced recycled water costs should assist the State in reaching goals for increasing use of recycled water.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $442,698
EPIC Funds Encumbered: $1,306,185	**EPIC Funds Spent:** $73,375
Match Partner and Funding Split: Professor George Tchobanoglous, Ph.D., P.E. : $12,000 (0.8 %) WesTech, Inc.: $194,050 (12.3 %) Linda County Water District: $24,700 (1.6 %) Kennedy/Jenks Consultants: $41,000 (2.6 %)	**Match Funding:** $271,750
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-088 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

The method for backwashing the FlexFilter as well as the unique nature of the engineered bladder that provides a porosity gradient are both patented features of the FlexFilter. The applicable US Patent numbers are 7,223,347 7,143,781 as well as 7,435,351 and application 13/534,822. Any design criteria or specific information about the pilot unit must remain confidential.

Update:

Kennedy/Jenks is competitively bidding the installation of the demonstration system at Linda County Water Department's Wastewater Treatment Plant and has begun the evaluation of the baseline conditions.

168. EPC-15-089

Project Name:

Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases

[EPC-15-089]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/22/2016 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Operational Tools, Models, and Simulations to Improve Grid Resource Planning

Issue:

Significant work to-date has addressed communication standards for smart inverter distributed energy resource systems in general, but communication standards to support large scale energy storage systems are still in their infancy. Current protocols are based on a global effort to define standard functions for smart inverters. However, implementation by manufacturers and evaluation within field demonstrations have been primarily focused on solar photovoltaic systems. Battery storage functions are included in the photovoltaic profiles, but there is a need to expand and refine the function set with energy storage in mind.

Project Description:

This project supports open communication with energy storage systems by focusing on a Distributed Network Protocol (DNP3) for smart inverters. The Recipient will develop tools to make adoption of DNP3 for communication and controls of distributed energy resource (DER) systems simple and seamless. An ancillary benefit will be to improve communications with stand-alone energy storage systems and control of other inverter-based devices, including solar and plug-in electric vehicle fleets. The approach is to evaluate the current state of communications to DERs and address any gaps in functionality, work with the DNP3 Users Group to update the existing energy storage and solar specifications to support the most advanced energy storage use cases, create an open-source DNP3 client to simplify product development of smart inverters, and develop the appropriate conformance testing tools to ensure interoperability.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

By updating the DNP3 protocol the California grid capability will be advanced through enabling greater flexibility on the grid in the form of greater utilization of energy storage systems. Increased grid flexibility with the addition of energy storage systems overcomes a major barrier that will allow the utility's infrastructure, operations, and energy security to move toward the State's energy goals.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011

Applicable Metrics: CPUC Metrics- 1a, 1h, 1i, 2a, 3a, 5a

Greater Reliability:

This project will expand the capability of utilities to control energy storage systems, which provides them with opportunities to maximize flexibility of energy storage systems.

Environmental Benefits:

Environmental benefits of this project would stem from realizing the advanced use cases for energy storage that help reduce peaks and minimize the need for generators to provide support at peak times.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $187,517	
EPIC Funds Encumbered: $873,516		**EPIC Funds Spent:** $146,460	
Match Partner and Funding Split: Electric Power Research Institute (EPRI): $105,228 (8.5 %) MESA Standards Alliance: $75,000 (6.1 %) SunSpec Alliance: $130,100 (10.5 %) Xanthus Consulting International: $50,500 (4.1 %)		**Match Funding:** $360,828	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 23 out of 29 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-089 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In 2017 the team reviewed where communications protocols were limiting the capabilities of energy storage systems and developed solutions with industry stakeholders. They received input from a 150+ person international advisory group representing utilities, manufacturers, and researchers. Gaps were identified by the team, shared with major stakeholder groups, and solutions determined jointly. The result is that all communication protocols for solar and storage systems will realize these benefits in future updates to these standards enabling greater flexibility on the grid. The project team then focused on the protocol used by utilities to

control large scale storage systems (DNP3) and applied these changes. The published update is expected by end of 2017. In 2018 the team will streamline the adoption of this update to DNP3 through tech transfer, open source tools, and compliance testing.

169. EPC-15-090

Project Name:

Integrated Distributed Energy Resources Management System (iDERMS)

[EPC-15-090]

Recipient/Contractor:

The Regents of the University of California (UC Riverside)

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/22/2016 to 2/25/2019

Program Area and Strategic Objective:

Applied Research and Development

S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020

Issue:

The number of distributed energy resources (DER), such as solar photovoltaic panels, electric vehicles, energy storage devices, and flexible loads has increased exponentially in the past few years. Traditional distribution automation systems designed under a centralized control scheme can no longer handle the task of coordinating the control of thousands of heterogeneous devices.

Project Description:

This project will develop an Integrated Distributed Energy Resource Management System (iDERMS) to coordinate the operations of a large number of DERs. In the normal state, large amounts of DERs consisting of flexible loads, renewable resources, and energy storage systems will be aggregated together. The DERs will be coordinated to optimize power flow and respond to a distribution system operator run electricity market. In an emergency state, Volt-VAR control will be used to provide any needed reactive power support to the distribution grid with smart inverters. The final restorative state will be developed to use high levels of renewable resources to make the distribution network a self-healing grid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State's statutory energy goals by designing a three-state decentralized distribution system control framework to create virtual generators by aggregating distributed energy resources. There aggregated virtual generators are capable of providing energy shifting, frequency regulation, and flexible ramping services to mitigate the uncertainties brought by renewable generation outputs. Therefore, the Integrated Distributed Energy Resources Management System (iDERMS) has great potential in increasing renewable penetration potential, reducing GHG emissions and making energy storage systems cost competitive with centralized power plants.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1g, 3a, 3f, 5a

Lower Costs:

The project team has estimated that the iDERMS will yield annual electricity saving of 4,840 GWh, distribution system peak reduction of 450 MW, and quantifiable electricity cost reduction of $360 Million per year.

Environmental Benefits:

The project team has estimated this project will yield annual greenhouse gas emission reduction of 2.2 million metric tons.

Public Health:

It is estimated that the reduced electrical generation from fossil fuel power plants due to increased distributed renewable generation will result in cleaner air. This will lead to improvement in health for California residents.

Energy Security:

This project enables higher renewable penetration, reduces reliance on foreign oil, and enhances energy security for California.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $77,873	
EPIC Funds Encumbered: $1,119,437		**EPIC Funds Spent:** $145,524	
Match Partner and Funding Split: Lawrence Livermore National Laboratory: $254,161 (14.1 %) PetaPower, Inc.: $49,500 (2.7 %) eMIT, LLC: $100,024 (5.5 %) University of California, Riverside: $282,742 (15.7 %)		**Match Funding:** $686,427	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 23 out of 29 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-090 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The project team continued to work on developing a market coordination model. The team completed studies on the rules, design, and operational elements of a Distribution System Operator managed electricity market. The team is now working on adding distribution system operations to the model. This analysis includes evaluating computational strategies to develop optimal solutions to distribution system operations.

170. EPC-15-091

Project Name:

Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System [EPC-15-091]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 12/30/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Current irrigation practices for California fruit crops, such as grapevines, is to apply water according to a weekly schedule with a fixed quantity of water each time, or based on climate conditions, regardless of the actual water needs of the plants. This method results in over-irrigation and is often detrimental to the quality of the fruit or its yield.

Project Description:

This project addresses the specific problem of fixed watering schedules for agricultural crops by demonstrating a new irrigation system that saves both water and energy. This system performs on the principle that crops are watered only when needed, and not just on a set time-interval. The additional benefits of this system are the improved quality and yield of the crop. The goals of this project are to demonstrate the Plant Aware Irrigation (PAI) system on perennial crops, quantify the energy and water savings for at least 12 months, and engage customers' feedback of perceived benefits while acknowledging their concerns. The technology is being demonstrated in three vineyards.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Currently, crops are irrigated on a set schedule regardless of whether water is needed or not needed. In this project, the technology being demonstrated precisely detects when crops need water, triggering irrigation only when needed. Delivering less water reduces pumping and the associate energy use, lowering GHG emissions. Expanded deployment to other California perennial fruit crops has the potential to save significant amounts of energy and water, moving the state closer to its energy goals.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 1h, 3g, 4a, 4c

Lower Costs:

The project could lower costs to growers through reduced water consumption and reduced energy consumption from pumping well water. An estimate of 30 percent water savings per farm on average would lead to statewide water savings of about 500,000 acre-feet per year (or 160 billion gallons per year). This corresponds to about 220 million kilowatt hours of electricity savings, most of which will happen between the months of May and September, the period of greatest stress on the electricity grid.

Environmental Benefits:

The project achieves environmental benefits through reduced water consumption. Water is currently wasted by watering crops on a regular schedule while this technology will save water by watering based on plant needs. Reduction in water use cuts down the need for water pumping and associated energy use, thus resulting in lower greenhouse gas emissions.

Consumer Appeal:

Limiting water to wine grapes could produce higher quality grapes as measured by earlier berry ripening, improved sugar per berry and individual berry weight, resulting in higher grade wines.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $307,688	
EPIC Funds Encumbered: $1,097,990		**EPIC Funds Spent:** $61,980	
Match Partner and Funding Split: Fruition Sciences: $331,000 (23.2 %)		**Match Funding:** $331,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-091 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

In 2017 the contract with primary subcontractor Fruition Sciences was executed. Site-analysis measurements were conducted at all three vineyards where the PlantAware technology is being demonstrated to determine fitness for the project and to enable equipment selection. Assessment technologies included spacial and physiocap measurements that assess shoot quantities and diameters. The project team met with vineyard personnel to get a basic understanding of each general vineyard plot layout and operations approach, and to identify specific plots allocated to the project. M&V equipment was identified and ordered. PlantAware sap sensors were installed and initial measurement data were collected. As of yearend, all water meters are installed and water use measurements are being taken to establish background water use. A TAC meeting was held in conjunction with a site visit in Napa County.

171. EPC-15-092

Project Name:

Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal

[EPC-15-092]

Recipient/Contractor:

Tomorrow Water dba BKT United

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Many of California's groundwater aquifers are unused for drinking water due to contamination by nitrate and/or perchlorate. Existing groundwater treatment methods generate a concentrated brine stream that requires disposal measures rendering it unsuitable for inland sites. Existing biological treatment alternatives do not generate a brine stream but are very energy intensive. A cost effective, low energy treatment option for contaminated ground water resources is needed for inland communities in Central and Southern California to increase water supply.

Project Description:

The project is demonstrating a bio-filtration system that uses 15-20 percent less energy when compared to conventional technology used to treat contaminated water to meet drinking water standards or for use in industrial and/or agricultural applications. The technology is being demonstrated in the City of Barstow and the focus is removal of nitrate, perchlorate and turbidity from the wastewater. The project includes water testing to secure Conditional Acceptance as a Title 22 drinking water treatment technology from the State Water Resources Control Board.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project is anticipated to offer a lower energy alternative for treatment of the most common contaminants preventing use of ground water resources in California. The project could enable the development of new water supplies in many of the drought challenged regions of the State. Local treatment of impaired groundwater will provide additional energy benefits by eliminating the cost associated with transporting clean water from distant sources. The BioFiltration treatment technology has the potential of efficiently treating contaminated water in an energy efficient manner while generating no waste brine.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 4a, 4d

Lower Costs:

The BioFiltration system in this project yields cost savings through reduced energy use because the media used in the system is backwashed by gravity rather than pumping. Additionally, recirculation pumping, common in other biofiltration systems that use activated carbon, requires regular interval replacement. The BKT BioFiltration technology uses a floating media and does not require regular replacement. The recipient estimates a 70 percent reduction in electricity costs and a 20 percent reduction in operating costs compared to typical up-flow treatment systems .

Environmental Benefits:

This low energy system treats contaminated water so that it can be used as drinking water supply. This can provide a source of local drinking water and eliminates the need to transport clean water from distant sources. The system also does not generate brine which is a byproduct waste which typically require landfill disposal.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $9,920
EPIC Funds Encumbered: $1,722,072	**EPIC Funds Spent:** $951,622
Match Partner and Funding Split: Kana Engineering Group, Inc.: $100,000 (4.7 %) City of Barstow: $75,000 (3.5 %) Khalil Kairouz Consulting: $5,000 (0.2 %) Eurofins Eaton Analytical: $49,860 (2.3 %) Tomorrow Water dba BKT United: $172,637 (8.1 %) MWH: $15,000 (0.7 %)	**Match Funding:** $417,497
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-092 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The Recipient has finished design, assembly and installation of the Bio-Filtration Vessel system. The system is undergoing commissioning before operation with the full flow of influent planned for the demonstration. The project's Monitoring and Verification Plan has been finalized. The Recipient has met with State Water Resources Control Board to size the filtration and disinfection unit for future Conditional Permit Acceptance.

172. EPC-15-093

Project Name:

Accelerating Drought Resilience Through Innovative Technologies

[EPC-15-093]

Recipient/Contractor:

Water Energy Innovations, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/13/2016 to 10/31/2018

Program Area and Strategic Objective:

Market Facilitation

S20: Accelerate the Deployment of Energy Technologies in IOU Territories Through Innovative Local Planning and Permitting Approaches.

Issue:

California's historic drought has been especially severe in the San Joaquin Valley and rural communities have been significantly affected. Immediate solutions are needed to support the communities. Unfortunately, traditional water infrastructure solutions are expensive, often energy intensive, and have long lead times for implementation which makes it difficult to quickly identify and finance the best technologies that save water and energy for a specific project site.

Project Description:

This project is pulling data from county utilities to find what industries had the highest energy impact during the drought. Then, the project will provide input on what water-energy technologies would have had lessened the impact during future droughts. Finally, the team will assist local jurisdictions in implementing strategies and measures that reduce development times and costs, as well as recommending innovative financing mechanisms and cutting edge water-energy technologies. The recipient is piloting the model for Tulare County in an effort to develop a roadmap for implementation of the model in other similar rural agricultural communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop a comprehensive regional drought resilience plan that will match high potential energy and water efficiency technologies with potential adopters. This will lead to greater reliability and drought resiliency while reducing agricultural energy demand.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 3e, 4c

Lower Costs:

The project is helping to lower costs by streamlining the deployment of drought resilient technologies that reduce the amount of electricity needed to collect, transport, treat and deliver water to end use customers.

Greater Reliability:

The project is developing a replicable model that matches advanced water and electricity

technologies with high priority projects in California's rural agricultural communities. The model integrates streamlined permitting and approval processes and finance mechanisms, enabling the adoption of innovative technologies that increase water and electricity reliability.

Consumer Appeal:

The project is creating strategies, toolkits and technology portfolios that will be easily transferrable to entities in rural and agricultural communities. This project is also assessing agricultural, residential and non-residential market and customer barriers to adopting advanced water and energy technologies.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $178,824	
EPIC Funds Encumbered: $1,000,000		**EPIC Funds Spent:** $330,347	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-093 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient is finalizing a baseline water-energy profile for Tulare County. Once this is completed, the recipient will be able to make targeted recommendations from a portfolio of residential and industrial water technologies that meet site specific needs while saving water and energy. Additionally, stakeholders including SCE, water agencies, and local governments are currently engaged with the project to look for opportunities for streamlined permitting and innovative uses of these technologies.

173. EPC-15-094

Project Name:

Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities [EPC-15-094]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan 2015-2017 Triennial Investment Plan	6/15/2016 to 3/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings

Issue:

California's zero net energy and global climate change goals will require a huge increase in building and end-use system efficiency. The immediate goal of all new homes to be zero net energy by 2020 will require a better understanding of cost effectiveness, technical feasibility and operational performance. Large scale field demonstrations that show integrated technology pathways in multiple climate zones are needed to demonstrate cost effectiveness, monitor and verify energy and cost savings and other benefits, and evaluate new technology and integration strategies, such as community solar and impacts on the distribution grid.

Project Description:

This project is demonstrating cost-competitive ZNE design strategies that combine occupant needs with technology solutions to create new pathways for residential ZNE communities. The project's goals are cost effectiveness for the customer, affordability, overcoming customer apprehension, establishing a track record of new technology for builders, enabling distribution grid integration, creating a planning process for ZNE communities, evaluating community solar and evaluating the impact of future changes to ZNE cost effectiveness. This project also aims to understand the operation and energy use of the unregulated loads.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This research will provide new methodologies for integrating occupant and technology needs into a cost effective and scalable zero net energy (ZNE) strategy. The project will analyze and define the savings and market barriers in residential communities and provide new, valuable performance data and models from the demonstrations. The products from this research will be essential to identifying the successes and barriers to meeting the ZNE goals for residential communities.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)
Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 4a

Lower Costs:

Zero net energy (ZNE) homes could result in significant savings in money, resources, operation and maintenance, energy, and greenhouse gas emissions. Both ratepayers and customers benefit from implementing ZNE residential communities. The estimated cost savings related to the energy savings is $1,242/home/year. Over a 50 year life of a ZNE home, this would translate to a net present value of nearly $80,000 in realized value for the homeowners.

Greater Reliability:

This project will provide new data, analysis, and designs for cost effective ZNE residential communities, which will improve the reliability with the integration of energy efficiency, demand control, and renewable power with buildings and the Smart Grid.

Increase Safety:

ZNE residential communities have the potential to increase safety due to the improved ability to control and integrate buildings' use of renewable power, storage, electric vehicle charging, and the Smart Grid. In addition, many of the networked ZNE technologies have additional monitoring and safety features.

Environmental Benefits:

The recipient estimates that a ZNE home in California will annually reduce electric and gas use by 7000 kWh and 200 therms, respectively (Climate Zone 10 – Riverside). Assuming 80,000 new single and multifamily new homes in California annually, the potential annual savings in energy use translates to as much as 560 GWh and 16 million therms. This is estimated to reduce greenhouse gas emissions per home by 6456 lbs annually (or 3.041 metric tons). If all new homes were ZNE that result in an annual reduction of 24,000 metric tons of GHG emissions).

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,460,838
EPIC Funds Encumbered: 2012-2014 Plan: $3,207,432 2015-2017 Plan: $1,735,377 Total: $4,942,809	**EPIC Funds Spent:** $4,112
Match Partner and Funding Split: De Young Properties: $200,000 (3.1 %) Electric Power Research Institute (EPRI): $309,482 (4.8 %) Meritage Homes Corporation: $500,000 (7.7 %) Southern California Edison: $500,000 (7.7 %)	**Match Funding:** $1,509,482

Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-15-094 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: In 2017 subcontracts with BIRAenergy and UC Davis were executed. Home design plans were developed for Net Zero communities in Clovis and Irvine. The first TAC meeting was held and was attended by all CA IOUs, DoE, EPA and multiple homebuilders. A new greenhouse gas emissions methodology was developed and provided to Energy Commission Efficiency Division staff as part of the evaluation of TDV vs. GHG metric for the 2022 building code. The project team also provided input to Energy Commission Codes and Standards staff for the 2019 Title 24 codes on grid harmonization, factoring project work into new grid harmonization metrics. ZNE packages that are less than 4% above cost for standard single family homes were developed. As of December 2017, the project scope is being revised to focus solely on demonstration sites paying prevailing wage.			

174. EPC-15-096

Project Name:

Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System

[EPC-15-096]

Recipient/Contractor:

American Water Works Company, Inc.

Investment Plan:	**Project Term:**
2012-2014 Triennial Investment Plan	6/30/2016 to 3/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Water utilities across the country struggle with aging pipe infrastructure, resulting in water loss from leaks. The loss of water in the water distribution lines means energy is being wasted because to produce potable water for delivery to customers requires substantial energy associated with treatment and conveyance--or the embedded energy in water. The longer the leak goes unidentified, the already treated water in the pipeline is wasted, along with all the energy used to produce and convey that water. Underground water leaks are difficult to detect and manage.

Project Description:

This project is demonstrating three leak detection technologies to reduce the amount of water lost from leaks and the amount of embedded energy wasted due to these leaks. The technologies tested include satellite imagery leak detection, correlating continuous acoustic monitoring, and flow sensitive pressure reducing valves and will have site demonstrations in four Southern California cities. The Recipient will present achievable and measurable water savings in water distribution systems and show the potential for water and energy savings. An economic analysis of the costs and benefits of the technologies will be developed to assist in considering solutions for water loss reduction and energy efficiency. The project benefits will be quantified through water saved, embedded energy saved and associated greenhouse gas emissions reduced.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will advance the technical knowledge of detecting and preventing underground water leaks and estimating the energy savings associated with the water leak detection/prevention strategies. As a substantial amount of water is loss through leaks, identifying and demonstrating tools to help water agencies monitor, assess and manage their water distribution systems conserves water resources, increases water system reliability, lower emergency and repair costs and reduces water and electricity costs for ratepayers. These benefits will be quantified through the volume of water saved and the embedded energy in the saved water.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 4c

Environmental Benefits:

The technologies demonstrated in this research project could provide information to water agencies on leaks in their system and to take action to repair leaky systems to save water. Water loss due to leaks impacts overall energy use due to the embedded energy associated with treating and transporting water that is no longer available due to leakage.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $222,664
EPIC Funds Encumbered: $1,517,780	**EPIC Funds Spent:** $67,681
Match Partner and Funding Split: American Water Works Company, Inc.: $311,641 (16.3 %) Hazen & Sawyer: $3,000 (0.2 %) Echologics: $76,820 (4.0 %)	**Match Funding:** $391,461
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 7

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-096 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

At the Duarte site, Utilis and Echologics have begun operations in detecting leaks and repairing them. At the Ventura site, flow monitors are being installed in various locations. At the Coronado site, the flow monitoring has detected a broken partially opened zone valve.

175. EPC-15-097

Project Name:

Achieving Zero Net Energy in Multi-family Buildings

[EPC-15-097]

Recipient/Contractor:

Build It Green

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/1/2016 to 3/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

There is a critical need for more research and evaluation of zero net energy multifamily design and construction approaches and practices. Many key design issues remain poorly understood in the multifamily sector, particularly for emerging all-electric heating, ventilating and air conditioning and domestic hot water technologies. These include the performance and economic trade-offs of technology solutions, lack of agreement between design and actual performance for key emerging technologies, and a lack of understanding of how these technologies will impact tenants and property managers.

Project Description:

This project demonstrates the potential of breakthrough electric water heating and space conditioning technologies as a pathway to zero net energy. The project explores the complex, interdependent systems in multifamily buildings and how they work together to achieve zero net energy status for the buildings in a cost-effective manner. Four multifamily buildings, designed to be affordable, are to be evaluated in various stages of design and development. These buildings share a goal of all electric zero net energy construction with 100 percent renewable energy generation, and utilize innovative new heat pump technologies to serve the buildings water heating and/or space conditioning needs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project demonstrates the technical and economic feasibility of zero net energy design for large multifamily projects and establishes design and installation best practices that minimize risks for developers. This includes documentation of best practices to ensure that energy and cost benefits of zero net energy are fully realized and identified, including the trade-offs between technology solutions, capital costs, operating and maintenance costs, environmental benefits and grid impacts.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

This project helps developers make more informed zero net energy design decisions which may reduce construction costs for multifamily buildings up to $2,000 per apartment and lower future operating (e.g., energy) costs for building owners and occupants.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $1,955,811		**EPIC Funds Spent:** $577,227	
Match Partner and Funding Split: Resources for Community Development: $45,090 (2.0 %) Corporation for Better Housing: $245,000 (10.9 %)		**Match Funding:** $290,090	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-097 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Product name: Confidential Utility Consumption Data
Patented equipment. High temperature heat storage itself is not a novel or patented concept by GE, but new controls (e.g. software and firmware) and the existing Geospring heat pump are proprietary.

Update:

This project is on track. All monitoring equipment such as meters, data loggers and sensors are installed at the Calistoga and Cloverdale sites. Data on the performance, energy consumption, water usage, water temperature and other area are being collected and analyzed. The research team is working on installing all monitoring devices needed at the other two project sites in Atascadero and Sunnyvale.

176. EPC-16-001

Project Name:

Measure Results from Affordable Zero Net Energy Homes

[EPC-16-001]

Recipient/Contractor:

Institute of Gas Technology dba Gas Technology Institute

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/30/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The California Energy Efficiency Strategic Plan includes four Big Bold Initiatives, one of which states that all new residential construction in California will be zero net energy by 2020. To help achieve this goal, demonstrated proof, in the form of measured field performance of new and emerging technologies can help overcome the skepticism about the magnitude of the energy savings potential and cost-effectiveness.

Project Description:

The project implements lessons learned from previous high performance housing research and measures the results in two new homes being built in partnership with Habitat for Humanity. Both houses include advanced architectural design features, high performance enclosures, advanced heating, ventilating and air conditioning systems, and low-cost water heating systems. One all-electric home and one mixed fuel (combined electric and natural gas) home is being built to demonstrate the respective cost-effectiveness of each set of features. In addition to measuring results from actual occupancy, the project is developing a guide to affordable residential zero net energy design and construction, a training curriculum, and offers training opportunities based on the project results. The houses are in a disadvantaged community in Stockton.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The technological advancement in this project is utilizing innovative construction approaches that couple advanced energy efficiency measures with integrated project design and delivery (IPD) in a cost effective manner. The innovative approaches explored in this project aim to reduce structural framing for minimum heat paths through the walls, improve wall and attic insulation values, increase equipment efficiency, reduce air infiltration levels, and improve water heater and HVAC performance. The approaches will emphasize minimum energy use, excellent indoor air quality, robust and appealing architectural design, solid structural integrity, and practical, low cost construction. If successfully pilot tested, these innovative approaches could become standard construction practice leading to widespread deployment of affordable ZNE homes.

CPUC Proceedings addressing issues related to this EPIC project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a

Lower Costs:

The advanced integrated energy efficiency packages included in this project could reduce annual energy costs for homeowners up to 50 percent.

Consumer Appeal:

This project will use low cost construction techniques and on-site renewable energy in combination with high performance housing approaches to yield affordable zero net energy houses.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $325,815
EPIC Funds Encumbered: $1,000,000	**EPIC Funds Spent:** $155,701
Match Partner and Funding Split: Dettson: $8,500 (0.7 %) Southern California Gas Company: $160,000 (13.7 %)	**Match Funding:** $168,500
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Project achievements to-date includes assembling and meeting with Technical Advisory Committee (TAC), finalizing ZNE pilot test design details, initiating construction of homes, and developing a technology/knowledge transfer plan.

177. EPC-16-002

Project Name:

Pathways to More Cost-Effective ZNE Homes

[EPC-16-002]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/1/2016 to 6/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The State of California has set the goal for all new residential construction be Zero Net Energy (ZNE) starting in 2020. This is a dramatic increase in volume, going from ~40 units in 2014 to >150,000 units in 2020. To date, there are no comprehensive studies on the cost-effectiveness of ZNE homes, the dependence of cost-effectiveness on building type (single family versus multifamily; all-electric versus non all-electric) and geographical location, and the impact of high volume production of ZNE components. This project will address these deficiencies to help inform policymakers on the best methods for cost-effective implementation of ZNE homes.

Project Description:

This paper study provides detailed cost-effectiveness modeling of all electric, Zero Net Energy (ZNE) homes compared to mixed-fuel ZNE homes with gas-based heating. Evaluation includes costs of building integration, energy efficiency packages, installed equipment, and lifetime investment costs. The project provides spatial and temporal analyses to enable an assessment of cost-effectiveness in four California climate zones. This information will help policy makers better understand the cost and benefit tradeoffs of ZNE policy - and allow for more informed planning to reach ZNE targets in 2020 and 2030. It will also provide the information on the climate trade-offs of all electric homes compared to those with electric and gas service.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project identifies key cost-reduction opportunities to inform future policy decisions and includes development of cost data on photovoltaic cost reduction potential, building shell measures, and future end-use appliance costs and performance and estimates of cost sensitivities of various ZNE related issues. The latter includes offsite renewable energy procurement, climate impacts, and policy levers, such as mortgage tax credits and incentives.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

By providing cost-effective Zero Net Energy building designs, this project could reduce construction costs for builders and operating costs for homeowners. This will result in a lower cost ZNE home due to economies of scale in manufacturing and lower energy bills for the occupant.

Greater Reliability:

The project could increase grid reliability by reducing demand side load and increasing adoption of distributed energy resources.

Environmental Benefits:

This project could reduce greenhouse gas (GHG) emissions by providing the building industry with the most cost-effective approaches toward implementing renewable energy and energy efficiency measures into community development projects. This offset of end-use demand will result in an avoided capacity needed at the generation level and potential reduction of GHG emissions associated with that demand.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $436,541	
EPIC Funds Encumbered: $1,000,000		**EPIC Funds Spent:** $632,840	
Match Partner and Funding Split: Lawrence Berkeley National Laboratory: $50,000 (4.8 %)		**Match Funding:** $50,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Preliminary energy modeling has been completed on single family and multifamily building prototypes for the 2019 Building Energy Efficiency Standards. A draft list of ZNE measures and costs for the modeled ZNE homes has been completed.

The project has been given exempt status by the Human Subjects Committee and should further streamline survey data collection. The team has completed a draft report on community renewable resources, which will inform the scenario modeling.

Lastly, the team has discussed future revisions for time-dependent valuation (TDV) numbers due to their impact on cost-effectiveness. New values have been proposed for future code implementation that feature updated energy prices and the CEC's PLEXOS production simulation case with updated inputs.

178. EPC-16-003

Project Name:

Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package

[EPC-16-003]

Recipient/Contractor:

Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/18/2016 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The traditional approach to building automation consists of a collection of independent control systems, one for each building end use, with limited or no communication among the individual devices. Several research efforts during the past decade were aimed at improving electric lighting or fenestration control methods, increase system reliability and reduce lighting energy use. However, few efforts accounted for the interdependence of lighting, fenestration and space conditioning systems and the consideration of the latter in an integrated approach to optimize whole building energy efficiency via a single, unified control platform.

Project Description:

This project tests an integrated building control package that maximizes energy efficiency for existing commercial buildings. The project refines novel control algorithms that utilize shared device state and environmental data for lighting, fenestration and heating, ventilating and air conditioning (HVAC) systems. Sharing data from multiple device types will further improve overall, sustained, system performance and operation. Control algorithms prioritize lighting or heating/cooling savings based on climate and building design. HVAC system management leverages passive ventilation through windows and skylights and dynamic adjustment of HVAC set point dead bands.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Much energy is wasted by unnecessarily lighting and cooling indoor spaces which are unoccupied. Sometimes lighting sensors also misinterpret input and dim or brighten lighting because of occupant movements in a space. This project seeks to improve sensor-controlled lighting and air conditioning systems by integrating and sharing information from multiple sensors, resulting in better quality indoor spaces with reduced energy cost.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 3e

Lower Costs:

Greater utilization of natural light and ventilation will reduce energy costs, and improve the quality of indoor lighting. Occupancy sensors for lighting which are integrated with air conditioning systems will reduce unnecessary use of cooling when spaces are not occupied. Reduction in lighting and cooling energy will result in cost savings to building occupants.

Consumer Appeal:

This project will develop systems which improve the functionality of lighting and heating, ventilating and air conditioning controls, and integrate operations with automated shading, natural ventilation, and air conditioning systems, to create more appealing and comfortable indoor environments.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $392,705	
EPIC Funds Encumbered: $1,999,089		**EPIC Funds Spent:** $222,536	
Match Partner and Funding Split: Regents of the University of California, Davis - California Lighting Technology Center: $263,967 (11.7 %)		**Match Funding:** $263,927	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has identified the pilot-testing site. The testing site is the Energy Conservation Office on the UC Davis campus. The team will install the integrated control system at the site to test real operating conditions. Currently, the team is still testing the integrated control system in order to refine overall performance and identify elements that might lead to reduced system performance. Staff conducted a site visit in 2017 to evaluate the testing lab and to do a preliminary walkthrough of the pilot-testing site.

179. EPC-16-004

Project Name:

Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices [EPC-16-004]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/30/2016 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Small commercial offices in California consume about 3,500 GWh of electricity annually and this usage is projected to increase due to increase in office electronics and potential decarbonization of space and water heating systems. As a result, opportunities exist for deep reductions in electricity usage but this sector faces a number of barriers to achieving energy reductions, such as lack of awareness on how to achieve energy targets and applicable integrated solutions, and affordable access to energy reduction services such as engineering and auditing services. Energy efficiency tools and services currently involve high costs on a per-square-foot or kWh-saved basis.

Project Description:

This project develops and evaluates cost-effective packages of pre-commercial integrated energy efficiency measures and controls to achieve zero net energy (ZNE) performance for small commercial offices in California. The packages target a minimum of 50 percent energy savings. Lawrence Berkeley National Laboratory's FLEXLAB are testing whole-building integrated systems under varied climate and use conditions. Data on energy, occupant comfort, and occupant behavior are being analyzed and packaged into best practices to be replicated elsewhere in the State.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project develops and validates integrated whole building retrofit packages using pre-commercial underutilized technologies and controls with the goal of reducing energy use in small commercial offices by at least 50 percent. The project also aims to increase system reliability by reducing peak energy loads and potentially supporting AutoDR implementation. The energy efficiency and demand reduction components of the project provide a path towards meeting the State's energy efficiency and climate goals along with a means to replicate these strategies.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a, 4a

Lower Costs:

The project aims to reduce energy use by at least 50% in small commercial offices.

Environmental Benefits:

Assuming 5 percent of small commercial buildings (less than 30,000 square feet) in California adopt the proposed retrofit measures (including on-site renewable energy generation) by 2030, greenhouse gas emissions could be reduced by 83,238 metric tons per year.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $706,115
EPIC Funds Encumbered: $2,000,000	**EPIC Funds Spent:** $1,175,556
Match Partner and Funding Split: Northern California test site partner: $2,000,000 (50.0 %)	**Match Funding:** $2,000,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Progress to-date includes securing a new test site, establishing the Technical Advisory Committee (TAC), and finalizing energy efficiency measures for pilot testing.

180. EPC-16-005

Project Name: Energy Efficient HVAC Packages for Existing Residential Buildings [EPC-16-005]	
Recipient/Contractor: Regents of the University of California, Davis	
Investment Plan: 2015-2017 Triennial Investment Plan	**Project Term:** 8/1/2016 to 6/30/2020
Program Area and Strategic Objective: Applied Research and Development S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.	
Issue: To meet California's long term energy efficiency plan, existing buildings must be retrofitted for energy efficiency to bring them on par or exceed current California efficiency building standards. Specifically, cooling of single-family homes will account for more than 5,700 GWh annually by 2024. While several new heating, cooling and ventilation (HVAC) technologies exist for improving energy efficiency, research and development is needed to create cost-effective retrofit packages for existing buildings, and to identify opportunities to encourage widespread adoption of these packages.	
Project Description: This project demonstrates innovative pre-commercial, cost-effective retrofit packages for cooling and ventilation for single family homes. Energy savings, occupant behavior and indoor air quality (IAQ) are to be measured for two specific retrofit packages that each includes three innovative technologies: (1) building envelope sealing, (2) two variants of smart mechanical ventilation that include pre-cooling strategies, and (3) compressor-free evaporative air-conditioning. Furthermore, barriers and opportunities towards adoption of such retrofits are to be identified through stakeholder interviews.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: To address the current issues with indoor air quality and energy efficiency in existing homes, this project will demonstrate and evaluate two residential retrofit packages that incorporate advanced technologies for achieving both of these goals. Better envelope tightness combined with a dedicated ventilation system and highly efficient evaporative cooler will increase indoor air quality, reduce energy use for air conditioning and reduce overall peak demand. Additionally, the project could increase comfort for building occupants and reduce energy costs for building owners.	
CPUC Proceedings addressing issues related to this EPIC project: Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014	

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a

Lower Costs:

This retrofit package could reduce HVAC energy costs in existing buildings by over 50 percent through the use of compressor-less cooling technology. The project also hopes to identify opportunities to encourage widespread adoption of these packages by promoting to utilities and builders, thus potentially reducing deployment costs.

Environmental Benefits:

The demonstration packages could reduce energy consumption and thus reduce greenhouse gas emissions, especially during peak demand hours. The energy savings is estimated to reduce greenhouse gas emissions by 56,000 metric tons per year by 2024. Also the evaporative cooling system provides an alternative to vapor compression cooling that reduces the usage of refrigerants are known to contribute to global warming.

Consumer Appeal:

The increased indoor air quality from a system that actively brings in filtered, fresh air will improve comfort and occupant health over a typical system that relies on uncontrolled building leakage to provide outdoor air.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $366,421	
EPIC Funds Encumbered: $1,200,000		**EPIC Funds Spent:** $59,145	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: Western Cooling Efficiency Center - UC Davis : $126,000		**Leveraged Funds:** $126,000	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Waiting for response from WCEC.

Update:

Baseline monitoring has begun at two sites and will be monitored for one year prior to the two similar but still different retrofit packages being installed. Both sites will receive aerosol sealing, and sub wet bulb indirect evaporative cooling with a fresh air vent system. Indoor air quality is also being measured and will monitor CO2 and PM2.5. A technical advisory meeting was held in July.

181. EPC-16-006

Project Name:

Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water

[EPC-16-006]

Recipient/Contractor:

ES Engineering Services, LLC

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/28/2016 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

In California, many groundwater sources cannot be used for drinking water because of arsenic, chromium and other contaminants. Current technologies to treat contaminated drinking water are expensive, complex, and energy intensive, such as reverse osmosis. Other factors driving costs higher for conventional treatment include the need for expensive chemicals, daily management of high volume of waste laden with contaminants, and active process control, monitoring and adjustment. An alternative treatment system is needed that can effectively remove heavy metal contaminants from water, minimize energy, operation and waste disposal costs and meet California drinking water standards.

Project Description:

The project is testing an innovative, low energy, zero liquid discharge water treatment system using adsorption process to potentially remove arsenic and other contaminants from a groundwater reservoir. The project is developing a demonstration-scale water treatment system to determine operational costs, energy and water savings of the single use adsorption system The demonstration will validate the reduction in spent adsorption media by natural dehydration to further save energy and water associated with residual solid waste handling. The project includes testing and reporting to secure state mandated acceptance of the novel drinking water treatment technology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project could result in an innovative way to treat water with high amounts of metal contaminants using a low energy treatment method to restore impaired drinking water sources. The hydrogel adsorption process offers benefits of being simple, with its minimal amount of equipment required and can save water that would normally be too difficult to treat. This treatment method is especially suitable for small inland treatment systems, where liquid backwash and brine disposal may be cost prohibitive or infeasible.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1h, 4c, 4d

Lower Costs:

This project could lower the cost of treating water contaminated with heavy metals and allowing it to be reused. The energy reduction compared to conventional technologies is 20-30 percent when applying this new, low energy technology.

Environmental Benefits:

Resurrecting groundwater wells that have been removed from operation due to contamination offers energy and cost savings by avoiding the need for additional driller and construction of new wells. Additionally, if successful, this project can improve water resources by removing heavy metal contaminants from water.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $986,262	**EPIC Funds Spent:** $317,540
Match Partner and Funding Split: Enova Water LLC: $65,000 (5.5 %) AQUAlity Engineering, Inc.: $15,474 (1.3 %) Khalil Kairouz Consulting: $4,000 (0.3 %) Municipal Management Group, Inc.: $5,000 (0.4 %) ES Engineering Services, LLC: $105,430 (8.9 %)	**Match Funding:** $194,904
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Enova has pre-existing intellectual property that is relevant to the project. The intellectual property is the single use adsorption media for metals, and is currently patented.

Update:

ES Engineering is completing the design for the proposed treatment system and the test plan. They are now beginning to fabricate the parts for the demonstration system.

182. EPC-16-007

Project Name:

Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings

[EPC-16-007]

Recipient/Contractor:

Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/1/2016 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The technical feasibility of achieving Zero Net Energy (ZNE) in many building types in California has been documented, but the optimal cost-effective strategy to reduce net electricity consumption toward ZNE goals remains unclear. The number of building types and technologies are too numerous to answer performance and cost-effectiveness questions through field studies. The open-source software tools and analysis methodologies are difficult to monetize and would require coordination among competitors, and are not being developed nor funded by competitive markets.

Project Description:

The recipient uses EnergyPlus, a building energy modeling tool, to analyze the cost-effectiveness of various electricity saving/generation measures for multifamily and commercial buildings in California. Each building type and climate zone will receive a cost-benefit analysis for each measure individually and an optimized package of measures to achieve as close to zero net energy as is cost-effectively possible.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will accelerate the adoption of cost-effective electricity saving/generation technologies, equipment, materials and construction practices in California multifamily and commercial buildings. The project will help overcome barriers by identifying and documenting the cost-effectiveness of available energy efficient technologies, equipment, materials and construction practices for multifamily and commercial buildings.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 3e

Lower Costs:

This project could influence construction practices in California and promote the development of affordable energy efficiency in commercial and multifamily buildings. This project will provide optimized recommendations for cost-effective electricity saving solutions for a wide variety of California's building portfolio in all 16 climate zones. Detailed modeling of building energy modeling packages will allow for accurate determination of cooling and heating loads, enabling right sizing of equipment which could extend equipment life for building owners. Equipment

<table>
<tr><td colspan="4">right sizing would provide lower costs due to smaller equipment sizes and potential for lower maintenance costs.</td></tr>
<tr><td colspan="2">Assignment to Value Chain:
Demand-side Management</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $151,821</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$1,000,000</td><td colspan="2">EPIC Funds Spent:
$181,205</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
Electric Power Research Institute (EPRI): $25,000 (2.3 %)
University of California, Davis: $80,000 (7.2 %)</td><td colspan="2">Match Funding:
$105,000</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
39 out of 39 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 4: Ranked # 1</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The recipient has begun the technology review of high efficiency measures, updated the DOE reference model of Multi-Tenant Light-Commercial to Title 24 building efficiency standard and identified gaps in cost database that will need to be addressed to be able to estimate the cost of each measure being addressed. The recipient has assembled the Technical Advisory Committee and will hold its first meeting in Spring of 2018. The recipient has submitted the Technology Review Report.</td></tr>
</table>

183. EPC-16-008

Project Name:

Santa Monica Advanced Energy District

[EPC-16-008]

Recipient/Contractor:

City of Santa Monica

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/15/2016 to 12/31/2018

Program Area and Strategic Objective:

Market Facilitation

S20: Accelerate the Deployment of Energy Technologies in IOU Territories Through Innovative Local Planning and Permitting Approaches.

Issue:

While many local governments could benefit from a multiuser microgrid, few are poised to take advantage of such district-scale energy systems as they lack the 1) technical knowledge of how to interconnect a suite of different energy resources with storage and control technologies, 2) regulatory frameworks that allow for multiple interconnection points by different customers at different locations, and 3) means to incentivize the private sector to deploy these systems to serve more than one end-user. Finally, ownership and fee structures that properly benefit the participants of multiuser microgrids are extremely complicated and it is not clear what role local governments should play.

Project Description:

The city of Santa Monica is designing an Advanced Energy District with a multiuser microgrid to be anchored at the City Yards, an old landfill site which is where most of the city's municipal buildings and fleets are housed. The microgrid will integrate a suite of local renewable energy sources, energy storage, and controllable loads into a single system that will later be scaled to interconnect adjacent, public and private properties inclusive of the Metro Maintenance Facility. The project team is exploring what role the city can play in delivering and wheeling power between customers, and what special utility tariffs and financing can help incentivize a system that shares the value of distributed energy resources equitably. The project team will then develop a financial and ownership model for constructing and operating a multiuser microgrid that achieves net zero, or near net zero energy district for the customers. A case study and "tool kit" of outreach materials is also being developed to share with stakeholders and other local governments.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project pilots innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs:

This project will reduce the time and costs needed to bring community-scale IDER projects to a shovel-ready state.

Greater Reliability:

The tools and resources developed under this project will assist in identifying citywide optimal microgrid sites that will have the most local generation potential and are most likely to have the least impact on grid reliability.

Economic Development:

This project will pilot new approaches that increase the financial attractiveness of community-scale IDER projects, which could lead to increased investment in the community.

Consumer Appeal:

Greater deployment of AECs will increase consumer familiarity and comfort with Zero Net Energy homes and communities, increasing the likelihood of consumers choosing to live and work in an AEC.

Energy Security:

Microgrids using renewable energy generation, coupled with storage systems, allows critical facilities to generate their own energy locally and be cost competitive to the grid. These systems also reduce transmission losses.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $570,347
EPIC Funds Encumbered: $1,487,609	**EPIC Funds Spent:** $0
Match Partner and Funding Split: City of Santa Monica: $217,460 (12.5 %) Arup North America Ltd: $10,970 (0.6 %) Hathaway Dinwiddie Construction Company: $100 (0.0 %) Miller Hull Partnership: $23,500 (1.4 %) Buro Happold Engineering: $1,000 (0.1 %)	**Match Funding:** $253,030
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	Funding Mechanism:	No. of Initial Passing Applicants/ Bidders:	Rank of Selected Applicant/ Bidder:
Competitive	Grant	27 out of 28 bidders	Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project officially kicked off in February and the team collaborated with the City Yards Redevelopment design team to develop a list of an owner's energy-use requirements for the planned microgrid. The project team continues to evaluate and model various distributed energy resources, including the feasibility of using gases from the landfill and solar PV, and different options for overcoming barriers related to the physical installation of the system when crossing rights-of-way with electrical (and possibly thermal) energy resources. Additionally, the city is assessing different ownership and financing structures such as benefits provided under a community choice aggregate, and a special tariff offered by Southern California Edison that would allow the city to share the net-export of power from the microgrid with other city-owned accounts.

184. EPC-16-009

Project Name:

Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse [EPC-16-009]

Recipient/Contractor:

Porifera, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/31/2016 to 8/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Potable water demand in California will continue to grow even as droughts become more common. The main sources for new water supplies in California are importing more water over long distances, desalination, and reuse. Of these three options, reuse requires the least amount of energy. A direct potable reuse (DPR) project has not yet been permitted in California. The main hurdle is public and regulatory concern over the public health risks of implementing DPR, which some call "toilet to tap". This concern is perpetuated by the lack of real-time fail-safe methods to ensure that contaminant barriers are intact at all times and performing as designed.

Project Description:

The project is testing a low-energy, dual barrier, direct potable reuse system, known as dprShield, with breach-activated barrier technology to demonstrate that this technology can improve public health safeguards and reduce the electrical energy, chemical consumption, maintenance and overall cost for potable reuse of municipal wastewater. While being energy efficient and cost-effective, this system effectively removes trace contaminants through two tight membranes. In the event that one of the membrane barriers is breached, a Breach Activated Barrier is triggered and the contaminants are pushed away from the clean water stream, ensuring safe operation in real time. This direct potable reuse technology could replace more energy intensive processes.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will demonstrate an energy efficient solution for direct potable reuse of municipal wastewater. The dprShield is estimated to use 65 percent less energy than State Water Project transfers, 75 percent less than desalination and more than 50 percent less energy than competing technologies for direct potable reuse of municipal wastewater, removal of contaminants from water and real-time membrane integrity monitoring.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 1h, 4c, 4d

Lower Costs:

This project could provide a reliable and cost effective solution for water and wastewater treatment. This project could reduce water treatment and reuse costs, and reduce energy requirements and emissions when compared to other treatment methods.

Increase Safety:

This project can increase safety and reliability of potable water reuse projects. As potable reuse grows in California, this advancement will help overcome barriers by demonstrating an energy efficient solution for removal of contaminants from water and real time membrane integrity monitoring. This technology could detect and react to small breaches and assure pathogens do not enter the clean product water when there is a breach.

Public Health:

This project can increase safety and reliability of potable water reuse projects. As potable reuse grows in California, this advancement will help overcome barriers by demonstrating an energy efficient solution for removal of contaminants from water and real time membrane integrity monitoring. This technology could detect and react to small breaches and assure pathogens do not enter the clean product water when there is a breach.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $248,634	
EPIC Funds Encumbered: $999,795		**EPIC Funds Spent:** $380,180	
Match Partner and Funding Split: Leland Stanford Junior University: $34,784 (3.0 %) City of Hayward: $10,000 (0.9 %) Orange County Water District: $70,000 (6.1 %) Porifera, Inc.: $30,000 (2.6 %)		**Match Funding:** $144,784	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Patents and trade secrets from Porifera, Inc. have been identified as relevant pre-existing intellectual property.

Update:

Currently the recipient is continuing with the dye testing, working on the pilot system design, and continuing experiments on the skid and optimization of element design and operation conditions. The working agreement with Stanford has been finalized. Work continues on the Pilot Plan.

185. EPC-16-010

Project Name:

Improving Water and Energy Efficiency in California's Dairy Industry

[EPC-16-010]

Recipient/Contractor:

The Regents of the University of California on behalf of the Davis campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	10/1/2016 to 9/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Milk is the most valued agricultural commodity in California. Approximately one of five dairy cows resides in California. Heat stress remains a major cause of diminished milk production and increased disease among lactating dairy cows, with annual losses directly related to heat stress exceeding $800 million. Current methods of reducing thermal stress require significant amounts of energy and water. Evaporative cooling is typically used with water sprayed on the cows using feed line soakers. These approaches require large amounts of energy to pump water and move air in sufficient quantities to reduce heat stress. The resulting hot, moist environment promotes bacterial growth.

Project Description:

This project tests and demonstrates two novel approaches to cooling livestock. With conduction cooling, the bedding area beneath the cow is cooled using heat exchange mats below the stall bedding. To reduce energy consumption, water flowing through the heat exchange mats is chilled using a novel Sub-Wet Bulb Evaporative Chiller. The second approach, targeted convection cooling, uses fabric ducting to direct cool air on the cows. The air is cooled using high-efficiency direct evaporative coolers. Both approaches promise significant water and energy savings, when compared to current approaches.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advances management strategies for reducing thermal stress in dairy cows while also reducing energy and water use. There are two methods of reducing thermal stress in cows: (i) lowering the cows' heat exposure and (ii) increasing the cows' ability to get rid of excess body heat. Current practice includes use of evaporative cooling with water sprayed on the cows using feed-line soakers, and cooling is enhanced by convective heat transfer via large overhead fans. This project will test and demonstrate an innovative approach that seeks to optimize the cow's ability to remove excess body heat by utilizing more efficient cooling technologies, and introducing alternate strategies for when and where to cool the cows. By combining these two approaches this project has the potential to significantly change the way dairy cows are cooled.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 4a, 4c

Lower Costs:

By optimizing cow cooling operations this project could reduce water use by up to 86 percent and energy use up to 38 percent. By reducing energy and water usage the dairy owners will see reduced utility, operating and maintenance costs. The conduction cooling approach has the potential to reduce water consumption by 73 percent and electricity consumption by 38 percent compared to the baseline. The targeted convection cooling approach has the potential to reduce water consumption by 86 percent and electricity consumption by 28 percent compared to the baseline.

Environmental Benefits:

This project could reduce greenhouse gas emissions by integrating novel energy efficiency cow cooling technology at dairies. This technology could reduce energy and water use over traditional cow cooling methods and thus reduce greenhouse gas emissions associated with avoided capacity needed at the generation and associated with the embedded energy in water. In addition to saving electricity, this technology has the potential to increase milk production due to reduced heat stress as well as reducing disease among lactating cows.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $191,936	
EPIC Funds Encumbered: $1,000,000		**EPIC Funds Spent:** $24,800	
Match Partner and Funding Split: Regents of the University of California (University of California, Davis): $164,710 (14.1 %)		**Match Funding:** $164,710	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

(1) US Patent 9,207,018 Sub-wet bulb evaporative chiller system with multiple integrated subunits or chillers.

(2) US Patent 8397677 B2 Thermal Conductive Cooling Method and System for Livestock Farm Operations (3) Targeted Convection and Hybrid Cooling of Dairy Barns
Update: The project has successfully completed pilot stage testing at the UC Davis Dairy. Data and results from the pilot testing has been collected and the team is analyzing the test data to determine which energy and water savings technologies are most promising. The most promising of the two technologies will be demonstrated in a larger dairy in Tulare, CA

186. EPC-16-011

Project Name:

Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations

[EPC-16-011]

Recipient/Contractor:

Kennedy/Jenks Consultants, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/1/2016 to 4/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Low-pressure membrane filtration, such as microfiltration and ultrafiltration, is used for drinking water, wastewater, and industrial water treatment. However, membrane treatment processes are energy intensive, largely due to membrane fouling (organic and inorganic) on the membrane surface and in the membrane pores which results in layered fouling that is difficult to remove and increased transmembrane pressure. The use of membrane treatment is likely to increase due to its ability to remove pathogens during drinking water treatment compared to conventionally used media filters, and to recent state initiatives to increase water reuse.

Project Description:

This project is demonstrating the performance of an innovative "amphiphilic" membrane (i.e., a combination of hydrophilic and hydrophobic properties) that keeps organic and inorganic foulants away from the membrane surface by incorporating an anti-adhesive. The amphiphilic membrane retards long-term foulant deposition, which allows for higher water flow through the membranes, increased water yield, and improved energy efficiency. The project demonstrates the effectiveness of the technology in treating surface water, backwash water and synthetic reclaimed water. Data is collected to document savings and benefits in order to encourage commercialization. Implementation of this technology does not require capital investment. Instead, treatment facilities could replace existing hydrophilic membranes with the amphiphilic membranes during routine scheduled membrane replacements.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

A survey by the American Membrane Technologies Association (AMTA) indicates that there are approximately 100 microfiltration/ultrafiltration treatment plants with a total design capacity of approximately 400 MGD, eight nanofiltration facilities (30 MGD), and over 100 reverse osmosis (RO) facilities (400 MGD) in California. As membrane treatment is energy intensive due to fouling, this technology could reduce energy demand for membrane treatment processes while decreasing the water need for backwashing.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 4a, 4c

Lower Costs:

The technology could reduce the use of chemicals and the frequency of membrane cleaning as well as reduce the frequency of membrane replacement. The recipient estimates a 50% reduction in the frequency of membrane cleaning and replacement, resulting in lower operation costs. Assuming a 50 percent market penetration, 40 percent energy savings for membrane filtration treatment, and 20 percent energy savings for reverse osmosis treatment, the technology could annually save wastewater treatment facilities an estimated 44,000 MWh in California or approximately $6.6 million.

Environmental Benefits:

The technology could minimize chemical use for membrane cleaning and increase water yield by approximately 12 million gallons per day, or the amount of water for 58,000 people.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $304,611	
EPIC Funds Encumbered: $882,430		**EPIC Funds Spent:** $66,873	
Match Partner and Funding Split: California Water Services: $20,000 (2.0 %) BASF: $60,000 (6.1 %) Kennedy/Jenks Consultants: $18,600 (1.9 %)		**Match Funding:** $98,600	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient has obtained a permit from City of Bakersfield to discharge Clean-In-Place (CIP) waste into the sanitary system. The project team has coordinated with the subcontractor to revise utility connection plans and developed the budget for installations. The project team is currently testing treatment of surface water and collecting data.

187. EPC-16-012

Project Name:

Power and Water Saving Advanced Hybrid Air/Wet Cooling System

[EPC-16-012]

Recipient/Contractor:

Altex Technologies Corporation

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/12/2016 to 9/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Advanced hybrid air/water cooling systems for refrigeration and power systems represent an important opportunity, as they have the potential to reduce electricity and water use, an important consideration in California and many other water challenged areas in the United States. However, conventional hybrid air/wet cooling systems have high capital and electric power costs, which constrain their use in many commercial/industrial and utility applications.

Project Description:

This project uses high performance porous fins to enhance cooling through water vaporization and mass transfer. By retrofitting the heat exchanger with a water spray feature, this project has the potential to reduce energy and water use of refrigeration systems in California..

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The hybrid cooling system is estimated to reduce fan power through low pressure drop characteristics and save water by only using water evaporation when ambient air temperatures are high. The system aims to improve efficiency in commercial and industrial refrigeration and air conditioning systems.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 4c

Lower Costs:

This project has the potential to lower costs to building operators by reducing energy and water usage, leading to lower utility bills. Assuming a 20 percent penetration of commercial and industrial markets, power and water will be reduced by 8,371 megawatt-hours and 725 million gallons per year.

Environmental Benefits:

This project has the potential to reduce greenhouse gas emissions by integrating a novel technology for energy efficient heating, ventilating and air conditioning (HVAC). The reduction

in demand will result in avoided electricity generation and the associated greenhouse gas emission reductions. The HVAC technology will also reduce water use compared to that of standard cooled chillers. Reduced water use will result in savings of embedded energy savings.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $529,685	
EPIC Funds Encumbered: $999,994		**EPIC Funds Spent:** $562,840	
Match Partner and Funding Split: Altex Technologies Corporation: $187,207 (15.8 %)		**Match Funding:** $187,207	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Altex will include pre-existing intellectual property. A patented advanced porous fin heat exchanger technology that enhances wet and dry cooling heat exchanger performance will be adapted for the application of interest by adding water spray features, to produce an effective hybrid air/water cooling system, called Altex Hybrid HEX (AHHEX).

Update:

The team has prepared a computer model to simulate heat exchanger performance. They are in the process of assembling the heat exchanger for full testing in early 2018.

188. EPC-16-013

Project Name:

Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort

[EPC-16-013]

Recipient/Contractor:

The Regents of the University of California on behalf of the Berkeley campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/8/2016 to 3/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Conventional thermostat-based control strategies for heating, ventilating and air conditioning systems use a narrow range of temperatures year-round that are prescribed by building operators, based on an assumed occupancy schedule. Operators and occupants typically do not optimize these schedules based on actual occupancy or actual occupant preferences for thermal conditions. At low speeds, ceiling fans may reduce heating energy use by de-stratifying room air temperatures. However architects, engineers, and owners do not understand the effects of air movement from ceiling fans to predict energy and comfort impacts that might result from new and innovative approaches to comfort.

Project Description:

This project develops an optimal system configuration for smart comfort controlled ceiling fans integrated with learning thermostats. This system is to be tested and evaluated for energy performance and occupant acceptance in low income multi-family residential and small commercial buildings in disadvantaged communities in California. This research and development advances the solution's technology readiness level and support market adoption acceleration. A design guide and energy code language are to be developed to facilitate widespread adoption.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Smart ceiling fans integrated with smart thermostats represent the next generation of energy efficiency that provides space conditioning while minimizing the need for compressor-based air conditioning systems. This project advances the state of knowledge and practical applications of an integrated strategy to retrofit applications, addressing occupant thermal comfort and HVAC energy use through innovative hardware and software. Additionally, this project is a scalable energy retrofit solution for commercial and residential buildings. Installation does not require specialized training—appropriately trained contractors or installers can easily perform the task. Operations are simple and do not need users to understand controls, set-points, or programming. Simple installation and controls with documented savings and no sacrifice on comfort could increase acceptance of this tech

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 3e, 4a

Lower Costs:

Developing cost-effective configurations and best practices will reduce the cost of adoption and operation while reducing the simple payback, thus enabling building owners to invest in the technology at lower risk. The team estimates the integrated solution to provide energy savings up to 37% in cooling and 15% in heating, which could add up to 985 GWh of annual energy savings for California or approximately $148,000,000 . The solution is a key component for passive heating and cooling design which supports CA zero-net energy (ZNE) goals and is demand-response ready.

Environmental Benefits:

Energy savings could add up to 719 million pounds of greenhouse gas emissions reduced assuming a 15 percent market penetration. Also, ceiling fans are enabling technology for compressor-free cooling with passive and/or radiant systems because they provide comfort at higher indoor temperatures, thereby reducing refrigerant purchase, use and disposal.

Consumer Appeal:

Automated learning controls make the technology operation easier for the customer and likely resulting in wider user acceptance. User acceptance is key to achieving broad adoption and meeting energy savings targets.

Energy Security:

The team estimates the integrated solution to provide energy savings up to 37% in cooling and 15% in heating, which could add up to 985 GWh of annual energy savings for California or approximately $148,000,000. The solution is a key component for passive heating and cooling design which supports CA zero-net energy (ZNE) goals and is demand-response ready.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $1,888,683		**EPIC Funds Spent:** $223,389	
Match Partner and Funding Split: Center for the Built Environment - UC Berkeley: $112,726 (5.1 %) BIG ASS FANS: $203,200 (9.2 %)		**Match Funding:** $315,926	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 39 out of 39 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The recipient is conducting laboratory testing of the integrated thermostat system in a test facility on campus designed to be used as a mock up prototype demonstration space. Data loggers, sensors and other devices were installed in July 2017 at all sites. Ceiling fans and thermostat installations are scheduled for April 2018. Once all equipment and monitoring devices are installed, data will start to be collected.

189. EPC-16-014

Project Name:

A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse

[EPC-16-014]

Recipient/Contractor:

Lawrence Livermore National Security, LLC

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/1/2016 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Desalination is currently the primary method of removing salt from industrial and municipal wastewater for reuse. However, this technology is energy intensive and expensive. Industrial processes and household activities continuously add salt to water, and as a result, the salt content of industrial and municipal waste water is often too high for reuse. The salt content of this waste water must be reduced to enable recycling and to avoid ecological damage but the technology must be more energy efficient compared to current practice.

Project Description:

This project is demonstrating how to reduce the energy used to remove salt from wastewater using the flow-through electrode capacitive desalination (FTE-CD) technology. This advanced technology removes salt from water by applying an electric field to two porous electrodes. The electrodes act like a magnet for salt while the field is applied and remove the salt from water that flows through the electrodes using less energy and less costly than reverse osmosis (RO). Energy use of an FTD-CD system is projected to be 50% less compared to the energy use for an RO system. The recipient is partnering with two water districts to test the use of FTE-CD devices to desalinate wastewater and determine how this small, flexible device can improve the energy and operating efficiency of wastewater treatment solutions for communities. Wastewater from the industrial and municipal sectors will be used to test the technology along with measuring energy use and performance, such as fouling and other operation issues.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The FTE-CD technology has the potential of reducing the cost and energy use associated with desalinating water with low to moderate salt content and will represent an advancement over current RO technology. This can increase the potential to increase water recycling and reuse at the community or industrial level, which could reduce the need to procure and transport fresh water sources. Also, this advanced FTE-CD technology is small and flexible which means that it can be customized to the scale needed for each community or industry, thereby increasing a community's water reuse potential which can increase drought resilience for the state.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4d

Lower Costs:

The FTE-CD system is projected to use 50 percent less energy than reverse osmosis (RO). Also, the technology is less costly than RO and operational costs are expected to be lower due to fewer chemicals used..

Environmental Benefits:

FTE-CD is expected to produce less wastewater than reverse osmosis due to higher water recovery rates. Also, FTE-CD can remove toxins from water such as nitrates and heavy metals, and could be deployed specifically to mitigate such hazards.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $448,176	
EPIC Funds Encumbered: $999,040		**EPIC Funds Spent:** $375,000	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 27 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The recipient has designed a new end plate that reduces mixing of water at the outlet. The overall cell resistance was studied with individual electrodes and four-probe test setups. The contractor has verified several assumptions about resistance and determined several configurations that should reduce the contact resistance and improve overall device performance and will demonstrate longevity of these methods in future months.

190. EPC-16-015

Project Name:

Los Angeles Regional Energy Innovation Cluster

[EPC-16-015]

Recipient/Contractor:

Los Angeles Cleantech Incubator

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/17/2016 to 3/31/2022

Program Area and Strategic Objective:

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

The Los Angeles region lacks necessary coordination of technical, business, and social supports for clean energy researchers and entrepreneurs to develop innovations and advance clean energy development into the regional economy. This lack of organizational support prevents the Los Angeles region from clearly understanding the best direction for its clean energy economy, specifically its regional energy needs, the size and strengths of the region's current clean energy ecosystem, the full range of technical and commercialization services currently available for clean energy entrepreneurs, and how to focus efforts to advance the region's clean energy economy.

Project Description:

This project established the Los Angeles Regional Energy Innovation Cluster to act as a regional hub of clean energy entrepreneurship, and gives promising clean energy entrepreneurs direct access to the region's top technical, business, and commercialization clean energy support services. This project assesses and addresses the LA region's energy needs by making use of and expanding the LA Cleantech Incubator's existing, successful resources (facilities, coaching, business support) for entrepreneurs in LA, and expand to three additional counties (Orange, Santa Barbara, Ventura). This project will support entrepreneurs through the region and interconnect the clean energy economy throughout the state.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. The project will develop and provide resources to entrepreneurs that enable the entrepreneurs to scale their businesses within the Los Angeles region. This project will foster the clean energy economy in the Los Angeles region by creating successful businesses within the region that will results in local job creation.

CPUC Proceedings addressing issues related to this EPIC project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 2a, 3e

Lower Costs:

This project will reduce the time and cost of new energy technology development by providing entrepreneurs with access to facilities and services needed to commercialize their innovation.

Economic Development:

The services provided by this cluster will support the development of local companies and further develop the clean energy economy throughout the Los Angeles region.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $541,645
EPIC Funds Encumbered: $4,999,247	**EPIC Funds Spent:** $244,752
Match Partner and Funding Split: Los Angeles Cleantech Incubator: $165,290 (1.9 %) Los Angeles County Office of Sustainability: $2,104,712 (24.3 %) Southern California Edison: $300,000 (3.5 %) California State Polytechnic University Pomona: $24,625 (0.3 %) CSU Dominguez Hills: $24,625 (0.3 %) California State University, Long Beach Research Foundation: $24,625 (0.3 %) CSU Los Angeles: $24,625 (0.3 %) CSU Water Resources and Policy Initiatives: $5,000 (0.1 %) California State University, Northridge: $24,625 (0.3 %) Cleantech Orange County: $597,998 (6.9 %) CSU Channel Islands: $49,500 (0.6 %) LA Business Technology Center: $99,000 (1.1 %) Los Angeles Cleantech Incubator: $99,000 (1.1 %) Economic Development Corporation of Los Angeles County: $99,000 (1.1 %) Community Environmental Council: $15,474 (0.2 %)	**Match Funding:** $3,658,099
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**

		2 out of 2 bidders	Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The LA regional energy innovation cluster (named Energize CA) recently accepted its first cohort of portfolio companies to receive services. This cohort includes companies developing solutions in commercial/industrial HVAC, on-site solar, insulation, grid management software, and electric vehicle mobility infrastructure. This year, Energize CA reached a few milestones on the way towards achieving project goals, including:

- Received $1,440,500 from non-EPIC grant funding opportunities.
- Solidified outreach approach to incorporate investors, startups, academia, business development groups, accelerators and incubators into LACI's network of resources for their portfolio companies.

191. EPC-16-016

Project Name:

Commercializing a Disruptively Low Cost Solar Collector

[EPC-16-016]

Recipient/Contractor:

Hyperlight Energy

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	10/14/2016 to 8/31/2018

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

Concentrated Solar Power (CSP) is a promising form of renewable energy that has been hampered by high solar collector costs and high power block costs. In addition, there is need to enable use of geothermal power plant turbines that are underutilized due to resource decline at many sites in California.

Project Description:

This project is developing a low cost Concentrated Solar Power (CSP) collector to advance the market readiness of this technology. Hyperlight's CSP collector is based on the linear Fresnel reflector (LFR) and is able to make dramatic cost reduction through breakthroughs in materials, design, manufacturing and installation. A major innovation of the system involves use of mirrors attached to UV stabilized and low-cost plastic tubes that are mounted on sealed water bed foundation. The project will develop: (1) a single 1,000 square foot module used for lifecycle testing and validation of upgraded design elements; (2) a one acre system for pilot testing and demonstration; and (3) a front end engineering design study to establish the feasibility and what is needed to scale up the system up to say ten acre and co-located with other renewable energy such as a geothermal facility. EPIC funds are being used as cost share funding to Hyperlight's $1.5 million grant from the US DOE.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will lead to technological advancement and breakthroughs by advancing a low cost CSP collector to commercial availability. In addition to the value of demonstrating the collector through the physical installation, the front end design study and the availability of this low cost collector is intended to enable geothermal power plant owners to use this innovative system to boost the output of their plants and provide more renewable energy to the grid.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 4a

Lower Costs:

This project will develop solar collectors that are roughly half the cost of current collectors, reducing overall system costs for concentrated solar to $99/m2 compared to existing cost of $200/m2. The project will target utility scale market. The increased efficiency from 30 percent to 50 percent will help in reducing the solar field costs as well as land impacts of CSP.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $177,896	
EPIC Funds Encumbered: $750,000		**EPIC Funds Spent:** $329,249	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: United States Department of Energy : $1,500,000 Combined Power, LLC, dba Hyperlight Energy : $752,694		**Leveraged Funds:** $2,252,694	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 43 bidders	**Rank of Selected Applicant/ Bidder:** N/A
If not the highest scoring applicant/bidder, explain why selected: The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions. System and method of generating energy from solar radiation.			
Update: Extensive optical, mechanical and thermal models were built that showed feasibility of technical targets. A prototype reflector of 20 feet by 50 feet was tested to 10,000 cycles representing a 30 year lifetime, and results of the testing showed minimal degradation. The project site preparation work has started and the pilot system is expected to be operating by spring 2018.			

192. EPC-16-017

Project Name:

Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology

[EPC-16-017]

Recipient/Contractor:

Silicon Valley Clean Water

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	11/10/2016 to 3/1/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Based on 100 year old technology, wastewater treatment has consumed abundant water, energy, and land, and fails to capture the significant energy resource value of wastewater. The result are systems that: 1) are energy-intensive, consuming 3 percent of electricity nationwide and generating significant amounts of greenhouse gas emissions, 2) produce large quantities of biosolids with high energy, greenhouse gas emissions, and monetary disposal costs, 3) neglect the value of wastewater as a reliable local water supply, nutrient resource, and energy supply, and 4) are at the end of their design life.

Project Description:

This project is demonstrating the elimination of aeration and its high energy demands as part of secondary water treatment at the Silicon Valley Clean Water wastewater treatment facility using a novel staged Anaerobic Fluidized Bed Membrane Bioreactor. This System is projected to generate 30 percent less bio-solids than conventional systems that require aeration. This project also seeks to demonstrate the potential for development of a new high quality local water supply through non-potable and advanced potable reuse treatment trains that eliminate process steps that normally precede the use of reverse osmosis.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project has the potential to lower energy costs of wastewater treatment and water recycling. The advanced technology used in this project is the Staged Anaerobic Fluidized Bed Membrane Reactor (SAFBMR) which eliminates the aeration stage of wastewater treatment. The aeration stage is one of the most energy intensive steps in wastewater treatment. The SAFBMR also has the potential to reduce operation and maintenance costs because bio-solids waste, which typically requires off-site disposal, is reduced, and the effluent does not require the typical microfiltration pre-treatment step prior to the reverse osmosis systems.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 4c, 4e

Lower Costs:

The technology has the potential to lower facility operating costs due to the removal of the aeration step from processing wastewater, the reduction of bio-solids that must be disposed, and the increased yield of methane biogas - a potential fuel source for on-site energy generation. The recipient estimates that a 1 million gallon per day treatment facility could achieve annual electricity savings of up to $185,000 from both efficiency and renewable energy generation over a 20 year life cycle. In addition, the technology is also estimated to result in 10 percent lower cost in capital and operation and maintenance cost compared to existing processes.

Environmental Benefits:

The lower energy use along with onsite renewable energy production will reduce greenhouse gas emissions. This project also will reduce biosolids waste that is typically trucked for off-site disposal. Additionally the project will also produce higher quality water for potential potable uses.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $327,386
EPIC Funds Encumbered: $1,999,962	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Leland Stanford Junior University: $400,000 (12.4 %) Santa Clara Valley Water District: $100,000 (3.1 %) GE Water: $210,000 (6.5 %) LG Water Solutions: $10,000 (0.3 %) Silicon Valley Clean Water: $499,943 (15.5 %)	**Match Funding:** $1,219,943
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 8 out of 8 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update: The agreement has been signed and the Kick-off meeting held, and work has commenced on the project. The team has established a technical advisory committee. The research team continues to gather data from literature and the demonstration site for the Benchmark Report. Approximately 90 percent of the preliminary design of the Staged Anaerobic Fluidized Bed Membrane Bioreactor system has been completed.

193. EPC-16-018

Project Name:

Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings

[EPC-16-018]

Recipient/Contractor:

BDP Technologies

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	11/21/2016 to 4/1/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

The most common secondary wastewater treatment process for nutrients removal is the activated sludge process. Most activated sludge processes are energy and land/space intensive as they include separated anoxic and aerobic tanks with secondary clarifiers. The infrastructure requires high capital, land footprint, and embedded energy and operation and maintenance costs. The current challenge for wastewater treatment plants in California is to meet the demand from population growth, increasingly stringent regulations and aging infrastructure while potentially reducing the energy and water consumption.

Project Description:

This project is demonstrating an efficiency technology that targets one of the major energy using steps in wastewater treatment. The Biological Double Efficiency Process (BDP) combines state of the art, easy to maintain aeration technology, airlift circulation/dilution technology, and an integrated all-in-one bioreactor technology to replace the separate anoxic and aerobic tanks associated with secondary clarifiers. The BDP is based on simultaneous nitrification/denitrification principles.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The innovative BDP technology has the potential to provide substantial energy savings to wastewater treatment plants, including reducing 50 percent of the aeration required for secondary treatment, thus decreasing electrical energy requirements and greatly improves oxygen transfer efficiency to 48-52 percent compared to 20-30 percent in conventional technologies.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

The BDP technology could reduce energy and water consumption and costs at wastewater treatment plants while also meeting California's growing water and wastewater needs. In addition, the BDP technology could provide advantages of reduced energy and land use, carbon footprint (CO_2 emissions), waste sludge generation, and operation and maintenance costs. The technology has the potential benefits of substantial 50 percent energy reduction, 30

percent less capital, 50 percent less land required, 50 percent reduction in operation and maintenance costs, and water savings opportunities.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $15,486
EPIC Funds Encumbered: $1,565,400	**EPIC Funds Spent:** $423,239
Match Partner and Funding Split: BDP Technologies: $330,904 (17.4 %)	**Match Funding:** $330,904
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 8 out of 8 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

As of October 17, 2017, the project is in the design phase (task 2) and the recipient is coordinating with the engineering firm to revise the design in order to reduce the construction costs. These construction costs are associated with the design of the retention basin. The recipient is on budget and schedule.. Securing the air and water permits are on schedule.

194. EPC-16-019

Project Name:

21st Century Solutions for 20th Century Wind Projects

[EPC-16-019]

Recipient/Contractor:

The Regents of the University of California on behalf of the Davis campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	2/13/2017 to 5/30/2019

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

California has a large population of aged wind turbines. According to the American Wind Energy Association project database, there are approximately 4,500 sub 300 kW turbines operating in California with rudimentary control systems. Those old turbines lack remote communication and control systems and cannot be remotely dispatched on and off. During periods without wind, the turbines remain online and energized, drawing grid power at high retail rates and costing owners up to $100,000 per year.

Project Description:

This project aims to develop inexpensive, standardized turbine upgrades that will allow aged turbines to behave more similarly to modern turbines by dispatching on/off when it is beneficial. The upgrade is a low-cost, robust, wireless communication and control system. The project includes installation of wireless communications and a field demonstration of the turbine upgrades and the forecasting algorithm at an operating wind plant in collaboration with CAISO and wind plant owners. A field test is at an operating wind farm in the Tehachapi region.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Through development of an innovative, real-time dispatch system for legacy turbines and implementation of a low-cost, robust form of remote communication and control, this agreement addresses the inability to efficiently and quickly on and off dispatch turbines when grid and market conditions demand. The project will deliver a low cost standardized communication and control system for aged turbines capable of remote on/off dispatch, and create a grid, market, and weather forecasting system to enable automated dispatching of turbines in response to oversupply and low/no wind conditions.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 1c, 3a, 3f, 4a, 5c

Lower Costs:

The upgrades implemented in this project will implement low-cost and reliable over-the-air remote communications and control for aged wind turbines. It will use the advances in wireless data transmission, communication, and microprocessor-based devices to develop a wireless communication system for aged turbines and will use existing 'off-the-shelf' equipment and technologies to develop low-cost, robust turbine upgrades that enable remote control and

communication.

Greater Reliability:

The upgrades implemented in this project will increase grid reliability by enabling dispatchability of legacy turbines from online to offline during periods of oversupply to reduce the need for other adjustments on the grid to respond to the excess wind generation. This contributes to improvement in overall system flexibility and reliability.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $322,793
EPIC Funds Encumbered: $810,438	**EPIC Funds Spent:** $20,537
Match Partner and Funding Split: Department of Mechanical and Aerospace Engineering - UC Davis: $124,916 (13.4 %)	**Match Funding:** $124,916
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 32 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

DNV GL's Forecaster weather modeling and short term power prediction tools and software will be used to support creation of a model that can identify optimum periods for dispatching aged turbines on & off. The dispatch algorithm developed for this project will utilize Forecaster inputs, but could be operated with forecasts from other systems.

Update:

A stakeholder workshop concluded that not all wind projects are exposed to negative pricing since the economic situation can vary from project to project. However, almost all projects are exposed to energy consumption and demand charges that erode their economics. Stakeholders expressed interest to determine a method for addressing negative price situations and energy consumption/demand charge reduction, and whether a solar PV and storage system could be a key element to reduce peak energy and demand charges. Researchers identified that communication systems currently used in wind farms demonstrate effectiveness to enable remote turbine dispatch and successfully integrate their radio communication solution into a legacy control panel equipped with relay equipment. However,

there is a need of developing a cheaper radio communication solution.

195. EPC-16-020

Project Name:

Recovery of Lithium from Geothermal Brines

[EPC-16-020]

Recipient/Contractor:

SRI International

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	1/16/2017 to 8/12/2019

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

Expansion of geothermal energy production in California will greatly benefit from the creation of a value stream produced by the recovery of useful metals from geothermal fluids. The efficient separation of metals, such as lithium, from geothermal brines promises to make the production of geothermal power economically favorable, even from low-temperature geothermal fluids. Revenue will be produced from the sale of the marketable metals, and the scaling and re-injection issues associated with the high-solid-content brines will be minimized.

Project Description:

This project aims to demonstrate a cost-effective integrated process for the recovery of lithium from geothermal brines based on: (1) new high-capacity selective composite sorbents comprised of inorganic lithium-ion sieves and lithium-ion-imprinted polymers; and (2) a new sorbent regeneration process using eco-friendly carbon dioxide/carbonic acid that will lead to the direct formation of high-purity lithium carbonate (Li2CO3). Compared to traditional methods of Li recovery from brines, the proposed high-capacity selective sorbents and their regeneration process are expected to lower the cost of Li production by enabling online separation with higher recovery efficiency, using smaller volumes of sorbents and minimizing processing time. The project demonstrates a lab-scale integrated separation process for the production of high-purity Li2CO3 from geothermal brines.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement by enabling co-production of power and high-value metals from geothermal resources. The co-production of metals will improve the economic viability of geothermal power production, therefore increasing the penetration of geothermal renewable energy.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 2a, 3g

Lower Costs:

The technology being developed by the project will lower the cost of geothermal production as a result of the recovery of useful metals from geothermal fluids. The economic value of the Salton Sea minerals is estimated at $1.5 billion. This is higher than the economic value of the net combined 327 MWe produced by the 10 power plants operating in the Salton Sea Known

Geothermal Resource Area.

Economic Development:

According to a 2008 feasibility study sponsored by the Imperial Irrigation District, developing geothermal resources could result in creation of some 7,000 to 9,000 jobs, many of which would likely be higher paying than typical jobs in the county. A number of these jobs are likely to be in communities to the north, east, and south of the Salton Sea; areas that meet the CalEnviroScreen designation as disadvantaged communities.

Environmental Benefits:

Additional geothermal energy sources in the Salton Sea Known Geothermal Resource Area will reduce air pollution, which may improve the health of people in affected zones. Revenue from the land leases and mineral recovery is expected to support Salton Sea restoration projects, which some sources estimate may cost on the order of $3 to $9 billion.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $437,858	
EPIC Funds Encumbered: $873,387		**EPIC Funds Spent:** $190,453	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 32 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project has finished testing sorbents using synthetic brines to characterize specific surface area, selectivity, capacity, and adsorption kinetics. They have also completed sorbent regeneration testing to determine the regeneration kinetics, sorbent stability, and the purity of the lithium carbonate product.

196. EPC-16-021

Project Name:

High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network

[EPC-16-021]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	2/13/2017 to 9/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

In operating geothermal fields, there is presently no method for imaging the movement of water and steam in a fractured geothermal reservoir in time and three-dimensional space. Tracer tests provide ground truth information about inter-well connectively, but they do not directly reveal the flow paths in the regions between the wells. Microseismicity mapped in three-dimensions can provide valuable information about fluid movement, but it is possible for water and steam to move through the fractured rock mass without triggering microseismicity, as well as for microseismicity to be triggered without fluids.

Project Description:

This project advances the current state for imaging subsurface flow paths, barriers, and heterogeneity in operating geothermal reservoirs through an integrated approach that combines the recent development of low-cost, dense seismic networks together with established state-of-the-art micro-earthquake imaging algorithms and rock physics concepts. The technical advancement of this project is the integration of these components into a system that can be cost-effectively, reliably and routinely deployed in operating geothermal fields to image the movement of fluids in space and time with high-resolution and fast-turnaround time from data collection, to processing, to imaging, to rock physics interpretations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement and assist the continued growth of California's broad portfolio of renewable energy, by providing tools to help geothermal operations to be more productive. This project will demonstrate the advantages of a micro-earthquake imaging system that uses a dense network of seismic stations and automated processing to perform fast-turnaround, high-resolution imaging of fluid movement in producing geothermal reservoirs.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 2a, 3a, 3b

Lower Costs:

A better understanding of the subsurface flow paths will allow them to optimize production activities and improve well targeting to drill more productive wells. Drilling wells with a 5-10% efficiency increase (whether in steam production or water injection wells) is a reasonable assumption with improved well targeting. At a 10% efficiency increase, 1 well in 10 could be eliminated from the drilling program. The Geysers well drilling program generally includes, at minimum, the equivalent of 10 deep wells and 5 shallow wells in 5 years. Deep wells cost approximately $6,500,000, while shallow wells cost approximately $3,000,000 to drill.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $531,029
EPIC Funds Encumbered: $1,672,639	**EPIC Funds Spent:** $520,000
Match Partner and Funding Split: Jarpe Data Solutions: $50,000 (2.9 %)	**Match Funding:** $50,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 32 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The dense network design for the 5 km x 5 km area of interest at the demonstration site is almost complete. Development of the automated micro-earthquake data processing system is in progress. Installation of the micro-earthquake stations at the demonstration site is on schedule to take place in 2018.

197. EPC-16-022

Project Name:

Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production

[EPC-16-022]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	2/13/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

The increased use of intermittent renewable energy (primarily wind and solar) increases the inherent variability and uncertainty in electricity demand and resource availability, and thus drives the need for operational flexibility of other renewables such as geothermal energy. Converting production from baseload to flexible production may result in significant changes to the system related to corrosion and mineral deposition (scaling) in wells, and mechanical fatigue damage to well components or the reservoir. A better understanding of the impacts of flexible-mode production on the reservoir-wellbore system is needed to assure safe and sustainable production.

Project Description:

This project seeks to address the specific challenges of base-load and flexible-mode geothermal production, including wellbore and reservoir integrity, scaling, and corrosion. An improved THMC model is being developed and applied to better understand these issues. Flexible mode production typically includes daily cycles in production rate that result in extraordinary stress on the wellbore and reservoir system. The modeling and assessment is being conducted to predict short- and long-term impacts of flexible-mode production from liquid-dominant geothermal reservoir systems representative in California and the site-specific vapor-dominated Geysers Geothermal Field with pilot test data on flexible production.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is designing, installing and evaluating integrated super high-efficiency solar panels with super high-efficiency pre-market energy storage batteries, along with low-cost control hardware to demonstrate the impact of an integrated community solar and energy storage system in a low-income community. The project is designed to demonstrate the impact of an integrated community solar and energy storage system in a low-income community, which is expected to reduce net energy consumption and reduce energy bills.

CPUC Proceedings addressing issues related to this EPIC project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 2a, 3a, 5a, 5f

Lower Costs:

The primary application of the solar PV and energy storage system will be to lower energy costs, by approximately 42%, for the individual tenants within the mobile home park. Additionally, by providing potential locational benefits such as reducing congestion on the distribution feeder or increasing the integration capacity of the circuit, the grid will function more efficiently, potentially deferring or offsetting grid transformer or line upgrades. Shifting excess solar PV generation from the middle of the day to evening residential peak hours will reduce the need to deploy more expensive peaker plants.

Greater Reliability:

Storage integrated with solar PV on the distribution system can increase system reliability through services such as local overload relief, renewable integrating on circuits with high penetration of intermittent generation, and local customer back-up.

Environmental Benefits:

The project could lead to reductions in greenhouse gas and air pollutant emissions through reduced energy consumption and generation. Deployed at 5% of mobile home and multifamily dwellings across the state by 2025, community-scale solar PV and energy storage operated as proposed could reduce annual energy generation needs, including peak-demand, by 800 MWh. This reduced energy consumption would result in an estimated reduction of roughly 505,000 metric tons of CO2 annually, with concurrent reductions in both NOx (criteria pollutant) and methane (GHG) emissions.

Consumer Appeal:

The integrated suite of solar PV, energy storage, and smart controls is anticipated to reduce annual energy usage by 38%, bringing total utility bills down by approximately 42%, which is substantial considering change to TOU billing and the energy discounts the park already receives through the California Alternate Rates for Energy (CARE) program. The same configuration and use cases piloted in this project could be replicated at other multifamily dwellings as well.

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $999,032	**EPIC Funds Spent:** $360,000
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	Funding Mechanism:	No. of Initial Passing Applicants/ Bidders:	Rank of Selected Applicant/ Bidder:
Competitive	Grant	29 out of 32 bidders	Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Grantee has identified the following as pre-existing project relevant IP:

1) Center for Sustainable Energy Name and Logo
2) Horizon Solar Power Logo
3) Kisensum Energy Storage Control Software

Update:

The project was awarded at the July 2017 Business Meeting and a kick-off meeting was held in December 2017. The researchers aim to execute an agreement with the selected deployment site in the first quarter of 2018.

198. EPC-16-024

Project Name:

San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)

[EPC-16-024]

Recipient/Contractor:

San Gabriel Valley Water Company

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	3/1/2017 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Typically, the 100 kW or less pressure reducing valves are located in above- or below-ground structures that were not designed for the addition of in-conduit hydroelectric systems. To adapt a water-to-wire system at these sites, resources are spent designing a custom powerhouse to include civil, mechanical and electrical equipment/systems. However, sub 100-kW sites often share characteristics that present an opportunity to integrate a standard civil, mechanical electrical powerhouse design (above or below grade), with an integrated water-to-wire system constituting a “plug and play” in-conduit hydroelectric packaged system.

Project Description:

The San Gabriel “Plug and Play” In-Conduit Hydropower Development Project aims to design, develop and demonstrate a modular, cost-effective in-conduit hydroelectric system designed for the sub-100-kW in-conduit hydroelectric market that will decrease the civil, mechanical, electrical and interconnection costs. San Gabriel Project includes a new 73 kW modular “plug and play” in-conduit hydroelectric station at a space-constrained site in an urban, potable water system, that will provide an estimated 381,000 kilowatt-hours (kWh) of renewable generation, while also providing a model that can be deployed to many undeveloped, small sub-100 kW in-conduit sites throughout the state.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State’s Statutory Energy Goals:

The project will recover wasted energy from an existing pressure reducing station, thereby addressing a key component of the Water-Energy nexus, an on-going proceeding at the CPUC and Energy Commission. The recipient estimates there to be about 120 similar-sized pressure reducing opportunities within California representing 9,000 kilowatts that will become economically viable if the project is able to meet its cost reduction goals.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 1a, 1b, 2a

Lower Costs:

This project is expected to benefit IOU electricity ratepayers by reducing the cost of sub 100 kilowatt hydropower by an estimated 20 percent.

Environmental Benefits:

Over the course of its 30 year asset life, the 78 kilowatt hydropower project is expected to reduce CO2e emissions by 8040 metric tons.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $13,082
EPIC Funds Encumbered: $500,000	**EPIC Funds Spent:** $76,733
Match Partner and Funding Split: San Gabriel Valley Water Company: $612,000 (47.7 %) NLine Energy, Inc.: $170,000 (13.3 %)	**Match Funding:** $782,000
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 32 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project kicked off in April, 2017. The project team is currently developing the conceptual civil, mechanical and electrical plans and specification for the project. The current schedule calls for construction to begin in late spring of 2018.

199. EPC-16-025

Project Name:

Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California

[EPC-16-025]

Recipient/Contractor:

Stantec Consulting Services Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	2/13/2017 to 10/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Less than 5% of the 255 MW in-conduit hydrogeneration potential forecasted has been approved for development since 2013. Although the regulatory, environmental, technical and financial environment incentivize stakeholders, the total market penetration is still under 10% of potential. A number of agencies have compiled information on small hydropower systems, providing high level, directional guidance recommendations for on-site and equipment selection, commissioning, operation and testing. The limitations associated with the publically available guidebooks and tools must be addressed to assist users in making appropriate and informed decision.

Project Description:

This project aims to conduct a comprehensive assessment of in-conduit hydropower generation potential in California and develop a guidebook and a business case assessment tool that assist municipal, agricultural, and industrial water purveyors with the cost effective implementation of in-conduit hydropower generation projects. The proposed guidebook and the business case assessment tool will provide invaluable knowledgebase for municipal (water and wastewater), agricultural and industrial agencies that are considering capturing hydrokinetic/hydrostatic energy and integrating in-conduit hydropower into the existing energy mix. The Business Case Assessment Tool will assist users with building a business case for implementation of an in-conduit hydropower project, providing qualitative and quantitative guidance on the selection of equipment and sites for fit-for-purpose applications.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Newer in-conduit hydroelectric turbine technology research and development has not been adequately covered in any published guidebook. The available guidebooks do not include many of these novel technologies nor do they include performance information, associated equipment, siting criteria, civil, mechanical and electrical design considerations, costs or other relevant information that will assist California's stakeholders in determining which in-conduit hydroelectric technologies are best suited for a particular site.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 1a, 3a, 3b

Lower Costs:

The development of a clear, concise and transparent guidebook for assessment of in-conduit hydropower in California will enable electricity ratepayers to benefit from effective deployment and avoid the risk of failed projects. Developing the tools for evaluating the economic and environmental impacts of in-conduit hydropower generation will help ensure that projects are cost-effective and reduce costs for California ratepayers.

Greater Reliability:

Deployment of justified in-conduit hydropower could provide a source of capacity and renewable energy that is not fundamentally intermittent. In-conduit hydropower projects could provide resource diversity benefits to system reliability.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $121,338	
EPIC Funds Encumbered: $400,000		**EPIC Funds Spent:** $64,754	
Match Partner and Funding Split: Stantec Consulting Services Inc.: $35,372 (7.3 %) NLine Energy, Inc.: $19,104 (4.0 %) Leland Stanford Junior University: $28,542 (5.9 %)		**Match Funding:** $83,018	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 32 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Researchers have collected 97 documents pertaining to in-conduit hydropower. The literature review identified several turbine technologies currently available in the market, compiled their technical specifications, limitations and benefits, applications, and corresponding manufacturers, and identified the potential applications of these turbines to various types of

conduits such as diversion structures, canals, concrete-lined chutes, aqueducts, pipelines, and wastewater treatment plant output stream. Researchers prepared a preliminary questionnaire survey to be submitted to water purveyors to supplement the findings of literature review. The questionnaire will collect information on site selection, technology/process, feasibility study, selection of key performance indicators for operations, regulatory and permitting, energy production and grid interconnection, and cost and financing.

200. EPC-16-026

Project Name:

Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants

[EPC-16-026]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/15/2017 to 12/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Demand Response (DR) has the largest opportunity in the industrial processes where storage is inherent. There is future growth available in end use sectors such as water pumping and frozen food processing and storage. However, much of the technology and automation needs development and testing in these sectors.

Project Description:

The agreement develops and pilot tests controls for demand response integration at two demonstration sites in California. The first is a water pumping station and the second is an industrial refrigerated warehouse facility at the Port of Long Beach. The technology will enable faster and more flexible demand response, optimized for energy bill savings, and on-site operations. The technology integrates controls, building energy costs, historic load data, and rate tariff information to allow for optimized demand response utilization. The Port of Long Beach refrigeration facility is in a disadvantaged community

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advances the adjustability of demand including fast ramping, ancillary service operating reserves, frequency regulation, and peak load reduction. Both test sites have built-in inherent storage---water storage in the case of water pumping and thermal mass in the case of frozen and refrigerated food-- that allows for fast and flexible demand response.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1g

Lower Costs:

The project has the potential to reduce demand by at least 20% for a variety of grid use cases including fast ramping, ancillary service operating reserves, frequency regulation, and peak load reduction. This can result in lower demand costs.

Greater Reliability:

Supporting fast and flexible demand response helps to augment power system reliability and

<table>
<tr><td colspan="4">results in less stress on the grid. These services can help with maintaining system reliability.</td></tr>
<tr><td colspan="2">Assignment to Value Chain:
Demand-side Management</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $884,720</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$3,000,000</td><td colspan="2">EPIC Funds Spent:
$0</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
Southern California Edison: $300,000 (8.7 %)
San Diego Gas & Electric Company: $15,000 (0.4 %)
Electric Power Research Institute (EPRI): $150,000 (4.3 %)</td><td colspan="2">Match Funding:
$465,000</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
phase 1: 27 out of 28 bidders</td><td>Rank of Selected Applicant/ Bidder:
Phase 1 Group 2: Ranked # 5</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
A site visit to the refrigeration facility took place in October 2017 where baseline monitoring is underway. The team is currently designing the load control approach, with completion expected in Q2 2018.</td></tr>
</table>

201. EPC-16-027

Project Name:

Facilitating On-farm Participation in Energy Demand Management Programs

[EPC-16-027]

Recipient/Contractor:

Irrigation for the Future, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/3/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Irrigated agriculture represents a significant source of energy-use and peak demand in California. California's level of irrigation management is advanced relative to the rest of the country, with 40% of irrigators using some form of scientific irrigation management when deciding when to irrigate. To reduce energy and water use further, partial irrigation timing strategies, such as deficit irrigation, are needed. Partial irrigation strategies can reduce energy use or shift demand times while maintaining or increasing farm profits, but these benefits are not well documented.

Project Description:

This project develops a management tool for optimizing irrigation at 10 farms in California. The sites have varied water requirements, growing a mix of almonds and alfalfa. The project is validating a pre-commercial water management system that allows irrigators to have more flexibility over when they irrigate and use energy. Instead of adding water whenever the soil is dry, this system will manage plant stress so that water can be delivered when costs are low and when needed by the plant. The purpose of the management technology is to enable irrigators to participate in utility incentive programs offering benefits to customers who can shift their energy demand. This management approach would enable participation in utility demand response, time of use, and automated demand response programs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The agreement tests an irrigation management system that facilitates use of partial irrigation strategies, enabling flexible energy load control. This will allow irrigators to participate in utility demand response and time of use programs while providing flexibility to the grid.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1b, 1e, 1f, 1g, 2a, 4c

Lower Costs:

This project could lower energy costs and demand through participation in utility incentive programs for time-of-use, demand response, and automated demand response. It could also reduce water use and cost by 15% per farm.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $166,426	
EPIC Funds Encumbered: $1,588,872		**EPIC Funds Spent:** $37,533	
Match Partner and Funding Split: Irrigation for the Future, Inc.: $126,663 (7.4 %)		**Match Funding:** $126,663	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 2: Ranked # 4
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions. The intellectual property contains copyrights to "Irrigation Management Online."			
Update: Water flow meters have been installed at the sites. Telemetry and calibration for the meter at each site has been completed, and the team is collecting baseline water use data. Recipient is in the process of developing water reduction algorithms to reduce energy costs through participation in utility programs.			

202. EPC-16-028

Project Name:

Irvine Ranch Water District Load Shifting and Demand Response Pilot Project

[EPC-16-028]

Recipient/Contractor:

Advanced Microgrid Solutions, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/7/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Water agencies operate within strict health, safety, and reliability and ratemaking constraints. Participation in demand response programs is not part of the core mission of water agencies and funding to increase demand response participation is not supported in the rate design. Electricity tariffs for water agencies intended to reduce peak demand are often at odds with the operating requirements of water and wastewater treatment facilities. Smart load control and demand response technologies are needed to automatically reduce peak demand, usage, and optimize cost, within existing tariffs and operational constraints of water agencies.

Project Description:

This project develops, tests, and validates a load-shifting optimization platform to reduce energy use and demand charges in the water sector. The platform advances pre-commercial demand response technologies to reduce: peak demand, energy use, and operational costs. The platform integrates advanced real-time monitoring, automated load shifting control, energy storage, and a pre-commercial cost optimization platform. Data generated by the project will validate the approach and identify best practices for increasing water sector participation in demand response programs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project integrates several pre-commercial and commercial technologies into a platform that enables operational equipment and energy storage resources to respond automatically to energy price signals. The integrated approach promotes greater participation in demand reduction events, including the ability to participate without prior-day notice.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1f, 1g, 1h, 4a

Lower Costs:

The project is estimated to reduce on-peak demand by 22 percent, or 650 kW; reduce energy usage 32 percent, or 267 MWh of electricity; and save $326,000 annually in reduced energy costs. The target market for this technology are the estimated 1,300 retail water and wastewater pumping, treatment, and storage facilities throughout California. If all eligible facilities statewide install the technology, the result would be 80 MW of reduced demand.

Greater Reliability:

The project will validate the ability of water agencies to participate in demand response events on an automated basis, enable a more rapid response, and allow for greater load reduction. This project has the potential to increase grid reliability by increasing participation in demand response programs and providing dispatchable load reduction.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $832,615
EPIC Funds Encumbered: $1,403,465	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Advanced Microgrid Solutions, Inc.: $712,293 (32.9 %) Enbala Power Networks: $25,000 (1.2 %) Irvine Ranch Water District: $23,100 (1.1 %)	**Match Funding:** $760,393
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project began in November 2017. The recipient is currently analyzing and modeling the project sites to develop a tailored energy savings approach.

203. EPC-16-029

Project Name:

Water/Energy Bank Proof-of-Concept

[EPC-16-029]

Recipient/Contractor:

Antelope Valley Water Storage, LLC

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/13/2017 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The State Water Project (SWP) which transports water annually from the northern part of the state southward is California's largest user of electricity - about 2% of the State's anticipated 2020 peak demand. A significant portion of the electricity is used to pump water over the Tehachapi Mountains which involves a nearly 3000 foot lift in elevation. The innovation of this project is that contractors will be incentivized to shift their water delivery schedules to non-summer months to optimize energy benefits. This project will enable a guaranteed peak load reduction in the summer months when electric grid demand is at its highest levels.

Project Description:

This proof of concept study is evaluating the feasibility of using groundwater storage and cycling surface reservoirs to shift the State Water Project's Southern California water deliveries to non-summer months to reduce summer electric grid peak demand. Shifting the timing of water deliveries could reduce solar and wind power over-generation risk during non-summer months when renewable energy is in surplus. This project investigates the technical, institutional, legal and economic feasibility of implementing a guaranteed water delivery shift and develop demand response and load shifting tools and strategies to manage peak load and demand and thereby reduce energy costs in the water sector.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project could lower peak demand on the electric grid during Summer months when power demand is at its highest levels. This will increase the reliability of the electric grid system, reduce the need to use high polluting peaker plants that operate on fossil fuels to meet system demand and operating margins, and lower Department of Water Resource's water transport costs by shifting electric demand to non-summer months when demand and energy rates are lower.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1f, 4a, 5b

Lower Costs:

This project could eliminate the need to meet peak electricity needs using fossil-fueled combustion turbines due to summer reductions of State Water Project pumping. Department of Water Resources costs to import water could also be reduced by using the lower rates for

electricity available during non-summer months. Estimates of lower costs are not yet completed.

Greater Reliability:

This project could improve electric grid reliability by providing a guaranteed summer pumping reduction that provides firm demand response to match the evening ramp up as solar arrays go offline. It is independent of natural gas availability - the fuel for the State's newer combined cycle power plants and higher polluting peaker plants. The water energy bank is a demand response resource that can address a grid emergency such as the loss of generation or transmission facilities to improve reliability.

Environmental Benefits:

The project has the potential to increase use of renewable energy generation during periods of over generation by pumping water through the State Water Project during these times. Use of renewable energy generation results in less use of fossil fueled combustion turbines to meet summer peaks.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $150,000	
EPIC Funds Encumbered: $1,000,000		**EPIC Funds Spent:** $130,451	
Match Partner and Funding Split: Antelope Valley Water Storage, LLC: $149,999 (12.2 %) To Be Determined: $75,001 (6.1 %)		**Match Funding:** $225,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 2: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			

Update:

The research team is undergoing a review of initial statistical assessment results describing the volumes of water deliveries that need to be re-scheduled to allow for elimination of Edmonston pumping during the summer peak months. HDR is preparing a sample water year graphic that shows the system characteristics. The team is analyzing average Dept. of Water Resources power costs for the State Water project.

204. EPC-16-030

Project Name:

Enabling Energy Efficient Data Centers in Smart Power Distribution Systems

[EPC-16-030]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Riverside Campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/8/2017 to 12/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Data centers consume an estimated 2% (100 billion kWh) of total U.S. electricity with a cost of around $10 billion. The peak demand of data centers represents over 2% of peak load in California and is expected to grow 4% annually in the next ten years. Therefore, it is critical to develop energy efficiency technologies for data centers in California.

Project Description:

This project is researching and testing technologies that improve data center energy efficiency at three different levels in a smart power distribution system. The technologies include increasing server energy efficiency, through coordinated deep sleep and dynamic voltage-frequency scaling (DVFS); data center workload balancing through phase and load balancing across multiple servers in a data center; and geographical workload balancing through phase/load balancing in a single or multiple power distribution network or feeder.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Data centers are a major consumer of electricity. In the PG&E service territory, peak demand of data centers is around 500 MW, representing 2.5% of peak load consumption. The energy use from data centers is expected to increase by 4% annually in the next 5-10 years. The development of agile energy efficiency solutions for data centers is needed. This project provides energy efficient technologies and software solutions to the data center industry, that has the potential of reduce electricity consumption by data centers by approximately 16 to 35% through deep sleep and dynamic voltage frequency scaling, peak efficiency scheduling and spatial workload scheduling.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1g, 2a

Lower Costs:

Much of the technology being developed by this project is software based and could have the capability of easy installation at other data centers which would help them lower their energy usage and the costs associated with it. The recipient estimates that implementation of three proposed techniques could annually save data center operators over 1,000 GWh, resulting in estimated cost savings of $173 million.

Greater Reliability:

Greater electricity reliability will be achieved by reducing the amount of electricity required of servers in idle.

Increase Safety:

Increased safety will be achieved through reducing the amount of electricity used during peak hours. Thus, the risk of equipment failure, such as transformers overheating, will be reduced.

Environmental Benefits:

If the three proposed techniques are implemented and saves data operators over 1,000 GWh annually, this results in a reduction of 365,863 metric tons of CO2 reduced. In addition, this project will prioritize redistribution of the server computing load to data centers that have renewable sources of power thereby lowering their carbon footprint further.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $306,631	
EPIC Funds Encumbered: $1,783,118		**EPIC Funds Spent:** $79,383	
Match Partner and Funding Split: The Regents of the University of California (UC Riverside): $265,567 (12.8 %) San Jose State Research Foundation: $31,497 (1.5 %)		**Match Funding:** $297,064	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 1: Ranked # 3
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			

Update:

The project team is drafting the Technology/Knowledge Transfer Plan with ARC Alternatives and continuing the development of the peak efficiency algorithm. The server setup (OS installation, network connection from both institutions) is almost finished. Development of Coordinated Deep Sleep and DVFS algorithm has been completed

205. EPC-16-031

Project Name:

VOLTTRON Testing Tool Kit

[EPC-16-031]

Recipient/Contractor:

SLAC National Accelerator Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	3/31/2017 to 3/29/2019

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

California's energy goals include high levels of utility-scale renewables and distributed energy resources (DER). These goals can be achieved only if the distribution utility can operate the grid reliably while supporting ever larger amounts of DER. Today's DER management and system integration projects are either not integrated with each other or are costly to implement. They require highly skilled labor to connect specialized equipment and program software to optimize system operation. As buildings and operations change, specialized software must be adjusted, tested, recalibrated for optimal use and performance.

Project Description:

This federal cost share project demonstrates the benefits of the VOLTTRON platform for DER management through the testing of the VOLTTRON Testing Tool Kit. VOLTTRON is a US Department of Energy funded open source platform intended to provide a software base for integrating management of energy demand in buildings, distributed energy resources, and the electrical grid. The tool kit expands the VOLTTRON platform beyond its original set of developers and encourages adoption by other organizations and private entities. By lowering implementation costs and adding additional features such as simulation test suites and debugging tools, the tool kit promotes wider use of the VOLTTRON platform.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Communication of DERs with grid operators is critical for successful utilization of distributed energy resources. DOE developed the VOLTTRON platform to facilitate such communication. However, the platform is in its early stages and requires additional support and an expanded user base to become widely adopted. The VOLTTRON Testing Tool Kit provides new tools to confidently run a high qualify open source project. All knowledge gained and software written will be pushed to GitHub for open source use. With the testing tool kit, VOLTTRON becomes a more effective platform for DER management. This will enable higher utilization of DERs in support of the state's renewable energy and GHG reduction goals.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1d, 1e, 1f, 1g, 1h, 4a, 5b

Lower Costs:

This project can facilitate interoperability and reduce the cost of DER integration projects by approximately 30%. An open source integration platform, with strong technical support, can reduce the integration costs by creating a community of developers that reuse and enhance codes over time, savings cost of design, development, and commissioning.

Greater Reliability:

This project has the potential to facilitate adoption of DER management and integration projects, allowing the electric grid to continue operating reliably while supporting more utility-scale renewables and distributed energy resources.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $28,501	
EPIC Funds Encumbered: $70,000		**EPIC Funds Spent:** $50,400	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: United States Department of Energy : $700,000 Kisensum : $105,000		**Leveraged Funds:** $805,000	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 43 bidders	**Rank of Selected Applicant/ Bidder:** N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project is on schedule and within budget. In Q3 2017 the recipient hosted a VOLTTRON Learning Lab at Stanford University. The goal of the learning lab was to start building a user and developer community for VOLTTRON by providing an overview of VOLTTRON and the VOLTTRON Testing Tool Kit. The event included hands-on demonstrations and individual projects for participants to create an analytics agent.

206. EPC-16-032

Project Name:

Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Façade, Lighting and Plug Loads

[EPC-16-032]

Recipient/Contractor:

New Buildings Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

The Los Angeles basin is in drastic need of energy and carbon reductions in the wake of the Aliso Canyon natural gas leaks. Deep building energy retrofits can realize large energy and carbon savings in existing buildings. However, barriers such as cost-effectiveness, unknown savings potential, and scalability have limited implementation of large scale building retrofits that would provide a significant impact.

Project Description:

The project team is demonstrating and validating new retrofit package solutions from laboratory pre-testing through field demonstrations in existing government-owned commercial buildings. The solution sets, dubbed "INTER", are comprised of shading products from Rollease Acmeda and lighting and plug load systems and integrated controls, including HVAC systems, from Enlighted. The technologies can be combined and customized to suit a variety of building types and spaces, resulting in an estimated whole building energy reduction of 20 to 32 percent. Beginning in the Los Angeles basin, the team is leveraging existing market connections to increase and accelerate market adoption of these retrofit solution sets to maximize the potential energy and carbon savings, first in the region and ultimately, throughout California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project creates a holistic, low-barrier integrated retrofit solution for significant energy savings. The scalable energy retrofit solution will be demonstrated in municipal government buildings but is also applicable to other commercial and residential buildings and to new construction and existing buildings. Installation does not require specialized training. The integration of technologies can produce higher savings than individual technologies operated in isolation. This solution will support California's statewide zero net energy and existing building goals.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

The project could reduce annual energy use in a typical large office building by 32 percent. The lighting control system is demand response capable. If this suite of technologies are implemented statewide in California's existing buildings over the next 15 years, estimated savings include 2,692 GWh, $421 million, and 1,965 million pounds of CO2, assuming a retrofit rate of just 3 percent annually.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $1,767,847
EPIC Funds Encumbered: $4,981,000	**EPIC Funds Spent:** $120,000
Match Partner and Funding Split: United States Department of Energy: $50,000 (0.7 %) Rollease Acmeda, Inc.: $676,000 (10.1 %) Delos: $28,000 (0.4 %) Enlighted Inc.: $809,500 (12.1 %) Southern California Edison: $150,000 (2.2 %) TRC Engineers, Inc.: $12,000 (0.2 %)	**Match Funding:** $1,725,500
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 8 out of 10 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

By January 2018, initial ground work for the retrofit of several buildings in disadvantaged communities in the LA-Basin will begin. Key steps have been taken to test the INTER system at LBNL's FLEXLAB. Accomplishments include meeting with manufacturers (Rollease and Enlighted) to obtain technical specifications and identify potential product tests and modifications, establishing FLEXLAB bench test methodology and priorities, creating selection criteria for demonstration sites including applicability of the technology packages, access to monitoring and verification and occupant feedback, and transferability of benefits to the larger California marketplace. The first Technical Advisory Committee meeting was held, potential

demonstration site building owners in Santa Ana were engaged, and the kickoff benefits questionnaire and draft technology transfer plan have been submitted.

207. EPC-16-033

Project Name:

Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration

[EPC-16-033]

Recipient/Contractor:

CSU Long Beach Research Foundation

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/30/2017 to 9/1/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Many existing building owners are reluctant to take on brand-new technologies or upgrades due to the need for additional in-house technical personnel and expertise. This agreement attempts to overcome this reluctance by demonstrating state-of -the art energy management technologies in a large academic building. The agreement performs assessments of an innovative pre-commercial energy management system based on internet of things (IoT) using ubiquitous sensing and controls.

Project Description:

This project develops and evaluates a pre-commercial energy management system at CSU Long Beach. The research demonstrates energy efficiency technologies with controls utilizing the internet of things (IoT), and optimizing load operation, load leveling, and peak shaving. The advancements in monitoring and controls from this project will enable deployment of similar systems at academic facilities in California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project aims to remove barriers to achieve widespread deployment of state-of-the-art energy management technologies. The project provides California IOUs, academic institutions (universities, including 22 CSU campuses), energy management technology developers, and other stakeholders with an IOT-based energy management platform. Additionally, the project provides a comprehensive assessment of the potential for large scale deployment, including technical considerations, building performance, energy savings, and non-energy benefits.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1g, 1h

Lower Costs:

The use of IOT-based controls will reduce on-peak energy demand (KW) and consumption (KWH) at a large university. by an estimated 20%.

Environmental Benefits:

Reduction in on-peak energy demand (KW) and consumption (KWH) will result in decreased

<table>
<tr><td colspan="4">greenhouse gas emissions</td></tr>
<tr><td colspan="2">Assignment to Value Chain:
Demand-side Management</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $402,014</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$2,509,946</td><td colspan="2">EPIC Funds Spent:
$0</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
Enlighted Inc.: $411,500 (11.5 %)
ControlWorks, Inc.: $88,500 (2.5 %)
Regents of the University of California, Riverside Campus: $163,400 (4.6 %)
CSU Long Beach Research Foundation: $409,558 (11.4 %)</td><td colspan="2">Match Funding:
$1,072,958</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
phase 1: 8 out of 10 bidders</td><td>Rank of Selected Applicant/ Bidder:
Phase 1 Group 2: Ranked # 2</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The project began in April 2017 and the recipient is utilizing baseline data to develop its design plans. They are also mapping the lighting, HVAC, and plug load control potential for the project. The first TAC meeting was held in December 2017.</td></tr>
</table>

208. EPC-16-034

Project Name:

Automated Cloud-Based Continuously Optimizing Building Energy Management System [EPC-16-034]

Recipient/Contractor:

Zero Net Energy Alliance, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/1/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Current building energy management systems (BEMS) are typically programmed and set to a predefined schedule to ensure set points are reached. However, most BEMS fail to optimize energy use because predetermined settings become rapidly obsolete. In addition, energy management systems do not detect when buildings and energy systems degrade over time, creating "drift" in the months and years following commissioning. Even state-of-the-art BEMS require regular reprogramming to achieve and sustain a high degree of energy efficiency.

Project Description:

The Automated Cloud-based Continuously Optimizing Building Energy Management System (ACCO-BEMS) overcomes limitations of existing energy management systems by automating optimized control of building systems and devices. The technology overcomes limitations of existing energy management systems and eliminates the need for expensive reprogramming needed to implement optimization measures. As such, the technology can co-exist with existing systems in retrofit applications, or it can be implemented as a new installation.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Energy performance monitoring and fault detection diagnostics software is a key technology that must be further enhanced and deployed to overcome barriers to achieving ZNE buildings. A principal barrier to real-time management of energy systems is the many, often incompatible, protocols and interfaces used by energy devices and sensors. These have long represented a barrier to the integration of discrete systems, sensors and actuators necessary to automatically assess and control energy use. This project uses an internet of things gateway to concurrently communicate with virtually all discrete energy devices using their native protocol and interface. The platform uses machine learning to assess real-time building performance and automatically adjust individual devices. The technology eliminates building drift and negates the need for expensive reprogramming or optimization measures.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs:

The project has the potential to reduce electric demand and enable real-time automated demand response (ADR). The technology is being demonstrated at two Southern California college campuses and is estimated to enable 1 MW of ADR with projected annual energy savings of 1,600 MWh or $250,000 per year. The target market for this technology is educational, non-grocery retail and office buildings--which represents 43% of the total statewide electric use. Once scaled, statewide annual savings potential is estimated to be 7,269 GWh or an estimated $1.1 billion statewide.

Consumer Appeal:

ACCO-BEMS can connect to existing energy management systems, sensors, controllers, and meters to communicate with each in its native protocol. This allows for use of the technology with existing, installed equipment, avoiding the need for equipment replacement retrofits, or for the customer to learn a new system.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $552,488	
EPIC Funds Encumbered: $2,500,000		**EPIC Funds Spent:** $236,660	
Match Partner and Funding Split: Zero Net Energy (ZNE) Alliance: $25,000 (0.7 %) MelRok, LLC: $1,159,891 (31.5 %)		**Match Funding:** $1,184,891	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 8 out of 10 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The following milestones have been completed: 1) on-site audits of the project buildings, including mapping of points (chillers, boilers, VAVs, pumps, and cooling towers) and documenting the energy performance of the buildings prior to the installation of ACCO-BEMS; 2) developing the measurement and verification plan; and 3) enabling automated access to the energy management data.

209. EPC-16-035

Project Name:

High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)

[EPC-16-035]

Recipient/Contractor:

Sunpreme, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/12/2017 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

Standard front side metallization of industrial silicon solar cells uses silver paste for contact formation. Silver metal contained in the paste is an important cost driver in the manufacturing process. At the same time, the conductivity of printed and fired silver metallization is limited due to glass compounds and a porous structure. A metallization scheme based on all-copper plating proposed under this agreement has the potential to lower these costs while improving the overall efficiency of the photovoltaic cells.

Project Description:

This project develops a next generation manufacturing tool for low-cost, high-performance copper patterning on solar photovoltaic cells using technologies from printed circuit board manufacturing, reducing costs by up to 35%, and increasing cell efficiency by 15%.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project is developing a next generation manufacturing tool for low-cost, high-performance copper patterning on solar photovoltaic cells using technologies from printed circuit board manufacturing. This new process will lower electricity-related greenhouse gas (GHG) emissions and improve solar cells' efficiency.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 1b, 1c, 2a, 3b, 4a

Lower Costs:

If successful, the production tools and processes developed under this agreement will allow for the manufacture of heterojunction silicon cells at 23.5% efficiency and 400W panels at a cost of 40¢ per watt.

Environmental Benefits:

Lower costs for photovoltaic panels will support California's transition to renewable sources of energy and result in reduced GHG emissions.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $730,620	
EPIC Funds Encumbered: $2,430,000		**EPIC Funds Spent:** $1,071,594	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: United States Department of Energy : $4,999,999 Sunpreme, Inc. : $4,540,310		**Leveraged Funds:** $9,540,309	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 43 bidders	**Rank of Selected Applicant/ Bidder:** N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Patents issued to Sunpreme, Inc.:

1) "Low-cost solar cells and methods for fabricating low cost substrates for solar cells"
2) "Low-cost multi-junction solar cells and methods for their production"
3) "Low-cost solar cells and methods for their production"
4) "Low-cost multi-junction solar cells and methods for their production"

Patent Application: "Flat tabbing solar panels".

Update:

Since the agreement started, the project team performed many tasks crucial for the establishment of a manufacturing lane for copper patterning on silicon photovoltaic cells. Among these tasks, the team ordered and installed exposure, developer, stripper, etcher, and laminator tools, and they modified a commercial laminator tool and developed a dual-sided exposure tool for high-throughput wafer patterning. Lamination process tests have demonstrated that wafer alignment, placement and immobilization meet the minimum requirements for high volume manufacturing (HVM). In the first quarter of 2018, the team will

fabricate a minimum of 10 test cells and perform in-house reliability testing (e.g. damp heat, thermal cycling, humidity-freeze and light soaking) on the cell test modules. A minimum of 15 copper-metallized modules will be submitted for 3rd party testing.

210. EPC-16-036

Project Name:

Thermoelectric Generator Application and Pilot Test in a Geothermal Field

[EPC-16-036]

Recipient/Contractor:

AltaRock Energy, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Growth of the geothermal industry has been held back by the need for large and costly power plants and large scale infrastructure to produce geothermal electricity economically. Typically, a geothermal project cannot produce electricity economically at a scale less than 5 MW. If smaller geothermal power plants could be economical, this would open up more opportunities to add geothermal power to the energy mix.

Project Description:

Thermoelectric Generator (TEG) technologies have the potential to produce geothermal electricity without as much infrastructure (turbines, steam piping, etc.) thus making small scale production and geothermal powered micro power grids both practicable and affordable. Small (<5 MW) geothermal projects could provide consumers with the same distributed power flexibility provided by solar and wind production with the additional benefit of being a more reliable baseload source of electricity. TEG technologies can also allow geothermal heat to provide balancing and grid support. This project is scaling up a TEG from the watt-level in the lab to a 20 kW unit for demonstration in a geothermal reservoir.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop a means to expand use of low temperature and stranded geothermal resources by making small scale production both practicable and affordable.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 2a, 3b

Lower Costs:

Many smaller resources in remote areas are not currently able to be developed because it would not be economical to build a traditional geothermal power plant on such a small scale. Thermoelectric Generator technologies have the potential to help small scale geothermal power generation to be more cost effective by requiring less infrastructure and less complicated mechanical equipment.

Greater Reliability:

New baseload and flexible renewable generation technologies will improve the performance and reliability of the state's electrical grid system. Geothermal thermoelectric generators will expand use of low temperature and stranded geothermal resources in the state which have not traditionally been used to produce electricity. The technology can supply peaking power and balancing of intermittent renewable resources at much lower cost than batteries.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $433,153
EPIC Funds Encumbered: $1,280,000	**EPIC Funds Spent:** $10,964
Match Partner and Funding Split: Leland Stanford Junior University: $5,000 (0.4 %) AltaRock Energy, Inc.: $113,095 (8.1 %)	**Match Funding:** $118,095
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The thermoelectric generator test unit has been designed and built. Lab testing is in progress.

211. EPC-16-037

Project Name:

The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project) [EPC-16-037]

Recipient/Contractor:

Amador Water Agency

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

One of the oldest turbine technologies in California is the Pelton turbine, designed for high pressure conduit sites. There are an estimated 62 MW of installed Pelton turbines in California that are nearing the end of their in-service asset life and an estimated 8.2 MW of new small, in-conduit Pelton sites that remain undeveloped due to lack of efficiency and high costs. There is an immediate need to design, test, and demonstrate an improved and more efficient Pelton turbine runner in order to provide a viable retrofit solution for degrading sites and expand small hydropower deployment in new sites throughout California.

Project Description:

The goal of this project is to design, test, and demonstrate a 417 kW in-conduit Pelton turbine runner at an existing Pressure Reducing Station (PSR) site located in Ione, California. The project will demonstrate the ability to maximize the wasted energy captured at the station using an improved design of a higher-efficiency Pelton turbine runner specifically designed for small, in-conduit hydroelectric applications to contribute in the integration of in-conduit small hydropower into the existing state energy mix.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The system developed under this project will recover and maximize the capture of wasted energy in Pressure Reducing Station (PRS) commonly used by the water agencies and industry; improve the efficiency, performance and cost of the Pelton turbine technology to capture wasted energy and provide a viable retrofit solution for degrading sites; and expand small hydropower deployment.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 3a, 3b, 4a

Lower Costs:

Water agencies throughout the state will have an opportunity to generate additional revenue and/or offset ever-increasing electricity costs associated with treating, distributing and collecting water to help reduce costs to IOU ratepayers.

Greater Reliability:

The project will help achieve greater electricity reliability by supporting the generation of 72,000 MWh over a 50-year asset life of distributed, baseload renewable power using rotating equipment.

Environmental Benefits:

The ability to maximize and capture the wasted energy at the Pressure Reducing Station (PRS) to generate over 72,000 MWh of renewable power will offset 50,650 metric tons (MT) of CO2 equivalent over the 50-year useful asset life of the project.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $750,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: NLine Energy, Inc.: $108,334 (5.8 %) Amador Water Agency: $1,006,666 (54.0 %)		**Match Funding:** $1,115,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 32 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project kick-off meeting was held on July 14, 2017. The project is currently in the design phase and deployment is planned for late spring 2018.

212. EPC-16-038

Project Name:

Use of Indoor Rearing for Head-Starting Desert Tortoises

[EPC-16-038]

Recipient/Contractor:

The Regents of the University of California on behalf of the Davis campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/8/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Development of utility-scale solar energy electricity generation facilities is occurring rapidly in the desert southwest due to its high amounts of solar insolation. The Mojave desert tortoise is a frequently affected special-status species whose preservation often conflicts with development in southern California. Current law and implemented policies require that negative impacts to protected species be minimized or offset. Research is needed to evaluate the efficacy of head-starting as a mitigation tool for offsetting or minimizing impacts to the desert tortoise as well as aiding recovery of the species to streamline future permitting for renewable energy development.

Project Description:

The project conducts experimental releases of juvenile desert tortoises raised since 2011-2013 to evaluate the trade-offs of head-start duration on post-release survival of desert tortoises. The recipient is dividing hatchlings into two cohorts, raising half of them exclusively outdoors and the other half under a combination of indoor/outdoor rearing, releasing them as 2 year olds, and comparing their post-release survival. Data on the growth and survival of animals in this study provides guidance on the minimum duration of outdoor head-starting and whether indoor head-starting should be pursued in future head-starting programs for desert tortoises. Ultimately, the results of the proposed study can inform the extent to which head-starting both indoors and outdoors is a viable solution for mitigating localized impacts to tortoise populations affected by development for solar energy production facilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The research will be the first to evaluate the trade-offs in duration of head-starting on post-release survival in the eastern Mojave Desert where numerous solar production facilities have been recently constructed. Because longer head-start periods cost more, finding the optimal head-starting duration will help develop more cost-effective head-starting programs. The research will also evaluate indoor-head-starting. If the increase in size also results in an increase in post-release survival compared to outdoor-reared animals, indoor head-starting could dramatically reduce the costs of rearing animals to releasable size and also increase production of head-starting facilities.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 4f, 4g

Lower Costs:

This project will result in the ratepayer benefit of lower costs by making head-start mitigation more cost-effective, reducing obstacles to future renewable energy deployment. It is important to determine the best practice methods for head-starting juvenile tortoises, including reducing time spent in captivity and increasing survival in the wild after release. This will minimize mitigation costs.

Environmental Benefits:

New scientific knowledge on minimum size required at release while improving survivorship, resource needs, and translocation practices will guide management in the future. Implementation of more effective mitigation practices may increase probability of de-listing the desert tortoise in the future.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $77,924	
EPIC Funds Encumbered: $493,089		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: The Regents of the University of California, Davis Campus: $61,119 (11.0 %)		**Match Funding:** $61,119	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 14 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The research team collected 61 tortoise hatchlings in 2017 and allocated them to either the indoor or outdoor experimental groups. All captive tortoises from 2017 and previous years were measured to track their growth rates in different treatments. The 2016 indoor rearing group have been transitioned to outdoor pens for the second year of their head-starting. The project team is collaborating closely with the complementary project (EPC-16-053) in several areas, such as using a common technical advisory committee.

213. EPC-16-039

Project Name:

A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment

[EPC-16-039]

Recipient/Contractor:

The Regents of the University of California, Irvine

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/8/2017 to 8/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Scalable stationary energy storage is a critical component for facilitating the increased integration of renewable resources and meeting California's energy goals. However, the information about environmental and human health impacts of the emerging large-scale energy storage technologies is largely incomplete. A better understanding of the potential issues associated with their life cycle supply chain will enable these technologies to be scaled to the capacity levels necessary for providing widespread grid services without creating negative externalities.

Project Description:

This project investigates whether flow batteries are a viable option for providing grid energy storage at the large scale, either in place of or alongside lithium-ion battery technology. A life-cycle based characterization of the environmental impacts and resource usage associated with three chemistries of flow batteries (Vanadium Redox (V2O5), Zinc-Bromide (ZnBr), and Iron-Sodium (FeNa)) are being examined. Specifically, the materials use, energy use, and toxic waste outputs of the life-cycle phases of each flow battery type - including materials extraction, manufacturing, use, and disposal or recycling as applicable - are being investigated.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project provides guidance for California policymakers and planning agencies for selecting emerging energy storage technologies that can facilitate the increased uptake of renewable resources and decarbonization of California's energy system in a way that minimizes the externalities of environmental and human health impacts. This study provides the knowledge base and understanding necessary to allow flow batteries to be deployed in a manner which alleviates or circumvents potential obstacles related to environmental and human health.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Smart grid: R.08-12-009

Applicable Metrics: CPUC Metrics- 2a, 3e, 4b, 4c, 4d, 4e, 4f, 5d, 5e

Environmental Benefits:

This project will provide information that can be used to avoid environmental and safety issues that could result from the scale up of energy storage technologies.

Public Health:

The project will characterize the human health impacts from different grid-scale energy storage technologies. If successful, the project will help avoid potential health and safety issues that could hinder the scale up of new energy storage technologies.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $98,142
EPIC Funds Encumbered: $600,000	**EPIC Funds Spent:** $0
Match Partner and Funding Split: The Regents of the University of California, Irvine: $186,219 (23.7 %)	**Match Funding:** $186,219
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 14 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project kick-off meeting was conducted in July 2017. After the kickoff, the research team initiated formal exploration of flow battery manufacturing processes and material content in dialogue with the flow battery manufacturers. Researchers visited and toured two of the three flow battery manufacturing sites and explored patent literature to establish baseline understanding of material content. The researchers also started the foundation for the life cycle analysis for flow batteries, including the selection of software and methodologies. In November 2017, the recipient visited the third flow battery manufacturing site.

214. EPC-16-040

Project Name:

Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling

[EPC-16-040]

Recipient/Contractor:

The Regents of the University of California, Davis Campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/8/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

The majority of California power plants are located in areas designated as nonattainment for (PM10). The increasing demands and decreasing supply of naturally available freshwater throughout California result in state policies discouraging the use of freshwater for the purpose of heat rejection in cooling towers for recently approved thermal power generation plants. Degraded waters contain higher concentrations of total dissolved solids (TDS) and thus higher calculated emissions that required the purchase of costly PM offsets. These increases in emissions are a significant burden for power plant developers and may discourage the use of degraded water sources for cooling.

Project Description:

This project measures PM2.5 and PM10 across the spray drift plume from two power plant cooling towers that use fresh water and brackish water. These measurements are used to develop and validate a model of power plant PM2.5 and PM10 emissions. The end result is a model that power plant operators can use to minimize the PM2.5 and PM10 effects of brackish water use in cooling towers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Plume measurements from fresh and brackish water cooling towers will be utilized to develop a model of the droplet and particle size distribution changes in cooling tower plumes as a function of cooling water composition, meteorological conditions, and cooling tower operating parameters. The model will be based on first principles of chemistry and physics and validated using the measurement data. The model enables the use of brackish water instead of expensive fresh water, leading to decreased costs for electric utilities and ratepayers and frees up more fresh water for use in homes, industry, and agriculture in California.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 1c, 2a, 3a, 4b, 4c

Lower Costs:

This project decreases power plant operating costs by switching from fresh water to brackish water, saving money to the operators of the facility, since brackish water is less expensive than fresh water.

Environmental Benefits:

This project enables the use of brackish water in cooling towers in California, conserving valuable fresh water resources.

Public Health:

The modeling work focuses on decreasing the concentration of PM2.5 and PM10 downwind of power plant cooling towers when brackish water is used for cooling, thereby improving air quality in these locations.

<table>
<tr><td colspan="2">Assignment to Value Chain:
Generation</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $108,004</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$700,000</td><td colspan="2">EPIC Funds Spent:
$0</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
None</td><td colspan="2">Match Funding:
$0</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
14 out of 14 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 4: Ranked # 1</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
Since the kickoff meeting, the project team has been working on access to sites for field work. Thus far, the progress has been slow in gaining access to sites.</td></tr>
</table>

215. EPC-16-041

Project Name:

Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment

[EPC-16-041]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/8/2017 to 12/16/2019

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

California has an aggressive target to phase down high global warming potential refrigerant greenhouse gas emissions by 40 percent by 2030 (SB 1383) from 2013 levels, including goals to ban high-global warming potential (GWP) refrigerants greater than 150 in non-residential refrigeration by 2020 and high-GWP refrigerants greater than 750 in commercial and residential air-conditioning by 2021. Currently these hydrofluorocarbons are the fastest growing segment of GHGs in California, increasing about 10 percent per year since 2000.

Project Description:

This project will develop test procedures for alternative refrigerants for flammability and energy savings characterization and to develop a “favorability” index of end-use market segments and equipment types based on potential GHG savings impact and commercial feasibility and adoption.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State’s Statutory Energy Goals:

This project is advancing the knowledge of using alternative low global warming potential (GWP) refrigerants that will also result in higher energy efficiency for cooling equipment. This project will identify current barriers and technical issues, and assess the potential for an expanded set of products that could use low GWP A3 refrigerants. The project will incentivize manufacturers to develop product prototypes that could be tested at the recipient's facility. This can help equipment manufacturers and vendors with product development and lead to an increase in the supply of equipment with much lower lifetime GHG emissions. By transitioning to refrigerants with lower GWP refrigerants, the result will be lower GHG emissions in the 2030 and 2050 timeframes.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Environmental Benefits:

Transitioning to lower-GWP refrigerants for all product types by 2030 and 2050 reduces refrigerant emissions and greenhouse gas emissions by an estimated 5 and 6 Mt CO2e, for the a refrigeration and air conditioning sector, respectively.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $221,625	
EPIC Funds Encumbered: $500,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Institute for Governance & Sustainable Development: $500,000 (50.0 %)		**Match Funding:** $500,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 14 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 7: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The agreement is awaiting execution by all parties. The project was approved at the April 2017 business meeting.			

216. EPC-16-042

Project Name:

Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion

[EPC-16-042]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Current commercially available thermoelectric materials can only operate reliably up to 250 degrees C in temperature and has a low efficiency (5 percent). Few materials that have been evaluated at higher temperature suffer from reliability issues due to use of lead and oxidation and sublimation problems. Silicon is abundant and stable at high temperature but although thermoelectric device made from Si holds much promise, bulk Si has low figure-of-merit. One established strategy for increasing figure-of-merit is to employ nanostructuring to decrease thermal conductivity. Silicon nanowires represent a new, highly scalable technology that overcomes the limitations of previous efforts.

Project Description:

This project is developing a cost-effective mid- to high-temperature range (400-800C) p-type thermoelectric material for waste heat recovery using silicon nanowire arrays. The intent is to surpass technologies implementing an organic Rankine cycle or similar processes by having low parasitic losses, compact, and able to be modularized for a broad scale of distributed applications. To achieve the goal, the project will advance the state of the art in nanowire characterization; demonstrate an optimized process for the production of Si-nw arrays and a process to produce a freestanding array of aligned nanowires; characterize the thermoelectric and mechanical properties of these arrays and single Si-nw; optimize the fabrication of Si-nw arrays; and integrate into devices capable of heat-to-power conversion. The results of device performance will be used to evaluate the techno-economic impacts of this technology. Taken together, the project will move silicon nanowire technology's Technology Readiness Level (TRL) from 2 to a prototype technology demonstration in a relevant environment (TRL5).

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will address principal barriers to the widespread application of current thermoelectric materials by providing a low-cost, reliable, affordable and mass-producible technology that can be ubiquitously applied to convert high-temperature heat that is currently wasted at the production and retail levels in California.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 1h, 3h, 4a

Greater Reliability:

This project will create a cost-effective Thermoelectric Waste Heat Recovery system that will reduce energy use in the industrial sector, thus benefitting California ratepayers by increasing

electrical reliability and lowering electricity costs.

Economic Development:

The total waste heat potential in California is 763 megawatts. Assuming a system cost of $1.5/watt and a 10 percent penetration, the estimated levelized cost of electricity is $0.015/kWh. Considering the value of renewable electricity generated and a 20 year asset life, the net present value at 10% penetration is estimated at $1.2 billion, with a payback period of just over one year.

Energy Security:

Based on the assessment sponsored by Oak Ridge National Laboratory, the total potential net savings in electricity use per year from harvesting waste heat is about 0.022 quads for California. This is based on one-third of the theoretical maximum efficiency limit for heat engines (also known as the Carnot efficiency). Assuming an average source temperature of 800 F and a 10 percent efficiency for the silicone nanowire thermoelectric conversion system, the total potential for this technology is approximately 0.011 quads.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $440,167	
EPIC Funds Encumbered: $2,000,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Alphabet Energy, Inc.: $3,487,686 (63.6 %)		**Match Funding:** $3,487,686	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The project kick-off was held on September 13, 2017. A company reorganization at Alphabet Energy, the major subcontractor responsible for manufacturing thermoelectric test articles, has led LBNL to hold off on expending project funds until Alphabet principals can organize an alternate structure for performing the work.

217. EPC-16-043

Project Name:

Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation [EPC-16-043]

Recipient/Contractor:

Natel Energy

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/1/2017 to 3/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

A 2006 report issued by the California Energy Commission estimated approximately 120 MW of low-head small hydropower available in irrigation structures in California. Additionally, hydropower generation is controlled by the irrigation district's delivery schedules and generally suffers outside the irrigation season, greatly affecting the economics of hydropower for many of these opportunities. Innovative strategies to reduce costs through effective equipment or site design, standardization, or increasing the water flows can bring many projects into an attractive return on investment.

Project Description:

This project aims to scale in-canal hydropower retrofits by lowering project footprint and civil works costs. As most drop structures in irrigation canals have a consistent design, the goal is to design and implement a modular powerhouse and standard plant design that can be replicated across irrigation drops in California. Using a more simple and more easily scalable design will support the installation of the system to scale across the low-head sites identified across California with in-canal potential.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Greater reliability will be achieved by enabling greater penetration at significant total megawatts of new, distributed baseload renewable energy with predictable generation profiles. The project will also significantly reduce the capital cost of installing small hydropower in existing irrigation drop structures by reducing the cost of construction and civil works by an estimated 50 percent when compared with installing custom designed works and equipment for each site.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 1a, 1b

Lower Costs:

The over canal design being pursued in this project is estimated to lower the LCOE of low-head hydropower at irrigation system drop structures to $55/MW by 2019, unlocking approximately 150 MW of baseload renewable capacity in the state.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $954,715		**EPIC Funds Spent:** $15,793	
Match Partner and Funding Split: Natel Energy: $954,715 (50.0 %)		**Match Funding:** $954,715	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 32 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The project kicked-off in July 2017. The project team is currently in the design phase, focusing on site layout, civil works and initiating interconnection study for at least one of the proposed sites in Yolo County. The team has also determined that at least one of the pre-identified sites will result in an uneconomic project and requested three more sites in Calaveras County be added to its list of proposed sites at no additional cost to ensure at least two demonstrations can take place during the project term.			

218. EPC-16-044

Project Name: Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling [EPC-16-044]	
Recipient/Contractor: Terzo Power Systems, LLC.	
Investment Plan: 2015-2017 Triennial Investment Plan	**Project Term:** 5/1/2017 to 12/31/2020
Program Area and Strategic Objective: Applied Research and Development S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.	
Issue: The greatest barrier to the adoption of current energy saving technology in hydraulic power systems is high cost and long break-even period. This barrier has not been addressed due to the research and development costs associated with integrating the newest, highest efficiency technology.	
Project Description: This project is developing an economical and efficient configuration for large scale integration and adoption of highly efficient liquid cooled permanent magnet motors, and fully integrated, liquid cooled motor controls. The goal is to use these technologies in the development of a smart pump motor unit that can quickly be commercialized and adopted statewide.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: This project could reduce the operating cost for hydraulic power systems by integrating an efficient permanent magnet motor, efficient motor controller, and a combined liquid cooling loop. Hydraulic power systems are found in nearly all industrial facilities.	
CPUC Proceedings addressing issues related to this EPIC project: Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014	
Applicable Metrics: CPUC Metrics- 1f, 1h Lower Costs: Project will increase efficiency of hydraulic pump systems by up to 80% thereby reduce energy costs by an estimated $18,974,250 assuming 100% market penetration by 2025.	
Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $99,350
EPIC Funds Encumbered: $2,311,050	**EPIC Funds Spent:** $126,685

<table>
<tr><td colspan="2">Match Partner and Funding Split:
Terzo Power Systems, LLC.: $19,589 (0.8 %)
Ansync Labs, Inc.: $126,100 (5.1 %)</td><td colspan="2">Match Funding:
$145,689</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
phase 1: 27 out of 28 bidders</td><td>Rank of Selected Applicant/ Bidder:
Phase 1 Group 1: Ranked # 2</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
As of October 17, 2017 the recipient has completed reports on the efficiency of insulated-gate bipolar transistor and metal-oxide-semiconductor field-effect transistor. Other tasks in progress include obtaining quotes on long lead time equipment, and research on selecting design components such as: lab equipment set-up and validation, preliminary component selection for pump motor unit sub-systems, and identifying/obtaining evaluation kits for component prototype validation.</td></tr>
</table>

219. EPC-16-045

Project Name:

Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates

[EPC-16-045]

Recipient/Contractor:

Polaris Energy Services Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/1/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

This project is developing a new technology application that will facilitate participation in demand response (DR) programs by agricultural irrigation pumps. Control of irrigation pumps through an optimization platform will allow growers to minimize total water use by targeting irrigation based on need. The same technology will allow pumps to be operated according to electric rate schedules and in response to time-varying electric rates and demand response events. Crop needs for water are relatively robust in terms of the precise timing of the watering cycle. Research is needed to show that optimizing between crop and grid needs is feasible with proper control and monitoring technology.

Project Description:

This project will result in the development of a smart irrigation control system that improves and expands on current remote irrigation pump switching technology. The technologies developed provide growers with the ability to automate their preferred load control strategies in response to new time-of-use electricity rates. Beyond that basic capability, the systems facilitate automated response to utility and system operator demand response signals, enabling participation in current and future demand response and reliability programs. The system is being deployed and tested on multiple farms in PG&E service territory in the Fresno area.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

For many electrical utilities, agriculture is a significant component of their peak load. Collectively there are between 160,000 and 170,000 irrigation pumps in the Central Valley. This project addresses the direct electricity cost of irrigation for agricultural customers and the indirect cost to all electricity ratepayers of procuring sufficient resources to meet marginal peak demand, integrating variable renewable energy generation, and building sufficient infrastructure to support agricultural pumping load peaks. Developing control systems and operational strategies that minimize water use, optimize and coordinate pumping loads across large numbers of irrigation pumps, and can adapt to different rate designs, including dynamic and DR-program tariffs, could be financially beneficial to growers.

CPUC Proceedings addressing issues related to this EPIC project:

Smart grid: R.08-12-009 Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1g, 1h, 3f

Lower Costs:

The technology could facilitate effective response to time of use rates and facilitate participation in demand response programs through the shifting of agricultural irrigation pumping to lower cost time or in response to program incentives, lowering customer costs as well as enabling effective implementation of programs/tariffs designed to reduce system costs and meet state policy goals.

Greater Reliability:

The technology could facilitate participation in demand response programs through the shifting of agricultural irrigation pumping to periods of surplus renewable energy, which improves system reliability by matching load to available supply

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $2,884,912	**EPIC Funds Spent:** $258,055
Match Partner and Funding Split: Polaris Energy Services Inc.: $649,485 (18.4 %)	**Match Funding:** $649,485
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Michael Hardy, Control Dynamics, and Polaris developed the core hardware and associated firmware communications needed to remote control irrigation pumps remotely. The recipient intends to use this platform and methods to develop the new controller.

Update:

The project is on track. The work began in May of 2017 and focused on the task of engaging customers, setting up the irrigation controls systems and developing recommendations for customer participation in the available utility demand response programs. As of December 2017, the recipient has quantified potential savings (as a percentage of energy charges) for 11 meters if they were exposed to market pricing during 2016 as represented by CAISO Day Ahead prices and the required number of hours shifted to consume the same amount of energy each week in the lowest cost hours. They have also deployed features of their customer relationship management system for agricultural DR management with a focus on efficiently acquiring utility settlement data and generating statements and payments in a semi-automated process.

220. EPC-16-046

Project Name:

Pilot Testing of Isothermal Compression

[EPC-16-046]

Recipient/Contractor:

Institute of Gas Technology dba Gas Technology Institute

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/12/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Currently, gas compression is limited by the thermodynamics of an adiabatic process which causes the gas being compressed to heat up during compression, making it harder to compress. This heating process can also lead to high operating temperatures which can increase the friction and wear of moving components. It is estimated that as much as 90% of the mechanical work input into an air compressor results in a loss of energy compared to the useful work output of the compressed air that is used to power an industrial process. Heat of compression is the biggest driver of this energy loss.

Project Description:

Gas Technology Institute (GTI) and Carnot Compression LLC (Carnot) are developing and field testing a novel, near isothermal air compressor which will enable improved efficiency, maintenance and reliability. The unit will be tested at an industrial facility in southern California. This project hopes to reduce the energy consumption in industrial, water, agricultural, and commercial applications that require compression of air and other gases. This project demonstrates a more efficient compressor that will use less electricity to meet the same performance metrics of existing air and gas compressors. If successful this project could improve the energy efficiency of compressed air/gas systems which are prevalent in all industrial processing facilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This near isothermal compressor, or Carnot Compressor, solves the heat of compression problem by using a working liquid to compress a gas, while actively removing the heat of compression throughout the compression process. By removing the heat throughout the compression step, the energy required to compress air from near atmospheric pressure to ~100 psig can be reduced by up to 50% compared to commercial air compressors, such as piston, screw, and scroll designs. These energy savings are expected to significantly improve the efficiency of industrial air applications.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

The technology has the potential to reduce energy consumption from air and gas compressors by up to 50%. Once commercialized, the isothermal compression process will deliver significant energy efficiency gains across a broad spectrum of compression applications.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $628,022
EPIC Funds Encumbered: $2,570,946	**EPIC Funds Spent:** $199,209
Match Partner and Funding Split: Carnot Compression LLC: $238,700 (8.5 %)	**Match Funding:** $238,700
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was kicked-off in April of 2017 and the project team is currently working on preliminary design of the isothermal compressor system.

221. EPC-16-047

Project Name:

California Biopower Impact Project

[EPC-16-047]

Recipient/Contractor:

Humboldt State University Sponsored Programs Foundation

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/10/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Biomass is a potentially attractive energy resource that supports California's climate goals. However, there are significant gaps in existing life cycle assessment frameworks and methodologies regarding the climate impact associated with GHG emissions from biomass utilization for electricity generation. Furthermore, biomass residue extraction has complex environmental and ecosystem impacts (positive and negative), some of which have not been well integrated into current life cycle assessments. Finally, there are significant market barriers to biomass mobilization, particularly in the forestry sector, that can render well intentioned policies ineffective if not appropriately addressed.

Project Description:

This project develops an attributional life cycle assessment framework for various biomass-to-electricity supply chain and end-use scenarios that are specific to California. The research effort quantifies on a fine geospatial scale amount of technically recoverable forest and agricultural biomass residue material in California considering future impact projections from different climate change scenarios and fire risk probabilities under various harvest and land management scenarios. Based on the estimates, a detailed life cycle inventory - disaggregated by parcel, supply chain, and end-use characteristics will be developed. Results will support development of the California Residual Biomass-to-energy Carbon Accounting Tool (CARB-CAT) that will be made available to public and could inform policy makers regarding their decisions on the role of biomass residues in California's energy portfolio.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project informs the state's Integrated Climate Adaptation and Resiliency Program, identifies the potential for biomass residues to meet SB 350 goals, clarifies potential pathways for meeting the state's Bioenergy Action Plan, and answers key questions that directly respond to the Governor's State of Emergency Proclamation on Tree Mortality.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 2a, 3a, 3g, 4a, 4b

Lower Costs:

Lower costs may be realized if the ecosystem service payments coupled with value estimates of potential carbon abatement from biopower exceed the internalized average or marginal wholesale cost per MWh of displaced generation.

Greater Reliability:

Increased electricity reliability will be brought about by policies that encourage grid resilience through distributed generation facilities powered by biomass that would diversify California's mix of energy resources.

Increase Safety:

Increased electricity safety will be achieved through forest fuel load reduction and management practices that reduce wildfire risk and the associated risks to transmission and distribution infrastructure.

Environmental Benefits:

The lifecycle assessment of biomass utilization for electricity generation will consider specific harvest practices, feedstock collection and handling practices, post-harvest treatments (briquetting, torrefaction, pelletization, etc.), feedstock management pathways, and conversion technologies, and provide information on the GHG implications from altered wildfire risk and severity and from altered long-term soil nutrient balance.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $247,784	
EPIC Funds Encumbered: $1,000,000		**EPIC Funds Spent:** $50,170	
Match Partner and Funding Split: Sierra Institute for Community and Environment: $78,000 (6.9 %) Humboldt State University Sponsored Programs Foundation: $53,575 (4.7 %)		**Match Funding:** $131,575	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 14 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The project kick-off meeting was conducted in July 2017. After the kickoff, the recipient finalized subcontracting and formed the Technical Advisory Committee. The first TAC meeting took place in Arcata, CA in December 2017.

222. EPC-16-048

Project Name:

Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant

[EPC-16-048]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/5/2017 to 12/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Most ammonia-based cooling systems in use today require large amounts of ammonia and are prone to leakage from the mechanical shaft seal between the motor and compressor, and require special handling. Additionally, most ammonia systems used today are either water cooled or evaporative cooled, which require water, a very limited and precious resource in California due to recent droughts.

Project Description:

This project is pilot testing and demonstrating an air-cooled, low-charge ammonia refrigerant-based, integrated package closed cooling system for an industrial food processing application. The project is demonstrating the effectiveness of a water-saving innovation with the use of a micro-channel, air-cooled condenser. The project is demonstrating the expected energy savings of 20% compared to a chiller using hydrofluorocarbon (HFC) refrigerant for similar end use at the same site. This system eliminates the need for water for cooling. The entire system can be prepackaged and factory charged, and brought to site as an integrated package which simplifies field installation and makes it cost effective.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

An air cooled, low-charge, ammonia refrigerant based integrated closed-packaged system with semi-hermetic motor/compressor seal that eliminates the mechanical seal between the compressor and the motor is not available in the U.S market today. As this is a packaged product, this breakthrough will make it much easier for customers to implement this new technology and reap the energy and water savings benefits from it.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a

Lower Costs:

Expected energy savings of 20% compared to a chiller using hydrofluorocarbon (HFC) refrigerant for similar end use at the same site. This system eliminates the need for water for cooling, which further adds to on-site cost savings.

Economic Development:

Expected energy savings of 20% compared to a chiller using hydrofluorocarbon (HFC) refrigerant for similar end use at the same site. This system eliminates the need for water for cooling, which is very limited and precious resource in California due to recent droughts.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $804,238	
EPIC Funds Encumbered: $2,406,054		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: TAKARA SAKE USA: $305,000 (10.1 %) Electric Power Research Institute (EPRI): $300,000 (10.0 %)		**Match Funding:** $605,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 1: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This agreement was executed in September 2017 and kick-off meeting was conducted on September 26, 2017. The subcontractor, Mayekawa, is assembling the chiller system in Torrance, CA.

223. EPC-16-049

Project Name:

Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System

[EPC-16-049]

Recipient/Contractor:

University of California - Merced

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Heavy traffic of ground vehicles and pedestrians on highways, streets and sidewalks provides considerable mechanical energy. There is an untapped opportunity to harvest the mechanical energy with under-pavement piezoelectric generators to exploit the large generation potential from traffic on the nation's highways and in major cities. This project aims to create a piezoelectric energy harvesting system with ultra-high density and efficiency.

Project Description:

This project leverages a multidisciplinary system approach to investigate the energy recovery potential of dual-mode piezoelectric generators to create roadway piezoelectric energy harvesting systems with ultra-high power density and efficiency. The goal is to design and test a piezoelectric roadway energy harvesting system, consisting of multi-layer stack generators and power electronics, to capture over 50% of the compression mechanical energy as electricity from passing vehicles. This project will demonstrate electric power generation, in the laboratory and on a 95 feet x 12 feet section of a road at the UC Merced campus, and will determine feasibility for future large-scale demonstrations on highways and streets with piezoelectric under-pavement.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project aims to create a piezoelectric energy harvesting system with ultra-high density and efficiency. Using an award-winning piezoelectric technology with unique dual-mode and multi-layer generator design and under-pavement installation strategy for smooth drive of passing vehicles and pedestrians, this project will help the ratepayers in California by reducing cost of electricity and reducing emissions related to power generation.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1e, 3h, 4a

Lower Costs:

At commercial scale, electric power density and cost are estimated to be 333 watts per square foot and $9,010/kW respectively. The levelized cost of electricity is estimated to be less than $0.20/kWh.

Environmental Benefits:

This project will reduce approximately 40 metric tonnes of CO2 equivalent. By retrofitting 1 percent of useable roadways, the environmental benefits will include reduction of CO2 emissions by more than 100 kilotons per year.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $310,100
EPIC Funds Encumbered: $1,270,000	**EPIC Funds Spent:** $0
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project has completed design and fabrication of a batch of multi-layer piezoelectric generators and is currently conducting laboratory evaluation.

224. EPC-16-050

Project Name:

Scaling Reliable, Next-Generation Perovskite Solar Cell Modules

[EPC-16-050]

Recipient/Contractor:

The Regents of the University of California, on behalf of the San Diego campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

There is need to deploy renewable energy to meet additional energy demand as well as replace fossil energy. Perovskite technology holds promise in dramatically reducing the cost of solar cell technology compared to silicon and thin-film solar cells, because these cells can be fabricated at low-temperature around 100°C. However, there is a need to address perovskite cell efficiency degradation, which may occur within hours of fabrication.

Project Description:

Recent advances have pushed the solar conversion efficiency, making perovskites one of the most efficient solar technologies in existence. This project will use a scalable large-area manufacturing approach for fabrication of the perovskite solar absorber, the solar cell's transport and contact layers, and the encapsulation of the solar cell modules. The project will also include bifacial module design, where light enters from both front and back.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Currently, encapsulated perovskite cells degrade in several hundred hours even in controlled low-oxygen and low-humidity conditions. This project integrates materials innovations developed to date at UC San Diego in the perovskite absorber layer, the solar cell's contact layers, and the encapsulation of the module to make breakthrough advances in perovskite solar cell reliability and scaling. Combining these materials together in a module assembly with glass on top and bottom slows degration by a factor of 1,000. In addition, the bifacial design of module boosts its efficiency.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 2a, 4a

Lower Costs:

This project aims to increase annual production of solar cells by reducing absorber and cell manufacturing costs relative to commercialized Si and thin-film technologies.

Greater Reliability:

Integrating bifacial glass-glass modules should result in more energy production over time from solar cells and orders of magnitude improvement in perovskite solar cell durability, achieving at least 10 year operational lifetimes.

Economic Development:

Over 75,000 people are employed in in California's solar industry, installing over 3 GW of solar in 2015. The number of solar jobs would jump when next-generation perovskite modules are introduced at half the cost of silicon modules, resulting in vastly expanded demand.

Environmental Benefits:

A 1% market penetration on IOU-territory rooftops will produce 1.36 TW-hr/yr of renewable energy. The value of the renewable energy produced annually is $235.8 million with 4.48 million metric tonnes CO2e avoided.

Public Health:

In addition to avoiding greenhouse gas emissions, solar energy generation does not produce toxic air emissions including mercury, NOx, SOx and particulate matter that produce smog and are detrimental to health. A 1 GW deployment of the perovskite module technology would reduce emissions of NOx by at least 400 tons annually by displacing burning of natural gas.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $184,540	
EPIC Funds Encumbered: $1,450,000		**EPIC Funds Spent:** $50,145	
Match Partner and Funding Split: The Regents of the University of California, San Diego: $146,050 (9.2 %)		**Match Funding:** $146,050	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The project team successfully transferred graphene atop perovskite layers, developed new electron transport layers, and are improving cell process by characterization and new absorber layer chemistry. The project team is starting to compare the unencapsulated perovskite against the graphene barrier layer encapsulated perovskite cells and expect to complete during next three months.

225. EPC-16-051

Project Name:

Increased Energy Efficiency via Programmable Irrigation and Fertigation

[EPC-16-051]

Recipient/Contractor:

PowWow Energy, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	4/12/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Current energy efficiency programs do not address the complexity of farming, and in some cases conflict with each other at the farm. The lack of automation also slows the adoption of new irrigation and fertilization practices. An integrated approach to test cutting-edge technologies and demonstrating new irrigation strategies is necessary to provide additional energy and water savings without affecting crop yields. Geo-spatial and automated systems developed for the 3 commodity crops in the Midwest do not address the specific needs of California agriculture that grows over 350 specialty crops and produces more than 50% of the fruits, nuts and vegetables in the country.

Project Description:

PowWow Energy, in collaboration with WiseConn Engineering, West Hills College Coalinga (WHCC) and UC Santa Barbara (UCSB), are developing an automated, programmable irrigation management system that integrates cutting-edge technologies to increase the energy efficiency of irrigation (defined as using less energy to achieve the same level of crop production). Pilot-scale tests of the integrated technology platform will be conducted at two sites on commercial farms located in disadvantaged communities: an almond orchard near Delano (AgWise Enterprises, SCE territory) and a field with a rotation of row crops (tomato, garlic, etc.) near Huron (Woolf Farming and Processing, PG&E territory).

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project integrates three new strategies for water and energy efficiency on farms (continuous pump testing with automated remote pump control, programmable irrigation for specific soil types and plant varieties, and management of water and fertility) with PowWow's software. If successful, this project could help individual farms realize energy, water and cost savings without affecting crop yield or quality.

CPUC Proceedings addressing issues related to this EPIC project:

Water-Energy Nexus: R.13-12-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1h, 4a, 4c

Lower Costs:

The project could lower energy and water costs by an estimated 25% annually while achieving optimum efficiency at each farm.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $341,285	
EPIC Funds Encumbered: $2,992,660		**EPIC Funds Spent:** $180,748	
Match Partner and Funding Split: TBD Professional Services: $10,000 (0.3 %) West Hills College Coalinga: $56,028 (1.7 %) Environmental Studies Program & Bren School of Environmental Science & Management - UC Santa Barbara: $19,870 (0.6 %) WiseConn Engineering: $7,000 (0.2 %) Aduro Accounting & Consulting, LLC: $42,000 (1.3 %) Mamala Research, LLC: $3,000 (0.1 %) PowWow Energy, Inc.: $212,649 (6.4 %)		**Match Funding:** $350,547	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 27 out of 28 bidders	**Rank of Selected Applicant/ Bidder:** Phase 1 Group 1: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: The recipient completed the first version of a model for continuous pump efficiency testing on single speed pumps, and the results look reasonable. In October 2017, the team continued validation of the model and developed a model for variable speed pumps. Project team is finalizing the 2017 summary reports for both pilot sites.			

226. EPC-16-052

Project Name:

Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery [EPC-16-052]

Recipient/Contractor:

Pyro-E, LLC

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Congested roadways present an opportunity for improving transportation and mobility. But the cost of new construction is expensive. An alternative approach is to leverage technology to make existing roads more energy sustainable and adaptable to real-time conditions. Regenerative devices, such as piezoelectric, have the ability to harvest energy from deflection, vibrations and applied mechanical stresses from overpassing vehicles.

Project Description:

The project develops, designs and installs a multitude of pavement-embedded devices to demonstrate energy harvesting from overpassing motor vehicles on the road in smart pavement covering 36 feet x 6 feet. The system consists of materials that exhibit the piezoelectric effect and results in generating an electric charge.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project demonstrates and assesses the potential of Regenerative Pavement technology, a roadway-embedded energy harvester that uses the untapped energy of car movements. The hardware devices developed using smart materials harvest energy from pavement deflections and vibrations under normal driving conditions. Simultaneously, energy performance data is collected to determine the technology's potential for wide scale adoption in roadways and other surfaces.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1e, 2a

Economic Development:

This project is expected to displace grid electricity with reduced rates, and will displace 9,550 kWh/year of electricity. By retrofitting 1% of useable roadways (about 10% of total California roads), resulting in about 70,000 homes serviceable during peak traffic hours and about 500 GWh/year of peak load reduction and demand response.

Environmental Benefits:

The project will generate electricity by piezoelectric effect of overpassing vehicles on the road

and will displace 3.65 kg/year of CO2. By retrofitting 1% of useable roadways, the environmental benefits will be significant including reducing about 210 kilotons of CO2 emissions and displacing 250 million gallons of fresh water from cooling gas power plants every year.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $234,596
EPIC Funds Encumbered: $1,000,000	**EPIC Funds Spent:** $43,256
Match Partner and Funding Split: Pyro-E, LLC: $100,007 (9.1 %)	**Match Funding:** $100,007
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team completed basic design for the vibrational energy harvester, with a goal to maximize life under repeated impact and compression cycles from a vehicle. A batch of flexors, for converting vertical compression into horizontal extension, was fabricated and calibrated with force transducers and strain instruments to ensure proper specifications. A uniform subscale piezo-ceramic stack prototype will be fabricated and assembled during next three months to prevent stress concentrations under buckling loads.

227. EPC-16-053

Project Name:

Habitat Influences on Desert Tortoise Translocation Success

[EPC-16-053]

Recipient/Contractor:

Zoological Society of San Diego dba San Diego Zoo Global

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/1/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

With planned expansions in the California deserts, renewable energy projects potentially represent a major contributing factor in the continued decline of the threatened Mojave desert tortoise. Head-start methods have been identified as a potential recovery tool and mitigation action for the desert tortoise, but current methods that rely on more than 4 years in captivity are expensive and therefore may be impractical.

Project Description:

The recipient is determining if habitat characteristics of the release sites can improve survival of smaller juveniles to equivalent rates of the animals that have reached the desired size target. Careful measurement of resources that may help tortoises avoid predation or meet nutritional requirements will allow investigators to differentiate excellent habitat from merely adequate habitat. They are also studying the effects of outdoor rearing on juvenile desert tortoise behavior and health, and size-age relationships to survival in the wild upon their release. The project will generate quantitative, defensible information about the most cost-effective husbandry and release methods during and following a head-start program for this threatened species.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will increase the effectiveness of conservation actions designed to mitigate renewable energy impacts on Mojave desert tortoises. This will be achieved by evaluating the relative effectiveness of head-start and release methods in an experimental framework. Improvements to the effectiveness of habitat management to encourage natural recruitment of juveniles will also be tested experimentally where possible.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 4f

Lower Costs:

This project is expected to lower costs by making head-start mitigation more cost-effective, reducing obstacles to future renewable energy deployment. It is important to determine the best practice methods for head-starting juvenile tortoises, including reducing time spent in captivity and increasing survival in the wild after release. This will minimize mitigation costs and maximize the contributions of these actions to desert tortoise recovery.

Environmental Benefits:

New scientific knowledge on minimum size required at release while improving survivorship, resource needs, and translocation practices will guide release site selection and management in the future. A better understanding of the habitat features that allow tortoises to thrive can also be applied to management decisions about which land parcels to protect and set more meaningful restoration targets. Implementation of more effective mitigation practices may increase probability of de-listing the desert tortoise in the future.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $32,237
EPIC Funds Encumbered: $499,605	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Zoological Society of San Diego dba San Diego Zoo Global: $390,528 (43.9 %)	**Match Funding:** $390,528
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 14 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project is just getting underway as of Fall 2017. Sites for the captive rearing at Edwards Air Force Base and Cadiz, Inc. have been identified and rearing pens are being constructed. The project team is collaborating closely with the complementary project (EPC-16-038) in several areas, such as using a common technical advisory committee.

228. EPC-16-054

Project Name:

Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services

[EPC-16-054]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 12/31/2019

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

The CPUC defines electric vehicles as a distributed energy resource along with distributed renewable generation resources, energy efficiency, energy storage, and demand response technologies. There is an issue with integrating and synchronizing vehicle-to-grid (V2G) with the utility, independent system operator, and local distributed energy resource management systems to optimize customer mobility needs and grid energy efficiency. The CPUC 'California Storage Mandate' requires investor owned utilities to procure and operationalize 1.3 gigawatts of storage with a provision that V2G technologies are viable for meeting the mandate requirements.

Project Description:

This project will develop a "3-in-1" smart inverter, charging station, and building management system. The project focuses on defining and developing control algorithms to implement vehicle-to-grid (V2G) and vehicle-to-building (V2B) with minimal impact to the plug-in electric vehicle (PEV) battery life. This project develops and demonstrates an off-vehicle, V2G power conversion and control algorithm that can be applied to residential and small commercial applications. The system integrates a bidirectional direct-current (DC) PEV charger, photovoltaic inverter, and stationary storage battery, with an integrated local energy and power management system for power and energy management, grid communications, and ancillary services.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will determine the strategies and methodologies for V2G to become a value-added distributed energy resource (DER) asset. Results will inform investor-owned utilities on how V2G/V2B can be a viable resource to meet the Assembly Bill 2514 Storage Mandate and the CAISO energy storage and distributed energy resource initiative. The project will enable validation of the most effective use cases and intelligently aggregate distributed energy resources to enable V2G/V2B charging and discharging profiles to alleviate constrained distribution system nodes.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007

Applicable Metrics: CPUC Metrics- 1c, 1e, 2a, 3f, 4a, 5b

Lower Costs:

The project will mitigate distribution system stress and maintenance costs through institution of microgrid and zero net energy operational modes utilizing V2G integrated building DER management and control. The increased integration of renewable energy with V2G-enabled PEVs can provide a value of over $350 million per year in added capacity and reduced grid congestion.

Greater Reliability:

The technologies developed under this project can provide ancillary services by combining V2G enabled vehicles' charge and discharge profiles that are locally and distribution system constrained to alleviate localized hotspots. The V2G services will smoothen the grid load profile by charging batteries during renewable over-generation and discharging back to the grid during peak load periods can provide approximately 2,000 MW of capacity to the grid.

Environmental Benefits:

The V2G-capable PEVs can enable higher penetration of distributed PV by mitigating renewable energy over-generation.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $370,849
EPIC Funds Encumbered: $1,500,000	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Flex Power Control, Inc.: $760,000 (19.8 %) Electric Power Research Institute (EPRI): $1,220,140 (31.8 %) Oak Ridge National Laboratory: $250,000 (6.5 %) National Renewable Energy Laboratory (NREL): $110,861 (2.9 %)	**Match Funding:** $2,341,001
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

IEEE 2030.5 Software - A platform independent software implementation of IEEE2030.5, that provides all of the functions required to implement a Server, Client and Gateway. This implementation may be ported to both embedded, SBC or a Cloud processor. An extensive set of API's allow the development of powerful applications.

Update:

This project kicked off in July 2017. Activities and next steps for this project include advancing the system integrated DER (including V2G) communications and control technology to provide potential solutions for home and building Zero Net Energy and Community DER aggregation use case scenarios.

229. EPC-16-055

Project Name:

Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers

[EPC-16-055]

Recipient/Contractor:

Zeco Systems dba Greenlots

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

With new PEVs having larger batteries and faster charging capability, direct current (DC) fast chargers for intra- and intercity quick charging needs have risen in demand. DC fast charging is expensive to operate due to high demand charges, and cause high stress on the distribution circuits to provide the charging power. There is currently no way to manage these demand charges or create any potential new revenue streams to the operator by providing additional services to the grid. Unmanaged DC fast charging can cause the demand load and grid congestion to grow exponentially as more DC fast chargers are installed at a site.

Project Description:

The project enables day-ahead and real-time pricing for DC fast charging by developing an integrated hardware and software platform to reduce demand charges from DC fast charging and address intermittency and renewable energy over-generation issues. The site controller and network-based platform advances smart and efficient charging by managing four multi-port fast charging to minimize grid impact and lower the cost of operating fast chargers, evaluates suitability of DC fast charging to participate in demand response programs, and develops and evaluates advanced technologies to efficiently integrate second-life PEV batteries for demand management with DC fast charging. By addressing intermittency and renewable energy over-generation issues, the project will reduce grid impact and increase renewable penetration in the grid by aggregating four DC fast charging stations with stationary battery storage from second-life PEV batteries.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The site controller will aggregate the DC fast chargers to optimize vehicle charging from either the grid or the stationary battery storage based on the day-ahead and real-time pricing data from the electric utility. This optimization will lower the cost of EV charging, directly translating into cheaper plug-in electric vehicle (PEV) charging for the ratepayers and increase PEV penetration.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007

Applicable Metrics: CPUC Metrics- 1e, 1h, 2a, 4a

Lower Costs:

Integrated DC fast charging management with second-life PEV batteries offers lowered operating costs, and can increase operating revenues by more than $4,000 per year for each DC fast charger.

Greater Reliability:

Intelligent software control will enable the availability of flexible capacity to the grid, which will allow additional renewable integration and reduced stress on grid during peak hours with demand response capacity.

Environmental Benefits:

Using second-life lithium batteries removed from PEVs as energy storage provides another marketable use for these batteries and an alternative to disposal or the more expensive option of recycling.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $826,250		**EPIC Funds Spent:** $90,919	
Match Partner and Funding Split: Zeco Systems dba Greenlots: $302,008 (26.8 %)		**Match Funding:** $302,008	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

- The patent covers a case when a charge station does not have a direct connection to the network. The patent also includes the concept of queuing, with messaging to drivers to increase utilization of charging stations.
- The patent application is for methods to calculate the likelihood of a demand response

event or change in real time price based on measurements from a distributed network of sensors.
Update: This project kicked off July 11, 2017. The project team is developing the demand charge reduction algorithm. The team completed the development, functional testing and regression testing of the DR notifications, multiple DR profiles and EVSE curtailment based on DR profile. Development is currently underway for defining the architecture to integrate DC fast charging, storage, and building load DR.

230. EPC-16-056

Project Name:

Performance Evolution, Specification and Verification of Building Control Sequences [EPC-16-056]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/10/2017 to 12/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

In most cases, commercial buildings fail to perform up to their technical design and equipment potential. Annually, more than one quad/year is wasted from common deficiencies in dysfunctional building control design and implementation. Building designers who wish to explore opportunities to compare the energy implications of different control strategies lack tools to compare energy opportunities of different control strategies and to refine the best strategies.

Project Description:

The project develops IT based component technologies to enable more efficient building operations and reduce costs. The project is expected to reduce the time to specify, implement and verify the proper operation of control sequences and make a strong business case for designers, controls contractors and controls manufacturers to adopt the new technology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This federal cost share grant with the US DOE, will develop open source tools that will enable verification of building control strategies and will rectify building controls with technologies that integrate active façade, lighting and HVAC with the smart grid to provide fast and slow demand response. A project breakthrough will be that designers can use pre-tested ASHRAE building control sequences or custom sequences, adapt and optimize, and test their impact on energy, peak power reduction, indoor air quality and thermal and visual comfort. The control sequences can be exported to the control vendor to obtain cost estimates and can be used by commissioning agents to verify that the original design intent is realized. This will enable accountability for controls performance between design and operation and is expected to have broad adoption and impact.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 3a, 3b, 3f, 4a

Lower Costs:

The expected results include reductions in energy use of commercial buildings and in equipment maintenance costs as a result of improved design and implementation of building controls. Assuming a 12 percent energy savings in existing building energy use, potential cost

<table>
<tr><td colspan="4">savings to California building owners is estimated at $120 million per year.</td></tr>
<tr><td colspan="2">Assignment to Value Chain:
Demand-side Management</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $473,633</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$1,000,000</td><td colspan="2">EPIC Funds Spent:
$0</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
None</td><td colspan="2">Match Funding:
$0</td></tr>
<tr><td colspan="2">Leverage Contributors:
United States Department of Energy : $2,000,000
Kilowatt Engineering, Inc. dba kW Engineering, Inc. : $20,000
Stanford University : $75,000
Integral Group, Inc. : $75,000</td><td colspan="2">Leveraged Funds:
$2,170,000</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
43 bidders</td><td>Rank of Selected Applicant/ Bidder:
N/A</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The agreement had a kick off meeting in December 2017 and a CPR meeting is scheduled for the first quarter of 2018.</td></tr>
</table>

231. EPC-16-057

Project Name:

Development of Smart Charging Infrastructure Planning Tool (SCRIPT)

[EPC-16-057]

Recipient/Contractor:

Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 7/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

There is a tradeoff between maximizing use of plug-in electric vehicle charging infrastructure and building more infrastructure to facilitate flexibility and market growth. For example, a congested and busy charging station would not have much flexibility for demand management through smart charging. However, an expanded charging infrastructure network would allow vehicles to stay plugged in longer than the minimum time required to finish charging without affecting other drivers' travel plans. Thus, providing additional flexibility for smart charging is desirable but needs to be done at a certain cost.

Project Description:

This project develops the Smart Charging Infrastructure Planning Tool (SCRIPT) to enable predictive smart charging of Plug-In Electric Vehicles (PEVs) and performs cost-benefit analysis for investment in charging infrastructure. SCRIPT will determine daily predictive smart charging strategies that foresee the future travel needs of drivers and grid conditions. SLAC will study the role of different charging infrastructure investment strategies in the effectiveness of EV smart charging techniques to accommodate state level renewable penetration goals in California. SLAC will test the tool using real-time charging data to determine the maximum amount of solar generation that can be absorbed by the vehicles through smart charging. SLAC will also study the trade-offs between investing in new charging infrastructure compared to better management of existing infrastructure via smart charging.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

There are significant benefits from workplace smart charging that may be shared with the vehicle owners. By exercising the flexibility of the vehicle charging in the workplace, commercial customers can save from energy and demand charge costs. Smart charging can decrease energy charges by up to 1.5% of the overall utility bill, and decrease demand charges by up to 24.7%. Further benefits can be achieved from adding PV to the distributed energy resource at a site, even without that addition, there is significant benefit to both the EV owner and workplace where the EV is being charged.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007

Applicable Metrics: CPUC Metrics- 1e, 1f, 3a, 3f, 4a, 5b

Lower Costs:

The predictive smart charging system allows PEV owners to charge during the periods of the day when energy is the cheapest. SCRIPT also allows for intelligent management of the existing charging and grid infrastructure which reduces maintenance costs and future equipment costs.

Greater Reliability:

SCRIPT's predictive smart charging algorithms will allow PEVs to intelligently charge during periods of renewable energy overgeneration, which reduces the amount of energy flowing back into the distribution grid.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $328,945	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $660,641	
Match Partner and Funding Split: ChargePoint, Inc.: $32,808 (2.1 %) UC Santa Barbara: $61,345 (3.8 %)		**Match Funding:** $94,193	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The SLAC team has initiated the subcontracting process with project partners: E3, University of California, Santa Barbara, Chargepoint, and Gridmatic. A Script Design Document has been developed and outlines several scenarios for EV adoption and charging infrastructure investment strategies.

The SLAC team will obtain and synchronize disparate data sources as part of the Data Ingestion task that includes building the infrastructure to obtain and synchronize the current charging infrastructure status, historical charging data with 15 minute sampling rate of average

and maximum power demand, and location of charging station from Chargepoint Inc. This data will be used to develop forecasts of EV load shapes.

The team is working towards building an equivalent time-variant storage model for the flexible demand of EVSEs, the team will use this model to forecast EV flexibility.

232. EPC-16-058

Project Name:

Advanced Transit Bus VGI Project

[EPC-16-058]

Recipient/Contractor:

Prospect Silicon Valley

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	5/15/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

California has established ambitious goals for zero emissions vehicles (ZEV), including an expected target of 100% transit conversion to ZEVs by 2040. Currently, electric buses (e-bus) are significantly more expensive than conventional buses, have no integration with critical commercial operational tools, and conversion planning for agencies is complex and costly. In addition, renewable goals require more responsive energy services to address grid variability.

Project Description:

This project addresses critical real-world needs to commercialize and scale electric transit fleets with robust grid-serving energy services. Leveraging Santa Clara Valley Transit Authority's plan to purchase up to 35 all-electric buses to electrify its 500-bus fleet, the four-year project builds on the strategies, technologies and partnerships from existing vehicle-grid integration (VGI) efforts to implement a world-class electric transit fleet showcase. This Agreement will drive down the costs of responsive grid assets and deliver lower cost energy services; b) improve the business case of e-buses, including reducing cost via advanced management, establishing revenue generation opportunities, and addressing commercial fleet management needs; c) address the need for deep understanding on the potential for transit e-bus VGI and strategies for scaling through a statewide roadmap; and d) ensure benefits reach all communities by delivering VGI enabled e-bus transit to underserved communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will make the following advances: translate automotive VGI advancements to a commercial e-bus fleet, including retail and wholesale energy services; deliver advanced optimization of battery life and cyber security; integrate energy services and management with leading commercial fleet management tools; integrate key Energy Commission funded VGI platforms and provide a roadmap for statewide deployment.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007

Applicable Metrics: CPUC Metrics- 2a, 4a, 4b

Lower Costs:

The project will lower costs for transit agencies including a projected $220,000 per year in reduced demand charges and energy services revenues for the pilot. The project will also result in reduced grid costs by providing significant grid services at lower cost than dedicated assets purchased for such services.

Greater Reliability:

Highly predictable duty cycles of VGI transit buses enable greater resource availability certainty to utilities and the CAISO to address grid variability as needed.

Increase Safety:

Diesel fuel usage reduction will also reduce the needs to produce, deliver and store diesel fuel and concurrent health risks from fumes (increased risk of cancer, asthma and other health issues) as well as handling hazards such as explosions.

Economic Development:

The project will train workforce on VGI services to provide economic opportunity.

Environmental Benefits:

Accounting for CA electric carbon intensity, this project will reduce 4,000 metric tons of CO2 (MMtCO2) per year representing a 78% reduction from the current buses. A statewide conversion would reduce 2.4 MMtCO2 per year - 1.5% of current statewide transportation carbon emissions and more as the grid becomes cleaner.

Public Health:

Conversion to e-buses also significantly reduces criteria pollutant emissions, particularly NOx, CO, VOCs and particulate matter, especially important for underserved communities. For the pilot, assuming replacement of typical diesel buses (97% of VTA fleet) with emissions at the level of state standards and typical utilization (100 mi/day), annual reductions include up to 255,000g CO, 21,000g hydrocarbons, 3,200g NOx and 170g PM. VTA serves an estimated 500,000 residents in underserved communities.

Consumer Appeal:

E-buses are quieter, less polluting and more comfortable, delivering a better rider experience.

Energy Security:

Electrification of the bus fleet improves energy security and independence by reducing liquid fuel use, and allowing for domestic production of the vehicle feedstock (i.e., electricity), which can be provided by renewable sources or from domestically produced natural gas. This reduction means that the overall petroleum import into California will reduce the exposure of the state economy's risk to volatile global petroleum costs.

<table>
<tr><td colspan="2">Assignment to Value Chain:
Demand-side Management</td><td colspan="2">Total Budgeted Project Admin and Overhead Costs: $0</td></tr>
<tr><td colspan="2">EPIC Funds Encumbered:
$1,899,199</td><td colspan="2">EPIC Funds Spent:
$0</td></tr>
<tr><td colspan="2">Match Partner and Funding Split:
Santa Clara Valley Transit Authority: $1,005,018 (34.3 %)
Proterra Inc.: $30,000 (1.0 %)</td><td colspan="2">Match Funding:
$1,035,018</td></tr>
<tr><td colspan="2">Leverage Contributors:
None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
29 out of 31 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 4: Ranked # 4</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The project kickoff was held in August. The recipient has developed the existing bus duty cycle to create a baseline and to assess the future potential for integration of electric buses.</td></tr>
</table>

233. EPC-16-059

Project Name:

Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration

[EPC-16-059]

Recipient/Contractor:

DOE- Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	10/11/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

Plug-in electric vehicles (PEVs) can provide energy storage needed to support renewable power generation through vehicle-to-grid (V2G) and vehicle-to-building (V2B) services. However, the risk of accelerated battery degradation is commonly cited as a concern inhibiting implementation of V2G and V2B technology. Additionally, second-life battery applications can provide value after a battery pack has exhausted its useful life in a vehicle. To bolster stakeholder confidence in V2G, V2B, and second-life battery applications, real-world demonstrations are needed to complement existing battery degradation models and projections.

Project Description:

This project demonstrates an automated control system for a fleet of plug-in electric vehicles and repurposed second-life batteries that reduces the overall cost of ownership by maximizing battery lifetime, shifting load to reduce electricity and demand charges, and providing V2G and V2B services, including those supporting the use of onsite solar generation. The demonstration is adding a stationary second-life battery installation to the existing PEV fleet site at Los Angeles Air Force Base.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is developing and implementing an optimization and control algorithm that includes impacts on battery health expressed as an economic cost, using models and parameters derived from actual battery measurements. These activities will help demonstrate PEV ownership lifecycle cost reductions, and will advance scientific knowledge of the impacts of V2G and V2B services on mobile and second-life PEV batteries.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Energy storage: R.15-03-011

Applicable Metrics: CPUC Metrics- 1h, 3f, 4b

Lower Costs:

The project reduces the lifecycle cost of PEV ownership for fleets by increasing the useful service capacity and lifetime of PEV batteries, including accounting for recycling costs and waste generation from manufacturing new batteries. Utility costs can also be lowered through load shifting and demand management. If 10% of commercial and government fleet vehicles were converted to bi-directional PEVs and an equal number of second-life batteries were

installed, and the fleet owners shifted on-peak demand to off-peak periods and were subject to a typical commercial IOU tariff, the annual savings in demand charges would be approximately $62,000,000.

Environmental Benefits:

Deferring PEV battery recycling will enable recyclers to better plan for and schedule recycling in-flow to avoid the need to store hazardous materials while waiting for market prices to meet necessary thresholds. PEV batteries removed from transportation service, but retained as storage assets at their primary location, will result in significant increases in useful service life prior to recycling. Furthermore, a California Energy Commission report forecasting the potential impacts of second-life batteries predicted that 15% of the expected annual reduction in greenhouse gases could be achieved using second-life batteries for peak shifting.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $407,071	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $701,533	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This grant agreement was executed in mid-October 2017. Data from a previous LA Air Force Base V2G demonstration project (Contract 500-11-025, supported by another Energy Commission program) will feed into and support this project. Activities are now underway to develop optimization and control strategies for V2G and V2B to maximize battery life, provide adequate PEV charge for mobility needs, and integrate on-site renewable generation.

234. EPC-16-060

Project Name:

Adaptive Chargers for Delivery Customers Demonstrating California Advances in Charging [EPC-16-060]

Recipient/Contractor:

Motiv Power Systems, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/9/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

For electric vehicles, controlled charging and grid integration have the potential to increase stability of the grid and reduce charging costs for fleets. However, the technologies needed for integration are expensive off-board solutions that do not make sense for most fleets, and the technologies have not been scaled for medium- and heavy-duty applications. This challenge has not been adequately addressed, because development of this technology is limited by costs and risks in market penetration. Additionally, regulated utilities are operating on time frames that make them unable to develop and rapidly move solutions to market.

Project Description:

Motiv Power Systems is developing both a smart charger solution and a bi-directional charger solution to enable vehicle-grid integration (VGI) with electric fleet vehicles. This technology is being demonstrated with AmeriPride Services delivery trucks in Fresno, Bakersfield, Merced, and Stockton. Motiv is developing both a software-only smart charger solution as well as a bi-directional on-board charger solution for vehicles that can be easily purchased as an option for installation on existing vehicles. This solution will fit within a scalable and modular powertrain already used in a variety of vehicle applications, thus allowing VGI solutions to fit within a variety of emerging markets and be supplied to vehicle builders from a variety of delivery trucks, work trucks, shuttle buses, and school buses. This allows VGI to fit both within goods movement and freight plans as well as clean transit and zero-emission bus plans.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

A future-focused approach that enables zero emission vehicles (ZEV) to be more cost competitive than diesel by enabling VGI through an on-board charger technology has the potential to reach a higher percentage of the California vehicle market. Compared with a more costly VGI approach that puts the power processing on the charge station, this approach has a greater chance of capturing the future heavy-duty ZEV market that is being supported through policy mandates such as the ZEV action plan, Sustainable Freight Plan, AB32 and SB32 emission reduction goals, and SB 350.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Energy storage: R.15-03-011

Applicable Metrics: CPUC Metrics- 1e, 1h, 2a, 3f, 4a, 4b, 5b

Lower Costs:

By allowing for demand response, fleets can reduce their peak usage and associated demand charges. This both reduces fleet costs and also allows the utilities to provide the same service without spending money on system upgrades.

Environmental Benefits:

Switching from conventional fossil fuel delivery trucks to zero emission vehicles will aid efforts to reduce greenhouse gas emissions.

Public Health:

ZEV delivery trucks will improve air quality, an important public health benefit.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $818,672
EPIC Funds Encumbered: $4,529,956	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Motiv Power Systems, Inc.: $1,513,524 (25.0 %)	**Match Funding:** $1,513,524
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The kick-off meeting for this project took place on June 28, 2017. Motiv Power Systems is working on development of the bi-directional on-board charger.

235. EPC-16-061

Project Name:

Intelligent Electric Vehicle Integration (INVENT)

[EPC-16-061]

Recipient/Contractor:

Nuvve Corporation

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/3/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

Despite limited market success, plug-in electric vehicles (PEVs) are still too expensive for most people. Purchase and ownership costs must be reduced further to enable mass market penetration. However, as the PEV population grows, demand for electricity as a transportation fuel may lead to congestion and overloading on the transmission and local distribution grid. Simultaneously, increasing the introduction of renewable energy sources requires more closely coordinated grid capabilities being adopted to effectively regulate grid voltage and frequency on a real time basis and especially to address the issues pertaining to morning and afternoon ramping.

Project Description:

This project is deploying vehicle-grid integration (VGI) technology with unidirectional and bidirectional power flow capabilities using light fleet and consumer vehicles. These vehicles will provide local grid support by controlling the charge rate based on energy and power capacity available locally, controlling the voltage, and providing grid-wide support by participating in frequency regulation or adjusting the reactive power. The mix of services provided will be optimized within a campus laboratory setting with the goal of expanding this technology into a real-world setting.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is developing an advanced vehicle-to-grid integration technology to optimize the blend of one-directional "managed charging", bi-directional "vehicle-to-grid", and "vehicle-to-building" functions, for different real world grid applications such as frequency regulation, power quality, voltage control, and grid support. The project will show the value of EVs as distributed energy resources, with the ability to defer or eliminate the need for grid upgrades, address the "duck curve," and enable greater renewable energy penetrations.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1h, 3f, 4b

Lower Costs:

The combination of load adjustment and energy storage is the most cost-effective way to integrate PEV and renewable energy sources at the same time. The EV owner has already paid for the EV inclusive the battery. By sharing the battery when the EV is not used (parked and connected) the grid will have access to a low cost distributed storage resource, which in

turn will make it possible to introduce more non-dispatch able renewable energy such as solar or wind.

Greater Reliability:

Since the batteries in the EVs function as distributed storage resources, they can improve grid reliability by stabilizing the grid-wide frequency as well as mitigating local grid overload in transformers or feeders.

Environmental Benefits:

Helping to make EVs more affordable will increase the penetration of EVs. This will help to lower the local pollution by reducing fossil fuel consumption within local transportation, especially in large cities.

Energy Security:

Combining EVs and distributed energy resources (DERs) through a highly dynamic platform that can dispatch resources based on grid-wide and local-grid needs will increase grid reliability and therefore, increasing energy security.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $4,200,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: The Regents of the University of California, San Diego: $335,604 (4.2 %) Strategen: $13,100 (0.2 %) FleetCarma: $13,892 (0.2 %) Nuvve Corporation: $3,335,148 (42.2 %)		**Match Funding:** $3,697,744	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 5
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			

The owner of the Patent is the University of Delaware with patent number 9,043,048, and the length of the patent is from Sep. 21 2010 through May 26 2015.
Update: The project was recently approved and an initial benefit questionnaire was delivered along with the list of technical advisory committee members.

236. EPC-16-062

Project Name:

Advancing Demand Response in the Water Sector

[EPC-16-062]

Recipient/Contractor:

Regents of the University of California, Davis

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/5/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Water utilities are high users of energy, but lack the ability to participate in demand response events, or shift loads to reduce their energy costs. The water utility's energy uses are complex, demand inflexible, and there is a lack of knowledge about effective solutions to reduce costs. Finding feasible, energy cost saving solutions requires assessment of the conditions at the plant, the system configuration, and assessing real time water and energy data.

Project Description:

This project is developing a demand management system to optimize energy use and operations at the Moulton Niguel Water District. By better optimizing its system, the water utility will be able to reduce its energy bill by participating in demand response and load shifting incentive programs. The demand management system uses real-time energy analytics to: (1) reduce and/or shift peak energy loads, (2) account for different energy tariff structures, and (3) balance the grid's intermittent renewable load generation. The project will optimize load for the potable and recycled water systems at Moulton Niguel.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The development of a water system demand management tool to enable water utility participation in demand response and load shifting utility programs, along with marketing and communicating the technology benefits will inform other water utilities, and could result in increased use and acceptance. Given the impact of energy consumption by the water industry in California, widespread use of the proposed methodology could help achieve energy demand reduction needed to support the state's energy goals.

CPUC Proceedings addressing issues related to this EPIC project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011

Applicable Metrics: CPUC Metrics- 1e, 1g, 1h, 2a, 3h, 4a

Lower Costs:

This project will result in lowers costs for the water utility though participation in energy utility incentive programs. It will also likely result in a reduction in systems costs through avoided demand charges and reduced constraints on the electric grid during congested periods. Moulton Niguel is expected to reduce peak demand by 25% by participation in this project.

Economic Development:

This agreement can reduce energy costs in the transmission and distribution system by lowering peak energy needs, and avoiding transmission and distribution charges for the energy conserved.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $282,171
EPIC Funds Encumbered: $2,984,983	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Moulton Niguel Water District: $90,865 (2.9 %) Helio Energy Solutions: $14,900 (0.5 %)	**Match Funding:** $105,765
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	phase 2: 6 out of 7 bidders	Phase 2 Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

The intellectual property contains patent and trade secret to "PredictEnergy" software owned by Helio Energy Solutions. The proprietary technology will be used to develop the products in multiple tasks in this agreement.

Update:

The team has developed a hydraulic model of the Moulton Niguel Water District water system that will be used to develop and test energy management strategies. They are also refining data and inputs to the energy demand management system software, including gathering tariff and grid operation characteristics information from the utilities and California Independent System Operator. Water meters and other hardware are being installed in preparation for testing in Q2 2018.

237. EPC-16-063

Project Name:

Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning

[EPC-16-063]

Recipient/Contractor:

University of California, San Diego

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 8/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

There are two basic ways to produce climate scenarios for California. One of them involves the use of dynamic regional climate models. These "weather forecast models" are very expensive to run. The second option is to use statistical methods that use historical relationships with outputs from global climate models to create high resolution climate scenarios for California. This approach is far less expensive than running an entire weather forecast model but it is unclear if the historical statistical relationships will be valid under future conditions. The researchers will develop and test a hybrid downscaling technique that will merge the benefits of statistical and dynamic models.

Project Description:

This project develops new and better ways of merging the two approaches, using both weather forecast models (more generally called dynamical models) and inferences from past history (statistical models). The combined method is called a hybrid dynamical-statistical approach for inferring fine-resolution climate information from the coarse-resolution global climate models. Ideally, the hybrid approach will be able to capture many of the physical processes simulated by the costly weather forecast models, but with the reduced expense of statistical models. The hybrid approach will be applied to three key areas of California's climate that have important implications for the state's ratepayers: wind, clouds, and hydrology: wind, clouds, and hydrology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will include an extensive quantification/measurement (model validation) effort, which will be based on data from observed meteorological stations and existing coastal upwelling indices (for wind), satellite records of low cloudiness compiled by project members (for cloudiness and aerosols), and USGS stream-flow and groundwater observations (for the hydrologic modeling). The method under development could be used for California's Fifth Climate Change Assessment and future energy planning.

CPUC Proceedings addressing issues related to this EPIC project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 5c

Lower Costs:

Knowing how the climate is likely to change provides a sound scientific basis for minimizing economic impacts on the electricity system. For example, better projections of wind fields at heights of interest to wind generation and at appropriate time scales (i.e., sub-daily) will help guide long-term planning for wind generation. Improved, cost-effective planning for integration of renewables to meet California's Renewables Portfolio Standards potentially has significant benefits for California ratepayers.

Greater Reliability:

This research will develop a method to produce high-resolution projections of climate parameters that are of great importance for managing the electricity system, in particular for managing peak demand and for shifting to a grid that is dominated by low-carbon, intermittent resources. For example, improved understanding of how low-lying coastal cloud cover is projected to evolve can improve planning for peak demand. Similarly, improved understanding of availability of intermittent renewable generation fosters better management. This potentially has significant benefits in the form of increased reliability for California ratepayers.

Increase Safety:

This research offers enhanced GCM resolution for predictive modeling. therefore, knowing how the climate is likely to change means that the effects on the state's residents, infrastructure, and economy can be minimized. This potentially has significant benefits for California ratepayers

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $192,928	
EPIC Funds Encumbered: $1,399,888		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 14 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-063 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: This project started late in the summer of 2017. The research team assembled the Technical Advisory Committee and is finalizing sub-awards to UCLA and UC Riverside.

238. EPC-16-064

Project Name:

Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect

[EPC-16-064]

Recipient/Contractor:

US Geological Survey

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/8/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

PV utility-scale solar facilities in California (and elsewhere) are sources of bird mortality. Currently, it is unknown what behavioral processes and mechanisms lead to bird mortality observed at solar facilities. The leading hypothesis suggests that large fields of photovoltaic panels reflect light in a manner similar to large bodies of water. Moreover, the presence of these water-like surfaces in arid landscapes may add to their attractiveness to passing birds. Left unaddressed, this problem will lead to increased costs to ratepayers as solar energy projects face greater environmental permitting challenges associated with developing and operating these facilities.

Project Description:

The recipient is exploring the behavior of attraction by birds to solar facilities, particularly in relation to the "lake effect" hypothesis. Specifically, they are studying 1) the ability of birds to detect potentially attractive visual cues associated with solar facilities (e.g., polarized light, irradiance); 2) the corresponding change in flight behavior characteristic of movement toward solar facilities; and the 3) mortality and natural history of birds that actually occupy solar facilities. First, the recipient is examining the sensory basis of attraction through field and lab experiments. Second, radar and thermal imaging are used to measure the degree to which birds alter their flight paths to settle at solar facilities. Data on behavior and mortality from multiple solar facilities are gathered to inform a statistical model to determine what characteristics of solar facilities and species' natural history together explain variations in mortality exhibited across sites.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will be the first systematic study to determine whether birds are attracted to solar energy facilities and if so, to develop an understanding of the sensory basis and proximal response of birds to solar facilities in relation to the "lake effect" attraction phenomenon. Following from that new understanding, the project will identify potentially viable methods for deterring birds from approaching solar facilities and informing future siting decisions in ways that reduce the likelihood of birds encountering solar facilities.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 2a, 3a, 4f, 4g

Lower Costs:

This Agreement will result in the ratepayer benefit of lower costs by streamlining the permitting process of renewable energy projects in California. Renewable energy projects are often delayed because information on the impacts on wildlife required by state and federal law is insufficient or unavailable. Better information on the effects of these projects will reduce permitting delays. The findings of the research may also help to focus pre-construction surveying and post-construction monitoring and mitigation actions to the species at greatest risk from this form of attraction, which would also reduce the soft costs of deployment of solar energy technologies.

Environmental Benefits:

By combining existing mortality and natural history data with new data gathered during the proposed project, solar energy companies, state and federal agencies, and the public will have access to the best information for risk assessment and future siting decisions. The eventual adoption of such techniques reduces the likelihood that solar facilities impact species of concern, particularly state and federal threatened and endangered species. Suggested deterrent and mitigation strategies may lead to the application of technologies that reduce bird mortality.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $177,072
EPIC Funds Encumbered: $499,785	**EPIC Funds Spent:** $0
Match Partner and Funding Split: United States Geological Survey: $348,152 (28.1 %) Bard College: $75,390 (6.1 %) Humboldt State University Sponsored Programs Foundation: $12,244 (1.0 %) 8minuteenergy Renewables, LLC: $50,000 (4.0 %) First Solar: $50,000 (4.0 %) NextEra Energy: $50,000 (4.0 %) NRG Energy, Inc.: $50,000 (4.0 %) Recurrent Energy: $100,000 (8.1 %) Western EcoSystems Technology, Inc.: $4,465 (0.4 %)	**Match Funding:** $740,251
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 14 out of 14 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: This agreement was approved at the May 2017 business meeting, but the agreement is still being finalized as of December 2017.

239. EPC-16-065

Project Name:

California E-Bus to Grid Integration Project

[EPC-16-065]

Recipient/Contractor:

Zero Net Energy (ZNE) Alliance, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

On-road diesel emissions are a key factor in lung disease and the state's asthma epidemic. Electrification of transit and freight represents a tremendous opportunity to achieve cornerstone climate goals such as Assembly Bill (AB) 32, State Bill (SB) 350, and Executive Orders B-30-15 and B-16-2012. This project's unparalleled scale represents an opportunity to demonstrate a real-life operating context and inform best practices for commercial-scale procurements of electric buses throughout the state, since cost and reliability are the largest barriers to scaled adoption of medium and heavy-duty electric vehicles (EV), and battery and vehicle prices have come down substantially.

Project Description:

The California E-Bus-to-Grid Integration Project represents the integrated demand side management of EVs. It couples smart charging with smart driving, and places an equal emphasis on the three pillars of change management: technology, people, and process. Just as California's loading order emphasizes energy efficiency, demand response, and renewable resources first, before using fossil fuel, this project focuses on improving fuel economy (i.e., vehicular energy efficiency) in conjunction with the design and implementation of novel VGI services. The fuel economy improvements that come from smart driving result in operational cost savings and more effective smart charging by reducing the frequency and duration of in-route charging. By reducing the likelihood that several/all E-Buses will be charging at once, the smart charging platform provider (Olivine) will achieve greater flexibility to mitigate demand charges and provide grid services achieving customer benefits.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

E-Buses have the technical and economic potential to rapidly displace diesel and CNG transit buses given current replacement cycles. Buses are being deployed with onboard telematics to understand the vehicle's operating health and parameters, and high-power wireless inductive charging is now a viable solution for in-route charging. Together, these technologies help overcome range limitations and uncertainty. However, while these technologies alone provide great value and overcome key adoption barriers, integrating them with analytics and distributed energy resource (DER) management platforms can unlock even greater value.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 2a, 3f, 4a

Lower Costs:

This project will smooth demand spike during nighttime depot charging and demonstrate how to minimize demand charges during the day when buses need to be charged using high-powered chargers such as the 250 kW Wireless Advanced Vehicle Electrification chargers being deployed by Antelope Valley Transit Authority.

Greater Reliability:

Enabling grid services to provide grid operators with the increased flexibility and resiliency required for the growing demands associated with renewable intermittency, excess generation, and portfolios of DERs. Traditional grid service providers are not able to adequately meet the increasing need for flexible ramping and frequency regulation.

Consumer Appeal:

Enabling advanced analytics of operating behaviors and environmental conditions to identify and encourage efficient operator behaviors. Operator fuel economy at Antelope Valley Transit Authority ranges from 1.5 kW/mile to 5 kW/mile. This kind of volatility represents risk for fleet managers, and has resulted in only the most efficient operators being assigned to the E-Buses in the fleet.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $3,327,953		**EPIC Funds Spent:** $21,612	
Match Partner and Funding Split: Antelope Valley Transit Authority: $3,729,000 (52.8 %)		**Match Funding:** $3,729,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project has just started in August 2017. The team has begun to create a VGI valuation model and will apply different use cases to this model to identify the best revenue streams for the Antelope Valley Transit Authority E-Fleet.

240. EPC-16-067

Project Name:

Robust Super Insulation at a Competitive Price

[EPC-16-067]

Recipient/Contractor:

Lawrence Berkeley National Laboratory

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/14/2017 to 12/2/2020

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

Currently conventional building insulation is economical but has low R-values. There are some emerging technologies with high R-values but also high price tags. There is a need to develop a robust insulation with a high R-value to significantly reduce cooling and heating loads that can be sold at a competitive price.

Project Description:

Heating and cooling represents the greatest energy consumption in buildings. This agreement develops thermal building insulation material with high R-value at a cost competitive to conventional insulation materials. The expected result provides a significant increase in energy efficiency for retrofitting buildings.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Currently, there is no thermal building insulation material that can cost-effectively be assembled with high R-values. The recipient will develop a manufacturing process to achieve a high R-value and decrease the installed thickness of the insulation, making retrofits easier because much less space will be needed to accommodate existing building wall assemblies.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1h

Lower Costs:

This agreement develops cost-effective insulation material expected to achieve 2 to 4 times increase in R-value without increasing the cost.

Assignment to Value Chain:	**Total Budgeted Project Admin and Overhead Costs:** $42,679
Demand-side Management	
EPIC Funds Encumbered:	**EPIC Funds Spent:**
$100,000	$0

Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: U.S. Department of Energy : $1,700,000		**Leveraged Funds:** $1,700,000	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 43 bidders	**Rank of Selected Applicant/ Bidder:** N/A
If not the highest scoring applicant/bidder, explain why selected: The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-16-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions. Technical results will be made public after securing intellectual property, as is customary.			
Update: The first TAC meeting will be held in January and a CPR meeting is planned for March.			

241. EPC-16-068

Project Name:

Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits

[EPC-16-068]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

There is a need to ensure equal access to energy innovations to all sections of society and enable everyone to derive the economic and quality of life benefits from meeting California's energy and climate goals. To meet these goals, research gaps remain such as: (1) assessment of new, high efficiency solar technologies that can address space constraints in commercial and multifamily buildings, (2) test how integration of solar, energy storage and connected end-use load control can potentially manage customer needs with electrical grid benefits and (3) evaluation of approaches to enable community solar and storage as a tool to enable grid reliability

Project Description:

This project demonstrates the feasibility of using an integrated community-scale solar plus storage system, sited at a low income multi-family disadvantaged community in Willowbrook, CA, as a distribution asset. The technology solution balances a combination of grid-connected distributed energy resources (DER), including advanced solar PV, energy storage, smart inverter, demand response, and load management. The project team is working with Southern California Edison to study the distribution grid impacts that the DERs can mitigate, realizing cost savings and enabling increased PV penetration. It is also investigating innovative business strategies to maximize the value of DER to both end-users and the utility. Another objective of the project is to demonstrate a cost-effective solution to achieving Zero Net Energy (ZNE) within an affordable housing community to realize California’s 2020 goal for new sustainable and scalable ZNE communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State’s Statutory Energy Goals:

The project includes high efficiency solar that can substantially assist commercial and multifamily buildings with roof area constraints, as well as the integration of solar and storage with smart inverters that include segmentation of storage for meeting multiple needs. The project also demonstrates a platform that can manage both loads and storage while integrating DC mini grids to eliminate conversion losses for solar PV.

CPUC Proceedings addressing issues related to this EPIC project:

Self-Generation Incentive Program: R.12-11-005 Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3f, 4a, 4b

Lower Costs:

The project will demonstrate energy savings of 231,240 kWh to the grid on an annual basis from the solar generation. With the inclusion of an additional 10% savings through reduction in conversion losses and another 10% through energy efficiency measures, the project will save 289, 050 kWh annually. If this project were replicated to cover 15% of California residential energy use (20% of ratepayers are low income, and 75% of low income is multifamily), Californian's total energy bills would be reduced by $185 million per year.

Environmental Benefits:

The project shows a potential, if replicated to cover 15% of California residential energy use, for energy use reduction of 1089.4 GWh per year, which translates to statewide CO2 reduction of 397,631 tons per year.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $821,664
EPIC Funds Encumbered: $2,976,991	**EPIC Funds Spent:** $0
Match Partner and Funding Split: E-GEAR: $137,564 (3.5 %) OhmConnect, Inc.: $108,000 (2.7 %) Chai Energy: $25,000 (0.6 %) EPC Power: $5,000 (0.1 %) Nextek: $10,000 (0.3 %) Prism Solar: $10,000 (0.3 %) Southern California Edison: $300,000 (7.5 %) Electric Power Research Institute (EPRI): $407,336 (10.2 %)	**Match Funding:** $1,002,900
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

EPRI developed a tool called the “Distribution Resource Integration and Value Estimation” tool

or “DRIVE.” The tool was developed through funding from EPRI’s utility members. The tool is embedded in distribution planning software made commercially available by license. DRIVE is pre-existing IP.
Update: The kickoff meeting for this agreement was held on September 20, 2017. In December 2017, EPRI began project preparation work by submitting site readiness verification documents and the draft measurement and verification plan. In the first quarter of 2018, EPRI will finalize the measurement and verification plan, complete the concept design, including the control systems architecture requirements, and begin to build and develop control interfaces and algorithms.

242. EPC-16-069

Project Name:

Demonstrate the Phase III functions of a PV smart inverter and a storage inverter with a communications gateway.

[EPC-16-069]

Recipient/Contractor:

Advanced Microgrid Solutions, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/7/2017 to 3/20/2020

Program Area and Strategic Objective:

Applied Research and Development

S6: Advance the Use of Smart Inverters as a Tool to Manage Areas with High Penetrations of PV.

Issue:

There is a critical need to demonstrate and validate the Smart Inverter Working Group's (SIWG) Phase III recommendations to enable Distributed Energy Resources (DERs) to provide coordinated, targeted support to the distribution grid. In addition, batteries can provide storage of excess solar power without reducing PV curtailment, thereby mitigating daytime oversupply and meeting evening peak demand to effectively level out the net-load "duck curve".

Project Description:

Demonstrate the Phase III functions of a PV smart inverter and a storage inverter with a communications gateway. This project will test and validate the Phase III functions of a PV smart inverter and a storage inverter with a communications gateway to support higher penetrations of solar on the grid at the South Coast AQMD Headquarters in Diamond Bar, California. This agreement will test, validate, and demonstrate all eight Smart Inverter Working Group (SIWG) Phase III functions in a system composed of a PV smart inverter, a bi-directional storage inverter, behind-the-meter solar and storage, and a communications gateway. This will increase circuit hosting capacity for solar and decrease distributed PV integration costs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop an advanced communications gateway and system controller to operate and demonstrate the use of Phase III functions for smart inverters and energy storage to enable greater operability of these distributed energy resources.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Level Interconnection (Rule 21): R.11-09-011 Smart Inverter: D.14-12-035 (in R.11-09-011)

Applicable Metrics: CPUC Metrics- 1b, 4a, 5b

Lower Costs:

The Project is expected to reduce the demand charges at the demonstration site by 28% and reduce the overall electric bill by 18%. These benefits are accrued over the course of a 25-year minimum guaranteed contract.

Greater Reliability:

The Project will increase grid reliability and reduce the likelihood of blackouts or brownouts by reducing peak energy demand at the demonstration site by 16% or more (approximately 347 kW for the Project); and total energy usage by >10% (approximately 736 MWh per year) to reduce congestion.

Environmental Benefits:

This Project will reduce GHG emissions by an estimated 325 tons each year.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $594,333
EPIC Funds Encumbered: $2,729,943	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Nemaste Solar: $719,955 (14.7 %) Advanced Microgrid Solutions, Inc.: $1,393,325 (28.4 %) South Coast Air Quality Management District: $60,102 (1.2 %)	**Match Funding:** $2,173,382
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	31 out of 35 bidders	Group 4: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project has just started. Advanced Microgrid Solutions gave a presentation on the project at the EPIC Fall Symposium. A kickoff meeting will be scheduled now that the agreement is signed and in place.

243. EPC-16-070

Project Name:

Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting [EPC-16-070]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S15: Demonstrate Advanced Energy Storage Interconnection Systems to Lower Costs, Facilitate Market and Improve Grid Reliability.

Issue:

Although it is recognized that front-of-the-meter and community-scale storage projects can benefit the grid and provide greater value to customers, it is not yet clear what those values are or how they can be maximized (nor how the possible adverse impacts of high penetrations of PV can be minimized). In addition, current storage systems are deployed in an ad-hoc basis within distribution systems.

Project Description:

The purpose of this Agreement is to fund demonstration and research of an integrated, interoperable, cost-effective, and scalable solution that integrates distributed front-of-meter energy storage with smart PV inverters and solar forecasting to address grid readiness limitations and enable multi-tiered value stacking for DER.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will demonstrate an interoperable solution that integrates front-of-the-meter energy storage with smart PV inverters and satellite-based solar forecasting to address grid readiness limitations. The idea is enabling PV as a grid asset through beneficial integration with storage, capacity management, and communications. To accomplish this, advanced modeling techniques will be leveraged including EPRI's existing tools for hosting capacity calculation and energy storage value simulation. Technological knowledge advancement that will result from this demonstration will enable aggregated DER control and optimization.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 SB 1122 Bioenergy feed-in tariff: R.11-05-005 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 1a, 1e, 3a, 4a

Lower Costs:

This project will demonstrate a cost-effective integrated energy storage deployment methodology. Energy storage technology selected for this deployment has been designed specifically for quick installation, open integration, cutting edge reduced physical footprint, high level of battery and component safety, and enhanced product reliability.

Greater Reliability:

The project will provide new data, analysis and design for cost-effective integration of distributed PV with energy storage. This will improve reliability at two levels: (1) at the distribution system level, by mitigating adverse PV impacts such as voltage violations; and (2) at the bulk level, by leveling out the "duck curve" and limiting dependency on operating reserves.

Increase Safety:

This project will demonstrate a mid-size distributed storage architecture sited in an industrial facility to optimize safety. Each cell has built-in overcharge protection, built-in fuse, integral vent, puncture protection, and is contained in a fireproof metal envelope with a safety layer between the cell materials and the enclosure. The battery management system monitors the cell balance, voltages and temperatures, and in the event of any departure from normal operating parameters will disconnect the battery. The entire system will be monitored by a CAISO certified aggregator through a CAISO certified RIG (remote intelligent gateway)

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $1,832,770		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Craig Wooster Engineering: $361,685 (14.9 %) Electric Power Research Institute (EPRI): $229,753 (9.5 %)		**Match Funding:** $591,438	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

244. EPC-16-073

Project Name:

Valencia Gardens Energy Storage

[EPC-16-073]

Recipient/Contractor:

Natural Capitalism Solutions, dba Clean Coalition

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/1/2017 to 6/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S15: Demonstrate Advanced Energy Storage Interconnection Systems to Lower Costs, Facilitate Market and Improve Grid Reliability.

Issue:

Renewable energy combined with energy storage on the distribution grid has been acquired one rooftop at a time. These systems are developed without an assessment of a local area's energy system potential as a whole and without the integration and automation of all the required components, such as energy storage operating on feeders, in front of the meter, that accelerate and scale these deployments. The absence of an area-wide, integrated distributed energy planning process results in lost opportunities to accelerate the adoption and scale of distributed renewable energy while achieving a more operationally-viable and cost-effective outcome.

Project Description:

The purpose of this project is to utilize distributed energy storage as part of an optimized local energy system that both increases the ability of the distribution grid to support more local solar, while improving overall grid operations and economics. This project will provide a replicable model for California by deploying local energy storage in front of the meter that achieves multiple uses: interoperability with normal grid operations, including participation in existing wholesale market opportunities; enhanced interconnection hosting capacity to accommodate far more local solar; and indefinite solar-driven backup power for prioritized loads. Additionally, this project will recommend advancements in policy, interconnection processes, and market mechanisms that maximize and recognize the full value of local energy storage deployments that are interconnected in front of the meter.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of California's statutory energy goals by utilizing energy storage as a local balancing and optimization solution on a circuit in the distribution grid. The project will demonstrate a combination of advancements and breakthroughs including, but not limited to an advanced local energy system that utilizes energy storage on a circuit to optimize local circuit balancing, increase PV hosting capacity, and provide CAISO ancillary services.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5b

Lower Costs:

The project has the potential to bring more than $1.3 million in benefits to California ratepayers through peak capacity savings, T&D line loss savings, and new transmission capacity savings alone.

Greater Reliability:

This project will enable higher penetrations of distributed renewable energy, improve circuit reliability and optimize local balancing of electricity supply and demand. It will utilize indefinite, renewables-based backup power to critical loads during grid outages to achieve greater community resilience.

Economic Development:

This project will support regional economic development, including job creation and increased tax revenue, at $4.6 million.

Environmental Benefits:

This project will decrease reliance on fossil fuels for electricity generation, and thereby reduce greenhouse gas emissions (more than 225 million pounds) and other hazardous emissions from power plants.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $1,994,687	**EPIC Funds Spent:** $37,463
Match Partner and Funding Split: PATHION, INC: $620,470 (23.7 %)	**Match Funding:** $620,470
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 6: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update: The project kicked off in September. The recipient is actively working on the site readiness verification documents such as the lease agreement and the memorandum of understanding.

245. EPC-16-077

Project Name:

Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility [EPC-16-077]

Recipient/Contractor:

The Regents of the University of California, on behalf of the Riverside Campus

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Current Photovoltaic (PV) generation and Battery Energy Storage System (BESS) activities do not adequately integrate the meter side community energy conditions and Utility Demand Response (DR) functions. BESS integrated energy management activities have the risk of potentially increasing peak demand and peak utility loads. Additional PV generation also increases generation uncontrolled by the utility. Unmanaged energy production and storage creates additional challenges for utility energy management and distribution. Commercially viable products have failed to materialize with solutions to existing barriers, dampening market interest.

Project Description:

The project deploys a 100 kW high-performing solar PV system, a 150 kW/150 kWh li-ion battery energy storage system, and an advanced energy management platform (smart inverter) to demonstrate the advancement of these technologies compared to standard commercially available products. These components will be integrated to optimize flexibility in demand side energy management through Load Shifting, Solar PV Self-consumption, Emergency Back-Up, Demand Response, and Ancillary Grid Services. The proposed system will be able to autonomously meet demand response and energy management requests while critical loads at the building are maintained, minimizing operational impacts.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will integrate energy storage and PV technology with advanced control algorithms and smart inverter autonomous functions. The solar+ system will use high efficiency solar panels DC coupled with Li-ion battery storage and demonstrate various smart inverter functions to provide autonomous grid services and energy management practices under a variety of operational conditions. The team will assess the impact smart inverter-provided grid services and solar storage operation has on each other. The project provides BESS and PV technology integrated with EMS to support diurnal energy loads. This project will implement utility initiated DR functions and create an architecture that allows expansion to future power regulation and potential wholesale market participation.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Distribution Resources Plans (AB 327): R.14-08-013 Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1g, 1h, 2a, 3d, 3f, 3h, 5a

Lower Costs:

This project will utilize PV generation integrated with BESS to manage energy use through load shifting and solar PV self-consumption. The integration of proposed EMS components will reduce peak energy demand by utilizing BESS to shift building and community loads. The reduction of peak energy use will reduce the costs associated with procuring additional energy during periods of peak demand, as well as reduce consumer's energy bills. For example, the project site, a low-income/affordable housing facility, is estimated to receive an energy cost savings of $262,800 and a peak demand charge reduction of $190,507 over a ten year period.

Greater Reliability:

This project will utilize PV generation integrated with BESS to manage energy use through load shifting, emergency back-up, demand response, and ancillary grid services. The integration of proposed EMS components will reduce peak energy demand by utilizing BESS to shift building and community loads. The project is scalable in both size and quantity. Therefore, this effort will demonstrate the commercial feasibility to deploy many MWh of dispatchable energy integrated in a PV/BESS configuration with smart inverters.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $332,995
EPIC Funds Encumbered: $2,110,657	**EPIC Funds Spent:** $0
Match Partner and Funding Split: LINC Housing Corporation: $80,000 (3.2 %) Regents of the University of California, Riverside Campus: $265,259 (10.5 %) Pacific Energy/Masters Electric: $19,500 (0.8 %) EnSync Energy Systems: $46,750 (1.9 %)	**Match Funding:** $411,509
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

While the agreement was approved by Commissioners at the June 2017 Business Meeting, there were delays in finalizing the agreement package. Work on technical tasks will commence in early 2018, but the overall project timeline will not be impacted.

246. EPC-16-079

Project Name:

Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration

[EPC-16-079]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	6/30/2017 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S6: Advance the Use of Smart Inverters as a Tool to Manage Areas with High Penetrations of PV.

Issue:

California Rule 21 was revised to include autonomous device control, data communication, and dynamic electrical control functions for smart inverters. While a limited set of smart inverter functions became mandatory through the Smart Inverter Working Group Phase I activity, a number of additional functions with potential to substantially increase the grid's solar hosting capacity are deferred to a Phase III, the timeline for which is uncertain. Phase III includes functions that affect the real power produced by solar PV systems and there are both technical and economic questions that must be answered if these capabilities are to come into use in California and beyond.

Project Description:

This project will comprehensively evaluate the SIWG Phase III functions. The process will include computer modeling of California distribution circuits, implementation in multiple inverter brands, laboratory testing, and field pilot testing. The integration will include communication and control via a commercial aggregation system and utilization and assessment of the IEEE 2030.5 communication protocol. The analysis will utilize Sky Imager data to extrapolate the results of the study and will determine effective control strategies for Phase III functions to achieve a 25% increase in PV hosting capacity. An economic analysis will build on the technical findings, identifying the impact to the asset owner, performing an economic valuation of these impacts, and providing guidance regarding potential compensation. A comprehensive cyber security assessment of the communication system will be performed and public key infrastructure will be established to support the cyber security needs in California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help overcome three major barriers to achieving the state's energy goals by: 1) proving that CA Rule 21 Phase III functions can be deployed feasibly, safely and predictably via standardization; 2) demonstrating that grid penetration levels can be increased by 25% or more via use of the Phase III advanced control functions; and 3) enabling secure, scalable and affordable cyber security infrastructure that can be accessed by all Californians now and in the future.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Distribution Level Interconnection (Rule 21): R.11-09-011 Smart Inverter: D.14-12-035 (in R.11-09-011)

Applicable Metrics: CPUC Metrics- 1a, 1b, 5a, 5b, 5f, 5g

Lower Costs:

This project enables more Californians to own and operate more solar generation. This accelerates the availability of advanced function inverters that are compatible with CA Rule 21 Phases I-III and enables DER systems to provide grid support functions that otherwise require expensive physical grid upgrades. Open standard test procedures and certification criteria remove financial barriers for vendors, thus stimulating the inverter market without increasing cost.

Greater Reliability:

This project delivers standardized DER control functions that minimize and mitigate reverse power flows, voltage sags/dips, and other conditions that degrade grid stability and DER performance, thus increasing grid reliability and increasing the availability of access to locally-harvested solar energy.

Increase Safety:

The standardized methodology for demonstrating compliance to CA Rule 21 Phase III requirements eliminates the variability implied by proprietary solutions and enables dynamic electrical control functions to be deployed safely at scale. The availability of cyber security best practices and a public key infrastructure ensures that common security pitfalls are avoided as compliant systems are deployed in the field in volume.

Economic Development:

This project demonstrates that DER systems can be deployed at grid penetration rates that are increased by 25% more, increasing the total potential market for fuel- and emissions-free solar PV by almost double.

Consumer Appeal:

The advanced functionality and increased security delivered by this project enable PV system owners to participate in emerging wholesale ancillary grid services markets and aggregation networks, thus diversifying the potential revenue sources available.

Assignment to Value Chain: Grid Operations/Market Design	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $2,935,822	**EPIC Funds Spent:** $33,447
Match Partner and Funding Split: SunSpec Alliance: $177,502 (3.9 %) Sunrun: $1,102,122 (24.0 %) Electric Power Research Institute (EPRI): $379,453 (8.3 %)	**Match Funding:** $1,659,077

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None</td><td colspan="2">Leveraged Funds:
$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
31 out of 35 bidders</td><td>Rank of Selected Applicant/ Bidder:
Group 4: Ranked # 1</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
Funds were awarded to passing proposals in rank order.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-16-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
The project has just started. A kickoff meeting was hosted at Energy Commission on August 15, 2017. EPRI’s cost benefit analysis (CBA) group has started working on the white paper titled ‘A Framework for Evaluating Economic Management of Real Power on Distribution Systems’. The IEEE 2030.5 compliance test procedures for Rule 21 functions have been developed by SunSpec.</td></tr>
</table>

247. EPC-17-001

Project Name:

Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions

[EPC-17-001]

Recipient/Contractor:

Taylor Engineering, LLC

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/31/2017 to 12/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Typically, energy reduction efforts focus on equipment replacement, which often has high costs. Updating the controls for existing systems to operate more efficiently presents a prime opportunity to achieve cost-effective savings. However, the current upgrade model presents a barrier for building owners and operators to effectively scale installation of advanced controls. This project demonstrates a large-scale application to test the validity of installing optimized plug and play control solutions for the commercial building sector.

Project Description:

This project optimizes and simplifies control upgrades to demonstrate energy savings while improving occupant comfort. This demonstration uses automated fault detection and diagnostics and continuous commissioning with the use of advanced measurement and verification procedures. The agreement includes recommendations for strategies, tools, and initiatives to address market barriers and promote large scale market adoption.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help achieve the State's energy goals by scaling up the market adoption of control retrofits that result in significant energy savings in commercial buildings. The successful demonstration of the system as a scalable energy savings solution, and development of pre-tested, plug-and-play integrated packages to achieve energy savings will also allow commercial building owners and operators to maximize energy savings across large portfolios of buildings while reducing transaction costs.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs:

Deploying a simplified approach to achieving sustained operational savings can reduce costs for building owners and operators. Further, integrating measures into single installations (which can yield upwards of 20% energy savings) can reduce overall project costs and payback periods for measures.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $932,257	
EPIC Funds Encumbered: $2,966,716		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Kaiser Permanente Medical Center: $2,300,000 (40.1 %) Enlighted Inc.: $246,750 (4.3 %) KGS Buildings: $25,000 (0.4 %) Delos: $57,000 (1.0 %) Alerton: $15,000 (0.3 %) Trane U.S., Inc.: $15,000 (0.3 %) Automated Logic Corporation: $30,000 (0.5 %) Siemens Corporation, Corporate Technology: $10,000 (0.2 %) United States Department of Energy: $75,000 (1.3 %)		**Match Funding:** $2,773,750	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 2: 13 out of 15 bidders	**Rank of Selected Applicant/ Bidder:** Phase 2: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.			
Update: Project work started October 18, 2017. Work to-date includes finalizing subcontracts, assembling the Technical Advisory Committee (TAC), and estimating project benefits to California ratepayers.			

248. EPC-17-002

Project Name:

Scaling Solar+ for Small and Medium Commercial Buildings

[EPC-17-002]

Recipient/Contractor:

Humboldt State University Sponsored Programs Foundation

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/31/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Although a range of distributed energy resources (DER) and storage are being designed to power and support the fast changing electric grid, these DER are often procured separately. Without coordination between them, there are missed opportunities to reduce the soft costs of deployment and better support bulk power and distribution system operations. Integration technology elements appropriate for small-to-medium sized commercial buildings (SMB) are not commercially available, making it too costly to effectively deploy smart, integrated DER. This project addresses these challenges by developing standardized components for a Solar+ system designed specifically for the SMB sector.

Project Description:

The research team is designing, implementing, operating, and evaluating a Solar+ system in a pilot scale application for convenience stores. The project is designed to innovate across three key priority areas necessary for technology scale-up: hardware design guidelines, integration software, and site targeting. Filling these knowledge gaps will help move the deployment of Solar+ technologies forward, thereby bringing substantial benefit to individual building owners, as well as opening opportunities to provide service to the broader distribution and bulk power systems. This project focuses on the convenience store/fueling station SMB sector, but lessons learned and products developed can likely be extrapolated to other SMB sectors.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will integrate DER, energy storage, and controllable loads to increase the value of Solar+ systems in the SMB sector. Optimized relative sizing of batteries to PV and flexible operations from MPC-enabled building automation will demonstrate how investment in an integrated system can save costs and create efficiency. The project will develop and demonstrate an open-source model-predictive control (MPC) algorithm with hierarchical control awareness of embedded and distributed control logic to manage building systems and improve load control. Improved hardware-software interfaces will integrate solar electric systems with localized energy storage and MPC-improved load control systems. This will allow SMB owners to optimize the benefits of distributed solar power and approach net-zero energy buildings while also supporting the larger grid power system.

CPUC Proceedings addressing issues related to this EPIC project:

Self-Generation Incentive Program: R.12-11-005 Energy storage: R.15-03-011 Distribution Resources Plans (AB 327): R.14-08-013 Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1c, 1e, 1f, 1h, 1i, 2a, 3d, 3h, 5a, 5f

Lower Costs:

This project will reduce onsite energy demands and peak loads, resulting in customer bill savings. For example, the estimated site benefits include energy and demand charge savings of $0.20 per watts of PV a year, along with payments for demand response for the distribution system and build power system of $0.20 per watts of PV a year. The project will develop hardware design guidelines, integration software, and a site targeting toolkit to reduce the soft costs of installing solar PV, battery energy storage, and smart inverter equipment.

Greater Reliability:

This project will expand the ability to provide power for critical services (e.g., fuel dispensing and refrigeration loads) in times of emergency when the utility grid is disabled (e.g. after a natural disaster). These project benefits will accrue both to the site host and to the local distribution grid. However, the greatest benefits from the project will likely come from amplification effects through the improved ability to promote smart deployment of Solar+ systems at scale throughout California.

Environmental Benefits:

Preliminary calculations indicate significant distributed energy resource capacity could be deployed through the framework and systems this project is developing. On first order, if each of the 12,000 convenience stores in California were to install or procure the equivalent of 50 kW in PV capacity, this would result in 600 MW of additional statewide capacity that generates 880 GWh annually. If there were no commensurate reduction in the RPS compliance requirements (because the generation would be behind the meter) this would represent accelerated progress on GHG reduction and save 300,000 tonnes CO2e per year.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $413,443	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Humboldt State University Sponsored Programs Foundation: $41,577 (2.3 %) Serraga Energy, LLC at Blue Lake Rancheria: $258,665 (14.0 %) Tesla Motors, Inc.: $25,000 (1.4 %) Southern California Edison: $20,000 (1.1 %)		**Match Funding:** $345,242	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: A kick-off meeting for this project was held on October 10, 2017. The team completed their site readiness verification documentation and a draft measurement and verification plan in December 2017. The team also plans to have an engineering plan set, specifications, and cost estimates 90% complete by March 2018.

249. EPC-17-003

Project Name:

Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar [EPC-17-003]

Recipient/Contractor:

Clean Power Research, L.L.C.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/31/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

California experiences a wide range of meteorological phenomena including coastal and valley fog, monsoon events, and temperature inversion/smog events. These phenomena impact the reliability of both satellite-based and Numerical Weather Prediction (NWP) forecast models due to the challenge of predicting cloud formation/dissipation during these conditions. This weather-based uncertainty translates into PV simulation uncertainty. This uncertainty translates into costs to the California ratepayer by imparting this uncertainty to load forecast uncertainty. This forecast uncertainty is mediated by the increasing adoption of PV and other DERs.

Project Description:

This project provides CAISO with an improved next-minute to day-ahead high resolution, system-wide, probabilistic power production forecast for all California PV systems. The comprehensive forecast includes both behind-the-meter and utility-scale PV systems. The project is quantifying the costs and benefits of these improvements. The team uses mid-term DER adoption forecasts adapted from the IOUs' DRPs to project distribution of DERs into the future. The team is combining the result with the improved PV forecast to integrate results into CAISO load forecasts using Itron's load forecast engine.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advances the state of PV forecasting in California by improving the accuracy of solar irradiance and PV forecasts, particularly rooftop solar, which is not currently well-understood. Participants in the Energy Commission's January 2017 forecasting workshop identified the lack of visibility into DER impacts on net load as a major barrier to generating accurate forecasts. Forecast inaccuracies cost California millions of dollars annually and result in the unnecessary curtailment of renewable generation.

CPUC Proceedings addressing issues related to this EPIC project:

Long-Term Procurement Proceeding (LTPP): R.13-12-010

Applicable Metrics: CPUC Metrics- 1c, 2a, 3a, 5c

Lower Costs:

A reduction of 57 MW in spinning reserves required to accommodate day-ahead forecast errors for the existing PV fleet across the CAISO reflects a 28.7 percent reduction--versus persistence--in the RMSE of day-ahead forecasts. Assuming the average price of spinning

reserves at CAISO is $10.11/MW, such an increase in forecast accuracy reflects savings of roughly $5 million per year for California. Previous studies have shown that these reserve savings only constitute 5-10 percent of total savings from improved economic dispatch and unit commitment. If this is the case, then savings for the state of California from such an improvement in accuracy are on the order of $50 million per year.

Greater Reliability:

This project will integrate an improved PV production forecast into CAISO operations, increasing electric power system reliability across California. The uncertainty of PV generation imparts costs to the California ratepayer because the CAISO must carry spinning and non-spinning reserve resources to accommodate this uncertainty. Reducing uncertainty reduces required reserves. This project will quantify reductions in reserve requirements. Further, the project will provide knowledge to the grid operator and California decision-makers to help the state plan for increased adoption of DERs while maintaining reliability standards by examining the impacts of DER adoption on forecast accuracy.

Environmental Benefits:

Assume that the deferred reserves correspond (from an environmental standpoint) to the average California energy mix. The CEC references 0.73 lbs of CO2 per kWh as the average carbon footprint reflecting the energy mix in California. Therefore, the increased forecasts defer 57 MW of reserves for the entire year for a day-ahead forecast RMSE improvement of 28.7 percent versus baseline. This corresponds to roughly 500 GWh of displaced electricity. The corresponding environmental impact is roughly 166,000 Teq (Tons-equivalent) of CO2.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $176,606	
EPIC Funds Encumbered: $750,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: State University of New York at Albany: $20,000 (1.9 %) Clean Power Research, L.L.C.: $300,000 (28.0 %)		**Match Funding:** $320,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The kick-off meeting for this project was held September 22, 2017. After the kick-off, CPR worked on improvements to the accuracy of both the irradiance and PV forecast. CPR will complete the Final Irradiance Forecast Accuracy Improvement Report and hold its first TAC meeting in the first quarter of 2018.

250. EPC-17-004

Project Name:

Enhanced Modeling Tools to Maximize Solar + Storage Benefits

[EPC-17-004]

Recipient/Contractor:

Energy and Environmental Economics, Inc. (E3)

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/17/2017 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Customer adoption of PV and storage and other DER is set to substantially increase in California as technology costs decrease, new products are brought to market, and the relationship between customer and utility evolves. DER could have very different costs to ratepayers depending on how customers are incentivized to use them. If the incentivized use of DER by customers through their tariffs or programs is not aligned with the needs of the grid, DER adoptions could be very costly.

Project Description:

This research is developing a solar + storage optimization tool to evaluate the dispatch and operations and value proposition, for integrated solar + storage systems. The tool is capable of evaluating distributed solar with storage and an array of advanced controls and dispatchable DER technologies, and evaluates optimal dispatch for a wide range of customer programs and incentives. The tool is designed to integrate into the California Public Utility Commission (CPUC) Distributed Resource Planning (DRP) process and is used to evaluate the range of solar + storage systems being supported by the Energy Commission.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is developing a tool, in consultation with the three large IOUs, capable of simulating the operations of DER under different tariff and program designs and determining the new designs that will maximize the benefits of DER to ratepayers. Current planning tools do not consider how different tariff and program designs will affect DER locations and adoption rates that will affect system reliability and cost.

CPUC Proceedings addressing issues related to this EPIC project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 2a, 3b

Lower Costs:

$420 million in distribution capital expenditures are driven by peak load growth and are potentially deferrable by targeted deployment of DER. Assuming deferral of 10% of those costs ($42 million) for 3 years and a utility WACC of 7.9%, the cost reduction for ratepayers is $9 million for 2017 and $34 million over 5 years. The project will enable DER deployment targeted to areas with highest deferral value. Conservatively estimating that this doubles the deferral value (e.g. from $50 to $100/kW-Yr.) for 5% of the deferral opportunities, the annual ratepayer

savings are $21 million. The present value of similar savings of each of five years would be $84 million.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $457,030
EPIC Funds Encumbered: $987,379	**EPIC Funds Spent:** $29,863
Match Partner and Funding Split: Southern California Edison: $50,000 (4.6 %) San Diego Gas & Electric Company: $50,000 (4.6 %) Energy and Environmental Economics, Inc. (E3): $8,655 (0.8 %)	**Match Funding:** $108,655
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The kick-off meeting for this project was held September 22, 2017. E3 worked on the draft of the Solar + Storage Tool, which it expects to submit to the Energy Commission in the first quarter of 2018.

251. EPC-17-005

Project Name:

Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid

[EPC-17-005]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/17/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Regulatory and economic factors in California have created accelerated penetration of rooftop Photo Voltaic (PV) in the small commercial segment, benefitting facility managers in energy savings while helping to achieve California's renewable goals. However, uncontrolled and uncoordinated renewable generation creates issues with stability and reliability of the distribution grid. Given that implementation of PV, Storage, and Energy Efficiency /Energy Management Systems (EMS) technologies is typically siloed, cumulative benefits are difficult to realize. An integrated Distributed Energy Resource (DER) management approach is needed to balance commercial customer and grid requirements.

Project Description:

At a brownfield site, this project, with an established load profile and a real economic use (Wholesale Coffee Roasting) in a Disadvantaged Community, is designed to add technologies sized together to maximize benefit while minimizing costs. To develop the DER integration framework and platform in this project, EPRI has created a team which, collectively, has decades of experience in Commercial building EMS and DER integration.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

For California to achieve its long term greenhouse gas reduction goals, there is a greater need for flexibility at all levels of grid operations. Periods of overgeneration and undergeneration, as well as evolving the distribution systems for two way power flows, are a substantial departure from today's one way power flows. Developing the capability for active and reliable control of customer owned loads and resources can reduce the cost of infrastructure improvements by reducing the need to build larger and more transmission, substations, feeder lines, distribution transformers and building wiring needed to account for the possibility of a couple hours a year of high generation with low loads.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 Net energy metering: R.14-07-002

Applicable Metrics: CPUC Metrics- 1h

Lower Costs:

Synergistic integration with storage further reduces grid stress and expensive peak generation at ramp-up time, improves distribution capacity utilization, and reduces stress to prolong asset life and reduce costs of distribution system upgrades. Total lifecycle cost (capital cost, installation, O&M) for behind the meter solar + storage system is expected to be reduced by up to 10% through energy system integration.

Greater Reliability:

This project reduces distribution system stress through better dispatchability and improves management of both over-generation and 'ramp-up' periods through flexible load and storage management.

Environmental Benefits:

Solar generation helps reduce greenhouse gas and air emissions associated with grid power, particular when off-setting peak power.

Consumer Appeal:

Better integration of customer preferences and operational priorities with grid preferences. Cost-effective implementation reduces both acquisition costs and O&M costs.

Assignment to Value Chain: Distribution		**Total Budgeted Project Admin and Overhead Costs:** $360,079	
EPIC Funds Encumbered: $1,491,764		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Electric Power Research Institute, Inc.: $271,090 (15.4 %)		**Match Funding:** $271,090	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Patent application for novel daylighting panels. Smart Software Algorithms to charge Electric Vehicles from the grid or battery system based on time of day and utility rates. Smart software algorithms to monitor, control and visualize energy and power flows from renewable power sources, distributed energy storage system and other grid generation and transmission assets.
Update: The project was awarded at the July 2017 Business Meeting and held a Kick-Off Meeting before the end of 2017. Project aims to execute an agreement with the selected deployment site in the first Quarter of 2018.

252. EPC-17-006

Project Name:

Development, Implementation, and Integration of a Holistic Solar Forecasting System for California

[EPC-17-006]

Recipient/Contractor:

Electric Power Research Institute, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	10/5/2017 to 6/28/2020

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

Successful integration of renewable resources into power system operations will require the ability to forecast the output of these resources in timeframes from less than an hour to days ahead. Fog and stratus affect solar irradiance in California throughout the year, and shortcomings in predicting fog and stratus dissipation currently constrain the accuracy and confidence of short-term solar irradiance forecasts. The value of using improved forecasts is still not well understood by grid operators and utilities, due to the difficulty of assessing return on investment for an improved forecasting system, particularly, for deploying instruments to improve the data used in forecasting models.

Project Description:

The purpose of this project is to develop an improved forecasting system for solar irradiance in California, with a particular focus on fog and stratus conditions, through targeted deployment of instrumentation. The improved forecasts will be integrated into operational tools for use by the California Independent System Operator (CAISO) and utilities. This project utilizes a targeted instrumentation network, consisting of existing and new sensors, to improve the models used for forecasting fog and stratus conditions. The Recipient will design and deploy this network with the aim of improving the forecasts that are most important to CAISO and/or utility operations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The use of an advanced network of existing and new instrumentation to inform numerical weather and statistical model improvements will significantly improve the current state of solar forecast modeling in California. The holistic forecasts produced will showcase a combination of various aspects of the weather forecast value chain, not previously demonstrated, linking observation systems and advanced physical and statistical modeling for solar forecasting. The project's focus on fog and marine layer forecasts, which are traditionally challenging to predict, assures that these issues are well-understood in advance of increased PV penetration in the coming years.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 2a

Lower Costs:

Improved forecasts help to reduce operating costs by improved commitment and dispatch of generating resources, reductions in solar power curtailment, and more optimal procurement of resources for IOUs.

Greater Reliability:

Improved forecasts support the advancement of reliability of renewable energy by reducing uncertainty that the Investor Owned Utilities (IOUs) and CAISO are exposed to, and therefore ensuring supply/demand balance across the CAISO system, improved voltage control on distribution systems and ensuring that utilities can perform transmission and distribution switching.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $632,032	
EPIC Funds Encumbered: $749,740		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: AWS Truepower, LLC: $177,229 (16.5 %) Sonoma Technology, Inc.: $83,000 (7.7 %) Electric Power Research Institute, Inc.: $64,601 (6.0 %)		**Match Funding:** $324,830	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 5: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

Researchers have selected five data collection sites to ensure the effective use of the equipment and instrumentation during the project. The data collection sites are located in Los Angeles, Ontario, Visalia, San Jose, and Benicia. The project team will add new radiometers in Ontario, Visalia (cool season only), and San Jose (warm season only). New Sodar will be added only in San Jose. New ceilometers will be added in Ontario, Visalia (cool season only),

and San Jose. And a new surface metrology will be added in Benicia.

253. EPC-17-007

Project Name:

Integrated Community Solar and Storage at a Low Income Mobile Home Park

[EPC-17-007]

Recipient/Contractor:

Center for Sustainable Energy

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	7/13/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Distributed solar photovoltaic (PV) systems will continue to be deployed to meet California's GHG reduction and renewable energy goals, but daytime grid oversupply and meeting evening demand must be addressed to provide stable, reliable generation. Energy storage can help to shift PV generation from peak hour to later in the day, but rates do not incentivize daytime mid-peak charging periods. Residential customers do not benefit from peak demand reduction, and energy storage installations are often based on unclear end customer value propositions. Adding storage to existing solar PV installations requires duplication of permitting, installation, and commissioning efforts and costs.

Project Description:

The Center for Sustainable Energy (CSE), in partnership with Kisensum and Horizon Solar Power, is applying high efficiency solar and storage technologies to create an integrated community solar and storage energy system at a low income, mobile home park in Bakersfield, California. The project illuminates operational strategies for storage to provide clear value propositions to end-use customers with existing tariff structures and demonstrate alternate structures and additional value streams that can increase the value of storage to the end customer while better achieving distribution system operational goals.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is designing, installing and evaluating integrated super high-efficiency solar panels with super high-efficiency pre-market energy storage batteries, along with low-cost control hardware to demonstrate the impact of an integrated community solar and energy storage system in a low-income community. The project is designed to demonstrate the impact of an integrated community solar and energy storage system in a low-income community, which is expected to reduce net energy consumption and reduce energy bills.

CPUC Proceedings addressing issues related to this EPIC project:

Energy storage: R.15-03-011 Distribution Level Interconnection (Rule 21): R.11-09-011 Net energy metering: R.14-07-002

Applicable Metrics: CPUC Metrics- 3h

Lower Costs:

The primary application of the solar PV and energy storage system will be to lower energy costs, by approximately 42%, for the individual tenants within the mobile home park. Additionally, by providing potential locational benefits such as reducing congestion on the

distribution feeder or increasing the integration capacity of the circuit, the grid will function more efficiently, potentially deferring or offsetting grid transformer or line upgrades. Shifting excess solar PV generation from the middle of the day to evening residential peak hours will reduce the need to deploy more expensive peaker plants.

Greater Reliability:

Storage integrated with solar PV on the distribution system can increase system reliability through services such as local overload relief, renewable integrating on circuits with high penetration of intermittent generation, and local customer back-up.

Environmental Benefits:

The project could lead to reductions in greenhouse gas and air pollutant emissions through reduced energy consumption and generation. Deployed at 5% of mobile home and multifamily dwellings across the state by 2025, community-scale solar PV and energy storage operated as proposed could reduce annual energy generation needs, including peak-demand, by 800 MWh. This reduced energy consumption would result in an estimated reduction of roughly 505,000 metric tons of CO2 annually, with concurrent reductions in both NOx (criteria pollutant) and methane (GHG) emissions.

Consumer Appeal:

The integrated suite of solar PV, energy storage, and smart controls is anticipated to reduce annual energy usage by 38%, bringing total utility bills down by approximately 42%, which is substantial considering change to TOU billing and the energy discounts the park already receives through the California Alternate Rates for Energy (CARE) program. The same configuration and use cases piloted in this project could be replicated at other multifamily dwellings as well.

Assignment to Value Chain: Grid Operations/Market Design		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $2,005,923		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Resident Owned Parks, Inc.: $340,905 (14.5 %)		**Match Funding:** $340,905	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 31 out of 35 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Grantee has identified the following as pre-existing project relevant IP:

1) Center for Sustainable Energy Name and Logo
2) Horizon Solar Power Logo
3) Kisensum Energy Storage Control Software

Update:

The project was awarded at the July 2017 Business Meeting and a Kick-Off Meeting was held in December 2017. The project team aims to execute an agreement with the selected deployment site in the first quarter of 2018.

254. EPC-17-008

Project Name:

Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores

[EPC-17-008]

Recipient/Contractor:

Center for Sustainable Energy

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/1/2017 to 1/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

California Senate Bill 350 aims to double statewide electricity and gas end use savings from energy efficiency (EE) and conservation measures by 2030. This is equivalent to a 20% reduction in projected statewide building energy use. Meeting this aggressive target will require the commercial building industry to install holistic energy efficiency technology packages, specifically those that leverage, emerging, pre-commercial products. According to the 2013 Navigant California Potential and Goals Study, aging, existing commercial buildings, particularly in inland communities, present the greatest energy savings potential.

Project Description:

This project demonstrates the impact of an integrated suite of pre-commercial energy efficiency technologies in a large, existing, retail building located near a disadvantaged community. One of the technologies that comprise the installation package includes a novel supervisory controller to provide system-wide optimization, to reduce electricity consumption across numerous building subsystems, including lighting, refrigeration, and heating, ventilation, and air-conditioning (HVAC). This could enable site electricity savings of greater than 20%.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project demonstrates how pre-commercial energy efficient technologies can deliver cost-effective, deep electric savings in a big-box retail environment, while also showcasing the demand reduction potential of these strategies. To overcome barriers associated with the package, the team resolves and documents identified system integration and operational challenges. Additionally, rigorous M&V and extensive energy modeling quantifies beneficial technology synergies.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 3a, 4c

Lower Costs:

The project could result in lowering on-site electricity use by 20 percent.

Greater Reliability:

The project adds valuable capacity to California's electrical transmission and distribution system. The project includes significant focus on reducing the power consumption of packaged HVAC systems which are disproportionately responsible for critical capacity shortfalls. The DR resources will provide efforts to integrate variable renewable resources into the electric grid to minimize impacts that destabilize the reliability of the system.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $686,589
EPIC Funds Encumbered: $2,824,685	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Walmart: $250,000 (7.0 %) Southern California Edison: $100,000 (2.8 %) Robert Bosch LLC: $248,400 (6.9 %) Software Motor Corporation: $62,704 (1.7 %) Apana, Inc.: $10,080 (0.3 %) SmartGreen: $59,800 (1.7 %) Transformative Wave: $17,000 (0.5 %) Integrated Comfort: $12,000 (0.3 %)	**Match Funding:** $759,984
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 2: 13 out of 15 bidders	**Rank of Selected Applicant/ Bidder:** Phase 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team will begin to gather physical and operational data for the pre-selected big-box retail demonstration site. This information will be used to support baseline M&V planning and the development of the baseline site energy model. Staff and the project team will attend a walk-through of the site with store personnel to define operational schedules and develop an equipment inventory list for major HVAC, refrigeration, and lighting hardware components.

255. EPC-17-009

Project Name: Bundle-Based Energy Efficiency Technology Solutions for California (“BEETS for California”) [EPC-17-009]	
Recipient/Contractor: Willdan Energy Solutions	
Investment Plan: 2015-2017 Triennial Investment Plan	**Project Term:** 8/1/2017 to 3/28/2021
Program Area and Strategic Objective: Technology Demonstration and Deployment S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.	
Issue: Much of California's existing buildings stock is old and high-energy consuming. An estimated 50% of the state's existing buildings were built before California's Building Energy Efficiency Standards went into effect in 1978. Commercial facilities consume 37% of the state's electricity, more than any other sector. Yet there remains significant energy reduction potential for this sector. Adoption of comprehensive energy efficiency packages has been limited. Market barriers such as lack of stakeholder knowledge, fear of early adoption, and the high cost of emerging technologies means significant energy savings opportunities remain.	
Project Description: This project demonstrates three innovative bundles of pre-commercial technologies. The technology bundles were strategically developed through a systems-level approach to address the most energy-intensive areas in commercial buildings. These include: (1) Chilled Water Plants: Optimized all-variable-speed chilled-water (CHW) plants utilizing alternative refrigerant chillers. (2) Office and Exterior Space LED fixtures with integrated advanced controls, advanced building management system (BMS), and plug load controls controllable for demand response (DR), and off-grid, exterior, LED lighting in the parking lot, and lastly (3) Advanced laboratory ventilation, fume hood exhaust, and direct current (DC) lighting systems.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State’s Statutory Energy Goals: The demonstration project offers an innovative approach applicable to a range of commercial buildings. This strategy will accelerate adoption of energy savings technologies, contributing to reaching the state's energy efficiency and GHG reduction goals. By demonstrating this comprehensive approach in a real-world application this research has the potential to lead to further scale up and adoption of similar technology packages in other government and commercial buildings.	
CPUC Proceedings addressing issues related to this EPIC project: Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014	

Applicable Metrics: CPUC Metrics- 1f, 1h, 3b

Lower Costs:

Energy savings achieved through implementation of these technologies could generate cost savings for building owners and operators. It is projected that these technologies will save an estimated 20% of building energy consumption. Future adopters will benefit from lower costs associated with economies of scale as production increases.

Economic Development:

Large-scale adoption of these technologies will promote industry growth through increased manufacturing and construction, spurring new growth and leading to further investment in research and development of additional new technologies.

Environmental Benefits:

In addition to GHG emission (CO2) reductions associated with the energy savings of the project, the project includes chillers that utilize low global warming potential (GWP) "alternative refrigerant" that contain no stratospheric ozone depletion compounds. These refrigerants are in alignment with the Montreal Protocol Kigali Agreement to phase out high GWP refrigerants. It also supports the California Air Resources Board's target to reduce short lived climate pollutants.

Assignment to Value Chain: Demand-side Management		**Total Budgeted Project Admin and Overhead Costs:** $875,037	
EPIC Funds Encumbered: $3,994,256		**EPIC Funds Spent:** $4,618	
Match Partner and Funding Split: ASWB Engineering: $5,330 (0.1 %) Aris Wind: $33,250 (0.5 %) Trane U.S., Inc.: $50,000 (0.8 %) Willdan Energy Solutions: $2,293,645 (36.0 %)		**Match Funding:** $2,382,225	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 2: 13 out of 15 bidders	**Rank of Selected Applicant/ Bidder:** Phase 2: Ranked # 2
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The agreement is in place and work has begun. The team recently completed a report on best practices for permitting of the project technologies. The next phase is a technical feasibility study for each of the proposed technologies.

256. EPC-17-010

Project Name: Integrated Heat and Moisture Calculation Tool for Building Envelopes [EPC-17-010]	
Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory	
Investment Plan: 2015-2017 Triennial Investment Plan	**Project Term:** 8/14/2017 to 12/1/2020
Program Area and Strategic Objective: Applied Research and Development S11: Provide Federal Cost Share for Applied Research Awards.	
Issue: Moisture in buildings can degrade both its durability and thermal performance. This project designs user-friendly, yet powerful software that brings together the interaction between heat, thermal transfer and moisture in the building envelope.	
Project Description: This agreement develops a new tool that integrates moisture and thermal analysis. By integrating these two properties the optimal strategies can be determined for improving envelope design for new construction and retrofit applications. This agreement provides building professionals with a user-friendly engineering software tool at no cost.	
How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals: The cost-effective modeling tool will enable improved envelope designs for new construction and retrofit applications, thus increasing building energy efficiency.	
CPUC Proceedings addressing issues related to this EPIC project: Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014	
Applicable Metrics: CPUC Metrics- 1f, 1h Lower Costs: The software tool could increase building envelope designs and reduce HVAC energy use by 5%.	
Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $59,000
EPIC Funds Encumbered: $125,000	**EPIC Funds Spent:** $0

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$0</td></tr>
<tr><td>Funding Method:
Competitive</td><td>Funding Mechanism:
Grant</td><td>No. of Initial Passing Applicants/ Bidders:
43 bidders</td><td>Rank of Selected Applicant/ Bidder:
N/A</td></tr>
<tr><td colspan="4">If not the highest scoring applicant/bidder, explain why selected:
The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.</td></tr>
<tr><td colspan="4">Treatment of Intellectual Property:
Pre-existing intellectual property identified in agreement EPC-17-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.</td></tr>
<tr><td colspan="4">Update:
Project is underway and the first TAC meeting will be in January.</td></tr>
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257. EPC-17-011

Project Name:

Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility [EPC-17-011]

Recipient/Contractor:

HZIU Kompogas SLO Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/9/2017 to 9/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

Newly adopted state goals have called for increased production of renewable energy, increased waste diversion from landfills, and a reduction of short lived climate pollutant emissions. Increased deployment of anaerobic digester systems can help meet all of these goals by producing renewable energy, diverting organic waste from landfills, and reducing associated short lived climate pollutant emissions. However, anaerobic digester systems tend to be logistically complicated, technologically complex, and prohibitively expensive. There is a need to demonstrate and deploy cost-effective anaerobic digester systems in local communities.

Project Description:

The purpose of this project is to develop, demonstrate, and operate an innovative, state-of-the-art anaerobic digestion facility designed to convert organic waste from San Luis Obispo County into renewable electricity. The community-scale bioenergy system will convert food waste and green waste into renewable electricity, compost, and liquid fertilizer. In cooperation with waste haulers, the feedstock will be locally sourced from cities, communities, and unincorporated areas of San Luis Obispo County. Food collection and distribution programs will also be incorporated into the project to ensure recoverable food is used for human consumption before being disposed of at the facility. Electricity will be sold and exported to the grid, while compost and liquid fertilizer will be sold and distributed by a local farming supply company.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will benefit California ratepayers by demonstrating an innovative, state-of-the-art anaerobic digester facility. Once economical operation is proven, similar facilities can be replicated across California to provide similar benefits to other local communities.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 2a, 3a, 3b, 3g, 3h, 4a

Lower Costs:

This project will demonstrate a cost-effective approach for utilities to meet their bioenergy mandates while also lowering the cost of bioenergy for electric ratepayers.

Greater Reliability:

This project will produce approximately 6.2 million kWh of renewable distributed generation annually, improving local system reliability and reducing the stress on the grid.

Environmental Benefits:

Diversion of organic waste from landfills will result in avoided methane and nitrous emissions, powerful short lived climate pollutants. The project team estimates the system will result in net annual greenhouse gas emission reductions of approximately 5,300 metric tons of carbon dioxide.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $4,000,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: HZIU Kompogas SLO Inc.: $5,278,373 (56.9 %)		**Match Funding:** $5,278,373	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

This project will utilize the Hitachi Zosen Innova digester system originally developed in Japan.

Update:

The project kick off meeting was held in December 2017 and work on the technical tasks is now underway.

258. EPC-17-012

Project Name:

Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power

[EPC-17-012]

Recipient/Contractor:

Taylor Energy

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/1/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

In 2016, the US Forest Service estimated there are over 102 million dead and dying trees in California's forests. This buildup of dry fuel increases the likelihood of large, unpredictable wildfires which have significant negative impacts to the environment, human health, and safety. Disposal of these dead and dying trees is necessary to mitigate wildfire risk, however, it is extremely expensive with little opportunity to recover the costs. Adoption of community-scale bioenergy systems can create a sink for forest wood waste while generating renewable electricity and local revenue. There is a need to identify technologies which can cost-effectively convert forest waste biomass to energy.

Project Description:

The project tests and evaluates three different energy pathways for conversion of woody biomass to electricity. The three pathways tested with the pilot-scale gasifier system are: 1) clean fuel gas production for baseload power generation, 2) syngas to Fischer-Tropsch liquid production for storage and flexible power generation, and 3) direct bio-crude production for storage and flexible power generation. Results from the three pathways will be compared and an optimal pathway will be identified for extended testing. After performing extended testing of the optimal pathway the technical, environmental, and economic performance of a full-scale facility will be evaluated.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will test and evaluate new biomass-to-energy pathways which is critical to meeting several of California's energy goals and provides numerous economic, environmental, and safety benefits to California ratepayers.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 3e, 4a

Lower Costs:

The technology aims to significantly reduce the capitol costs of biomass gasification systems, subsequently reducing the cost of renewable electricity generated. The technology is expected to provide at least 20 percent improvement in cost-effectiveness compared to existing systems and would be capable of delivering power at $0.118/kWh for a full-scale system.

Increase Safety:

Increased use of forest waste biomass can reduce the risk of catastrophic wildfires which can have major impacts on human health and safety.

Environmental Benefits:

The technology aims to produce significantly reduced criteria pollutant emissions compared to conventional biomass boiler generator systems, which will be quantified during the project. Compared to conventional natural gas power plants, this technology aims to reduce greenhouse gas emissions by 50 percent. In addition, increased utilization of forest-derived biomass may reduce wildfire rates which produce the majority of black carbon emissions in California.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $254,980	
EPIC Funds Encumbered: $1,499,000		**EPIC Funds Spent:** $21,824	
Match Partner and Funding Split: None		**Match Funding:** $0	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

The technology employs "shockwave gasification". Shockwave Gasification employs pulse-detonation power to increase biomass gasification process intensity. The technology was developed, tested, and reduced to practice under a previous EISG grant program that compared gasification methodologies, using a pulse-deflagration method compared to a pulse-detonation method.

Update:

The project conducted its kickoff meeting in September 2017. The project team plans to complete system modifications and perform testing of the first pathway, clean fuel gas production for baseload power generation, by mid-2018. The project team will then perform system modifications required for the other two pathways, which it will begin testing by the end of 2018.

259. EPC-17-012

Project Name:

Small Scale Forest Waste Power System

[EPC-17-012]

Recipient/Contractor:

Altex Technologies Corporation

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/1/2017 to 4/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

The risk of forest fires is very high in the semi-arid climate of California. Innovative management of woody biomass can reduce the serious risk of high severity forest fires. Forest wasted material could be utilized as a renewable fuel resource to help California achieve its renewable portfolio standard goals. However, use of forest biomass for power production has been challenging due to high collection, pre-processing and transportation costs. One of the possible solutions is an operationally reliable and affordable modular biomass power plant that can utilize this abundant resource to produce cost effective and competitive renewable electricity.

Project Description:

This project develops a pilot-scale modular biomass power system called Altex Forest Power Technology (FORPOWER) that uses biomass from forest management as fuel to generate renewable electricity. FORPOWER, which is based on an indirectly fired gas turbine technology that separates the fuel combustion products from the clean gas turbine working fluid by using a novel heat exchanger, uses forest slash as a renewable fuel while meeting criteria pollutant requirements, reducing greenhouse gas emissions, supporting renewable energy goals, and improving forest sustainability. The Altex FORPOWER will cost effectively convert forest slash to electric power and interconnect with the grid at distributed locations within IOU regions that are close to forest resources.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Integrating a low cost feedstock densification approach and innovative heat exchanger with gasifer and externally fired gas turbine to efficiently generate electricity from forest slash will provide multiple benefits to California IOU electricity ratepayers including reduced power cost relative to alternative approaches and improved electric power generation reliability while reducing the risk of forest fires and pollutant emissions and creating economic development opportunity near the forest region.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 1a, 2a

Lower Costs:

The Altex FORPOWER uses a low-cost forest slash densification approach (developed under PIER) that further reduces an already relatively low feedstock by 31% relative to conventional logistics; combining this approach with an externally fired turbine and innovative heat exchanger further lowers the cost of power by over 39% compared to a typical forest biomass gasifier coupled to an IC engine. Once scaled up to 3 MW and deployed, savings in fuel cost could range from $6 million for 10 units deployed.

Greater Reliability:

A successful distributed generation technology like FORPOWER will help improve system reliability once dispersed in different locations by distributing feed in of power to the grid at multiple locations thereby reducing loads on transmission lines and substations.

Economic Development:

Ten units of the scaled up system (at 30 MW of total capacity) could provide revenue of over $20 million per year from generated electricity. Revenue from the production of power from biomass power plant operation and sales of power plant units along with collection and transport of biomass will bring economic development near forests and create jobs. Researchers estimate that 10 units would create 90 direct jobs.

Environmental Benefits:

FORPOWER technology will help reduce fossil fuel use and the associated emissions of criteria pollutants and greenhouse gas. Assuming a 31% reduction in forest management costs and 50 units of the technology are deployed over 10 years, the reduction in GHG emissions could surpass one million tons per year.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $768,611	
EPIC Funds Encumbered: $1,499,994		**EPIC Funds Spent:** $151,936	
Match Partner and Funding Split: The Avogadro Group, LLC: $7,250 (0.4 %) Altex Technologies Corporation: $154,478 (9.3 %)		**Match Funding:** $161,728	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions. The Altex developed process and apparatus for densification of biomass material will be used in the proposed FORPOWER system, to densify the Forest Slash Feedstock, for use in the system process.
Update: This project started in September 2017. Progress was made on the woody biomass densification subsystem design, and acquisition of necessary equipment and feedstock. Work is also progressing on the design of the woody biomass to heat and liquid fuel conversion system component of the technology, which will produce 50% of the biomass energy in oil and 50% in non-condensable fuel gas and char. Additionally, design work is proceeding on the char feeder, as well as the microturbine based cyclone gasifier and downstream combustor coupled with a heat exchanger, for a two stage direct and indirectly fired combustion process applied to the biomass conversion products, to limit emissions.

260. EPC-17-014

Project Name:

Advanced Plug Load Controls and Management in the Educational Environment

[EPC-17-014]

Recipient/Contractor:

Newcomb Anderson McCormick, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	11/8/2017 to 3/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Advanced Plug Load Management Device (APMD) demonstration projects have only been conducted on a small scale (This project deploys APMD technology over a large sample size, at approximately 55,000 computer workstations at several Community Colleges, and focuses on integrating the technology with facility operations to ensure that they meet the needs of the sites and staff. Key features of the proposed project include outreach and individual education programs to California Community College Districts, evaluation of sites for participation in the project, purchase and installation of APMDs at approved sites, measurement and verification (M&V) activities both pre- and post-APMD implementation at the selected demonstration sites, and stakeholder satisfaction information from demonstration facilities staff and APMD end-users through interviews and surveys.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Significant electricity consumption and cost savings will be delivered to the participating Community College Districts via the implementation of the APMD technology. These savings will begin to accrue as the devices are deployed in a phased approach, and be fully achieved once the EPIC project is complete. Following project completion, the APMD systems will continue to provide savings throughout their 8 – 10 year expected useful life. Successful deployment at participating Districts will then be leveraged to expand technology adoption throughout the remainder of the California Community College system.

CPUC Proceedings addressing issues related to this EPIC project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005, R. 12-01-005, R.09-11-014

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a

Lower Costs:

A conservative estimate of savings to the participating California Community College Districts is $850,000 per year in immediate and ongoing annual savings.

Environmental Benefits:

Energy savings will reduce overall GHG emissions of 3,320 metric tons per year and relieve pressure on the state's electric grid.

Consumer Appeal:

The project gathers a wide range of data about the technology and its performance that will be incorporated into an outreach campaign to build awareness and accelerate adoption of APMD technology with IOUs, technology vendors, and property owners in institutional and commercial buildings statewide. In addition, APMDs will provide a new data visualization capability and plug load energy information system to the participating sites.

Assignment to Value Chain: Demand-side Management	**Total Budgeted Project Admin and Overhead Costs:** $181,567
EPIC Funds Encumbered: $5,000,000	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Ibis Networks: $1,823,736 (24.6 %) Embertec: $599,034 (8.1 %)	**Match Funding:** $2,422,770
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 2: 13 out of 15 bidders	**Rank of Selected Applicant/ Bidder:** Phase 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project team has developed and finalized the guidelines for interfacing with District staff at each site, instructions and requirements for project tracking, and customized data collection approaches for each participating manufacturer. The team will meet with each participating site staff and develop a customized implementation plan for each site.

261. EPC-17-015

Project Name:

Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)

[EPC-17-015]

Recipient/Contractor:

Nevados Engineering

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	8/21/2017 to 12/31/2019

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S17: Provide Federal Cost Share for Technology Demonstration and Deployment Awards.

Issue:

Module mounting systems for large-scale, ground-mount solar projects are hindering opportunities for growth, improvements on return on investment, and installations in the solar industry. Single axis trackers (SATs) are vastly preferred by solar developers in the United States (over 70% of large-scale solar power plants in 2017 are expected to be installed on SATs). Although SATs generate more energy per module (up to 25%), they are limited to flat terrain, which limits potential installation sites and usually requires expensive soil grading and environmental mitigation after the soil has been disturbed by grading.

Project Description:

This project is demonstrating a novel single axis solar PV tracking system. The innovative tracking system which can fit on sloped and rolling terrain will help solar developers build projects on lands closer to load centers and interconnection points that typically would not be considered, creating more site options. The construction costs are dramatically reduced by eliminating the need for grading soil with reduced environmental damage and mitigation costs. The new tracker was developed through a DOE award and a full-scale system is under testing at a rolling terrain near Davis. This Energy Commission grant is funding improvements and testing of the various tracker components in an effort to find cost-cutting opportunities to update the product design and optimize it for full-scale manufacturing.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will lead to technological advancement by increasing the available land for installing solar power plants, and reducing the cost of the energy produced by reducing the costs of installing solar power plants and increasing the amount of energy generated by each solar module in those power plants. This will result in the ratepayer benefit of lower costs and enable faster adoption and installation of solar power throughout California.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 California Solar Initiative: R.12-11-005

Applicable Metrics: CPUC Metrics- 1e, 2a, 3a, 3b, 4a

Lower Costs:

Installing the new solar tracking system on sloped, rough, and rolling terrain, will eliminate the need for soil grading typically necessary for solar installations, resulting in 3-10% total project cost reductions. This also increases application zones for the system to areas where only low-efficiency fixed tilt systems could be installed before, and can increase output by up to 7%

over other tracking systems if installed on a south-facing slope.

Economic Development:

Through further development, testing and certifying of equipment, pilot manufacturing and business case analysis that will lead to anticipated manufacturing cost to $0.128/W or less, the technology will be competitive in the industry allowing commercialization and subsequent economic development.

Environmental Benefits:

The new tracker removes the need to grade top-soil, hence preserving the natural beauty of the site and protecting locally sensitive environments. As soil grading is diminished, millions of gallons of water usage currently sprayed on dry disturbed soil to keep dust down at construction sites will be eliminated.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $76,846
EPIC Funds Encumbered: $999,822	**EPIC Funds Spent:** $0
Match Partner and Funding Split: None	**Match Funding:** $0
Leverage Contributors: United States Department of Energy : $1,999,542 Nevados Engineering, Inc. : $920,126 Steve Ihnen : $62,496 Nick Foster : $17,200	**Leveraged Funds:** $2,999,364

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 43 bidders	**Rank of Selected Applicant/ Bidder:** N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This grant agreement was executed in late October 2017. Since the kickoff meeting, the project focused on field testing of newly manufactured parts for the next-generation of the tracking system and sent some parts for final UL testing. The project team has also developed a quality/product management tool, and completed a prototype to run through the company's supply chain. The project team will complete testing of all components of the new system in 2017 in concert to work out any issues that remain, fine-tune the accuracy of the controls system, and compare the accuracy of the controls and software to high-accuracy testing equipment.

262. EPC-17-016

Project Name:

An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California [EPC-17-016]

Recipient/Contractor:

University of California, Davis

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	9/1/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

It has been estimated that $650,000 of up-front capital is necessary in the current investment landscape to develop a project to the point at which private capital will invest. Much of those costs are related to evaluating feedstock supply, harvest methods, transportation costs and grid capability. Many businesses and communities that aspire to produce energy from woody biomass are small businesses, start-ups, or communities that cannot easily afford the preliminary studies necessary to assess project feasibility and how to begin development.

Project Description:

This project develops a decision support system that will reduce the soft costs of estimating and planning new bioenergy power plants that consume woody biomass from sustainable forest management activities. The open-source facility siting tool will be hosted online and allow users to quickly evaluate economic feasibility and environmental performance potential of particular locations for development as a wood-based biomass power plant. The research team will perform case study analysis to understand feasibility and barriers to develop biopower facilities in high risk hazard zones.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will increase the cost competitiveness of biopower plant projects, resulting in expanded opportunities for utilization of biomass waste streams. The online and open application architecture will ensure that everyone has open, public and equal access to this resource.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 3b, 3h, 4a, 5d, 5e

Lower Costs:

This bioenergy facility siting tool will achieve lower costs for renewable biomass electricity generation by reducing the cost of siting a bioenergy facility, thus increasing the cost competitiveness of bioenergy facility projects.

Increase Safety:

The bioenergy facility siting tool will reduce risk of wildfire impacts to grid infrastructure by

facilitating markets for residual woody biomass.

Environmental Benefits:

This tool will expand opportunities for the utilization of biomass waste streams which would otherwise contribute to criteria air pollutants, and higher levels of climate pollutants from prescribed burns or wildfire.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $203,977	
EPIC Funds Encumbered: $1,222,284		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Regents of the University of California (University of California, Davis): $28,523 (2.3 %)		**Match Funding:** $28,523	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The project was approved at the August Business Meeting. The project kickoff meeting was held in December 2017.

263. EPC-17-017

Project Name:

The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management

[EPC-17-017]

Recipient/Contractor:

All Power Labs, Inc.

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	11/8/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Climate change contributes to California's forest health crisis, with a tree mortality emergency of over one hundred million dead trees, at risk of being ignited in catastrophic wildfires. There is a need for an economical and climate-sensitive way to reduce the risk of catastrophic wildfire, while also addressing the state's need for renewable energy. All Power Lab's pre-commercial Powertainer, a containerized 150kW gasification system that converts forestry waste into renewable energy and sequestered carbon, technology is designed to run profitably under the SB1122 BioMAT feed-in-tariff. Yet high technological and economic barriers to widespread commercial deployment remain.

Project Description:

This project supports the development of the Powertainer+, (PT+) a multi-modal power and products platform designed to generate low-cost renewable energy, process thousands of tons of forestry waste derived from California's unprecedented tree die-off, and sequester large amounts of carbon. The Powertainer+ will include a combined heat and power module, increase the power capacity (from 150kW to between 210-250kW) and increase the forestry waste processing capacity to up to 2200 (twenty-two hundred) bone dry tons per year.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Broadly, the goals of this project are to decrease the modular technology platform's Levelized Cost of Electricity, increase its forestry residue processing capacity, add new value streams in the forms of hot water and biochar production, and enhance the system's carbon sequestration capacity.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 SB 1122 Bioenergy feed-in tariff: R.11-05-005 Combined heat and power: D.10-12-035., R.08-06-024.

Applicable Metrics: CPUC Metrics- 1a, 1f, 3g, 4a, 4e

Greater Reliability:

The PT+ will increase PG&E's grid reliability by reducing peak loading by up to 250kW. The technology supports increased grid reliability in hard to serve places and reduced peak demand charges for rural businesses under net energy metering arrangements. The technology will provide on-demand, non-weather dependent, renewable energy.

Increase Safety:

By creating a market demand for forestry biomass residue, this project will increase safety by creating an economic driver to support sustainable forestry management activities, thus reducing the risk of catastrophic wildfire and the associated damage to the Investor Owned Utility infrastructure, such as transmission lines and remote substations. The proposed size is now receiving over 80% of their materials from CalFire designated High Fire Hazard Zones.

Economic Development:

The PT+'s biochar offtake provides the critical linkage between the forest and agricultural industries' value chains. The PT+ creates economic benefit by selling the biochar it generates to distribution companies or directly to farmers, creating a biochar market out of the nascent demand in California. The biochar sold into this market creates economic and environmental value for the agricultural industry, as it increases soil fertility and water retention and decreases nutrient inputs and runoff.

Environmental Benefits:

By processing forestry residue from CalFire designated High Hazard Zones, the PT+ creates demand for biomass that was previously considered waste, creating value and increasing incentives to remove residues that would otherwise not be economical and providing an alternative to controlled open slash burning. This reduces GHG emissions and lowers wildfire risk.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $1,500,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Humboldt State University Foundation, Schatz Energy Research Center: $17,235 (0.8 %) Anderson Biomass Complex: $50,000 (2.2 %) All Power Labs, Inc.: $682,765 (30.3 %)		**Match Funding:** $750,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 1: Ranked # 1
If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.			

Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: This project was approved at the October 2017 Business Meeting and a kick-off meeting was held in December 2017. The researchers aim to execute an agreement with the selected deployment site in the first quarter of 2018.

264. EPC-17-018

Project Name:

Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units

[EPC-17-018]

Recipient/Contractor:

University of California, Davis

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	10/18/2017 to 10/17/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

The common model for managing food waste generally involves disposal in a landfill where the organic material releases methane gas (a greenhouse gas, GHG, with 25 times the global warming potential of carbon dioxide) to the atmosphere as it degrades. The conversion of food waste to electricity and heat via anaerobic digestion (AD) provides a promising alternative solution to the current model, but the appropriate scale of AD infrastructure (i.e. establishing centralized vs. decentralized AD systems) for food waste has not yet been well-defined.

Project Description:

This project assesses the potential for a highly standardized and rapidly deployable decentralized AD solution as a compelling alternative to large-scale centralized AD facilities. By implementing on-site AD at locations where food waste is generated and electricity demand exists, it is possible to reduce/avoid 1) the consumption of non-renewable electricity, 2) the transmission and distribution (T&D) losses associated with the delivery of electricity across long distances on the regional grid, and 3) the transport costs (inclusive of the monetary, environmental, and public health costs) of hauling food waste long distances to feed larger AD generators.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by addressing the knowledge gap regarding the optimal scale for the deployment and utilization of AD technology to convert food waste into renewable electricity, heat, and fertilizer. To meet this need, researchers will perform techno-economic and environment assessments of increased deployment of micro-scale AD systems across the state. Researchers will also develop new information about the performance variability of micro-scale AD systems relative to fluctuating and heterogeneous food waste feedstock inputs.

CPUC Proceedings addressing issues related to this EPIC project:

SB 1122 Bioenergy feed-in tariff: R.11-05-005

Applicable Metrics: CPUC Metrics- 1a, 1b, 2a, 3b, 3g, 4a, 4e

Lower Costs:

This project will result in the ratepayer benefits of lower costs through the on-site generation and utilization of electricity produced through the AD of food waste. The small-scale, on-site AD system will directly avoid the longer term marginal costs of electricity supply expansion. The pilot unit is expected to reduce the Naval Base's net peak demand on the SCE grid by 60 kW, approximately saving $72,246 a year, or $152/MWh. At a modest estimate of 1% market penetration, the decentralized AD technology would save ratepayers approximately $5.38M / year.

Greater Reliability:

This project will result in the ratepayer benefits of greater reliability through the on-site generation and utilization of electricity produced through the AD of food waste. By implementing on-site AD at locations where food waste is generated and electricity demand exists, it is possible to reduce/avoid 1) the consumption of non-renewable electricity, 2) the transmission and distribution (T&D) losses associated with the delivery of electricity across long distances on the regional grid, 3) the transport costs (inclusive of the monetary, environmental, and public health costs) of hauling food waste long distances to feed larger AD generators.

Environmental Benefits:

This technology demonstration project will reduce the amount of food waste going to landfills by about 1,220 tons of municipal food waste per year locally, and avoid a total tipping fee of $72,236 per year. The technology will avoid an estimated 427.2 metric tons of CO2 emissions per year.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $171,649	
EPIC Funds Encumbered: $2,411,007		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: SeaHold, LLC: $20,800 (0.7 %) Biodico, Inc.: $610,886 (19.3 %) UC Davis: $124,447 (3.9 %)		**Match Funding:** $756,133	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: The agreement was approved at the September Business Meeting. A Kick-Off Meeting for the project was held in November 2017.

265. EPC-17-019

Project Name:

Burney-Hat Creek Bioenergy

[EPC-17-019]

Recipient/Contractor:

Fall River Resource Conservation District

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	10/18/2017 to 9/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

As of the end of 2016, six of the 10 closest biomass power plants serving northeastern California are closed. The loss of 50 megawatts (MW) of biomass power plants has been devastating to the health of the surrounding forest lands. With this decreasing number of biomass power plants, there is a growing need to advance cost-effective, efficient and low emissions biopower facilities that are suited to local communities and further emphasizes the need to advance modular biopower technologies that could be economically transported or replicated at forest locations or be economically and easily scaled up.

Project Description:

This project seeks to bring West Biofuels gasification technology, a technology funded by EPIC under an applied research and development program grant (EPC-14-024), to full commercialization. The West Biofuels gasification solution is designed to utilize forest derived biomass and is ready for scale up demonstration and deployment. To advance its commercial readiness, this project is developing and demonstrating a community-scale forest biomass facility in the Burney – Hat Creek region that is designed to address the need for increased markets for forest biomass resources. The bioenergy facility will be consistent with the requirements of the BioMAT Category 3 and obtain a power purchase agreement at a financially viable price. The plant will consume about 22,000 BDT of forest sourced feedstock per year, generate 2.88 MW of renewable energy at full rated capacity, and have a capacity factor that is greater than or equal to 75%.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The Burney-Hat Creek Bioenergy facility will be the first commercial deployments of West Biofuel's CircleDraft gasifier. Several other companies have developed larger community-scale projects in California, but have not been able to demonstrate their success due to environmental compliance and operating challenges. A current R&D funding with West Biofuels has taken a measured and strategic approach to designing a 500kW modular gasification system for forest materials, which brings the CircleDraft gasification technology from research to commercial operations and will represent a transformative point in the California market for community-scale biomass.

CPUC Proceedings addressing issues related to this EPIC project:

Applicable Metrics: CPUC Metrics- 1a, 1b, 2a, 3g, 3h, 4a, 4b, 4e

Lower Costs:

California IOU's have been mandated to procure 250MW of biomass electricity through SB 1122. Burney-Hat Creek Bioenergy is a cost-effective option for the utilities to acquire this capacity through SB 1122 BioMAT program. Relatively low capital cost using essentially free feedstock while leveraging local partnership of technology manufacturer and the construction company, yield LCOE for the project that is well below the average price identified by Black & Veatch for Category 3 projects.

Greater Reliability:

Distributed forest biomass projects provide important grid reliability in northeastern California, a remote region of the PG&E grid. Burney-Hat Creek Bioenergy will help provide greater reliability through: reduced power losses and the reduction in system harmonics through local distributed generation minimizing the heat generation from long-distance transmission; improved grid resilience to climate change by supporting sustainable forest management and reducing black carbon emissions from wildfire; and faster outage restoration time by providing the opportunity for micro-grid operations limiting the impact of a fault-event.

Increase Safety:

By developing the region's biomass infrastructure, the project will promote fire-safe forest management which will reduce local wildfire which protects ratepayer property and grid infrastructure.

Public Health:

Diverting biomass from pile and burn reduces criteria pollutants, which cause significant acute and chronic respiratory illness, by more than 75 percent.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $0	
EPIC Funds Encumbered: $5,000,000		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: Hat Creek Bioenergy, LLC: $5,000,000 (50.0 %)		**Match Funding:** $5,000,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	**Rank of Selected Applicant/ Bidder:** Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected: Funds were awarded to passing proposals in rank order.
Treatment of Intellectual Property: Pre-existing intellectual property identified in agreement EPC-17-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.
Update: This project was approved at the September 13, 2017 Business Meeting and the kickoff meeting conducted in November 14, 2017. At the kickoff meeting, the Recipient presented new information that must be evaluated by the staff. The project is on hold as of December 2017.

266. EPC-17-020

Project Name:

Demonstration of Vehicle-Grid Integration under Non-residential Scenarios

[EPC-17-020]

Recipient/Contractor:

Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	10/10/2017 to 12/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

There are several knowledge gaps on fleet charging including: 1) How to quantify the flexibility of EVs as a resource (in a consistent well-developed and tested methodology); 2) How to develop accurate physical models of charging stations and integrate these with distribution system models; 3) How to quantify the impact of EV charging on the distribution system assets (transformer load tap changes, etc.); 4) How to minimize the impact of EV charging on the distribution system, by its location, while minimizing the utility costs for the consumers without compromising the original mission of the vehicles; and 5) Identifying the value streams.

Project Description:

This agreement will demonstrate vehicle-grid integration in non-residential facilities to show the flexibility of smart charging, build and validate EV physical models as well as data-driven models that incorporate usage patterns, quantify the impacts of EV charging; develop controls to manage the smart charging to minimize grid impacts and utility costs, and calculate the value streams and costs associated with realizing those value streams.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will develop and demonstrate advanced model-predictive control strategies that are more sophisticated than current state of the art technology. This project will demonstrate how to minimize electric vehicles charging impacts on the distribution system while analyzing EV fleet capabilities under non-residential scenarios by combining a wide variety of sites with diverse constraints.

CPUC Proceedings addressing issues related to this EPIC project:

Alternative Fueled Vehicles: R.13-11-007 Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1h, 3f, 4b

Lower Costs:

Lower the cost by extending the life of distribution grid assets and reducing peak load impacts from uncontrolled charging. In particular, reducing the transformer aging in hot climate regions due to reduced loading.

Greater Reliability:

Greater reliability due to mitigation of voltage, current and harmonics issues with EV clusters. This project is estimated to improve power losses and voltage drop by at least 10% via smart charging.

Environmental Benefits:

This demonstration project will accelerate EV adoption by improving infrastructure availability and decreasing distribution system upgrade costs by at least 10%, thus reducing greenhouse gases with the adoption of more EVs.

Assignment to Value Chain: Distribution	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $2,340,000	**EPIC Funds Spent:** $0
Match Partner and Funding Split: Google Inc.: $200,000 (6.8 %) ChargePoint, Inc.: $61,248 (2.1 %) Kisensum: $75,000 (2.6 %) UC Santa Barbara: $61,345 (2.1 %) Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory): $200,000 (6.8 %)	**Match Funding:** $597,593
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 29 out of 31 bidders	**Rank of Selected Applicant/ Bidder:** Group 4: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

This project was awarded late in the year. The recipient is working on filing the application for interconnection, obtaining all permits, and developing a technical advisory committee member list.

267. EPC-17-022

Project Name:

Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities

[EPC-17-022]

Recipient/Contractor:

Lystek International Limited

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	11/28/2017 to 11/29/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

California is striving to achieve a greater diversion of wastes and increase renewable energy generation. The goal of this diversion is to reduce greenhouse gas emissions from controllable sources. As an alternative to traditional solid waste facilities, other existing processing facilities, such as wastewater treatment plants, are being looked at as potential receiving stations for processed organics. The primary output of taking processed organics is greater generation or co-generation of renewable energy. A lack of proven and viable alternatives will delay meeting waste diversion goals and limit possible contributions to renewable energy goals from waste treatment facilities.

Project Description:

The project will construct and demonstrate an innovative technology to pretreat organic wastes prior to anaerobic digestion at a wastewater treatment facility to enhance operational efficiencies and increase biogas production. The pretreatment technology will be constructed as skid-mounted mobile units for processing source-separated organic wastes and biosolids and will have cogeneration capabilities, thereby further increasing the energy generation from the wastewater treatment system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will combine the organic processes and anaerobic digestion that will yield greater biogas generation and utilization resulting in higher diversion of organic wastes while producing more renewable electricity than conventional digester systems. If successful, the combined technologies will provide wastewater treatment operators with greater confidence in working with organic generators and processors for accepting feedstock material suitable for co-digestion.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 1a, 2a, 4a, 4e, 5b

Lower Costs:

The project will result in lower costs by demonstrating a technology that both diverts organic waste and increases the biogas yield and renewable electricity generation. The increase in gas production of about 385 kW per ton of organics processed. This is an increase of at least 20% in biogas production for moderate performing anaerobic digesters. The lower quantity of biosolids resulting from the process will lower expenses for disposal management.

Environmental Benefits:

The proposed approach to biosolids processing, land application and enhanced energy recovery through the improved anaerobic digestion process may result in net greenhouse gas reductions of 47–65 tonnes of CO2 per 100 dry tonnes of biosolids processed. Assuming 723,000 dry tonnes of biosolids could be converted by Lystek in California for beneficial use every year for biogas enhancement and electricity generation, there is potential for about 339,800 Mg CO2e of GHG offset potential.

Assignment to Value Chain: Generation	**Total Budgeted Project Admin and Overhead Costs:** $0
EPIC Funds Encumbered: $1,589,163	**EPIC Funds Spent:** $0
Match Partner and Funding Split: GHD, Inc.: $123,000 (5.9 %) Design2Operate: $58,000 (2.8 %) Lystek International Limited: $312,075 (15.0 %)	**Match Funding:** $493,075
Leverage Contributors: None	**Leveraged Funds:** $0

Funding Method:	**Funding Mechanism:**	**No. of Initial Passing Applicants/ Bidders:**	**Rank of Selected Applicant/ Bidder:**
Competitive	Grant	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

The Lystek Thermal Hydrolysis Process will be used as part of the organics-to energy grant project. This patented technology will be used to support the conclusion that energy can be

obtained by the digestion of organic matter and the collection/conversion of biogas to electricity.
Update: The project was approved at the November 8, 2017 Business Meeting and technical work will begin in 2018.

268. EPC-17-023

Project Name:

High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site

[EPC-17-023]

Recipient/Contractor:

Jason Cotrell, dba RCAM Technologies

Investment Plan:	**Project Term:**
2015-2017 Triennial Investment Plan	12/26/2017 to 6/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

Large wind turbines benefit from economies of scale from larger components such as taller towers, but are constrained by the logistics and transportation size and weight. As a result, the average conventional wind turbine tower height installed in the U.S. is slightly over 80 meters tall even though an ultra-tall 140 meter tower increases the amount of energy produced by more than 21% at a site with moderate wind shear. These alternative steel and concrete tall tower configurations have not been fully explored in California due to prohibitively high manufacturing and assembly costs.

Project Description:

This project aims to develop and test a reinforced concrete additive manufacturing (RCAM) technology for building low cost ultra-tall wind turbine towers onsite at a wind plant. Taller wind turbine towers capture more wind energy from faster winds aloft, but are constrained by transportation size and weight. The key goal is to develop a RCAM technology that can be used to fabricate a hybrid wind turbine tower on-site in one day at half of the cost of conventional steel towers, and reduce the levelized cost of wind generated electricity in a low wind speed site by 11%.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Substantial recent investments and advancements in concrete additive manufacturing technologies for buildings make this an opportune time to use the RCAM technology for constructing tall wind turbine towers in California. Concrete additive manufacturing technologies are being developed by countries around the world; however, most development has been performed on concrete printing manufacturing methods for buildings that have little or no structural reinforcement necessary for highly loaded wind turbine towers. The project team will build upon the state-of-the art technology to develop innovative RCAM method that incorporates reinforcement in concrete printing for ultra-tall turbine towers.

CPUC Proceedings addressing issues related to this EPIC project:

Renewables Portfolio Standard: R.11-05-005 [closed], R.15-02-020

Applicable Metrics: CPUC Metrics- 2a

Lower Costs:

RCAM technology provides new transformative design possibilities that reduce cost and energy consumed by using less concrete and labor than conventional wind tower construction, and by eliminating concrete forms. The RCAM offers the potential of reducing the construction time by 66% and additional cost reduction potential using automation. The RCAM technology has the potential to reduce the levelized cost of wind generated electricity in a low wind speed site by 11%.

Greater Reliability:

An ultra-tall wind turbine with a hub height between 140-170 meters increases the amount of energy produced by more than 21%, compared to an 80-meter tower. For instance, 140-meter RCAM towers increase California area with gross capacity factors above 35% by tenfold, adding flexibility and reliability of the electrical system by increasing geographic diversity. Ultra-tall towers can be used with larger rotors to obtain further increases in capacity factor.

Assignment to Value Chain: Generation		**Total Budgeted Project Admin and Overhead Costs:** $1,078,363	
EPIC Funds Encumbered: $1,249,982		**EPIC Funds Spent:** $0	
Match Partner and Funding Split: RCAM Technologies: $30,000 (2.3 %)		**Match Funding:** $30,000	
Leverage Contributors: None		**Leveraged Funds:** $0	
Funding Method: Competitive	**Funding Mechanism:** Grant	**No. of Initial Passing Applicants/ Bidders:** 19 out of 19 bidders	**Rank of Selected Applicant/ Bidder:** Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Update:

The agreement was approved at the November 2017 Business Meeting. A kickoff meeting for the project is expected to be held in January 2018.

APPENDIX C:
EPIC Project Status Report

Specific information for each project awarded EPIC funds, including new awards, active and completed projects in 2017, is provided in this annual report as Appendix C. An electronic spreadsheet format using the template provided in Attachment 6 of CPUC Decision 13-11-025 is also available as a separate document to this annual report.

Appendix C: EPIC Project Status Report

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date: Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($)*****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
2012-2014 Triennial Investment Plan	CEC	300-15-004 Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions	Applied Research and Development	This research improves upon optimization models for hydropower operations by taking future climate conditions into account, under three greenhouse gas emissions scenarios, and compares the optimized model to a more realistic partial optimization model that considers legal and institutional constraints in hydropower management.	3/9/2016	No	Generation	$650,000	$650,000	$5,141	N/A	$5,141	$114,054	$12,500,000	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	300-15-005 Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change	Applied Research and Development	The main focus of this research project is to develop grid-wide forecasts of inflows and electricity demands based on ground sensors and remotely sensed data, with emphasis on the effects from temperature fluctuations on electricity demands, hydrologic conditions, and grid performance. Furthermore, the project improves the accuracy of an existing near real-time Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN) product, originally developed at UC Irvine's Center for Hydrology and Remote Sensing.	3/9/2016	No	Generation	$720,000	$720,000	$0	N/A	$0	$144,000	$12,500,000	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	300-15-006 Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction	Applied Research and Development	The purpose of this project is to fund research that reduces the stress on current water infrastructure in California. Research includes: (1) development of high water recovery desalination processes for non-traditional waters, (2) characterizing the potential for non-traditional water use in California, (3) development of recycled water scenarios for electricity generation, and (4) improving the characterization of California's snowpack.	3/9/2016	No	Demand-side Management	$1,130,000	$1,130,000	$0	N/A	$0	$198,000	$12,500,000	None	$0	0.0%

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date: Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($)*****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
2012-2014 Triennial Investment Plan	CEC	300-15-007** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative - Technical Consulting (Tasks 1, 2, 3, 5 and 7)	Applied Research and Development	The CalSEED Initiative helps develop California's next generation of clean energy entrepreneurs, providing two levels of seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough solutions that will benefit electric ratepayers in Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric service territories.	3/9/2016	No	Demand-side Management	$9,788,043	$9,788,043	$523,899	N/A	$523,899	$1,563,250	$0	California Clean Energy Fund dba CalCEF Ventures; Los Angeles Cleantech Incubator; Elemental Excelerator; The Grant Farm, Inc.; Umberg Zipser; Greenlining Institute	$3,396,223	9.3%
2015-2017 Triennial Investment Plan	CEC	300-15-007** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative - Technical Consulting (Tasks 1, 2, 3, 5 and 7)	Applied Research and Development	The CalSEED Initiative helps develop California's next generation of clean energy entrepreneurs, providing two levels of seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough solutions that will benefit electric ratepayers in Pacific Gas and Electric, Southern California Edison, and San Diego Gas Electric service territories.	3/9/2016	No	Demand-side Management	$20,211,957	$20,211,957	$0	N/A	$0	$0	$0		$0	0.0%
2012-2014 Triennial Investment Plan	CEC	300-15-008 Research Roadmap for Getting to Zero Net Energy Buildings	Applied Research and Development	Itron is working with Energy Commission staff to develop a gaps analysis that identifies, describes and prioritizes research, development, demonstration, and deployment (RDD&D) gaps that need to be addressed to achieve the state's goals for Zero-Net Energy (ZNE) buildings in a safe, equitable and cost-beneficial manner. The gaps analysis is being developed in consultation with stakeholders and subject matter experts through interviews, written comments, and public workshops.	4/13/2016	No	Demand-side Management	$999,884	$999,884	$28,751	N/A	$28,751	$171,332	$0	None	$0	0.0%

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date: Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($)*****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
2012-2014 Triennial Investment Plan	CEC	300-15-009** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Market Facilitation	This contract will provide market analysis that will address the barriers that hamper commercial development of emerging energy technologies. Tasks under this work authorization contract could include tracking past and current award EPIC technology solutions to monitor successes, more accurately consider future EPIC funding opportunities, inform technology gap analyses, and develop online resources. The deliverables from this project will help prioritize future Energy Commission funding towards technologies that solve the addressed issues.	4/13/2016	No	Demand-side Management	$6,825,763	$6,825,763	$266,156	N/A	$266,156	$3,302,587	$0	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	300-15-009** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Market Facilitation	This contract will provide market analysis that will address the barriers that hamper commercial development of emerging energy technologies. Tasks under this work authorization contract could include tracking past and current award EPIC technology solutions to monitor successes, more accurately consider future EPIC funding opportunities, inform technology gap analyses, and develop online resources. The deliverables from this project will help prioritize future Energy Commission funding towards technologies that solve the addressed issues.	4/13/2016	No	Demand-side Management	$112,126	$112,126	$0	N/A	$0	$0	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	300-15-010 Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors	Applied Research and Development	Energetics Incorporated is working with Energy Commission staff and in consultation with stakeholders and subject matter experts to develop a technical assessment and gaps analysis that identifies, describes and prioritizes key research, development, demonstration, and deployment needs for achieving the state's goals for advancing technologies in the industrial, agricultural, and water sectors.	5/17/2016	No	Demand-side Management	$647,728	$647,728	$185,494	N/A	$185,494	$122,646	$0	TSS Consultants; Energetics Incorporated; Taylor Biomass Energy, LLC; Renewable Oil International LLC	$29,610	4.4%

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date: Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($)*****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
2012-2014 Triennial Investment Plan	CEC	300-15-011 California Commercial End-Use Survey	Market Facilitation	This project is (1) developing a methodology to conduct a survey of the characteristics of commercial utility customers that will serve as a baseline and support the Energy Commission's work on the demand forecast, (2) implementing the survey, and (3) providing an unbiased, comprehensive analysis of the data. The Commercial End-Use Survey (CEUS) is facilitating the commercial success and market adoption of technologies, strategies, and other innovations.	5/17/2016	No	Grid Operations/ Market Design	$7,990,063	$7,990,063	$0	N/A	$0	$3,426,324	$0	ADM Associates, Inc.	$100,893	1.2%
2015-2017 Triennial Investment Plan	CEC	300-15-013 California Investor-Owned Utility Electricity Load Shapes	Market Facilitation	This project will develop analysis to characterize existing and future electricity load in the service territories of Pacific Gas & Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company that will inform the Energy Commission's demand forecast. This information will, by including a mix of emerging energy trends and demand-side innovations, be used to identify and target opportunities to further reduce cost, improve safety, and improve reliability through clean energy technology research, development, deployment, and market facilitation opportunities.	6/14/2016	No	Grid Operations/ Market Design	$1,147,406	$1,147,406	$124,715	N/A	$124,715	$430,673	$0	ADM Associates, Inc.	$58,330	4.8%
2012-2014 Triennial Investment Plan	CEC	EPC-14-001 Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart	Applied Research and Development	This project improves solar forecasts for grid-connected PV in California, uses those improved forecasts to create enhanced net-load forecasts, and applies these enhanced forecasts to reduce scheduling errors for utilities and the California Independent System Operator (CAISO). Furthermore, this project quantifies the value of improved forecasts for utilities and grid operators. Therefore, this work will reduce the operational uncertainty behind the Duck Chart by producing high accuracy solar generation forecasts for utilities and the CAISO, and linking these generation forecasts to methods for forecasting net loads at higher temporal resolution. This increased fidelity and connection to net load forecasts will provide critical insights to better manage the rapidly evolving grid in California.	12/10/2014	No	Generation	$998,926	$998,926	$273,248	N/A	$273,248	$0	$0	Clean Power Research; Itron, Inc., dba IBS	$453,462	31.2%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-002 Investigating Flexible Generation Capabilities at the Geysers	Applied Research and Development	This project is investigating how the operation of Geysers geothermal facilities may be modified in order to address the greater demands imposed on the grid by the significant addition of intermittent resources. To do so, the project is developing an integrated model that simulates the effects of providing flexible operation on the reservoir, wells, pipelines, and power plants. The model is being tested at isolated wells, pipeline and power plant sites, and then at a cross-tied location, to determine the effects of flexible operation on the larger steam field. Results will be used to identify risks to structure and operations. Management and mitigation strategies needed to address specific flexible generation objectives will be identified and tested at a variety of representative problem areas. An evaluation of management strategies and costs will be developed to provide flexible generation and ancillary services.	12/10/2014	No	Generation	$3,000,000	$3,000,000	$981,427	N/A	$981,427	$0	$0	Geysers Power Company, LLC; TBD-Major Mechanical Contractor; TBD-Major Mechanical Equipment Supplier ; TBD-Reservoir Engineering Contractor	$4,362,373	59.3%
2012-2014 Triennial Investment Plan	CEC	EPC-14-003 Low- Cost Thermal Energy Storage for Dispatchable CSP	Applied Research and Development	The purpose of this project is the development and demonstration of a cost-optimal, robust, and low-cost thermal energy storage (TES) fluid, elemental sulfur. Use of sulfur as a TES fluid will enable overall low system costs, long lifetime, and scalability for a wide range of concentrating solar power (CSP) applications and temperatures.	12/10/2014	No	Generation	$1,497,024	$1,497,024	$406,076	N/A	$406,076	$198,528	$0	Southern California Gas Company	$300,000	16.7%
2012-2014 Triennial Investment Plan	CEC	EPC-14-005 Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	Applied Research and Development	This project aims to integrate high-accuracy solar forecasting to optimize the operation of distributed energy resources, and utilize the value of solar forecasting in utility grid operations to improve grid reliability, reduce ratepayer costs and increase safety. The objectives are to apply forecasts to inform control and scheduling decisions for distributed energy resources with emphasis on energy storage and electric vehicle charging control at warehouse photovoltaic clusters in the LA-Orange-Riverside-San Bernardino-San Diego Counties as well as the UCSD microgrid.	12/10/2014	No	Generation	$999,984	$999,984	$66,475	N/A	$66,475	$157,282	$0	San Diego Gas & Electric Company; Itron, Inc. dba IBS; University of California, San Diego, San Diego Supercomputer Center; Strategen	$999,984	50.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-007 Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area	Applied Research and Development	This project comprises coordinated atmospheric field measurements and computational modeling improvements to improve the accuracy of prediction of short-term wind ramps (i.e. large, rapid changes in wind power production). The Tehachapi Pass Wind Resource Area is the focus of the project. Since the area features complex terrain and meteorology, the findings can be readily adapted and applied to many other regions.	12/10/2014	No	Generation	$1,000,000	$1,000,000	$814,246	N/A	$814,246	$247,542	$0	Department of Mechanical and Aerospace Engineering - UC Davis	$90,325	8.3%
2012-2014 Triennial Investment Plan	CEC	EPC-14-008 High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)	Applied Research and Development	The purpose of this project is the development and validation of tools capable of monitoring and forecasting DNI and POA irradiance and the power generation accurately, from 5 minutes out to 72 hours in the future, mainly at the Ivanpah Solar Thermal plant, but also at the California Valley Solar Ranch (CVSR) plant. The project also includes the development of tools for predicting wind speed, which affects the heliostats' deployment, and improve the power generation forecast via Resource-to-Power Model (RTP) for Ivanpah CSP and CVSR (Tracking PV) plants. The goal of this system is aimed at reducing uncertainties associated with operation, regulation and scheduling of Ivanpah. The new forecast models will be used as a feed forward input to the RTP model in the solar field controls system that will enable the solar field to preemptively position itself for weather transients.	12/10/2014	No	Grid Operations/ Market Design	$999,898	$999,898	$560,818	N/A	$560,818	$168,624	$0	Itron, Inc. dba IBS; NR(	$764,019	43.3%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-009 Optimizing Radiant Systems for Energy Efficiency and Comfort	Applied Research and Development	This project develops new design and operation tools for radiant cooling and heating systems in order to provide a standardized guidance for radiant systems in commercial buildings. The agreement includes full-scale laboratory experiments, whole-building simulations, development of simplified models for radiant system controls, validation of these new methods in field studies, occupant satisfaction surveys, and an update to Title-24 for radiant systems. The project is expected to produce: 1) a simplified tool for calculating the cooling load and cooling capacity of a radiant slab system, including calculation methods with significant direct solar radiation, 2) a simplified online operational tool for radiant slab systems, and 3) updates to the Title 24 Alternative Calculation Method Reference Manual to enable improved modeling capabilities of radiant systems.	2/25/2015	No	Demand-side Management	$2,939,964	$2,939,964	$1,761,095	N/A	$1,761,095	$450,466	$0	Center for the Built Environment - UC Berkeley; Price Industries	$299,194	9.2%
2012-2014 Triennial Investment Plan	CEC	EPC-14-010 Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	Applied Research and Development	This project (a) quantifies the energy savings, peak demand reduction, urban cooling, and air quality improvements attainable from cool walls in California; (b) assesses the performance of existing cool wall technologies, and develops innovative cool wall solutions; and (c) facilitates collaboration among government agencies, utilities, and industry to create a cool-wall infrastructure that includes application guidelines, a product rating program, incentives, and building code credits.	2/25/2015	No	Demand-side Management	$2,500,000	$2,500,000	$2,204,820	N/A	$2,204,820	$908,941	$0	_3M; BEHR; Metal Construction Association; PPG Industries; Saint-Gobain; Sherwin Williams; Tex-Cote; Valspar	$610,800	19.6%
2012-2014 Triennial Investment Plan	CEC	EPC-14-011 From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions	Applied Research and Development	This project focuses on the design and development of innovative LED lighting solutions for three key general illumination product categories. These solutions are a best-in-class medium, screw-base replacement lamp, linear tubular light emitting diode (TLED) replacement lamps and spectrally optimized, dedicated LED luminaires. Product design requirements are based on consumer light quality and functional performance preferences determined through a series of unique laboratory-based consumer preference and product characterization studies.	2/25/2015	No	Demand-side Management	$2,995,187	$2,995,187	$930,637	N/A	$930,637	$557,072	$5,000	Regents of the University of California, Davis - California Lighting Technology Center	$5,000	0.2%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-012 Comparing Attic Approaches for Zero Net Energy Homes	Applied Research and Development	The project focuses on the performance of different attic assemblies and their associated heating, ventilating and air conditioning (HVAC) systems. Field measurements of attic and HVAC system performance are conducted in two new high performance homes in California with sealed and insulated attics. One home will be built to be about 30 percent better than Title 24 and the other is a ZNE home. The attic insulation approach involves a new lower-cost approach using blown insulation that does not use expensive spray-foam. The results of the measurements are used directly to provide technical support for potential changes to Title 24 and provide information to contractors and builders on sealed and insulated attic performance and alternative approaches.	2/25/2015	No	Demand-side Management	$1,000,000	$1,000,000	$1,000,000	N/A	$1,000,000	$563,439	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-013 Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts	Applied Research and Development	This project is developing low-cost, low power, accurate, calibration-free, and compact airflow sensors (anemometers) for measuring: (1) room airflow in occupied commercial buildings; and (2) volumetric air flow in heating, ventilation and air conditioning (HVAC) systems. The technology saves energy by using the collected data to correct wasteful HVAC malfunctions that result in inefficient systems and uncomfortable buildings. The anemometers are wireless, able to be inexpensively installed in existing buildings, operate on a battery for years and communicate wirelessly via the internet to the building's control system. The device also senses temperature, and its orientation and location.	2/25/2015	No	Demand-side Management	$2,488,964	$2,488,964	$986,646	N/A	$986,646	$595,177	$0	Center for the Built Environment - UC Berkeley; BAF Technologies Inc.; Vigilent; Chirp Microsystems, Inc.; Price Industries	$249,000	9.1%
2012-2014 Triennial Investment Plan	CEC	EPC-14-015 Direct Current as an Integrating and Enabling Platform	Applied Research and Development	This project is evaluating DC and AC-DC hybrid applications to determine market segments where projects are technically and economically feasible. The research covers existing and new buildings. For the market segments identified, the Team is developing and piloting tools to help building developers incorporate these systems into their building designs. The tools include DC and AC-DC hybrid design guidelines, and design templates.	2/25/2015	No	Demand-side Management	$1,000,000	$1,000,000	$1,000,000	N/A	$1,000,000	$495,365	$0	EMerge Alliance; California LMCC IBEW-NECA	$100,000	9.1%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-016 Cost- and Energy-Efficient Attic Designs for California Homes	Applied Research and Development	This project demonstrates, evaluates, tests and refines three different attic designs in new California home construction. The project recommends the best approaches to home builders addressing cost-effectiveness and energy-efficiency. The baseline will be the current energy efficiency code practices for ventilated roof attics with no additional attic insulation and ducts within the attic that comply with the current energy code requirements for ducting.	2/25/2015	No	Demand-side Management	$1,000,000	$1,000,000	$733,217	N/A	$733,217	$228,148	$0	Owens Corning	$265,000	20.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-017 Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy	Applied Research and Development	The recipient is developing low-cost lighting components with open communication interfaces, that allow seamless integration into whole-building control and automation systems. The project targets future California Building Energy Efficiency Standards (Title 24), and establish methods by which the site-specific configuration and operation of networked lighting controls systems can be effectively addressed, and more easily implemented in the marketplace.	2/25/2015	No	Demand-side Management	$1,875,000	$1,875,000	$1,354,000	N/A	$1,354,000	$216,162	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-021 Development and Testing of the Next Generation Residential Space Conditioning System for California	Applied Research and Development	This project will develop a next-generation residential space-conditioning system optimized for California climates. The advanced efficiency solutions integrated into the HVAC system will include: variable-capacity compressor and variable-speed fans using state-of-the-art inverter technology; integrated ventilation to harness fresh air for "free cooling;" intelligent dual-fuel technology to decrease energy cost and empower consumers to choose between electricity and natural gas; zonal control to prevent conditioning of unoccupied rooms; demand-response interactivity to grid flexibility and reliability; advanced fault detection and diagnostics to ensure proper installation, operation, and maintenance; and alternative refrigerants for improved operation and significant reductions in the potential for global warming.	4/8/2015	No	Demand-side Management	$2,993,005	$2,993,005	$856,557	N/A	$856,557	$1,072,105	$0	Electric Power Research Institute (EPRI)	$322,281	9.7%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-022 The Lakeview Farms Dairy Biogas - To - Electricity Project	Technology Demonstration and Deployment	ABEC #3 LLC, DBA Lakeview Farms Dairy Biogas is installing and demonstrating an innovative covered lagoon digester system that will process dairy manure into biogas to generate renewable electricity for export to the electricity distribution grid. This particular project is located near 11 other dairies and will help launch the state's first "hub-and-spoke" dairy digester cluster by preparing the 1 MW generator platform to accept 2 MWs of future capacity potentially utilizing biogas from neighboring dairies and providing a means to off-take gas for vehicle fuel use. This hub and spoke approach was initially proposed in a case study prepared for the USDA on the economic feasibility of dairy digester clusters in California. The idea is to allow the dairies to benefit from the aggregation of capital investment and reduce operation and management costs by centrally locating the generators and associated electrical equipment.	3/11/2015	No	Generation	$4,000,000	$4,000,000	$3,369,242	N/A	$3,369,242	$32,107	$0	ABEC #3 LLC, dba Lakeview Farms Dairy Biogas	$4,500,000	52.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-023 Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits	Applied Research and Development	Eos is performing pilot testing of a 125 kW/375 kWh AC-integrated energy storage system consisting of approximately 140 Eos Znyth (Trademark) battery modules. The system is being installed at PG&E's testing facility in San Ramon, CA. System performance is being characterized against a variety of use cases including peak shaving, ancillary services, load following, and frequency regulation. Eos is modeling a portion of PG&E's distribution network to create simulated grid conditions that will allow for dynamic testing of the battery storage system.	4/8/2015	No	Distribution	$2,156,704	$2,156,704	$251,079	N/A	$251,079	$691,504	$0	Electric Power Research Institute, Inc.; Eos Energy Storage, LLC	$1,167,607	35.1%
2012-2014 Triennial Investment Plan	CEC	EPC-14-024 Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment	Applied Research and Development	This project develops and tests a modular biomass gasification system that can be rapidly deployed to communities across California to promote and support fire-safe management activities.	3/11/2015	No	Generation	$2,000,000	$2,000,000	$1,217,824	N/A	$1,217,824	$334,354	$0	TSS Consultants; West Biofuels, LLC ; Christiana Darlington; Soper-Wheeler Co. LLC	$539,914	21.3%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-025 Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems	Applied Research and Development	The project aims to install and test a 300 kW photovoltaic solar system with air driven trackers. Two key technical innovations are demonstrated. First, the use of mass-manufacturing for the drive system results in an extremely low cost structure and very low part count. Second, only tubing is connected to each actuator, removing requirements for outdoor wiring or individual control hardware. The research involves collecting six-month performance data for the proposed solar PV tracking technology.	3/11/2015	No	Generation	$1,000,000	$1,000,000	$636,135	N/A	$636,135	$157,497	$0	PV Evolution Labs; Sunfolding, Inc.	$1,171,565	54.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-026 Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment	Market Facilitation	This project conducted a quasi-experimental, econometric study of energy efficiency adoption and energy savings with a focus on differences between social, cultural, and socio-economic groups. The study applied modern economic methods to Southern California Edison's Quality Installation Program, including regression-discontinuity and propensity score matching. The large data sets and rigorous methods resulted in estimates to improve demand forecasts, energy efficiency program design, and future energy studies concerning social, cultural, and socioeconomic groups.	4/8/2015	No	Demand-side Management	$360,632	$360,632	$360,584	N/A	$360,584	$65,406	$0	The Regents of the University of California, Berkeley	$150,784	29.5%
2012-2014 Triennial Investment Plan	CEC	EPC-14-027 High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	Applied Research and Development	This project designed a low-cost 74kW pilot High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES) system that can efficiently store grid-level energy and release that energy when it is needed to meet peak demand, particularly for ancillary services and load following use-cases. This project documented and reported on the design, anticipated performance and lessons learned of the HTH-CAES system to increase knowledge and understanding of how these storage systems perform and the barriers to siting and operations.	4/8/2015	No	Distribution	$1,621,628	$1,621,628	$632,754	N/A	$632,754	$206,222	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-028 Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions	Applied Research and Development	This project deploys a pre-commercial technology demonstrating a sorbent-based biogas purification process for combined heat and power generation at the pilot scale that removes multiple troublesome impurities from biogas, upgrading the fuel to near-pure methane for combustion in conventional prime movers. The pilot plant will be installed and tested at a brewery wastewater plant and at a landfill site to demonstrate the environmental and cost benefits of biogas purification prior to use in combined heat and power applications.	3/11/2015	No	Generation	$1,318,940	$1,318,940	$107,641	N/A	$107,641	$105,570	$0	ES Engineering, Inc. formerly Environ Strategy Consultants, Inc.; Waste Management of California, Inc.; InnoSepra, LLC	$959,150	42.1%
2012-2014 Triennial Investment Plan	CEC	EPC-14-029 The West Star North Dairy Biogas-to - Electricity Project	Technology Demonstration and Deployment	This project advances digester design by building and demonstrating an innovative, double-cell covered lagoon digester and 1-megawatt (MW) generation system. The system will convert dairy manure into biogas and store the biogas above the primary and secondary lagoons under an inflatable cover. The biogas will be converted into renewable electricity and sold for export to the PG&E distribution grid. Further, dairy biogas systems qualify for participation in the CPUC's Assembly Bill (AB) 2514 electricity storage program. In a future phase, the biogas system may compete for an energy storage contract. The project will also improve groundwater protection by minimizing leaching of manure into the groundwater.	3/11/2015	No	Generation	$4,000,000	$4,000,000	$3,534,856	N/A	$3,534,856	$32,107	$0	ABEC #2 LLC, dba West Star North Dairy Biogas	$5,000,000	55.6%
2012-2014 Triennial Investment Plan	CEC	EPC-14-030 Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels	Applied Research and Development	This project highlights locations where waste biomass can be used most efficiently and sustainably for distributed generation by developing scenarios through 2050 that identify the most promising opportunities for waste biomass DG, identify key technical and regulatory hurdles to waste biomass DG utilization, develop tools for matching available waste biomass resources with energy production opportunities, and suggest solutions for achieving cost parity with fossil fuels.	3/11/2015	No	Generation	$1,500,000	$1,500,000	$1,189,154	N/A	$1,189,154	$670,276	$0	Energy Bioscience Institute; Allotrope Partners; PepsiCo R&D	$282,000	15.8%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-031 Pollution Control and Power Generation for Low Quality Renewable Fuel Streams	Technology Demonstration and Deployment	The project is using a 250 kW gas turbine system that converts relatively dirty, low heating value fuels into heat using gradual oxidation. This gradual oxidation technology was developed by Ener-Core, a California company, and has been demonstrated in operating systems for well over 500 hours, but has not yet been commercially deployed in California. The site for the demonstration is a closed landfill producing low quality gas that is currently flared. This site is a good match for the 250 kW demonstration as it eliminates the flaring of the otherwise unusable gas while generating electricity for onsite use and use in other county-owned facilities as facilitated by SB 1122 or SB 43. The project is being carried out in collaboration with Orange County Waste & Recycling who is responsible for the test site.	4/8/2015	No	Generation	$1,499,386	$1,499,386	$922,723	N/A	$922,723	$98,402	$0	Advanced Power and Energy Program (APEP) - University of California, Irvine; ES Engineering, Inc. formerly Environ Strategy Consultants, Inc.; Ener-Core, Inc.	$438,345	22.6%
2012-2014 Triennial Investment Plan	CEC	EPC-14-032 Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	Market Facilitation	This project focused on reaching Hispanic subpopulations in California to better understand the social, cultural, and behavioral aspects of their decisions to adopt energy efficient technologies and behaviors. The study combined data collected from participants via energy usage journals, in-home interviews, and energy meters to further the knowledge of Hispanic cultural associations and beliefs related to energy use decisions and choices. The information gathered in this study can be used to improve the metrics and assumptions underlying energy demand forecasting and energy efficiency potential and goals studies. In addition, the study provided information that can be used for targeted marketing of energy efficiency programs to the Hispanic population and improved levels of service to these households.	4/8/2015	No	Demand-side Management	$224,593	$224,593	$201,529	N/A	$201,529	$10,681	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-033 North Fork Community Power Forest Bioenergy Facility Demonstration	Technology Demonstration and Deployment	The North Fork Forest Bioenergy project is constructing and demonstrating a 1 megawatt (MW) forest waste bioenergy gasification-to-electricity facility in the foothills of the Sierra Mountains. The biomass gasification facility is targeted to be a commercial-scale, community-based facility capable of accepting and processing wood waste from forest management that would otherwise create wildfire and air quality challenges, and generating renewable grid-connected electricity. Critical to this gasification demonstration, the project is investigating the best practices and evaluating individual components and protocols to improve performance and reduce operating costs.	4/8/2015	No	Generation	$4,965,420	$4,965,420	$3,079,272	N/A	$3,079,272	$87,680	$0	TSS Consultants; The Watershed Research and Training Center; North Fork Community Development Council; Phoenix Energy; Yosemite Sequoia Resource Conservation and Development Council; Western Energy Systems; USDA Forest Service - Sierra National Forest; Kamalesh Doshi	$1,361,360	21.5%
2012-2014 Triennial Investment Plan	CEC	EPC-14-034 Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	Applied Research and Development	The purpose of this was to install and demonstrate an advanced modular bioenergy technology. The pilot-scale demonstration was intended to help determine if the performance of the technology, along with biomass co-product value creation enhancement strategy, was sufficiently powerful to overcome the affordability burdens that currently block the feasibility of distributed generation bioenergy projects in California.	4/8/2015	No	Generation	$2,000,000	$2,000,000	$1,353,332	N/A	$1,353,332	$264,400	$0	Interra Energy, Inc.	$4,627,400	69.8%
2012-2014 Triennial Investment Plan	CEC	EPC-14-035 Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors	Applied Research and Development	The research project is developing, demonstrating, and evaluating at the pilot scale, the ability of an integrated, advanced PV and storage system at a state-of-art test bed in the LBNL Facility for Low Energy Experiments (FLEXLAB). The system includes smart inverter control to enhance and optimize grid support and system performance. The strategy evaluates the use of distribution synchrophasor units data to support specific visualization and control applications on distribution circuits. The project includes a 13 to 15 kilowatt (kW) PV electric generating system and a 14 kW (56 kW-hour) battery storage installation at FLEXLAB.	4/8/2015	No	Grid Operations/ Market Design	$1,000,000	$1,000,000	$844,424	N/A	$844,424	$375,000	$0	Tesla Motors	$25,000	2.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-036 Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage	Applied Research and Development	The project is developing a complete solution of smart solar PV-based DER system that addresses key barriers impeding the progress towards high penetration of solar and DER. The work includes development of a CA Rule 21 test framework and test scripts; compliance testing of smart inverters with functionality as described in the CPUC CA Rule 21 Smart Inverter Working Group (SIWG) recommendations; monitor and control inverter operating functions including participation in ancillary service for diverse DER assets; increase of photovoltaic (PV) penetration and cost effectiveness while enhancing safety and reliability of the California grid. This agreement will deliver a smart inverter test framework and open source software tools to enable rapid product development and safety testing and will demonstrate the benefits to all stakeholders including ratepayers, utilities, manufacturers, investors and operators.	4/8/2015	No	Grid Operations/ Market Design	$2,000,000	$2,000,000	$671,001	N/A	$671,001	$162,005	$0	Olivine, Inc.; SunSpec	$2,066,875	50.8%
2012-2014 Triennial Investment Plan	CEC	EPC-14-037 Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption	Market Facilitation	This project is conducting a multidisciplinary, data driven study to understand the role and interactions of various factors influencing the adoption and utilization of residential energy efficiency measures. The study will provide awareness into the stand alone and interactive effects of factors such as income, ethnicity, language, and political orientation on the adoption of energy efficient technologies, with a primary focus on the Latino population in the Fresno area. Knowledge gained from this study can be used to enhance energy policy and program design to account for social, cultural, and behavioral factors.	4/8/2015	No	Demand-side Management	$599,924	$599,924	$414,838	N/A	$414,838	$166,993	$0	Renovate America	$214,000	26.3%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-038 Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design	Market Facilitation	This project uses empirical research methods grounded in anthropology and other social and behavioral sciences to explore the factors affecting behavior beyond simple economic rationale. This practice is achieved by documenting and analyzing emerging attitudes, emotions, experience, habits, and practices around technology adoption for purposes of devising predictive indicators for on-going potential studies regarding energy consumption in California.	4/8/2015	No	Demand-side Management	$574,545	$574,545	$366,994	N/A	$366,994	$40,208	$0	Indicia Consulting; California State University San Marcos	$52,500	8.4%
2012-2014 Triennial Investment Plan	CEC	EPC-14-039 Cultural Factors in the Energy Use Patterns of Multifamily Tenants	Market Facilitation	This project examined the cultural and demographic factors that correlate with multifamily tenants' electric energy use patterns, before and after energy efficiency upgrades, and tenant engagement activities. Using multilevel tenant surveys and interval meter data analytics this study investigated the who, what, and why variations in multifamily energy use patterns. The large data sets will help to improve demand forecasts and energy efficiency program design by providing lessons learned and guidance for how social, cultural, and socioeconomic groups use energy differently in multifamily settings.	4/8/2015	No	Demand-side Management	$379,019	$379,019	$259,129	N/A	$259,129	$107,714	$0	Pacific Gas and Electric Company	$100,000	20.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-040 Self-Tracking Concentrator Photovoltaics for Distributed Generation	Applied Research and Development	This research is developing, testing, and demonstrating a self-tracking concentrator photovoltaic (ST-CPV) system, a new concentrator photovoltaic technology that does not require a precision mechanical tracker to keep it aligned to the sun. The ST-CPV panel contains a thin layer of fluids that passively responds to the changing solar angle, automatically adjusting optical pathways within the device to ensure that incident sunlight is captured and concentrated over a wide range of angles. The passive internal tracking allows ST-CPV panels to be mounted in a stationary configuration or with a simple single axis tracker. This makes the system highly economical, greatly reduces installation and maintenance complexity, and enables distributed generation with higher efficiency CPV modules.	5/13/2015	No	Generation	$999,940	$999,940	$416,094	N/A	$416,094	$67,377	$0	United States Department of Energy; U.S. Department of Energy	$2,500,000	71.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-041 Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District	Technology Demonstration and Deployment	This project aims to design, build and install a continuously operating commercial scale emissions reduction system for the lean burn biogas engine(s) at a municipal wastewater treatment plant in Palm Springs California. The project will enable lean burn biogas engines to comply with existing and future air quality regulations when deployed at wastewater treatment plants, resulting in reduced flaring and net reductions in emissions.	4/8/2015	No	Generation	$2,249,322	$2,249,322	$11,858	N/A	$11,858	$0	$0	Anaergia Technologies, LLC	$450,000	16.7%
2012-2014 Triennial Investment Plan	CEC	EPC-14-044 Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy	Technology Demonstration and Deployment	The purpose of this project is to enable environmentally and economically sustainable deployment of technology that transforms organic municipal solid waste into heat, electricity, and compost via dry anaerobic digestion. A dry anaerobic digestion and composting facility processing the organic fraction of MSW will be scaled up from 40,000 tons/year to 90,000 tons/year, and will increase production of renewable electricity and heat.	4/8/2015	No	Generation	$4,300,000	$4,300,000	$2,987,486	N/A	$2,987,486	$1,497,504	$0	Zero Waste Energy Development Company	$1,500,000	25.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-045 Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation	Applied Research and Development	This project designs, develops and tests a waste-to-energy Process Development Unit (PDU), involving conversion of Refuse Derived Biomass into clean fuel gas by Thermal-Catalytic Gasification, Reforming and Pulse Detonation Technology. This is a two-stage process, with a primary gasification stage, followed by a reforming stage; and hot filtration, followed by wet scrubbing of the process gas. This project tests a 3-pound per minute PDU, evaluates the results, and provides engineering data to design a 30 ton/day plant generating 1-MW electric power.	4/8/2015	No	Generation	$1,499,481	$1,499,481	$1,292,649	N/A	$1,292,649	$188,248	$0	Taylor Energy	$46,616	3.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-046 Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction	Technology Demonstration and Deployment	The project demonstrates two complementary approaches to lower the overall cost of co-digestion: a new technology to lower preprocessing cost of food wastes, and a new strategy to lower the mass of cake solids requiring disposal. The new technology for the preprocessing of food wastes uses an organic waste preprocessing technique known as an organic extrusion press (OEP) for selective extrusion of organic materials and is capable of recovering 95% of organics. The project applies a new strategy in operating co-digestion systems that involves optimizing the organic waste loading in a way that will lower the mass of cake solids requiring disposal relative to the conventional process.	4/8/2015	No	Generation	$1,496,902	$1,496,902	$415,576	N/A	$415,576	$323,906	$0	Silicon Valley Clean Water (SVCW); Water Environment & Reuse Foundation	$2,630,000	63.7%
2012-2014 Triennial Investment Plan	CEC	EPC-14-047 Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process	Applied Research and Development	This goal of the project is to integrate Concentrating Solar Power (CSP) and Hydrothermal Processing (HTP) into a single, integrated system; confirm that it can convert dairy manure into RNG and bio-crude; study the economics of integrated CSP-HTP systems sited at dairy farms; and confirm that the RNG produced meets pipeline-transmission and geological-storage quality standards. In this way, the project anticipates proving that it is possible to store the energy contained in dairy manure waste in a manner that enables California natural gas plants to produce readily dispatchable, ultra-low-emissions renewable electricity.	4/8/2015	No	Generation	$1,494,736	$1,494,736	$851,946	N/A	$851,946	$98,501	$0	Southern California Gas Company (SoCalGas)	$600,000	28.6%
2012-2014 Triennial Investment Plan	CEC	EPC-14-050 City of Fremont Fire Stations Microgrid Project	Technology Demonstration and Deployment	This project will design and build low carbon-based microgrids at three fire stations in Fremont, California. Each microgrid consists of a microgrid energy management system, a parking lot canopy photovoltaic system, and a battery energy storage system. The automated microgrid control system will optimally manage local energy resources and loads. The microgrid will provide at least three hours a day of power for critical loads during a utility power outage.	4/8/2015	No	Distribution	$1,817,925	$1,817,925	$1,003,605	N/A	$1,003,605	$73,475	$0	City of Fremont; Gridscape Solutions, Inc.; Delta Products Corporation; Microgrid Energy	$657,260	26.6%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	Applied Research and Development	This project aims to design, deploy, and test a 150 kilowatt-electric (kWe) modular, mobile biomass gasification generator (the Powertainer) that converts forest slash biomass into on demand renewable energy and meets the California Air Emission Standards. The results of the demonstration will be analyzed to determine (1) optimal siting to enhance grid stability, (2) impact of monetizing current forest waste as fuel on ability to increase forest thinning and lower wildfire risk, and (3) impact of increased thinning on availability of hydrological resources.	4/8/2015	No	Generation	$1,990,071	$1,990,071	$1,292,604	N/A	$1,292,604	$463,311	$0	All Power Labs, Inc.	$686,038	25.6%
2012-2014 Triennial Investment Plan	CEC	EPC-14-052 Community Scale Digester with Advanced Interconnection to the Electrical Grid	Technology Demonstration and Deployment	The project's aim is to install and operate an innovative anaerobic digestion system using a high-rate biodigester technology that will process approximately 50 tons per day (TPD) of organic waste from a large supermarket (Albertsons) distribution center and 50 TPD (20,000 gallons) of high-strength slurry created by recovering and concentrating organics in wastewater streams. This project is co-located with the Co-West Commodities Wastewater Pre-Treatment Facility- an operation that collects wastewater (carbs, sugar, protein, and fat, grease, and oil known as FOG) from industrial businesses and pre-treats the material for disposal into the local sewer system.	4/8/2015	No	Generation	$5,000,000	$5,000,000	$1,845,252	N/A	$1,845,252	$252,977	$0	CleanWorld; Organic Energy Solutions	$7,772,939	60.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-053 A Renewable Based Direct Current Building Scale Microgrid	Technology Demonstration and Deployment	This renewable-based direct current (DC) microgrid will connect on-site generation with loads and provide a low cost, energy-efficient solution to save costs. Solar PV will be directly connected to energy-efficient DC lighting, DC energy storage systems, and ventilation on a 380 V DC bus to form a DC building microgrid. This microgrid system proposed for the Honda Distribution Center in Chino, California reduces the need for inverters for PV and rectification equipment in the loads, thus improving the overall utilization of solar energy by 7-10% as compared to conventional AC systems, while lowering component complexity and costs.	4/8/2015	No	Distribution	$2,817,566	$2,817,566	$1,178,165	N/A	$1,178,165	$276,825	$0	Maxwell Technologies; AMERICAN HONDA MOTOR COMPANY, INC.; Robert Bosch LLC; Regents of the University of California, Davis - California Lighting Technology Center; Imergy Power Systems	$1,797,544	38.9%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-054 Demonstrating a Community Microgrid at the Blue Lake Rancheria	Technology Demonstration and Deployment	This project will demonstrate the ability of a community-scale microgrid to bolster the resiliency of an American Red Cross critical support facility and the capability of the microgrid to power itself with a high penetration of local renewable resources. The microgrid will be designed to island indefinitely.	6/10/2015	No	Distribution	$5,000,000	$5,000,000	$4,146,573	N/A	$4,146,573	$832,908	$0	Humboldt State University Foundation, Schatz Energy Research Center; Pacific Gas and Electric Company; Siemens Energy and Automation, Inc.; Tesla Motors; Serraga Energy, LLC at Blue Lake Rancheria; GHD, Inc.	$1,318,422	20.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-055 Las Positas Community College Microgrid	Technology Demonstration and Deployment	This project will demonstrate the ability of a commercial-scale microgrid to optimize distributed energy resources for customers, distribution utilities, and the California ISO by using advanced energy management tools to coordinate a high penetration of customer renewable energy assets with multiple energy storage technologies on a community college microgrid.	4/8/2015	No	Distribution	$1,522,591	$1,522,591	$582,142	N/A	$582,142	$260,719	$0	Chabot-Las Positas Community College District	$450,000	22.8%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-056 Demonstration of Electric Vehicle Smart Charging and Storage Supporting Grid Operational Needs	Technology Demonstration and Deployment	This project will install PEV charging equipment in five sites in Santa Monica to demonstrate scenarios that represent new power needs, including smart charging, peak shaving, addressing the "duck curve" when there's abundant solar energy, load management, and load smoothing while improving power quality and grid stability. The selected sites will reflect a variety of scenarios including public charging, fleet charging, integration of solar generation with charging, and integration of energy storage with fast charging. Further, the project will assess the usefulness of vehicle to grid and vehicle to building technologies for allowing bi-directional energy flow and using PEVs as distributed energy storage. The projects objective is to provide a model (using simulations to predict grid behavior and emulations using real-world power flows) that will be leveraged for grid planning, pricing, and incentive decisions and provide a deep understanding of the impact these technological changes will have on load and power quality.	4/8/2015	No	Demand-side Management	$1,989,432	$1,989,432	$1,367,761	N/A	$1,367,761	$358,770	$500,000	City of Santa Monica; The Regents of the University of California, Los Angeles; Korea Institute of Energy Research (KIER); California Lithium Battery; Proximetry	$500,000	20.1%
2012-2014 Triennial Investment Plan	CEC	EPC-14-057 Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets	Technology Demonstration and Deployment	This project is developing an aggregation system for smart charging PEVs to provide demand response, mitigate demand charges, leverage time-of-use rates, and offer wholesale market services. The demonstration is tapping into the inherent flexibility in the time and rate of PEV charging to participate in PG&E's automated demand response programs, and CAISO wholesale markets for demand response and ancillary services. A charging control system is being applied to a fleet of vehicles owned by Alameda County and to charging stations that are used by both county vehicles and the public. The project is adding systems for intelligent prediction of PEV loads and control algorithms to create a flexible, modular, and scalable solution for smart charging county fleet and public PEVs.	4/8/2015	No	Demand-side Management	$1,993,355	$1,993,355	$1,483,530	N/A	$1,483,530	$812,829	$0	Bay Area Climate Collaborative; The Regents of the University of California, Berkeley; Kisensum; ChargePoint, Inc.; County of Alameda, General Services Agency	$536,761	21.2%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-059 Laguna Subregional Wastewater Treatment Plant Microgrid	Technology Demonstration and Deployment	This project is upgrading a wastewater treatment plant to act as a microgrid with the ability to provide ancillary services to the grid. Once the components are installed and commissioned, the project team will monitor the plant as it operates and gather data on the microgrid operations.	4/8/2015	No	Distribution	$4,999,804	$4,999,804	$211,444	N/A	$211,444	$187,080	$0	City of Santa Rosa; Parker Hannifin Corp; Nuvation Engineering	$2,290,000	31.4%
2012-2014 Triennial Investment Plan	CEC	EPC-14-060 Borrego Springs - A Renewable-Based Community Microgrid	Technology Demonstration and Deployment	SDG&E and the project team will demonstrate a utility-owned community microgrid at Borrego Springs. The renewable based microgrid will be able to island the entire community with a peak load of approximately 14 MW, serving approximately 2,500 residential and 300 commercial and industrial customers. SDG&E will utilize two large PV systems, 14 rooftop PV systems, two substation batteries and three distributed batteries.	4/8/2015	No	Distribution	$4,724,802	$4,724,802	$2,658,026	N/A	$2,658,026	$923,165	$0	San Diego Gas & Electric Company; SMA America; OSISoft, LLC	$1,739,560	26.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-061 Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife	Applied Research and Development	This research uses real-world data to understand renewable energy impacts to wildlife. The approach is to analyze observed wildlife fatalities and habitat loss to determine the significance of fatalities to population persistence; compare pre-construction predicted and post-construction actual impacts (fatalities) to sensitive species, as a foundation for improving predictive accuracy; and compare predicted and actual benefits of mitigation to sensitive species, as a foundation for improving predictive accuracy. The research goal is to produce a set of decision-making tools for renewable energy developers and permitting and regulatory agencies in California.	6/10/2015	No	Generation	$1,000,000	$1,000,000	$62,947	N/A	$62,947	$262,924	$0	US Geological Survey; University of Maryland Center for Environmental Studies Appalachian Laboratory; NextEra Energy	$1,617,177	61.8%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-062 Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems	Technology Demonstration and Deployment	This project involves setting up links using software and hardware at pumping stations for water delivery, storage or treatment that enable the integration and transmission of data from energy meters directly or indirectly into Supervisory Control and Data Acquisition (SCADA) systems that are traditionally set up to monitor water quality parameters in real time. Combined with historical energy use data on the platform operators can manage systems in real time to monitor and control peak demand.	5/13/2015	No	Demand-side Management	$3,017,034	$3,017,034	$581,127	N/A	$581,127	$452,544	$0	Inland Empire Utilities; OSISoft, LLC; Regents of the University of California, Riverside Campus; Opto 22; Cucamonga Valley Water District; Olivehain Municipal Water District	$1,722,732	36.3%
2012-2014 Triennial Investment Plan	CEC	EPC-14-063 Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water	Technology Demonstration and Deployment	This project is demonstrating an advanced wastewater treatment technology, the PFO Recycler, that produces high quality water while reducing energy, chemicals and maintenance required for treatment of industrial wastewaters. Treatment of industrial wastewater is very challenging because of the high solids, pulps, free and emulsified oils and greases and their high chemical and biological oxygen demand. If the project is successful then this technology could be used to treat challenging wastewaters to achieve high purity and provide high temperature water for reuse while using less energy than other processes. Reclaiming water for onsite reuse will reduce the need for fresh water purchases.	5/13/2015	No	Demand-side Management	$3,230,420	$3,230,420	$1,569,463	N/A	$1,569,463	$964,131	$0	Porifera, Inc.; CDM Smith, Inc. ; Dr. Bronner's Magic Soaps ; Wawona Frozen Foods ; Jackson Family Wines	$646,493	16.7%
2012-2014 Triennial Investment Plan	CEC	EPC-14-064 Aerosol Impacts on the Hydrology and Hydropower Generation in California	Applied Research and Development	This research team is enhancing and using a fully coupled aerosol-meteorology-snowpack forecast model for hydropower applications, using observational datasets (precipitation, snowpack, stream inflow) for Southern California Edison's hydropower plant on Big Creek. The main goal is to demonstrate that the use of advanced forecasts can improve the management of hydropower units.	5/13/2015	No	Generation	$399,818	$399,818	$76,587	N/A	$76,587	$92,951	$0	University of California, Riverside; University of California Los Angeles	$306,237	43.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-065 Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use	Technology Demonstration and Deployment	This project is demonstrating a new technology innovation, the PFO Concentrator, to reduce the energy, chemicals, and maintenance required for food and beverage processing and waste concentration. The PFO concentrator dewaters fruits and vegetables for production of food and beverage concentrates and purees and could replace energy intensive thermal evaporators. Additionally, water is extracted from the concentrated product for reuse on-site.	5/13/2015	No	Demand-side Management	$2,499,289	$2,499,289	$1,473,278	N/A	$1,473,278	$621,536	$0	Porifera, Inc.; CDM Smith, Inc. ; Los Gatos Tomato	$628,568	20.1%
2012-2014 Triennial Investment Plan	CEC	EPC-14-066 High-Performance Integrated Window and Facade Solutions for California Buildings	Applied Research and Development	This project develops, validates and quantifies energy impacts of a new generation of high performance facade systems and provides the design and management toolkits that will enable the building industry to meet challenging energy performance goals leading to zero net energy commercial buildings by 2030. This project considers cost-effective integrated system approaches to reduce energy-use associated with HVAC and lighting while improving occupant comfort.	5/13/2015	No	Demand-side Management	$3,000,000	$3,000,000	$1,875,000	N/A	$1,875,000	$1,308,746	$450,000	United States Department of Energy	$450,000	13.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-067 Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems	Applied Research and Development	This project develops improved snowpack forecasts within a representative Sierra Nevada watershed to bolster the hydrographic data network that supports hydropower planning and operations. The project is expected to reduce uncertainty in water forecasts in a changing climate, and assist in the development of reliable and flexible operations of hydropower dams that will also bring economic benefits to utilities and ratepayers.	5/13/2015	No	Generation	$1,100,000	$1,100,000	$140,251	N/A	$140,251	$205,897	$0	California Department of Water Resources; University of California Merced	$236,263	17.7%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-068 Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling	Applied Research and Development	This project analyzes the design, performance and cost of optimized hybrid cooling systems at utility power plant scale to illustrate the potential benefits of hybrid cooling in California. This project uses an existing Excel spreadsheet-based computational tool with the capability of specifying, at an "engineering-level", design parameters for optimized closed-cycle wet, direct dry, and parallel wet/dry hybrid cooling systems. The tool's output is checked against information from participating plants equipped with wet, dry, and hybrid cooling systems. The capability to make rigorous, reliable evaluations of hybrid cooling systems and the trade-offs between economic power production and water resource conservation enables the selection of preferred cooling systems for the economic and environmental benefit of California.	5/13/2015	No	Generation	$581,580	$581,580	$355,250	N/A	$355,250	$0	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-069 Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System	Applied Research and Development	This project advances the understanding of key parameters of long-term energy scenarios and greenhouse gas abatement options in the California energy system. Researchers will achieve this by further developing detailed scenarios and modeling capabilities of the California electricity sector, as well as interactions between the electricity sector and other sectors, and by exploring the implications of particular policy choices on the electricity system in the medium (2020-2030) and long term (2050). This project provides critical insight into some of the key challenges facing the low carbon transition in the electricity system, the options for addressing these challenges, and the dynamic interactions among these options, which are likely to grow more important over time.	5/13/2015	No	Grid Operations/ Market Design	$700,000	$700,000	$509,307	N/A	$509,307	$286,936	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-070 Wexus Energy and Water Management Mobile Software for the Agricultural Industry	Technology Demonstration and Deployment	This project deploys the Wexus (Water-Energy Nexus) mobile, cloud-based software platform in California's agricultural industry. The Wexus platform leverages existing utility meter infrastructure and helps agribusinesses to quickly assess energy (and water) usage and cost from virtually anywhere on any mobile device. Through customized alerts and reporting, the platform allows farms to quickly respond to changes in energy usage, adjust and optimize equipment in the field, and reduce operational expenses due to energy costs. Through collaboration with project partners, this project will further extend existing water-energy data analysis, visualization and remote controlling capabilities to the Wexus platform to further optimize water-energy resource management in the agribusiness sector.	5/13/2015	No	Demand-side Management	$4,000,000	$4,000,000	$2,456,363	N/A	$2,456,363	$571,397	$0	Wexus Technologies, Incorporated	$1,000,000	20.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-071 Rotor-Mounted Bat Impact Deterrence System Design and Testing	Applied Research and Development	The project designs and test (in lab and field) a new bat deterrence system using ultrasound transmitters mounted in an array along the rotor blades, providing complete coverage over the entire rotor/nacelle envelope. A field test study using substantially similar methods to prior bat impact studies is being implemented post-installation at the test site to measure the effectiveness of the new ultrasound system.	5/13/2015	No	Generation	$862,875	$862,875	$642,337	N/A	$642,337	$29,547	$249,000	Frontier Wind; Bruce Walker	$36,313	4.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-072 Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California	Applied Research and Development	The researchers developed long-term energy scenarios for California that comply with GHG emission targets and goals. The scenarios provide new insights about technology options and by when some of this options should be implemented.	5/13/2015	No	Generation	$700,000	$700,000	$700,000	N/A	$700,000	$236,701	$0	University of California, Berkeley	$65,000	8.5%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-073 Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures	Applied Research and Development	This project evaluates the distribution of air temperatures within urban heat islands in California and enhances the foundation for location-specific assessments of mitigation strategies. In collaboration with local governments and organizations in the Los Angeles Basin, the research team designed and implemented siting of fixed high-quality monitoring stations, supplemented with mobile monitoring and data from existing weather-station networks. This research assesses spatial and temporal variations in near-surface air temperature and recasts these observations for use in validating and calibrating the climate/meteorological models applied to assess potential benefits of urban heat island countermeasures throughout the state.	5/13/2015	No	Grid Operations/ Market Design	$500,000	$500,000	$500,000	N/A	$500,000	$116,818	$0	Altostratus, Inc.	$4,000	0.8%
2012-2014 Triennial Investment Plan	CEC	EPC-14-074 Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals	Applied Research and Development	The project uses climate change simulations to produce modeled conditions that disrupt electricity system generation, renewable capacity potential, and demand for the years of 2030, 2040, and 2050. The combined effect of these impacts is then simulated on the electricity system using an integrated electric grid modeling platform.	5/13/2015	No	Generation	$698,792	$698,792	$644,269	N/A	$644,269	$181,613	$0	Southern California Gas Company (SoCalGas); Southern California Edison	$300,000	30.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-075 Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems	Technology Demonstration and Deployment	The University of California at Berkeley, Massachusetts Institute of Technology, and the University of Chicago, have partnered with Lightapp Technologies to demonstrate a pre-commercial, software-based, optimized energy management system in industrial facilities. Together, they will demonstrate Lightapp's energy-monitoring system on compressed air systems in 100 California industrial plants served by the state's investor-owned utilities.	5/13/2015	No	Demand-side Management	$4,981,729	$4,981,729	$2,318,208	N/A	$2,318,208	$451,253	$0	University of California, Berkeley	$1,530,590	23.5%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-076 Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings	Technology Demonstration and Deployment	This project is extending the application of Cloth Depth Filters (CDF) to raw wastewater filtration at three wastewater treatment plants in California. The CDF concept replaces the current technology of primary clarification by offering the following advantages: (1) substantially higher removal of organic load resulting in significantly lower aeration electrical power demand, and (2) smaller footprint requirements both for primary and secondary treatment steps. CDF employs established principles of gravitational forces which results in minimal operational and maintenance complexities. The unique attribute which offers promise for CDF technology in raw wastewater is the vertical placement of the filter medium and flow direction of this filtration process. Unlike prevailing filtration systems, the vertical orientation of the filter medium permits heavy solids to settle within the tank.	5/13/2015	No	Demand-side Management	$3,476,085	$3,476,085	$1,830,831	N/A	$1,830,831	$1,184,735	$0	Kennedy/Jenks Consultants; Water Environment Research Foundation; Regents of the University of California (University of California, Davis); Aqua-Aerobic Systems, Inc.; Process Wastewater Technologies LLC; Linda County Water District	$1,288,340	27.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-077 Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	Applied Research and Development	The project was intended to design and develop a Demand Clearing House (DCH) to monitor published energy pricing from the California Independent System Operator's Fifteen-Minute Energy Market as well as load forecasts from San Diego Gas & Electric and other participating utilities through an Application Programming Interface translation from Open ADR 2.0b, a Demand Response protocol used by all California Investor Owned Utilities. The DCH would have then used algorithms that convert grid conditions into ISO/IEC 15118 "grid profiles," or Tariff Tables, which in turn would be communicated to 15118-capable charging stations and vehicles. A fully developed DCH would allow utilities to respond to supplemental energy market prices, proving a viable and scalable pathway toward using plug-in electric vehicles to manage variable grid conditions, solar oversupply, and other system wide challenges. This project was terminated early and will not complete.	6/10/2015	No	Grid Operations/ Market Design	$1,499,999	$1,499,999	$356,872	N/A	$356,872	$193,033	$0	Energy Solutions; Cent	$162,474	9.8%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-078 Next-Generation Grid Communication for Residential PEVs	Applied Research and Development	The project develops communication interfaces between PEV customers and utilities using cloud-to-cloud OpenADR 2.0b communication with a vehicle charging network and will leverage emerging means for retrieving vehicle information via the ISO/IEC 15118 standard for consideration in the decision process. The communication will be able to gather customer data and receive signals from a third party (utility) for the purpose of optimizing PEV charging in a mutually beneficial manner to the customer and the utility. In addition to investigation and implementation of the ISO/IEC 15118 standard, the project will also investigate using control methods that do not require having vehicle charging information. This may be done through statistical estimation, rate of charge output from charging stations or driver opt-in based on maximum charge needed.	6/10/2015	No	Demand-side Management	$1,500,000	$1,500,000	$541,482	N/A	$541,482	$139,418	$0	ChargePoint, Inc.	$142,500	8.7%
2012-2014 Triennial Investment Plan	CEC	EPC-14-079 Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy	Applied Research and Development	The purpose of this project is to resolve the limiting conditions that occur on California distribution systems when many PV systems are installed behind a single residential distribution transformer by evaluating advanced inverter functionality with specific goal of enabling higher penetration of photovoltaic on the grid. The project is identifying, implementing, and testing (both in lab and field) optimal methods by which smart inverters can mitigate the issues that otherwise would limit local high penetrations of residential PV. The process will identify how California Rule 21 functions can be used and configured so that multiple smart inverters work in harmony and will also identify how other naturally-occurring consumer devices, such as electric vehicle chargers and other smart loads, can serve to further enable high-levels of solar PV.	6/10/2015	No	Grid Operations/ Market Design	$1,705,478	$1,705,478	$338,382	N/A	$338,382	$400,537	$0	Electric Power Researcl	$891,414	34.3%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-080 Renewable Microgrid for a Medical Center	Technology Demonstration and Deployment	This project will demonstrate a full-scale renewable-based microgrid for a hospital. The microgrid consists of a solar photovoltaic array, battery energy storage, and a microgrid controller integrated with an existing combined heat and power system. The microgrid will provide at least three hours of power during a utility outage and will also use automated demand response to reduce electrical demand.	6/10/2015	No	Distribution	$4,776,171	$4,776,171	$3,849,024	N/A	$3,849,024	$729,842	$0	Princeton Power Systems, Inc.; OSISoft, LLC; Kaiser Permanente Medical Center	$2,095,835	30.5%
2012-2014 Triennial Investment Plan	CEC	EPC-14-081 Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption	Technology Demonstration and Deployment	This project is demonstrating a software tool that links groundwater extraction with smart meter data to provide growers with automated information on energy and water consumption. This data is augmented by weather data and optional soil moisture data from local sensors to provide information to growers regarding irrigation needs. Use of the software program could help inform growers and reduce irrigation while maintaining or optimizing yield. This technology is being applied over 1,000 acres of farms owned by several growers of alfalfa, tomato, pistachios and almonds.	6/10/2015	No	Demand-side Management	$2,292,829	$2,292,829	$1,960,956	N/A	$1,960,956	$332,162	$0	UC Santa Barbara; UC Davis; PowWow Energy, Inc.	$535,568	18.9%
2012-2014 Triennial Investment Plan	CEC	EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Technology Demonstration and Deployment	This project is deploying a biomass-fired combined heat and power system to provide heat and power to Plumas County health facilities. Biomass from local forest clearing operations will be used by a new biomass boiler to supply heat to an Organic Rankine Cycle (ORC) power unit. Waste heat from the ORC will be used to as a heat source for heat pumps, improving their performance for the winter heating season.	6/10/2015	No	Generation	$2,603,228	$2,603,228	$1,852,118	N/A	$1,852,118	$262,813	$0	Plumas County; Sierra Institute for Community and Environment	$652,400	19.9%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-082 **[Amendment 1]** Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Technology Demonstration and Deployment	This project is deploying a biomass-fired combined heat and power system to provide heat and power to Plumas County health facilities. Biomass from local forest clearing operations will be used by a new biomass boiler to supply heat to an Organic Rankine Cycle (ORC) power unit. Waste heat from the ORC will be used to as a heat source for heat pumps, improving their performance for the winter heating season.	6/10/2015	No	Generation	-$217,967	-$217,967	$0	N/A	$0	$0	$0	Plumas County; Sierra Institute for Community and Environment	-$59,084	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-14-083 College of San Mateo Internet of Energy	Technology Demonstration and Deployment	This project was initiated to demonstrate an integrated solar PV, energy storage, and advanced power electronics within a single module to significantly increase overall efficiencies by minimizing conversion losses. The demonstration was to include the integration of a 250 kW pre-commercial high-yield PV system from Flex, a 500 kWh stationary battery energy storage system, and advanced HVAC system and controls, with an advanced energy management system that uses the Internet of Energy concept to optimize performance of distributed energy resources and the local grid.	6/10/2015	No	Generation	$2,999,601	$2,999,601	$402,626	N/A	$402,626	$411,350	$0	Growing Energy Labs, Inc.; San Mateo County Community College District	$1,235,000	29.2%
2012-2014 Triennial Investment Plan	CEC	EPC-14-084 ABEC #4 Renewable Combined Heat and Power Project	Technology Demonstration and Deployment	The project uses biogas derived from on-site dairy manure to generate low-carbon, renewable electricity and achieve high overall efficiency by capturing waste heat from the power generation system, and uses it to drive an absorption chiller. The absorption chiller is designed to convert waste heat into chilling capacity, which will be used to chill milk produced by the dairy cows. New absorption chiller capacity directly offsets electricity consumption from existing electric chillers. Combining renewable generation with waste heat collection and cooling, the project increases energy efficiency of the existing dairy by an estimated 10% or more, while also reducing peak grid power demand.	6/10/2015	No	Generation	$3,000,000	$3,000,000	$1,756,927	N/A	$1,756,927	$32,107	$0	ABEC #4 LLC CE&S Dairy Biogas	$4,983,619	62.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-14-085 Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System	Technology Demonstration and Deployment	This project is demonstrating that the combination of advanced PV generation and an energy management system can reduce the community's average daily power and daily peak energy demand by more than 10%. The project includes a smart electrical energy storage system that integrates retired electric vehicle batteries. The generator and storage system are controlled by a commercial-grade microgrid controller, with the three levels of hierarchy. The demonstration site is located in the Robert Mondavi Institute at the UC Davis campus.	6/10/2015	No	Generation	$1,238,491	$1,238,491	$18,284	N/A	$18,284	$124,883	$0	UC Davis; OSISoft, LLC; Solexel	$658,729	34.7%
2012-2014 Triennial Investment Plan	CEC	EPC-14-086 Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	Applied Research and Development	The project develops an integrated vehicle-to-grid (V2G) system that can be tested and demonstrated to be distribution-aware, self-regulating, interoperable, secure and open as well as scalable and flexible. These real-world tests and demonstrations will provide confidence in the V2G systems that provide grid support functions and possibly influence investor owned utilities (IOUs) to add them to their Assembly Bill 2514 Storage Mandate compliance plans. The data gathered will also enable validation of cost effectiveness models through direct engagement with the IOUs' existing infrastructure and distribution networks, combined with simulated independent system operator interaction.	6/10/2015	No	Grid Operations/ Market Design	$1,499,977	$1,499,977	$659,091	N/A	$659,091	$666,988	$0	Electric Power Researcl	$795,754	34.7%
2012-2014 Triennial Investment Plan	CEC	EPC-14-088 Demonstration of Low-Cost Liquid Cooling Technology for Data Centers	Technology Demonstration and Deployment	This project is validating the performance, reliability, cost savings and payback of a data center efficiency technology that uses direct-to-chip liquid-cooling to cut data center cooling energy use. The technology is being demonstrated at two full scale data centers and the deployment is occurring with minimal operational disruptions during installation. Energy consumption, load, reliability and server performance are being monitored. The results of the demonstrations, along with "lessons learned", will be made broadly available to the data center community and public-policy makers to stimulate adoption of this technology.	6/10/2015	No	Demand-side Management	$3,552,678	$3,552,678	$2,448,921	N/A	$2,448,921	$1,038,931	$0	Lawrence Livermore National Laboratory; Asetek USA, Inc.	$1,519,738	30.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-003 Demonstration of Community Scale Generation System at the Chemehuevi Community Center	Technology Demonstration and Deployment	This project deploys and demonstrates a community energy generation system at the Chemehuevi Indian Tribe Community Center. The energy system incorporates two pre-commercial solar technologies with flow-battery energy storage integrated with energy management system. The integration of the energy management system components will reduce peak energy demand for the center by utilizing battery storage to shift building and community loads and provides an uninterruptable power for the center when it is used as an Emergency Response Center for the tribe.	10/14/2015	No	Distribution	$2,588,906	$2,588,906	$752,331	N/A	$752,331	$525,157	$0	Primus Power; The Regents of the University of California - Riverside; OSISoft, LLC; Solexel; Chemehuevi Indian Tribe; SunPower Systems	$706,698	21.4%
2012-2014 Triennial Investment Plan	CEC	EPC-15-004 Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand	Applied Research and Development	This project is developing and demonstrating a Climate Appropriate Air Conditioning system for commercial buildings that optimizes occupant comfort and can reduce energy use and peak demand. The project will apply a combination of Variable Refrigerant Flow (VRF) technology with Indirect Evaporative Cooling (IEC) integrated and operationally optimized through the building control system. The project will also investigate alternative non- Ozone Depleting Potential (ODP) refrigerants and HVAC system designs that could enable their usage in commercial buildings. This project will benefit small and medium commercial buildings, such as retail stores, offices buildings and food service and could be implemented in existing and new commercial buildings through direct replacement of rooftop packaged air conditioners. It is estimated that the HVAC systems for these sectors use 7,000 GWh and contributes 5 GW of peak demand. This project could reduce HVAC energy consumption and peak demand.	7/8/2015	No	Demand-side Management	$2,834,721	$2,834,721	$748,658	N/A	$748,658	$1,088,673	$0	Electric Power Research Institute (EPRI)	$440,509	13.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-005 Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.	Applied Research and Development	The project evaluates SLR vulnerability and adaptation options in the SDG&E service area at a level of detail appropriate for informing electricity sector policy and planning. ICF International is partnering with SDG&E to conduct a detailed and robust sea level rise vulnerability assessment and to identify and evaluate appropriate adaptation measures. This project identifies adaptation measures for the electrical system that are actionable and aligned with existing policies, based on a comprehensive understanding of the vulnerabilities of specific assets, how these combine at a system level, and significant feedback from the utilities. The results were formed with significant input from the IOU to ensure the adaptation measures are actionable.	10/14/2015	No	Generation	$499,929	$499,929	$225,966	N/A	$225,966	$240,425	$0	San Diego Gas & Electric Company	$166,200	25.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-006 Modeling the Impact of Wildfires on California's Transmission and Distribution Grid	Applied Research and Development	This study is advancing scientific knowledge by combining and enhancing several state-of-the-art models to produce the most detailed analysis to-date of California's future electric grid and fire risk under alternative conditions of climate change and grid evolution, including changes in the use of demand response, renewables, and distributed generation.	10/14/2015	No	Distribution	$500,000	$500,000	$500,000	N/A	$500,000	$169,786	$0	University of Hawaii at Manoa	$17,157	3.3%
2012-2014 Triennial Investment Plan	CEC	EPC-15-007 Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat	Applied Research and Development	This project is developing a sophisticated and in depth description of future electric grid demand, response, and vulnerability due to increased (and prolonged) heat events in Southern California Edison territory under current and future climate scenarios. It will enable innovative grid management and operation strategies and will identify adaptation guidance. Ultimately, researchers will provide the information to local governments, regional and state agencies, utilities, and the general public in tangible, easy-to-understand formats to enhance local and state capacity to respond to potential disruptions in transmission due to climate change.	10/14/2015	No	Distribution	$500,000	$500,000	$13,311	N/A	$13,311	$0	$0	County of Los Angeles; The Regents of the University of California, Los Angeles	$183,753	26.9%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-008 Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt	Applied Research and Development	This project develops a suite of analytical and outreach approaches to provide electricity system stakeholders with actionable data pertaining to local climate risks. The project is organized around three imperatives. The first is developing interactive, visually compelling, and useful web-based visualization applications depicting climate-related risks to the electricity infrastructure. The second is to build focused toolsets to support planning to protect energy infrastructure. Finally, the project includes outreach and training with energy stakeholders, climate practitioners, planners, managers, educators and ratepayers in the state through targeted workshops, webinars, and presentations. As articulated by electricity sector IOUs in the 2017 IEPR Adaptation Workshop, Cal-Adapt 2.0 is an instrumental tool for developing and implementing locally appropriate adaptation options in the electricity sector.	11/12/2015	No	Grid Operations/ Market Design	$400,000	$400,000	$259,692	N/A	$259,692	$74,324	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-009 Workforce Instruction for Standards and Efficiency (WISE)	Market Facilitation	This project is providing education, tools and on-the-job training to homebuilders in California's new residential construction market on High Performance Attics (HPAs) and High Performance Walls (HPWs), two new requirements in California's Building Energy Efficiency Standards for 2016. The project helps homebuilders better understand the new requirements and options for compliance, and provides them with technical support to enable the transition to the new requirements. Additionally, the project team provides on-the-job training to homebuilders, installing trades, subcontractors, and field crews on the proper installation of insulation and changes to other building systems that will be necessary to meet the new requirements.	11/12/2015	No	Demand-side Management	$4,431,918	$4,431,918	$1,641,157	N/A	$1,641,157	$1,667,291	$0	ConSol ; BASF; Owens Corning; KB Home; California Building Industry Association (CBIA); APA - Engineered Wood Association; Bayer Material Science; Ensoltis Green Hybrid Roofing; Panasonic Eco Solutions North America; PCBC; QC Manufacturing; Shea Homes; SIPA - Structural Insulated Panel Association; SPFA - Spray Polyurethane Foam Alliance; Taylor Morrison Homes of California, LLC; Tru Team of California	$15,685,075	78.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-010 Increasing Workforce Development Opportunities in Disadvantaged Communities through Automated Demand Response Communication Equipment Training	Market Facilitation	The project is recruiting workers from disadvantaged communities into apprenticeship programs at California Joint Apprentice Training Centers (JATCs), providing them with comprehensive classroom and on-the-job training on the installation and maintenance of AutoDR communications equipment. By addressing the acute skills gap by producing a workforce qualified to install and maintain cutting-edge AutoDR communications equipment, the project is enabling demand response to be deployed in the market at scale.	11/12/2015	No	Demand-side Management	$4,476,189	$4,476,189	$1,249,547	N/A	$1,249,547	$863,874	$0	California LMCC IBEW-NECA	$16,165,080	78.3%
2012-2014 Triennial Investment Plan	CEC	EPC-15-012 Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants	Technology Demonstration and Deployment	The project is demonstrating an on-line monitoring technology to directly measure colloidal particle monitoring technique. Direct detection of colloidal particles will help administration of optimal amount of pretreatment to remove colloidal particles and render membrane treatment energy efficient.	12/9/2015	No	Demand-side Management	$1,167,034	$1,167,034	$252,066	N/A	$252,066	$429,784	$0	Orange County Water District; West Basin Municipal Water District; Evoqua Water Technologies; Malvern	$336,000	22.4%
2012-2014 Triennial Investment Plan	CEC	EPC-15-013 Open Source Platform For Plug-in Electric Vehicle Smart Charging in California	Applied Research and Development	The project develops a one-way charging concept for PEVs that maximizes accommodation of intermittent renewable generation and minimizes impacts to the distribution grid. The project focuses on controlling the charging of PEVs in residential and small commercial settings using a novel and flexible open-source, open-software architecture charge communication and control platform. This software-based platform will be embedded in the context of overall utility and residential/business electrical and building automation systems, lending itself to potential broad implementation by commercial interests due to its flexible architecture and "agnostic" approach to communications standards. Control strategies and applications will be guided by an assessment of user needs and grid operation and ratepayer benefits, and the potential for one-way PEV charge control to lead to increased ability to accept intermittent renewable energy for California's electrical grid.	2/10/2016	No	Demand-side Management	$1,500,000	$1,500,000	$463,102	N/A	$463,102	$549,477	$0	BMW of North America	$90,000	5.7%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-015 Grid Communication Interface for Smart Electric Vehicle Services Research and Development	Applied Research and Development	Andromeda Power will develop an advanced smart grid communication interface that allows utilities to send dispatch signals to PEVs in real-time to optimize the bidirectional power flow of PEV battery packs depending on local power conditions such as congestion, power quality, voltage and frequency, while maintaining the driver's mobility needs. The grid communication interface operates with a virtual machine able to interface PEVs of any standard. The real time monitoring and control of the stations will provide to the California Electrical Investor Owned Utilities a means of quick Automated Demand Response.	1/13/2016	No	Demand-side Management	$681,693	$681,693	$377,046	N/A	$377,046	$304,177	$0	Suncharge; Verdek	$465,000	40.6%
2012-2014 Triennial Investment Plan	CEC	EPC-15-016 A Transformative Flywheel R&D Project	Applied Research and Development	This project will fully develop advanced manufacturing processes and improve the flywheel rotor geometries. The project will seek to build on developments that the Amber Kinetics flywheel engineering team made in the areas of improved materials processing for better strength, longer life, and improved rotor geometries to maximize energy storage density and reduce costs. Amber Kinetics' projected flywheel manufacturing cost targets are below $150/kWh, inclusive of power electronics.	1/13/2016	No	Demand-side Management	$2,000,000	$2,000,000	$1,215,133	N/A	$1,215,133	$388,000	$0	Amber Kinetics, Inc.	$12,000,000	85.7%
2012-2014 Triennial Investment Plan	CEC	EPC-15-018 Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems	Applied Research and Development	The goal of this project is to develop and test behind-the-meter residential and commercial battery storage applications, each on both a stand-alone basis and integrated with solar PV. This project is utilizing several kW-scale, AC-integrated Znyth (Trademark) battery technology storage systems. The residential and commercial systems are located at the University of California, San Diego (UCSD) campus. The project team is developing, modeling, and testing experimental rate designs and evaluating the impact on customer load profiles; developing control algorithms and demonstrating aggregation of multiple storage units to create virtual power plants that maximize the value of behind-the-meter storage to the utilities; and modeling, simulating, and extrapolating the economic impacts of installed systems and quantifying the benefits to CA utilities and ratepayers.	1/13/2016	No	Grid Operations/ Market Design	$1,894,866	$1,894,866	$75,546	N/A	$75,546	$218,866	$0	Eos Energy Storage, LL	$1,436,801	43.1%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-019 Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	Applied Research and Development	This project is addressing the high cost of GHEs for water-to-water and water-to-air heat pumps to facilitate increased implementation of efficient ground-coupled heat pumps in California. The project focuses on shallow (20-30 feet deep) and large diameter (2-3 feet diameter) ground heat exchanger designs using helical coil heat exchangers. The project team is developing models, validating them with field data from three existing sites, identifying optimal designs, and developing modeling methods that can be adapted for use with Title 24 standards compliance tools. The project is also producing typical design specifications that will support future Title 24 eligibility criteria. A design guide is being developed for use by the industry as a training aid, and a position paper is being prepared for the Department of Water Resources' California Geothermal Heat Exchange Well Standards Stakeholder Advisory Group.	3/9/2016	No	Demand-side Management	$1,212,186	$1,212,186	$356,706	N/A	$356,706	$361,292	$0	Davis Energy Group, Inc.	$18,826	1.5%
2012-2014 Triennial Investment Plan	CEC	EPC-15-020 Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	Applied Research and Development	This project is developing a low-cost smart thermostat with a simplified user interface. It is being tested in low-income and senior housing, but can be readily adapted to other building sectors, including small commercial. The smart thermostat will track user preferences and manage indoor conditions to optimize energy use. Internet connectivity is not required. By automatically optimizing thermostat settings, this project determines if smart thermostats can be a cost-effective method to address HVAC energy use in sectors where it does not make sense for building owner or tenant to make HVAC system upgrades.	2/10/2016	No	Demand-side Management	$2,705,759	$2,705,759	$221,572	N/A	$221,572	$903,766	$0	Electric Power Research Institute (EPRI)	$427,072	13.6%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-021 Mobile Efficiency for Plug Load Devices	Applied Research and Development	This project is designing a methodology guideline for plug load manufacturers to use in developing energy efficient plug load devices. In developing the guideline, the recipient will evaluate mobile design practices, hardware components, and power management software kernels to prove their effectiveness. The results will be used to develop the first virtual prototypes and reference designs for energy optimized hardware and software that can guide plug load device manufacturers to reach mobile energy efficiency levels. Manufacturers will use these reference designs to develop and mass deploy energy efficient plug load devices into the marketplace. The project will show a reduction of energy consumption of residential and commercial plug load devices, such as set-top boxes, TVs, computers, and game consoles. The project will also define and introduce a widely accepted industry standard through the Institute of Electrical and Electronics Engineers (IEEE) to support the newly developed unified design methodology and secure its long-term adoption and further evolution.	3/9/2016	No	Demand-side Management	$1,996,999	$1,996,999	$1,338,814	N/A	$1,338,814	$136,800	$0	AGGIOS, Inc.; Freescale; International Rectifier; Keysight; Mentor Graphics; Synopsys	$6,030,450	75.1%
2012-2014 Triennial Investment Plan	CEC	EPC-15-022 Power Management User Interface	Applied Research and Development	This project seeks to reduce computers' energy consumption by improving how users employ existing power management capabilities. Although all computers have the capacity to enter low-power modes such as sleep, and can be shut down when not in use, this potential for energy savings has not been realized in the majority of desktop computers. These computers remain on at full power when they are not used. The problem is one of user behavior. The project uses a software solution to change user behavior by changing the tool they are using. This approach is firmly based in behavior theory and human-computer interaction research, which have long demonstrated that the interface of a device can change users' behavior.	3/9/2016	No	Demand-side Management	$785,124	$785,124	$310,060	N/A	$310,060	$300,159	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-023 Gaming System Energy Efficiency without Performance Compromises	Applied Research and Development	This project provides a detailed market segmentation and baseline energy demand assessment of the gaming market, including development of measurement and benchmarking protocols for gaming software and hardware. Top-selling gaming PCs and games are then cross-benchmarked and retrofitted to achieve maximum energy savings beyond what commercialized products currently can attain.	3/9/2016	No	Demand-side Management	$1,386,530	$1,386,530	$1,386,530	N/A	$1,386,530	$658,250	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-024 Efficient and ZNE-Ready Plug Loads	Applied Research and Development	This project researches and develops new technologies and strategies to eliminate or significantly reduce energy use in standby mode by redesigning the power supply for plug load devices. This research project develops and demonstrates strategies to remove plug load devices from grid AC power by redesigning these devices to use DC power from photovoltaic power sources.	3/9/2016	No	Demand-side Management	$1,600,000	$1,600,000	$541,352	N/A	$541,352	$634,531	$0	United States Environmental Protection Agency; EMerge Alliance; Power Integrations; Delta Electronics	$495,000	23.6%
2012-2014 Triennial Investment Plan	CEC	EPC-15-025 Plug Load Reduction App: RYPL	Applied Research and Development	This project researches methods to reduce home idle loads by utilizing smart meter analytics, an engaging smart phone app, a new online crowd-sourced database of miscellaneous electric loads, and an online efficient product marketplace to educate California residents about the idle load of their home and ways to reduce it. The system is to be piloted within all three electric investor owned utility territories and measure actual energy savings through smart meter data.	3/9/2016	No	Demand-side Management	$884,100	$884,100	$666,292	N/A	$666,292	$0	$0	Home Energy Analytics; Enervee Corporation	$350,000	28.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-026 Unlocking Plug Load Energy Savings through Energy Reporting	Applied Research and Development	This project will develop an interoperable protocol that can be implemented in all plug-load devices, unhampered by proprietary restrictions which will implement energy reporting to enable plug-load devices to transmit operating information - such as identity, power consumption, and functional state - through a communications network to a central entity. After a communication infrastructure is established for plug-load devices, the data flow can be reversed to send control signals to individual devices. The central management system that this project will demonstrate is well positioned to provide comprehensive control over diverse plug-load devices.	3/9/2016	No	Demand-side Management	$1,630,699	$1,630,699	$848,910	N/A	$848,910	$123,700	$0	Lawrence Berkeley National Laboratory; Energy Solutions; The Watt Stopper	$494,318	23.3%
2012-2014 Triennial Investment Plan	CEC	EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment	Applied Research and Development	This project assesses the energy reduction potential of electric commercial plug load foodservice equipment at five different commercial kitchens and hopes to demonstrate reduced energy consumption through the use of pre-commercial appliance designs and control technologies.	4/13/2016	No	Demand-side Management	$937,469	$937,469	$6,421	N/A	$6,421	$392,763	$0	Fisher-Nickel, Inc.; Pacific Gas and Electric Company; NAFEM; Dalla Corte; Nuova Simonelli; Hatco	$202,450	17.8%
2012-2014 Triennial Investment Plan	CEC	EPC-15-028 Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations	Applied Research and Development	The research team is conducting a statewide assessment - at the zip code level - of the potential for electrification (e.g., use of electricity for space heating) to generate benefits to customer cost savings, statewide economy, climate, and air quality. The assessment will feed a comprehensive climate and energy model and a subsequent air quality analysis that will help determine public health benefits, with a focus on the South Coast and the San Joaquin Valley air basins.	4/13/2016	No	Generation	$799,444	$799,444	$90,374	N/A	$90,374	$234,351	$0	Electric Power Research Institute (EPRI); South Coast Air Quality Management District	$759,213	48.7%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-029 Distributed Generation Environmental Planner	Applied Research and Development	This project developed a tool to identify environmentally preferred areas for distributed solar generation (DG). The project demonstrated how disparate spatial information, such as solar capacity, environmental data and utility infrastructure, can be combined in a site screening tool for effective local DG planning. The project aimed to expand energy planning tools at the local level by leveraging the ongoing development of the statewide planning tools. The existing statewide tool (prototype currently called the "RE Infrastructure Planning Assistant") focuses primarily on environmental screening for utility scale renewable energy development. This project adds more detailed energy and economic information appropriate for distribution-scale solar siting and most importantly incorporates distributed generation into the prototype interactive mapping tool and tests it in Lancaster, California.	4/13/2016	No	Generation	$199,976	$199,976	$179,582	N/A	$179,582	$44,350	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-030** San Diego Regional Energy Innovation Cluster	Applied Research and Development	This project will develop a collaboration of clean energy organizations in the San Diego Region to provide and coordinate key services, resources, and infrastructure needed by entrepreneurs and researchers in the region. The project aims to accelerate the successful market entry of energy innovations that can benefit Investor Owned Utility (IOU) electric ratepayers. This project will also work with businesses, local jurisdictions and other organizations in the region to connect emerging technologies to region specific-needs.	4/13/2016	No	Demand-side Management	$3,000,000	$3,000,000	$580,210	N/A	$580,210	$880,681	$0	Cleantech San Diego Association; CONNECT	$3,097,934	38.3%

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2015-2017 Triennial Investment Plan	CEC	EPC-15-030** San Diego Regional Energy Innovation Cluster	Market Facilitation	This project will develop a collaboration of clean energy organizations in the San Diego Region to provide and coordinate key services, resources, and infrastructure needed by entrepreneurs and researchers in the region. The project aims to accelerate the successful market entry of energy innovations that can benefit Investor Owned Utility (IOU) electric ratepayers. This project will also work with businesses, local jurisdictions and other organizations in the region to connect emerging technologies to region specific-needs.	4/13/2016	No	Demand-side Management	$2,000,000	$2,000,000	$0	N/A	$0	$0	$0		$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-031 Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response	Applied Research and Development	This agreement develops integrated plug load control strategies for different spaces within multiple types of commercial buildings. The project implements a flexible energy management system (FEMS) to demonstrate the integrated control strategies for plug loads at pilot sites. This includes the installation of smart power outlets and integration of various plug load control strategies with building energy management and/or lighting control systems. The project demonstrates and measures the degree of effectiveness of the flexible control strategies developed for integrally managing operation of plug loads to achieve energy efficiency and demand reductions.	4/13/2016	No	Demand-side Management	$1,050,022	$1,050,022	$133,542	N/A	$133,542	$366,082	$0	Electric Power Research Institute (EPRI); San Diego Gas & Electric Company; To Be Determined; Enmetrics Systems; Ibis Networks; SkyCentrics; TBD - Technical Writer	$335,120	24.2%
2012-2014 Triennial Investment Plan	CEC	EPC-15-032** Bay Area Regional Energy Innovation Cluster	Applied Research and Development	This project will establish a Bay Area Regional Energy Innovation Cluster by expanding the Cyclotron Road program to provide commercialization support services to Bay Area entrepreneurs developing breakthrough materials and hardware devices in energy efficiency, energy storage, distribution, grid management, and power generation. This project will provide key services, infrastructure, expertise, and resources to energy entrepreneurs in the Bay Area region to successfully deploy and commercialize their innovations.	4/13/2016	No	Demand-side Management	$2,000,000	$2,000,000	$589,372	N/A	$589,372	$282,411	$0	Autodesk, Inc.; Lawrence Berkeley National Laboratory; Activation Energy, Inc.; DLA Piper LLP	$9,000,000	64.4%

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2015-2017 Triennial Investment Plan	CEC	EPC-15-032** Bay Area Regional Energy Innovation Cluster	Market Facilitation	This project will establish a Bay Area Regional Energy Innovation Cluster by expanding the Cyclotron Road program to provide commercialization support services to Bay Area entrepreneurs developing breakthrough materials and hardware devices in energy efficiency, energy storage, distribution, grid management, and power generation. This project will provide key services, infrastructure, expertise, and resources to energy entrepreneurs in the Bay Area region to successfully deploy and commercialize their innovations.	4/13/2016	No	Demand-side Management	$2,980,000	$2,980,000	$0	N/A	$0	$0	$0		$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-033 Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC	Applied Research and Development	Several technologies that deliver HVAC services and energy savings are being field tested at several schools in California. The technologies currently identified included in this study include heat recovery ventilators, air economizers, demand control ventilation, displacement ventilation, high performance filtration, and learning thermostats. These are advancements that are over and above the technologies typically used in California schools, and can greatly improve the energy efficiency of providing heating, cooling, and ventilation in classrooms.	4/13/2016	No	Distribution	$1,500,000	$1,500,000	$584,980	N/A	$584,980	$439,287	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-034 Emerging Energy Public Health Research Roadmap	Applied Research and Development	This research develops a research needs assessment that focuses on the known and potential public health impacts of emerging energy systems. The needs assessment is based on consultation with experts in emerging energy systems and occupational and environmental health (OEH) and with stakeholder representatives from labor, business, government, and community-based organizations.	4/13/2016	No	Generation	$151,000	$151,000	$135,899	N/A	$135,899	$0	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-035 Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability	Applied Research and Development	The project is quantifying current statewide energy use and costs attributable to groundwater pumping and developing near-term projections of energy use and statewide costs. The projections will factor in groundwater demand, groundwater levels, climate change scenarios, energy prices, and obstacles to implementing energy-efficient pumping and groundwater conservation measures. By expanding knowledge of the relationship between groundwater pumping and energy use, the proposed project will enhance the ability of the State of California and other stakeholders to coordinate water and energy resources planning. In addition, the project is providing key insights on how to improve groundwater use and pumping efficiency.	4/13/2016	No	Demand-side Management	$625,000	$625,000	$483,112	N/A	$483,112	$260,000	$0	Michael Hanneman	$22,550	3.5%
2012-2014 Triennial Investment Plan	CEC	EPC-15-036 Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling	Applied Research and Development	The research team developed and tested new forecast methods for temperature and humidity and extensive testing is taking place. The forecasts will be provided in the format used by energy planners and managers. The researchers are exploring the forecasting utility of parameters such as sea surface temperatures in the middle of the Pacific Ocean that can influence summer conditions in California months in advance. The decadal forecasts will be done using forecasts of large-scale predictor variables of climate from different research centers downscaled to the California region.	4/13/2016	No	Grid Operations/ Market Design	$400,000	$400,000	$151,154	N/A	$151,154	$53,531	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-037 Smart Ventilation for Advanced California Homes	Applied Research and Development	This project develops approaches and tools to enable smart ventilation techniques suitable for new and existing advanced and ZNE homes. Smart ventilation systems use information about current thermal, occupancy, system, and air quality conditions to optimize performance of ventilation-related equipment.	4/13/2016	No	Distribution	$1,500,000	$1,500,000	$621,240	N/A	$621,240	$649,037	$0	Lawrence Berkeley National Laboratory; United States Department of Energy; Aereco S.A.	$1,300,000	46.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-038** Central Valley Energy Innovation Cluster: BlueTechValley Energy Cluster	Applied Research and Development	This project expands access for clean energy entrepreneurs to a region-wide energy-water-food nexus incubator and commercialization services in California's Central Valley and North State regions. The Central Valley Energy Innovation Cluster (a.k.a. BlueTech Valley Energy Cluster) provides entrepreneurs with a variety of services, including technology evaluation, proof-of-concept validation and advisory support as well as opportunities to connect with investors, industry leaders and potential customers.	4/13/2016	No	Demand-side Management	$3,000,000	$3,000,000	$502,453	N/A	$502,453	$718,347	$0	Schatz Energy Research Center; California State University, Fresno Foundation; Los Angeles Cleantech Incubator; Kern Economic Development Corporation; Child Family Institute for Innovation and Entrepreneurship - UC Davis	$2,655,684	34.7%
2015-2017 Triennial Investment Plan	CEC	EPC-15-038** Central Valley Energy Innovation Cluster: BlueTechValley Energy Cluster	Market Facilitation	This project expands access for clean energy entrepreneurs to a region-wide energy-water-food nexus incubator and commercialization services in California's Central Valley and North State regions. The Central Valley Energy Innovation Cluster (a.k.a. BlueTech Valley Energy Cluster) provides entrepreneurs with a variety of services, including technology evaluation, proof-of-concept validation and advisory support as well as opportunities to connect with investors, industry leaders and potential customers.	4/13/2016	No	Demand-side Management	$2,000,000	$2,000,000	$0	N/A	$0	$0	$0		$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-039 Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle	Applied Research and Development	This project quantifies the impacts of large-scale solar arrays and long-term climate change on desert soil conditions (i.e. vegetation, microclimate, hydrology, and biogeochemistry) using coupled in- and ex-situ monitoring and analytical techniques, and determines the soil carbon budget response to these perturbations using climosequence analysis and advanced biogeochemical modeling. Data gathered in the course of this investigation provides the most comprehensive information to date on the influence of local soil surface and regional climate conditions on arid soil carbon storage and on soil biogeochemical processes more generally. The modeling and analytical work is at the forefront of studies on the desert soil carbon cycle and promises to yield fundamental insights into the terrestrial carbon budget in arid environments.	4/13/2016	No	Generation	$499,181	$499,181	$31,720	N/A	$31,720	$80,312	$0	SunPower Corporation	$72,000	12.6%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-040 Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy	Applied Research and Development	The project studies and tests the consequences of both passive and active relocation methods for burrowing owls (a California Species of Special Concern), and fills an existing need for robust scientific data on the relative effectiveness of relocation as a conservation method. Secondary goals are to provide data on owl movements and habitat use that will inform collision risk models and site selection decisions for renewable energy-generating facilities. The project team is fitting 50 owls with GPS tracking devices and dividing them into three study groups--active translocation, passive relocation, and a control group. Frequent site visits are providing information on mortality rates and reproductive output.	5/17/2016	No	Generation	$598,671	$598,671	$126,193	N/A	$126,193	$54,425	$0	United States Department Fish and Wildlife Service; Zoological Society of San Diego dba San Diego Zoo Global; Western Riverside County Regional Conservation Authority; Coachella Valley Conservation Commission	$602,936	50.2%
2012-2014 Triennial Investment Plan	CEC	EPC-15-041 MarketZero: Taking an existing grocery store to scalable near-ZNE	Technology Demonstration and Deployment	This project demonstrates a cost-effective pathway to achieving maximum energy efficiency in a grocery store. The project results in the identification and installation of a comprehensive cost-effective energy efficiency upgrade package that utilizes innovative strategies such as advanced heating, ventilating and air conditioning systems, refrigerants, fans, occupancy sensing measures and advanced lighting and controls. The project provides new design approaches that allow for rapid technology discovery and incorporation to ensure the most current technologies are implemented into the design.	4/13/2016	No	Demand-side Management	$2,999,591	$2,999,591	$515,848	N/A	$515,848	$846,723	$0	Whole Foods Market	$650,000	17.8%
2012-2014 Triennial Investment Plan	CEC	EPC-15-042 Zero Energy Residential Optimization - Community Achievement (ZERO-CA)	Technology Demonstration and Deployment	The project serves as proof of concept for large-scale deployment of Zero Net Energy (ZNE) single-family homes in California. The objective is to construct ZNE homes without creating undue cost burdens on builders, businesses or consumers, while assuring that changes to home design do not pose health, safety or other risks to occupants. The project also provides industry and regulators with a better understanding of site energy use and renewable energy generation.	5/17/2016	No	Demand-side Management	$4,819,805	$4,819,805	$530,175	N/A	$530,175	$1,488,701	$0	California Homebuilding Foundation (CHF)	$2,611,014	35.1%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-043 Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California	Applied Research and Development	This project develops a low-cost method that capitalizes on genomic data to create high-resolution spatial maps of bird populations and migration routes. This technology will be extended to identify migration routes for additional vulnerable and endangered species, assess population-level impacts of fatalities at renewable energy facilities, and map migration hotspots. This information will help with siting decisions of new facilities as well as operational decisions, such as when to turn off wind turbines to avoid vulnerable population fatalities, reducing the overall number of bird losses at renewable energy facilities. Accurate understanding of the distributions of vulnerable populations in space and time will lead to more effective siting, monitoring, and operation, ultimately lowering costs to California ratepayers.	4/13/2016	No	Generation	$599,236	$599,236	$0	N/A	$0	$114,850	$0	Regents of the University of California, Los Angeles	$888,250	59.7%
2012-2014 Triennial Investment Plan	CEC	EPC-15-044 Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	Applied Research and Development	This project is developing two key open-source software technologies: 1) Implementation of a complete, certified IEEE 2030.5 communication protocol that manufacturers can freely take and incorporate into their products. This reduces the cost and complexity of bringing systems to market, streamlines the certification process, and helps ensure that products can successfully connect and participate in grid programs; and 2) A certification procedure and associated test software by which any system or device can be checked for compliance to the standard. Independent evaluation provides manufacturers with an unbiased assessment of their products and provides both business and individual consumers with assurance that their purchases will work as expected. The project will validate the completeness and quality of these technologies by implementing the open-source client in a commercial DER system and performing field testing.	5/17/2016	No	Distribution	$816,539	$816,539	$169,696	N/A	$169,696	$203,973	$0	Electric Power Research Institute (EPRI); Xanthus Consulting International; SunSpec Alliance; Enphase Energy; QualityLogic	$243,722	23.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-045 Transactive Incentive Signals to Manage Electricity Consumption for Demand Response	Applied Research and Development	This project develops Transactive Load Management (TLM) signals, expressed in the form of proxy prices reflective of current and future grid conditions, and develops and implements software to calculate such signals. These signals are being designed to provide customers sufficient information to optimize their energy costs by managing their demand in response to system needs. The signals are transported via proven and available protocols and networks for use by projects that will test the efficacy of the TLM signals using the demand response projects awarded under GFO-15-311, Advancing Solutions that allow Customers to Manage Their Energy Demand.	5/17/2016	No	Grid Operations/ Market Design	$498,054	$498,054	$259,071	N/A	$259,071	$126,585	$0	Greenlots	$110,450	18.2%
2012-2014 Triennial Investment Plan	CEC	EPC-15-046 Developing a Distribution Substation Management System	Applied Research and Development	This project will develop an operational display for electrical distribution substations. This display along with the supporting software will show the current state of the distribution system, detect problems, and automatically suggest potential solutions to reduce outage times. The software will also automate routine and non-routine engineering and maintenance tasks that are performed on substation equipment.	5/17/2016	No	Distribution	$500,000	$500,000	$110,409	N/A	$110,409	$171,526	$0	Siemens Corporation, Corporate Technology	$455,000	47.6%
2012-2014 Triennial Investment Plan	CEC	EPC-15-047 Powernet - A Cloud Based Method for Managing Distribution Resources	Applied Research and Development	This project will further develop Powernet, a cloud-based method to manage energy resources in homes and businesses. Powernet will control and coordinate energy resources both behind the meter and at the distribution system for residential and commercial ratepayers to: (i) minimize costs, (ii) increase consumer quality of service, (iii) preserve grid stability and (iv) offer services to the grid.	5/17/2016	No	Distribution	$2,210,720	$2,210,720	$961,931	N/A	$961,931	$865,939	$3,500,000	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-048 Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources	Applied Research and Development	This project tests and validates an intelligent residential energy management system that communicates with a variety of DER such as solar PV, and energy storage in in 100 residences in San Diego, CA. The project integrates the use of pilot time-of-use utility rates in conjunction with simulated dynamic pricing signals to optimize cost savings. In addition, modeling and measuring the energy implications and costs without affecting occupant comfort is also being explored.	5/17/2016	No	Demand-side Management	$3,996,560	$3,996,560	$231,632	N/A	$231,632	$938,190	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-049 Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	Applied Research and Development	The project conducts a feasibility study that determines the value of energy storage and associated grid support benefits provided by Peak Hour Pumped Storage and Aquifer Pumped Hydro applications at an existing water bank. The feasibility study also identifies critical parameters for success for both technologies and identifies other water banking sites in the state where these technologies are likely to be successful.	5/17/2016	No	Generation	$197,300	$197,300	$123,116	N/A	$123,116	$15,276	$0	CIM Group	$199,353	50.3%
2012-2014 Triennial Investment Plan	CEC	EPC-15-050 Winery Water and Energy Savings	Technology Demonstration and Deployment	This project is testing two energy and water saving technologies at a winery facility in northern California. The first technology is a water treatment and reuse system to recycle wastewater for indoor barrel washing. The second is a wine-to-wine heat exchanger for the cold-stabilization of white wines. Both technologies have been installed on a single skid at the project location in Sonoma County, along with monitoring and verification equipment. Jackson Family Wines owns the bottling facility where the technologies are being tested.	5/17/2016	No	Demand-side Management	$1,989,201	$1,989,201	$90,870	N/A	$90,870	$157,088	$0	Jackson Family Wines	$404,625	16.9%
2012-2014 Triennial Investment Plan	CEC	EPC-15-051 The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings	Applied Research and Development	This project identifies, quantifies and evaluates the incremental costs and benefits of demand responsive (DR) lighting controls system requirements in the California Energy Code across existing, non-residential building stock. The project focuses on the incremental costs and benefits associated with adding the DR functionality to enhance general lighting upgrades in existing, non-residential buildings to enable them to act as DR resources.	5/17/2016	No	Demand-side Management	$500,000	$500,000	$412,875	N/A	$412,875	$130,529	$0	Energy Solutions	$138,648	21.7%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-052 ZipPower San Leandro	Market Facilitation	This project will develop and pilot a platform that optimizes distributed energy resource planning by integrating and automating all the data required to target optimal sites across city areas, and streamline pre-approval of the permitting and interconnection at those sites. The project will also use aggregated customer financing as an option to design, finance, deploy, scale, and replicate Advanced Energy Communities.	5/17/2016	No	Demand-side Management	$1,495,338	$1,495,338	$0	N/A	$0	$158,370	$0	ZipPower, LLC	$486,000	24.5%
2012-2014 Triennial Investment Plan	CEC	EPC-15-053 Customer-Centric Approach to Scaling IDSM Retrofits	Technology Demonstration and Deployment	This project develops and demonstrates an approach to scale residential retrofits for disadvantaged communities that will focus on customer-centric solutions. This project develops and demonstrates an innovative approach, focusing on energy efficient retrofit packages that are non-intrusive to occupants and have the potential of reducing energy use by 30 to 40 percent.	5/17/2016	No	Demand-side Management	$3,894,721	$3,894,721	$229,608	N/A	$229,608	$1,316,714	$0	Southern California Edison; BIRA Energy; LINC Housing Corporation	$799,559	17.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-054 Complete and Low Cost Retail Automated Transactive Energy System (RATES)	Applied Research and Development	This project will develop and pilot-tests a complete, low cost, and standards based Retail Automated Transactive Energy System (RATES), and behind the meter energy management solution. The purpose is to minimize the cost and complexity of customer participation in energy efficiency programs, maximize the potential of small loads to improve system load factor, shave peaks, integrate renewable generation, and provide low opportunity-cost resources to the grid. This project will work with Southern California Edison to facilitate customer participation and expand Demand Response Participation in the area served the Moorpark substation.	5/17/2016	No	Demand-side Management	$3,187,370	$3,187,370	$1,535,107	N/A	$1,535,107	$0	$0	Universal Devices, Inc.; TBD - Controls; TBD Electrical Contractor; TeMix, Inc.	$1,087,710	25.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-055 The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community	Market Facilitation	This project demonstrates how the City of Carson's disadvantaged downtown community worked with Chargebliss and its team to plan and design an advanced energy community that included an extensive electric vehicle charging network, high penetrations of photovoltaic (PV) generation, and stationary battery storage in their municipal parks and city-owned facilities. The project team is using transportation and utility data to best place EV charging stations in high utilization areas and how the increased energy demand will be balanced with solar and storage to minimize grid impacts. The team is conducting planning, permitting, financial modeling, and engineering design for over three megawatts of PVs and 40+ charging stations for a disadvantaged public sector and commercial area in the City of Carson. Charge Bliss is collaborating with two local government entities, South Bay Cities Council of Governments, and Southern California Association of Governments, as well as a collection of universities and private companies on this effort.	5/17/2016	No	Demand-side Management	$1,500,000	$1,500,000	$400,991	N/A	$400,991	$197,815	$0	Efacec; Edward Kjaer; Ji Min; Tanner Engineering	$96,937	6.1%
2012-2014 Triennial Investment Plan	CEC	EPC-15-056 Peninsula Advanced Energy Community (PAEC)	Market Facilitation	This project is planning and designing Solar Emergency Microgrid (SEM) within the southern portion of San Mateo County. The project is developing several case studies to guide SEM site selection based on which services will be included and their implicit or minimum loads, facility type, interconnection options, the resources available, and the proximity of the site to local hazards, in addition to available financing options. The project team is using these case studies to inform their work with the local planning and building departments to streamline zoning and engineering permitting for optimal SEM sites. To help incentivize microgrid investments, including for the project's SEM, the project team is working to establish a backup power valuation methodology to use in commercial applications.	5/17/2016	No	Demand-side Management	$1,318,997	$1,318,997	$738,937	N/A	$738,937	$312,711	$0	Natural Capitalism Solutions, dba Clean Coalition	$330,000	20.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-057 Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings	Applied Research and Development	The purpose of this project is to improve small and large commercial customer participation in demand response programs by providing a cost-effective energy management system that allows a wide range of service offerings as well as effective and automated price-based management. The project is providing a holistic solution and provides the demand response manager at each site with the following: 1) receive price signals and evaluate energy demand; 2) enable hetrerogenous customers to adapt to DR with individual preferences; 3) track, evaluate and control multiple devices; 4) interoperate with various building systems; 5) retain the electrical usage history of connected devices; 6) provide pricing based load management algorithms; 7) coordinate to maintain load diversity; 8) provide security and 9) provide customer value in addition to DR.	5/17/2016	No	Demand-side Management	$4,000,000	$4,000,000	$260,711	N/A	$260,711	$1,373,762	$0	Quantum Energy Services & Technologies, Inc. (DBA: QuEST); Siemens Corporation, Corporate Technology	$424,000	9.6%
2012-2014 Triennial Investment Plan	CEC	EPC-15-058 The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	Market Facilitation	This project is developing a model for a residential block-scale retrofit development of an integrated energy system combining energy efficiency, renewable generation, and water conservation technologies, called the EcoBlock. The development of the energy and water system components of the model serves as a case study to analyze different owner-operator, and financing structures that may be applicable to a residential community. This case study can help transform the EcoBlock model from a one-off demonstration to a sustainable and replicable model for the entire state. The City of Oakland will also use the EcoBlock model to develop new planning and permitting processes that can lower the time and cost of similar block-scale developments throughout the city.	5/17/2016	No	Demand-side Management	$1,500,000	$1,500,000	$119,752	N/A	$119,752	$117,432	$0	The Regents of the University of California on behalf of the Berkeley campus; Rexel Foundation; Morgan, Lewis & Bockius LLP; Arnold & Porter LLP; Perkins Coie	$769,846	33.9%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-059 UniGen Smart System for Renewable Integration	Applied Research and Development	This project is developing the UniGen Smart Software System to smooth energy output from a combination of variable energy resources (VERs). VERs generation often deviates from forecasts and schedules because of variations in weather. This can be alleviated by a fast-acting control system that automatically compensates for deviations from projected generation using a dedicated mix of energy resources (e.g., a photovoltaic system and an energy storage system). Onset's UniGen control system couples these resources with a primary power plant using proprietary algorithms in a software application in real time so that the combined output corresponds to the committed output. Any deviation is solved at the project or distributed level, making it easier for the ISO to manage grid performance.	5/17/2016	No	Grid Operations/ Market Design	$638,993	$638,993	$196,330	N/A	$196,330	$0	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-060 Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions	Applied Research and Development	This research quantifies how microhabitat conditions that affect rare plants, invasive plants, and sensitive insects vary across a gradient of solar energy configuration, including sites within a solar field, mitigation areas within a solar field, sites on the margin of a solar field, and similar undisturbed locations. Experiments are being used to determine how habitat variation affects target plant species and their essential species interactions, including herbivory, predation, and pathogens.	5/17/2016	No	Generation	$597,865	$597,865	$247,622	N/A	$247,622	$104,801	$0	Regents of the University of California (University of California, Davis); The Regents of the University of California, Santa Cruz	$103,297	14.7%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-061 Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	Market Facilitation	This project is funding the planning, permitting, and preliminary engineering needed for the integration of advanced energy technologies in a disadvantaged community. The design will provide locally generated, GHG-free electricity from community solar and storage to offset electricity consumption of participants who opt in to the AEC. The design will also enable participants to benefit from savings resulting from various onsite Integrated Demand Side Management (IDSM) actions at no up-front cost, including energy efficiency retrofits, demand response, energy management systems, and an energy education and support program. Participants will pay back retrofit costs and cost of capital for solar and storage assets through an on-bill financing mechanism, including a first-of-its-kind virtual net metering (VNEM) tariff across multiple county-owned sites and residential buildings piloted by Los Angeles Community Choice Energy (LACCE). The project has a strong focus on local outreach and engagement to promote community participation in the AEC, as well as robust data evaluation methods facilitated through the LA County Energy Atlas to ensure design and financing features are optimized.	5/17/2016	No	Demand-side Management	$1,497,996	$1,497,996	$61,580	N/A	$61,580	$449,666	$0	Regents of the University of California, Los Angeles; Los Angeles County Office of Sustainability	$316,807	17.5%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-062 Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems	Applied Research and Development	The project is testing several recently developed sensors with the capability to detect low NOx levels generated by dispatchable generation systems, such as internal combustion engines and/or micro-turbines. Deploying clean, efficient, distributed generation systems directly addresses goals stated in AB 32, SB 350, and the Clean Energy Jobs Plan. While reducing greenhouse gases and improving efficiency are vital, maintaining strict air emission standards is also important. DG systems often suffer performance degradation over time once deployed. As a result, it is critical that system performance be monitored and maintained. The proposed solution offers a cost effective means to monitor real time emissions performance of the system and information that can be used to optimize system performance and actually maintain low emission performance.	5/17/2016	No	Generation	$200,000	$200,000	$87,607	N/A	$87,607	$53,531	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-064 Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	Technology Demonstration and Deployment	This project demonstrates the installation of innovative technologies to retrofit an existing, low-income, mixed-use multi-unit building in a dense urban setting to become zero net energy (ZNE). Innovative strategies include a rapid new technology discovery and assessment approach, to ensure the most current emerging technologies are incorporated, as well as innovative measurement and verification. These approaches and other ZNE design process innovations are to be packaged into an advanced ZNE design methodology for use in the demonstration project as well as broad dissemination to the design and innovation community. Numerous technical innovations and pre-commercial technologies are planned for inclusion including dynamic chromatic glass, heat recovery ventilators, variable refrigerant flow, occupancy based plug-load management, and advanced light emitting diode lighting systems.	5/17/2016	No	Demand-side Management	$2,995,653	$2,995,653	$386,230	N/A	$386,230	$408,130	$0	Chinatown Community Development Center	$800,000	21.1%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-065 Berkeley Energy Assurance Transformation (BEAT) Project	Market Facilitation	The City of Berkeley is designing a clean energy microgrid community anchored around a public parking garage in the Downtown Berkeley area. The financing and regulatory models resulting from this project provide pathways for dense urban communities to develop microgrids that cross the public right-of-way (ROW) to maximize the resiliency and efficiency of distributed energy resources while reducing the city's carbon footprint. The financial and regulatory analyses from this project will help minimize the soft costs associated with the development of future community microgrid projects by proposing optimized owner-operator structures. Using this analysis, other dense, urban, microgrid projects looking to cross the public ROW will be able to accelerate the non-technical planning, modeling, and then deployment of their microgrids.	5/17/2016	No	Demand-side Management	$1,499,214	$1,499,214	$90,872	N/A	$90,872	$500,070	$248,009	URS Corporation; Center for Sustainable Energy; Office of Energy and Sustainable Development, City of Berkeley; West Coast Code Consultants Inc.; NHA Advisors; Bay Area Regional Energy Network	$250,121	14.3%
2012-2014 Triennial Investment Plan	CEC	EPC-15-066 Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego	Market Facilitation	This project will develop a prototype plan called the Encanto Social-Economic Education Development (EnSEED), designed to transform an existing disadvantaged community in Southeastern San Diego into a community of near-zero net energy (ZNE) buildings. This project will include close engagement with the local community, and development of a final system design, financing plan, and plan to obtain all required government review and approvals. A permitting plan will be developed to document the necessary permit processes and prepare permit applications to the point deemed complete by the responsible permitting agency. Upon completion of the permit review process, Groundwork will initiate the environmental review process with the City of San Diego. This process will determine the level of anticipated impact and type of environmental document needed.	5/17/2016	No	Demand-side Management	$1,500,000	$1,500,000	$780,641	N/A	$780,641	$129,898	$0	Blue Flame Energy Finance	$520,000	25.7%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-067 Integrated Community Resource Marketplace	Market Facilitation	This project pilots an innovative process for local governments and developers to aggregate community upgrade projects, helping lower costs by increasing buying power and reducing administrative costs. The Local Government Commission's process enables decision makers to prioritize community goals, review active building construction plans for the community, and connect local building projects with additional sources of capital that can help bring advanced energy technologies into the community. The system helps communities optimize available financing, and streamline planning and permitting for community projects. The system is currently being piloted for Fresno's Blackstone Corridor and Downtown Specific Plan.	5/17/2016	No	Demand-side Management	$1,500,000	$1,500,000	$444,152	N/A	$444,152	$432,890	$0	Local Government Commission	$12,445	0.8%
2012-2014 Triennial Investment Plan	CEC	EPC-15-068 Understanding and Mitigating Barriers to Wind Energy Expansion in California	Applied Research and Development	The research uses a combination of global re-analysis datasets, a unique set of observations, and high-resolution global climate model simulations to help identify and characterize the extent to which regions in California may exhibit vulnerability or new opportunity in terms of changes to wind resource magnitude, spatial and temporal variability, and/or operating conditions of sufficient magnitude to alter their viability for wind energy development. The unique strength and theme of this research lies in the use of a next generation variable resolution global climate model that has the ability to simulate climate change over a limited area region, i.e. California, in a computationally cost effective manner.	5/17/2016	No	Generation	$200,000	$200,000	$175,374	N/A	$175,374	$74,830	$0	UC Davis; DNV GL	$70,000	25.9%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-069 Lancaster Advanced Energy Community (AEC) Project	Market Facilitation	In collaboration with the City of Lancaster and Lancaster Choice Energy (LCE), this project will plan and permit a ZNE microgrid connected to a medium-density affordable housing project that enables the cost-effective deployment of advanced technologies. The microgrid design approach minimizes the impact of ZNE buildings and increasing renewables on the grid, increases DER design flexibility, and enables local control of energy management through LCE, all while exploiting the plummeting cost of islanding capability to provide valuable resiliency benefits to the community. The project team is also developing a community DER valuation framework that assesses the value of DERs on an aggregated and integrated network basis from multiple stakeholder perspectives by combining various value streams and evaluating evolving revenue and market participation opportunities. This framework is being used to inform the shared services model behind LCE's "Green District" program that integrates storage, solar, and smart building technology as a service for large commercial and industrial customers to reduce their demand charges while allowing LCE to save on procurement costs.	5/17/2016	No	Demand-side Management	$1,469,779	$1,469,779	$744,075	N/A	$744,075	$507,982	$0	City of Lancaster	$1,500,000	50.5%
2012-2014 Triennial Investment Plan	CEC	EPC-15-070 Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System	Applied Research and Development	This project develops and applies methodology to improve the representation of urban effects in probabilistic and short term forecasts for the electricity system. It quantifies intra-urban climate variability in California for inclusion into forecasts used by the Energy Commission and the utilities. The characterizations are based on state-of-science highly-urbanized atmospheric modeling supplemented by analysis of observational weather data. Detailed statistical correlations and analysis are being undertaken, focusing on summertime conditions, and transfer functions are being developed to facilitate use of results by the Energy Commission and utilities.	5/17/2016	No	Grid Operations/ Market Design	$193,326	$193,326	$95,017	N/A	$95,017	$14,035	$0	Altostratus, Inc.	$5,000	2.5%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-071 Zero Net Energy Farms	Market Facilitation	This project is developing and piloting a Project Management Application tool for farms and agricultural communities. Included in this tool is information gathered from a trade study of available equipment vendors that will compare cost effectiveness and reliability of technologies for solar, wind, anaerobic digestion, and gasification. A unique feature about this project is that it integrates Net Energy Metering Aggregation (NEMA), a program through the California Public Utilities Commission (CPUC) that enables agricultural communities to aggregate meters in a continuous property, with various other strategies to maximize the effectiveness of the Project Management Application. Development and testing will be done in collaboration with four local jurisdictions in the Central Valley, the San Joaquin Valley Air Pollution Control District, and the US Navy.	5/17/2016	No	Demand-side Management	$1,175,919	$1,175,919	$434,622	N/A	$434,622	$122,540	$0	West Hills Community College District; San Joaquin Valley Air Pollution Control District; Biodico, Inc.; Office of Community and Economic Development - CSU Fresno; City of San Joaquin; Fresno Council of Governments; PondelWilkinson; Red Rock Ranch, Inc.; San Joaquin Valley Clean Energy Organization ; 18Thirty Entertainment, LLC; City of Huron; Larry Alberg; Dr. Stephen Kaffka; Chelsea Teall, PE; Leon Woods III	$1,140,419	49.2%
2012-2014 Triennial Investment Plan	CEC	EPC-15-072 New Chemical Compounds for Cost-Effective Carbon Capture	Applied Research and Development	Many technologies for capturing carbon dioxide from fossil fuel energy conversion facilities use amines as solvents for carbon dioxide capture. Many practical shortcomings of amines could possibly be avoided, if a newly discovered naturally-occurring phosphoenol compounds featuring suitable combination of reaction enthalpy, solubility, viscosity and reaction rate would be further characterized and developed to be an inexpensive, non-toxic substitute for amines in carbon capture. The grant recipients are building upon their previous efforts by using sophisticated ab-initio quantum mechanical and molecular dynamics simulations to optimize and design a molecule from the class of phosphoenols by adding and removing different functional groups to make it more reactive with carbon dioxide (CO2) and more water soluble.	5/17/2016	No	Generation	$200,000	$200,000	$10,778	N/A	$10,778	$40,000	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-073 Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation	Applied Research and Development	This project is testing the effectiveness of innovative designs for demand response programs for residential customers using a behind-the-meter customer engagement platform developed by Chai Energy. Each of these innovative demand response strategies integrates a recent approach that energy researchers have shown to be effective in reducing customer consumption. These strategies include providing households with a) tailored energy-analytic feedback, b) aggregated versus single-period incentive information, c) non-financial environmental health benefit frames and d) social comparisons. An additional strategy is exploring how the timing of the delivered demand response information affects the magnitude of household participation and response.	5/17/2016	No	Demand-side Management	$2,007,875	$2,007,875	$181,556	N/A	$181,556	$203,115	$0	University of California Los Angeles; Chai Energy	$562,633	21.9%
2012-2014 Triennial Investment Plan	CEC	EPC-15-074 Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems	Applied Research and Development	This project develops co-optimization strategies for distributed energy resources (DERs). The purpose is to maximize customer and system value under existing CPUC-approved retail and California Independent System Operator (California ISO) wholesale tariff structures, future market structures and pricing, and the transactive energy pricing signals developed under agreement EPC-15-054. The project tests and configures two DER portfolios: a) one consisting of large retail customers and schools using battery energy storage, solar photovoltaics, and integrated load management, and b) the other consisting of hotels using passive thermal energy storage and energy efficiency. Both will be included as part of an integrated load management strategy, to respond to price signals as well as develop operational strategies that provide best practices for wholesale integration subject to the identified retail and wholesale tariffs and operational constraints.	5/17/2016	No	Grid Operations/ Market Design	$3,960,805	$3,960,805	$613,409	N/A	$613,409	$746,794	$0	Solar City Corporation;	$1,981,262	33.3%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-075 Customer-centric Demand Management using Load Aggregation and Data Analytics	Applied Research and Development	This project demonstrates how a large number of small electric loads, each impacted by and tuned to individual customer preferences can provide load management for both utilities and the California Independent System Operator (California ISO). The recipient works with an extensive spectrum of leading product providers covering all major distributed energy resources (DERs), such as Nest (thermostats), ThinkEco (plug loads), Honda and BMW (Vehicle Grid Integration), EGuana (smart Inverter) and Ice Energy (Thermal Storage). A variety of price signals are being tested for Time-of-Use customers such as Critical Peak Pricing and Demand Rate. The project is using deep analytics to evaluate individual customer preferences for demand management using microdata from devices and aggregate the responses to meet grid needs at different distribution and transmission levels.	5/17/2016	No	Demand-side Management	$3,998,587	$3,998,587	$118,850	N/A	$118,850	$1,163,894	$0	Electric Power Research Institute (EPRI); InTech Energy, Inc.; Pedagogy World, Inc.	$1,270,312	24.1%
2012-2014 Triennial Investment Plan	CEC	EPC-15-076 Richmond Advanced Energy Community Project	Market Facilitation	The City of Richmond Advanced Energy Community project will facilitate adoption of a comprehensive integrated policy, planning, program, and financing framework to transform the City of Richmond into a Zero Net Energy Community, using forward-looking policies that integrate energy, land use, and transportation planning, and progressive municipal financing mechanisms. As part of the project, ZNE Alliance will also facilitate the planning and permitting of approximately 20 abandoned homes to be converted into affordable ZNE homes available to working families via the First-time Home Buyers' Program. This redevelopment project will be accomplished by a Social Impact Bond administered by the Richmond City Council.	5/17/2016	No	Demand-side Management	$1,480,111	$1,480,111	$593,860	N/A	$593,860	$370,990	$0	Energy Solutions; City of Richmond; Olivine, Inc.; Richmond Community Foundation	$2,590,134	63.6%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-077 Huntington Beach Advanced Energy Community Blueprint	Market Facilitation	This project is designing an integrated energy system to transform the disadvantaged Huntington Beach community of Oak View, into an advanced energy community (AEC). UCI is working closely with ComUNIDAD, a community organization, to ensure the community needs are factored into modeling scenarios. The project team is developing new design tools that simulate an integrated energy infrastructure on a community-scale, expanding the capability from the existing single-building design tools. Multiple case studies will be evaluated for the most optimal energy technologies and business and financial models that align the community's various energy needs within the constraints of the existing electricity infrastructure.	5/17/2016	No	Demand-side Management	$1,500,000	$1,500,000	$337,423	N/A	$337,423	$508,226	$0	Southern California Gas Company (SoCalGas); Southern California Edison; County of Orange/City of Huntington Beach; The Regents of the University of California, Irvine Advanced Power and Energy Program; National Renewable Energy Laboratory (NREL); Altura Associates, Inc.	$810,998	35.1%
2012-2014 Triennial Investment Plan	CEC	EPC-15-078 Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector	Applied Research and Development	Researchers are developing a framework for assessing climate change risk and adaptation practices in the electricity sector, identifying perceived barriers to execution of resilience strategies, and delineating practices that are currently being implemented in the electricity sector. These initial activities form a basis for developing a dynamic model for long-term resilience planning that can identify optimal strategies to hedge against climate risks associated with future climate scenarios for California. The analysis also considers how independently initiated adaptation efforts perform relative to a system-wide strategy, with an eye toward identifying lingering electricity sector vulnerabilities.	5/17/2016	No	Grid Operations/ Market Design	$350,000	$350,000	$48,202	N/A	$48,202	$0	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-079 Advanced Renewable Energy Storage and Recycled Water Project	Technology Demonstration and Deployment	The Victor Valley Wastewater Reclamation Authority (VVWRA), in partnership with Primus Power, University of California Riverside (UCR), and Anaergia, is demonstrating an advanced, pre-commercial flow battery storage and control system at VVWRA's existing Regional Wastewater Treatment Plant, located in a disadvantaged community outside of Victorville. The project deploys Primus Power's ENERGYPOD flow battery system in a 240 kW/1,200 kWh configuration, managed by a UCR-designed controller system that is optimized specifically for management, generation and storage of renewable energy power. The project hopes to alleviate rapid fluctuations in the wastewater treatment plant's power demand that causes disruption of the disinfection system used to treat recycled water to California standards, resulting in the disposal of approximately 2.5 million gallons of water annually.	5/17/2016	No	Demand-side Management	$1,734,059	$1,734,059	$127,244	N/A	$127,244	$220,423	$0	Primus Power Corporation; Victor Valley Wastewater Reclamation Authority (VVWRA)	$902,215	34.2%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-080 Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies	Applied Research and Development	This pilot study for electricity sector climate adaptation involves vigorous stakeholder engagement and systems analysis to identify and systematically account for cascading impacts internal to and outside of the electricity sector as well as resilience options. These cascading impacts include climate impacts to supply chains for electricity generation and distribution, disruption to telecommunications that the electricity sector relies on in emergencies, and other impacts that may be initially felt far away but have consequences for California's electricity system. One example of supply chain interruption is that manufacturing facilities in East Asia that produce 500kV transformers, which the California distribution system relies on, are susceptible to flooding and other extreme events linked to climate change. This study pilots a systematic framework for assessing such long-distance linkages that can disrupt electricity services and cause ripple or cascading effects on critical infrastructure in the Greater Los Angeles region. Findings from this project, which includes many diverse stakeholders, could be used to inform planning in other areas of the state.	5/17/2016	No	Generation	$128,188	$128,188	$20,240	N/A	$20,240	$0	$0	None	$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-081 Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	Applied Research and Development	Analysis of quantitative and qualitative data sheds light on histories of key energy technology changes, planned and unplanned. Interpretation of these histories will provide examples, principles and insights that can be used in future planning. The research team is producing example scenarios that illustrate the differences that these insights can make in planning and technology design. This research pays particular attention to developing and disseminating this information in usable ways, via dialogue with policy makers and planners, and through communications with other stakeholders. Leveraging insights from historical technology transitions, the research team is designing, deploying and testing a flexible modeling platform with which researchers, utilities, and Energy Commission demand modeling and forecasting staff can draw upon the best available empirical data to simulate dynamic residential demands for AC. This model serves as a proof of concept that might later be broadened to other energy uses and demand sectors.	5/17/2016	No	Grid Operations/ Market Design	$400,000	$400,000	$0	N/A	$0	$0	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-082 Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation	Applied Research and Development	The project demonstrates operation of a microplasma array reactor converting a mixture of carbon dioxide and methane (two potent greenhouse gases) to synthesis gas, which could be combusted in gas turbines to produce electricity with very low emissions. The effort builds and characterizes a microplasma reactor ignited by high voltage nanosecond pulses to determine dependence of conversion rate, selectivity, and energy efficiency on plasma operating parameters. A performance model will be developed to optimize the conversion process and design an array reactor comprised of several individual reactors to demonstrate scale-up.	5/17/2016	No	Generation	$200,000	$200,000	$38,380	N/A	$38,380	$35,171	$0	The Regents of the University of California, Merced	$47,199	19.1%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-083 Empowering Proactive Consumers to Participate in Demand Response Programs	Applied Research and Development	This project contains three elements to provide data for policymakers and businesses to explore this new market. First, this project determines prosumer (producer/consumer) interest in a third-party demand response market by testing user acquisition via direct and non-direct engagement strategies. Second, experimentation with behavioral and automated users allows analysis of user yield under a variety of conditions and extract a set of shadow curves that can inform how much energy load shifting can be expected under various price incentives. Finally, this project creates a novel solution for using residential telemetry to connect prosumers and their Internet of Things (IoT) devices to the market operators.	5/17/2016	No	Demand-side Management	$3,995,028	$3,995,028	$1,789,516	N/A	$1,789,516	$33,903	$0	Honeywell, Inc.; Schneider Electric USA Inc.; OhmConnect, Inc.	$1,877,378	32.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-084 Total Charge Management: Advanced Charge Management for Renewable Integration	Applied Research and Development	This project explores the benefits and opportunities of Total Charge Management, where electric vehicle charging is managed across multiple charging events to maximize vehicle load flexibility. The project tests how flexible electric vehicle load can be if managed across a driver's daily or weekly charge events. This flexibility utilizes several pricing mechanisms to estimate the benefits of the Total Charge Management approach. The research develops and evaluates advanced vehicle telematics for utilities and grid operators to align vehicle battery status, driver mobility needs and grid conditions. Collaboration between the grid and the driver can yield a charging load profile that minimizes energy costs by aligning daily and weekly charging events to best meet grid needs.	5/17/2016	No	Demand-side Management	$3,999,900	$3,999,900	$250,374	N/A	$250,374	$207,398	$0	BMW of North America, LLC; Kevala, Inc.	$411,931	9.3%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-085 San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project	Technology Demonstration and Deployment	This project integrates pre-commercial energy efficiency measures, building automation and control systems, and behind the meter solar photovoltaic in three existing public libraries in San Diego. The project also evaluates the addition of energy storage. In addition, the project engages in a multiyear, flexible, and transparent collaboration to uncover, test, verify and publicize strategies for integrating energy efficiency, energy storage, solar photovoltaics, and other demand side resources to achieve near zero net energy and cost-effectiveness.	6/14/2016	No	Demand-side Management	$2,715,516	$2,715,516	$208,635	N/A	$208,635	$313,516	$0	San Diego Gas & Electric Company; City of San Diego; San Diego Green Building Council	$543,568	16.7%
2012-2014 Triennial Investment Plan	CEC	EPC-15-086 Substation Automation and Optimization of Distribution Circuit Operations	Applied Research and Development	This project will provide enhanced electrical substation control over grid assets, including generation resources, energy storage and controllable loads. This will improve grid management at the distribution level through the modification, implementation, and simulation of a Generic Microgrid Controller (GMC). Different tariffs and interconnection agreements will be assessed for a portfolio of scenarios to address the participation of DERs in the market. In addition, a fictitious retail/distribution market will be developed and assessed.	6/14/2016	No	Distribution	$932,718	$932,718	$331,241	N/A	$331,241	$124,021	$0	The Regents of the University of California, Irvine Advanced Power and Energy Program; OPAL-RT Corporation	$112,281	10.7%
2012-2014 Triennial Investment Plan	CEC	EPC-15-087 Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings	Technology Demonstration and Deployment	This agreement is funding the full-scale deployment demonstration of the Vortex Process Technology in cooling towers of commercial buildings. This technology has been used successfully in Europe and will be testing in California to address state specific goals for water and energy savings.	6/14/2016	No	Demand-side Management	$1,999,995	$1,999,995	$382,981	N/A	$382,981	$485,121	$0	Electric Power Research Institute (EPRI); Cypress LTD	$449,990	18.4%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-088 Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings	Technology Demonstration and Deployment	The project is demonstrating that Biofiltration is a technically viable and commercially attractive approach to achieve significant electrical energy savings at wastewater treatment plants. This project is quantifying the electrical energy reduction and water savings that can be achieved by Biofiltration based on demonstration results at the Linda County Water District plant. This project will provide the cost and performance data to evaluate the benefits from a sustained, full scale validation testing, including quantification of electrical energy savings, determination of water savings, organic solids removal efficiencies, operation and maintenance and design criteria, independent monitoring and verification and technology transfer.	6/14/2016	No	Demand-side Management	$1,306,185	$1,306,185	$73,375	N/A	$73,375	$442,698	$0	Kennedy/Jenks Consultants; Linda County Water District; WesTech, Inc.; Professor George Tchobanoglous, Ph.D., P.E.	$271,750	17.2%
2012-2014 Triennial Investment Plan	CEC	EPC-15-089 Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases	Applied Research and Development	This project supports open communication with energy storage systems by focusing on a Distributed Network Protocol (DNP3) for smart inverters. The Recipient will develop tools to make adoption of DNP3 for communication and controls of distributed energy resource (DER) systems simple and seamless. An ancillary benefit will be to improve communications with stand-alone energy storage systems and control of other inverter-based devices, including solar and plug-in electric vehicle fleets. The approach is to evaluate the current state of communications to DERs and address any gaps in functionality, work with the DNP3 Users Group to update the existing energy storage and solar specifications to support the most advanced energy storage use cases, create an open-source DNP3 client to simplify product development of smart inverters, and develop the appropriate conformance testing tools to ensure interoperability.	6/14/2016	No	Distribution	$873,516	$873,516	$146,460	N/A	$146,460	$187,517	$0	Electric Power Research Institute (EPRI); Xanthus Consulting International; SunSpec Alliance; MESA Standards Alliance	$360,828	29.2%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-090 Integrated Distributed Energy Resources Management System (iDERMS)	Applied Research and Development	This project will develop an Integrated Distributed Energy Resource Management System (iDERMS) to coordinate the operations of a large number of DERs. In the normal state, large amounts of DERs consisting of flexible loads, renewable resources, and energy storage systems will be aggregated together. The DERs will be coordinated to optimize power flow and respond to a distribution system operator run electricity market. In an emergency state, Volt-VAR control will be used to provide any needed reactive power support to the distribution grid with smart inverters. The final restorative state will be developed to use high levels of renewable resources to make the distribution network a self-healing grid.	6/14/2016	No	Distribution	$1,119,437	$1,119,437	$145,524	N/A	$145,524	$77,873	$0	University of California, Riverside; Lawrence Livermore National Laboratory; eMIT, LLC; PetaPower, Inc.	$686,427	38.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-091 Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System	Technology Demonstration and Deployment	This project addresses the specific problem of fixed watering schedules for agricultural crops by demonstrating a new irrigation system that saves both water and energy. This system performs on the principle that crops are watered only when needed, and not just on a set time-interval. The additional benefits of this system are the improved quality and yield of the crop. The goals of this project are to demonstrate the Plant Aware Irrigation (PAI) system on perennial crops, quantify the energy and water savings for at least 12 months, and engage customers' feedback of perceived benefits while acknowledging their concerns. The technology is being demonstrated in three vineyards.	6/14/2016	No	Demand-side Management	$1,097,990	$1,097,990	$61,980	N/A	$61,980	$307,688	$0	Fruition Sciences	$331,000	23.2%
2012-2014 Triennial Investment Plan	CEC	EPC-15-092 Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal	Technology Demonstration and Deployment	The project is demonstrating a bio-filtration system that uses 15-20 percent less energy when compared to conventional technology used to treat contaminated water to meet drinking water standards or for use in industrial and/or agricultural applications. The technology is being demonstrated in the City of Barstow and the focus is removal of nitrate, perchlorate and turbidity from the wastewater. The project includes water testing to secure Conditional Acceptance as a Title 22 drinking water treatment technology from the State Water Resources Control Board.	6/14/2016	No	Demand-side Management	$1,722,072	$1,722,072	$951,622	N/A	$951,622	$9,920	$0	MWH; City of Barstow; Tomorrow Water dba BKT United; Kana Engineering Group, Inc.; Khalil Kairouz Consulting; Eurofins Eaton Analytical	$417,497	19.5%

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2015-2017 Triennial Investment Plan	CEC	EPC-15-093 Accelerating Drought Resilience Through Innovative Technologies	Market Facilitation	This project is pulling data from county utilities to find what industries had the highest energy impact during the drought. Then, the project will provide input on what water-energy technologies would have had lessened the impact during future droughts. Finally, the team will assist local jurisdictions in implementing strategies and measures that reduce development times and costs, as well as recommending innovative financing mechanisms and cutting edge water-energy technologies. The recipient is piloting the model for Tulare County in an effort to develop a roadmap for implementation of the model in other similar rural agricultural communities.	6/14/2016	No	Demand-side Management	$1,000,000	$1,000,000	$330,347	N/A	$330,347	$178,824	$0	None	$0	0.0%
2012-2014 Triennial Investment Plan	CEC	EPC-15-094** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Technology Demonstration and Deployment	This project is demonstrating cost-competitive ZNE design strategies that combine occupant needs with technology solutions to create new pathways for residential ZNE communities. The project's goals are cost effectiveness for the customer, affordability, overcoming customer apprehension, establishing a track record of new technology for builders, enabling distribution grid integration, creating a planning process for ZNE communities, evaluating community solar and evaluating the impact of future changes to ZNE cost effectiveness. This project also aims to understand the operation and energy use of the unregulated loads.	6/14/2016	No	Demand-side Management	$3,207,432	$3,207,432	$4,112	N/A	$4,112	$1,460,838	$0	Electric Power Research Institute (EPRI); Southern California Edison; De Young Properties; Meritage Homes Corporation	$1,509,482	23.4%
2015-2017 Triennial Investment Plan	CEC	EPC-15-094** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Technology Demonstration and Deployment	This project is demonstrating cost-competitive ZNE design strategies that combine occupant needs with technology solutions to create new pathways for residential ZNE communities. The project's goals are cost effectiveness for the customer, affordability, overcoming customer apprehension, establishing a track record of new technology for builders, enabling distribution grid integration, creating a planning process for ZNE communities, evaluating community solar and evaluating the impact of future changes to ZNE cost effectiveness. This project also aims to understand the operation and energy use of the unregulated loads.	6/14/2016	No	Demand-side Management	$1,735,377	$1,735,377	$0	N/A	$0	$0	$0		$0	0.0%

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2012-2014 Triennial Investment Plan	CEC	EPC-15-096 Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System	Technology Demonstration and Deployment	This project is demonstrating three leak detection technologies to reduce the amount of water lost from leaks and the amount of embedded energy wasted due to these leaks. The technologies tested include satellite imagery leak detection, correlating continuous acoustic monitoring, and flow sensitive pressure reducing valves and will have site demonstrations in four Southern California cities. The Recipient will present achievable and measurable water savings in water distribution systems and show the potential for water and energy savings. An economic analysis of the costs and benefits of the technologies will be developed to assist in considering solutions for water loss reduction and energy efficiency. The project benefits will be quantified through water saved, embedded energy saved and associated greenhouse gas emissions reduced.	6/14/2016	No	Demand-side Management	$1,517,780	$1,517,780	$67,681	N/A	$67,681	$222,664	$0	Hazen & Sawyer; American Water Works Company, Inc.; Echologics	$391,461	20.5%
2015-2017 Triennial Investment Plan	CEC	EPC-15-097 Achieving Zero Net Energy in Multi-family Buildings	Applied Research and Development	This project demonstrates the potential of breakthrough electric water heating and space conditioning technologies as a pathway to zero net energy. The project explores the complex, interdependent systems in multifamily buildings and how they work together to achieve zero net energy status for the buildings in a cost-effective manner. Four multifamily buildings, designed to be affordable, are to be evaluated in various stages of design and development. These buildings share a goal of all electric zero net energy construction with 100 percent renewable energy generation, and utilize innovative new heat pump technologies to serve the buildings water heating and/or space conditioning needs.	6/14/2016	No	Demand-side Management	$1,955,811	$1,955,811	$577,227	N/A	$577,227	$0	$0	Resources for Community Development; Corporation for Better Housing	$290,090	12.9%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-001 Measure Results from Affordable Zero Net Energy Homes	Applied Research and Development	The project implements lessons learned from previous high performance housing research and measures the results in two new homes being built in partnership with Habitat for Humanity. Both houses include advanced architectural design features, high performance enclosures, advanced heating, ventilating and air conditioning systems, and low-cost water heating systems. One all-electric home and one mixed fuel (combined electric and natural gas) home is being built to demonstrate the respective cost-effectiveness of each set of features. In addition to measuring results from actual occupancy, the project is developing a guide to affordable residential zero net energy design and construction, a training curriculum, and offers training opportunities based on the project results. The houses are in a disadvantaged community in Stockton.	7/13/2016	No	Demand-side Management	$1,000,000	$1,000,000	$155,701	N/A	$155,701	$325,815	$0	Southern California Gas Company; Dettson	$168,500	14.4%
2015-2017 Triennial Investment Plan	CEC	EPC-16-002 Pathways to More Cost-Effective ZNE Homes	Applied Research and Development	This paper study provides detailed cost-effectiveness modeling of all electric, Zero Net Energy (ZNE) homes compared to mixed-fuel ZNE homes with gas-based heating. Evaluation includes costs of building integration, energy efficiency packages, installed equipment, and lifetime investment costs. The project provides spatial and temporal analyses to enable an assessment of cost-effectiveness in four California climate zones. This information will help policy makers better understand the cost and benefit tradeoffs of ZNE policy - and allow for more informed planning to reach ZNE targets in 2020 and 2030. It will also provide the information on the climate trade-offs of all electric homes compared to those with electric and gas service.	7/13/2016	No	Demand-side Management	$1,000,000	$1,000,000	$632,840	N/A	$632,840	$436,541	$0	Lawrence Berkeley National Laboratory	$50,000	4.8%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-003 Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package	Applied Research and Development	This project tests an integrated building control package that maximizes energy efficiency for existing commercial buildings. The project refines novel control algorithms that utilize shared device state and environmental data for lighting, fenestration and heating, ventilating and air conditioning (HVAC) systems. Sharing data from multiple device types will further improve overall, sustained, system performance and operation. Control algorithms prioritize lighting or heating/cooling savings based on climate and building design. HVAC system management leverages passive ventilation through windows and skylights and dynamic adjustment of HVAC set point dead bands.	7/13/2016	No	Demand-side Management	$1,999,089	$1,999,089	$222,536	N/A	$222,536	$392,705	$0	Regents of the University of California, Davis - California Lighting Technology Center	$263,927	11.7%
2015-2017 Triennial Investment Plan	CEC	EPC-16-004 Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices	Applied Research and Development	This project develops and evaluates cost-effective packages of pre-commercial integrated energy efficiency measures and controls to achieve zero net energy (ZNE) performance for small commercial offices in California. The packages target a minimum of 50 percent energy savings. Lawrence Berkeley National Laboratory's FLEXLAB are testing whole-building integrated systems under varied climate and use conditions. Data on energy, occupant comfort, and occupant behavior are being analyzed and packaged into best practices to be replicated elsewhere in the State.	7/13/2016	No	Demand-side Management	$2,000,000	$2,000,000	$1,175,556	N/A	$1,175,556	$706,115	$0	Northern California test site partner	$2,000,000	50.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-005 Energy Efficient HVAC Packages for Existing Residential Buildings	Applied Research and Development	This project demonstrates innovative pre-commercial, cost-effective retrofit packages for cooling and ventilation for single family homes. Energy savings, occupant behavior and indoor air quality (IAQ) are to be measured for two specific retrofit packages that each includes three innovative technologies: (1) building envelope sealing, (2) two variants of smart mechanical ventilation that include pre-cooling strategies, and (3) compressor-free evaporative air-conditioning. Furthermore, barriers and opportunities towards adoption of such retrofits are to be identified through stakeholder interviews.	7/13/2016	No	Demand-side Management	$1,200,000	$1,200,000	$59,145	N/A	$59,145	$366,421	$126,000	None	$0	0.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-006 Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water	Applied Research and Development	The project is testing an innovative, low energy, zero liquid discharge water treatment system using adsorption process to potentially remove arsenic and other contaminants from a groundwater reservoir. The project is developing a demonstration-scale water treatment system to determine operational costs, energy and water savings of the single use adsorption system The demonstration will validate the reduction in spent adsorption media by natural dehydration to further save energy and water associated with residual solid waste handling. The project includes testing and reporting to secure state mandated acceptance of the novel drinking water treatment technology.	7/13/2016	No	Demand-side Management	$986,262	$986,262	$317,540	N/A	$317,540	$0	$0	ES Engineering Services, LLC; Khalil Kairouz Consulting; Enova Water LLC; AQUAlity Engineering, Inc.; Municipal Management Group, Inc.	$194,904	16.5%
2015-2017 Triennial Investment Plan	CEC	EPC-16-007 Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	Applied Research and Development	The recipient uses EnergyPlus, a building energy modeling tool, to analyze the cost-effectiveness of various electricity saving/generation measures for multifamily and commercial buildings in California. Each building type and climate zone will receive a cost-benefit analysis for each measure individually and an optimized package of measures to achieve as close to zero net energy as is cost-effectively possible.	7/13/2016	No	Demand-side Management	$1,000,000	$1,000,000	$181,205	N/A	$181,205	$151,821	$0	Electric Power Research Institute (EPRI); University of California, Davis	$105,000	9.5%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-008 Santa Monica Advanced Energy District	Market Facilitation	The city of Santa Monica is designing an Advanced Energy District with a multiuser microgrid to be anchored at the City Yards, an old landfill site which is where most of the city's municipal buildings and fleets are housed. The microgrid will integrate a suite of local renewable energy sources, energy storage, and controllable loads into a single system that will later be scaled to interconnect adjacent, public and private properties inclusive of the Metro Maintenance Facility. The project team is exploring what role the city can play in delivering and wheeling power between customers, and what special utility tariffs and financing can help incentivize a system that shares the value of distributed energy resources equitably. The project team will then develop a financial and ownership model for constructing and operating a multiuser microgrid that achieves net zero, or near net zero energy district for the customers. A case study and "tool kit" of outreach materials is also being developed to share with stakeholders and other local governments.	8/10/2016	No	Demand-side Management	$1,487,609	$1,487,609	$0	N/A	$0	$570,347	$0	Arup North America Ltd; City of Santa Monica; Hathaway Dinwiddie Construction Company; Miller Hull Partnership; Buro Happold Engineering	$253,030	14.5%
2015-2017 Triennial Investment Plan	CEC	EPC-16-009 Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse	Applied Research and Development	The project is testing a low-energy, dual barrier, direct potable reuse system, known as dprShield, with breach-activated barrier technology to demonstrate that this technology can improve public health safeguards and reduce the electrical energy, chemical consumption, maintenance and overall cost for potable reuse of municipal wastewater. While being energy efficient and cost-effective, this system effectively removes trace contaminants through two tight membranes. In the event that one of the membrane barriers is breached, a Breach Activated Barrier is triggered and the contaminants are pushed away from the clean water stream, ensuring safe operation in real time. This direct potable reuse technology could replace more energy intensive processes.	8/10/2016	No	Demand-side Management	$999,795	$999,795	$380,180	N/A	$380,180	$248,634	$0	Orange County Water District; Leland Stanford Junior University; Porifera, Inc.; City of Hayward	$144,784	12.6%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-010 Improving Water and Energy Efficiency in California's Dairy Industry	Applied Research and Development	This project tests and demonstrates two novel approaches to cooling livestock. With conduction cooling, the bedding area beneath the cow is cooled using heat exchange mats below the stall bedding. To reduce energy consumption, water flowing through the heat exchange mats is chilled using a novel Sub-Wet Bulb Evaporative Chiller. The second approach, targeted convection cooling, uses fabric ducting to direct cool air on the cows. The air is cooled using high-efficiency direct evaporative coolers. Both approaches promise significant water and energy savings, when compared to current approaches.	8/10/2016	No	Demand-side Management	$1,000,000	$1,000,000	$24,800	N/A	$24,800	$191,936	$0	Regents of the University of California (University of California, Davis)	$164,710	14.1%
2015-2017 Triennial Investment Plan	CEC	EPC-16-011 Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations	Applied Research and Development	This project is demonstrating the performance of an innovative "amphiphilic" membrane (i.e., a combination of hydrophilic and hydrophobic properties) that keeps organic and inorganic foulants away from the membrane surface by incorporating an anti-adhesive. The amphiphilic membrane retards long-term foulant deposition, which allows for higher water flow through the membranes, increased water yield, and improved energy efficiency. The project demonstrates the effectiveness of the technology in treating surface water, backwash water and synthetic reclaimed water. Data is collected to document savings and benefits in order to encourage commercialization. Implementation of this technology does not require capital investment. Instead, treatment facilities could replace existing hydrophilic membranes with the amphiphilic membranes during routine scheduled membrane replacements.	8/10/2016	No	Demand-side Management	$882,430	$882,430	$66,873	N/A	$66,873	$304,611	$0	Kennedy/Jenks Consultants; BASF; California Water Services	$98,600	10.1%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-012 Power and Water Saving Advanced Hybrid Air/Wet Cooling System	Applied Research and Development	This project uses high performance porous fins to enhance cooling through water vaporization and mass transfer. By retrofitting the heat exchanger with a water spray feature, this project has the potential to reduce energy and water use of refrigeration systems in California..	8/10/2016	No	Demand-side Management	$999,994	$999,994	$562,840	N/A	$562,840	$529,685	$0	Altex Technologies Corporation	$187,207	15.8%
2015-2017 Triennial Investment Plan	CEC	EPC-16-013 Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	Applied Research and Development	This project develops an optimal system configuration for smart comfort controlled ceiling fans integrated with learning thermostats. This system is to be tested and evaluated for energy performance and occupant acceptance in low income multi-family residential and small commercial buildings in disadvantaged communities in California. This research and development advances the solution's technology readiness level and support market adoption acceleration. A design guide and energy code language are to be developed to facilitate widespread adoption.	8/10/2016	No	Demand-side Management	$1,888,683	$1,888,683	$223,389	N/A	$223,389	$0	$0	Center for the Built Environment - UC Berkeley; BIG ASS FANS	$315,926	14.3%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-014 A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse	Applied Research and Development	This project is demonstrating how to reduce the energy used to remove salt from wastewater using the flow-through electrode capacitive desalination (FTE-CD) technology. This advanced technology removes salt from water by applying an electric field to two porous electrodes. The electrodes act like a magnet for salt while the field is applied and remove the salt from water that flows through the electrodes using less energy and less costly than reverse osmosis (RO). Energy use of an FTD-CD system is projected to be 50% less compared to the energy use for an RO system. The recipient is partnering with two water districts to test the use of FTE-CD devices to desalinate wastewater and determine how this small, flexible device can improve the energy and operating efficiency of wastewater treatment solutions for communities. Wastewater from the industrial and municipal sectors will be used to test the technology along with measuring energy use and performance, such as fouling and other operation issues.	8/10/2016	No	Demand-side Management	$999,040	$999,040	$375,000	N/A	$375,000	$448,176	$0	None	$0	0.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-015 Los Angeles Regional Energy Innovation Cluster	Market Facilitation	This project established the Los Angeles Regional Energy Innovation Cluster to act as a regional hub of clean energy entrepreneurship, and gives promising clean energy entrepreneurs direct access to the region's top technical, business, and commercialization clean energy support services. This project assesses and addresses the LA region's energy needs by making use of and expanding the LA Cleantech Incubator's existing, successful resources (facilities, coaching, business support) for entrepreneurs in LA, and expand to three additional counties (Orange, Santa Barbara, Ventura). This project will support entrepreneurs through the region and interconnect the clean energy economy throughout the state.	8/10/2016	No	Demand-side Management	$4,999,247	$4,999,247	$244,752	N/A	$244,752	$541,645	$0	California State University, Long Beach Research Foundation; Southern California Edison; Community Environmental Council; California State University, Northridge; Economic Development Corporation of Los Angeles County; California State Polytechnic University Pomona; Los Angeles Cleantech Incubator; Los Angeles Cleantech Incubator; Los Angeles County Office of Sustainability; Cleantech Orange County; CSU Dominguez Hills; CSU Los Angeles; CSU Channel Islands; LA Business Technology Center; CSU Water Resources and Policy Initiatives	$3,658,099	42.3%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-016 Commercializing a Disruptively Low Cost Solar Collector	Applied Research and Development	This project is developing a low cost Concentrated Solar Power (CSP) collector to advance the market readiness of this technology. Hyperlight's CSP collector is based on the linear Fresnel reflector (LFR) and is able to make dramatic cost reduction through breakthroughs in materials, design, manufacturing and installation. A major innovation of the system involves use of mirrors attached to UV stabilized and low-cost plastic tubes that are mounted on sealed water bed foundation. The project will develop: (1) a single 1,000 square foot module used for lifecycle testing and validation of upgraded design elements; (2) a one acre system for pilot testing and demonstration; and (3) a front end engineering design study to establish the feasibility and what is needed to scale up the system up to say ten acre and co-located with other renewable energy such as a geothermal facility. EPIC funds are being used as cost share funding to Hyperlight's $1.5 million grant from the US DOE.	10/19/2016	No	Generation	$750,000	$750,000	$329,249	N/A	$329,249	$177,896	$2,252,694	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-017 Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology	Technology Demonstration and Deployment	This project is demonstrating the elimination of aeration and its high energy demands as part of secondary water treatment at the Silicon Valley Clean Water wastewater treatment facility using a novel staged Anaerobic Fluidized Bed Membrane Bioreactor. This System is projected to generate 30 percent less bio-solids than conventional systems that require aeration. This project also seeks to demonstrate the potential for development of a new high quality local water supply through non-potable and advanced potable reuse treatment trains that eliminate process steps that normally precede the use of reverse osmosis.	10/19/2016	No	Demand-side Management	$1,999,962	$1,999,962	$0	N/A	$0	$327,386	$0	Leland Stanford Junior University; Santa Clara Valley Water District; Silicon Valley Clean Water; GE Water; LG Water Solutions	$1,219,943	37.9%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-018 Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings	Technology Demonstration and Deployment	This project is demonstrating an efficiency technology that targets one of the major energy using steps in wastewater treatment. The Biological Double Efficiency Process (BDP) combines state of the art, easy to maintain aeration technology, airlift circulation/dilution technology, and an integrated all-in-one bioreactor technology to replace the separate anoxic and aerobic tanks associated with secondary clarifiers. The BDP is based on simultaneous nitrification/denitrification principles.	11/9/2016	No	Demand-side Management	$1,565,400	$1,565,400	$423,239	N/A	$423,239	$15,486	$0	BDP Technologies	$330,904	17.4%
2015-2017 Triennial Investment Plan	CEC	EPC-16-019 21st Century Solutions for 20th Century Wind Projects	Applied Research and Development	This project aims to develop inexpensive, standardized turbine upgrades that will allow aged turbines to behave more similarly to modern turbines by dispatching on/off when it is beneficial. The upgrade is a low-cost, robust, wireless communication and control system. The project includes installation of wireless communications and a field demonstration of the turbine upgrades and the forecasting algorithm at an operating wind plant in collaboration with CAISO and wind plant owners. A field test is at an operating wind farm in the Tehachapi region.	3/8/2017	Yes	Generation	$810,438	$810,438	$20,537	N/A	$20,537	$322,793	$0	Department of Mechanical and Aerospace Engineering - UC Davis	$124,916	13.4%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-020 Recovery of Lithium from Geothermal Brines	Applied Research and Development	This project aims to demonstrate a cost-effective integrated process for the recovery of lithium from geothermal brines based on: (1) new high-capacity selective composite sorbents comprised of inorganic lithium-ion sieves and lithium-ion-imprinted polymers; and (2) a new sorbent regeneration process using eco-friendly carbon dioxide/carbonic acid that will lead to the direct formation of high-purity lithium carbonate (Li2CO3). Compared to traditional methods of Li recovery from brines, the proposed high-capacity selective sorbents and their regeneration process are expected to lower the cost of Li production by enabling online separation with higher recovery efficiency, using smaller volumes of sorbents and minimizing processing time. The project demonstrates a lab-scale integrated separation process for the production of high-purity Li2CO3 from geothermal brines.	12/14/2016	No	Generation	$873,387	$873,387	$190,453	N/A	$190,453	$437,858	$0	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-021 High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network	Applied Research and Development	This project advances the current state for imaging subsurface flow paths, barriers, and heterogeneity in operating geothermal reservoirs through an integrated approach that combines the recent development of low-cost, dense seismic networks together with established state-of-the-art micro-earthquake imaging algorithms and rock physics concepts. The technical advancement of this project is the integration of these components into a system that can be cost-effectively, reliably and routinely deployed in operating geothermal fields to image the movement of fluids in space and time with high-resolution and fast-turnaround time from data collection, to processing, to imaging, to rock physics interpretations.	12/14/2016	No	Generation	$1,672,639	$1,672,639	$520,000	N/A	$520,000	$531,029	$0	Jarpe Data Solutions	$50,000	2.9%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-022 Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production	Applied Research and Development	This project seeks to address the specific challenges of base-load and flexible-mode geothermal production, including wellbore and reservoir integrity, scaling, and corrosion. An improved THMC model is being developed and applied to better understand these issues. Flexible mode production typically includes daily cycles in production rate that result in extraordinary stress on the wellbore and reservoir system. The modeling and assessment is being conducted to predict short- and long-term impacts of flexible-mode production from liquid-dominant geothermal reservoir systems representative in California and the site-specific vapor-dominated Geysers Geothermal Field with pilot test data on flexible production.	12/14/2016	No	Grid Operations/ Market Design	$999,032	$999,032	$360,000	N/A	$360,000	$0	$0	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-024 San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	Applied Research and Development	The San Gabriel "Plug and Play" In-Conduit Hydropower Development Project aims to design, develop and demonstrate a modular, cost-effective in-conduit hydroelectric system designed for the sub-100-kW in-conduit hydroelectric market that will decrease the civil, mechanical, electrical and interconnection costs. San Gabriel Project includes a new 73 kW modular "plug and play" in-conduit hydroelectric station at a space-constrained site in an urban, potable water system, that will provide an estimated 381,000 kilowatt-hours (kWh) of renewable generation, while also providing a model that can be deployed to many undeveloped, small sub-100 kW in-conduit sites throughout the state.	1/25/2017	Yes	Generation	$500,000	$500,000	$76,733	N/A	$76,733	$13,082	$0	NLine Energy, Inc.; San Gabriel Valley Water Company	$782,000	61.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-025 Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	Applied Research and Development	This project aims to conduct a comprehensive assessment of in-conduit hydropower generation potential in California and develop a guidebook and a business case assessment tool that assist municipal, agricultural, and industrial water purveyors with the cost effective implementation of in-conduit hydropower generation projects. The proposed guidebook and the business case assessment tool will provide invaluable knowledgebase for municipal (water and wastewater), agricultural and industrial agencies that are considering capturing hydrokinetic/hydrostatic energy and integrating in-conduit hydropower into the existing energy mix. The Business Case Assessment Tool will assist users with building a business case for implementation of an in-conduit hydropower project, providing qualitative and quantitative guidance on the selection of equipment and sites for fit-for-purpose applications.	1/25/2017	Yes	Generation	$400,000	$400,000	$64,754	N/A	$64,754	$121,338	$0	Leland Stanford Junior University; NLine Energy, Inc.; Stantec Consulting Services Inc.	$83,018	17.2%
2015-2017 Triennial Investment Plan	CEC	EPC-16-026 Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	Applied Research and Development	The agreement develops and pilot tests controls for demand response integration at two demonstration sites in California. The first is a water pumping station and the second is an industrial refrigerated warehouse facility at the Port of Long Beach. The technology will enable faster and more flexible demand response, optimized for energy bill savings, and on-site operations. The technology integrates controls, building energy costs, historic load data, and rate tariff information to allow for optimized demand response utilization. The Port of Long Beach refrigeration facility is in a disadvantaged community	5/10/2017	Yes	Demand-side Management	$3,000,000	$3,000,000	$0	N/A	$0	$884,720	$0	Electric Power Research Institute (EPRI); San Diego Gas & Electric Company; Southern California Edison	$465,000	13.4%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-027 Facilitating On-farm Participation in Energy Demand Management Programs	Applied Research and Development	This project develops a management tool for optimizing irrigation at 10 farms in California. The sites have varied water requirements, growing a mix of almonds and alfalfa. The project is validating a pre-commercial water management system that allows irrigators to have more flexibility over when they irrigate and use energy. Instead of adding water whenever the soil is dry, this system will manage plant stress so that water can be delivered when costs are low and when needed by the plant. The purpose of the management technology is to enable irrigators to participate in utility incentive programs offering benefits to customers who can shift their energy demand. This management approach would enable participation in utility demand response, time of use, and automated demand response programs.	3/8/2017	Yes	Demand-side Management	$1,588,872	$1,588,872	$37,533	N/A	$37,533	$166,426	$0	Irrigation for the Future, Inc.	$126,663	7.4%
2015-2017 Triennial Investment Plan	CEC	EPC-16-028 Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	Applied Research and Development	This project develops, tests, and validates a load-shifting optimization platform to reduce energy use and demand charges in the water sector. The platform advances pre-commercial demand response technologies to reduce: peak demand, energy use, and operational costs. The platform integrates advanced real-time monitoring, automated load shifting control, energy storage, and a pre-commercial cost optimization platform. Data generated by the project will validate the approach and identify best practices for increasing water sector participation in demand response programs.	3/8/2017	Yes	Demand-side Management	$1,403,465	$1,403,465	$0	N/A	$0	$832,615	$0	Advanced Microgrid Solutions, Inc.; Enbala Power Networks; Irvine Ranch Water District	$760,393	35.1%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-029 Water/Energy Bank Proof-of-Concept	Applied Research and Development	This proof of concept study is evaluating the feasibility of using groundwater storage and cycling surface reservoirs to shift the State Water Project's Southern California water deliveries to non-summer months to reduce summer electric grid peak demand. Shifting the timing of water deliveries could reduce solar and wind power over-generation risk during non-summer months when renewable energy is in surplus. This project investigates the technical, institutional, legal and economic feasibility of implementing a guaranteed water delivery shift and develop demand response and load shifting tools and strategies to manage peak load and demand and thereby reduce energy costs in the water sector.	3/8/2017	Yes	Demand-side Management	$1,000,000	$1,000,000	$130,451	N/A	$130,451	$150,000	$0	To Be Determined; Antelope Valley Water Storage, LLC	$225,000	18.4%
2015-2017 Triennial Investment Plan	CEC	EPC-16-030 Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	Applied Research and Development	This project is researching and testing technologies that improve data center energy efficiency at three different levels in a smart power distribution system. The technologies include increasing server energy efficiency, through coordinated deep sleep and dynamic voltage-frequency scaling (DVFS); data center workload balancing through phase and load balancing across multiple servers in a data center; and geographical workload balancing through phase/load balancing in a single or multiple power distribution network or feeder.	3/8/2017	Yes	Demand-side Management	$1,783,118	$1,783,118	$79,383	N/A	$79,383	$306,631	$0	San Jose State Research Foundation; The Regents of the University of California (UC Riverside)	$297,064	14.3%
2015-2017 Triennial Investment Plan	CEC	EPC-16-031 VOLTTRON Testing Tool Kit	Applied Research and Development	This federal cost share project demonstrates the benefits of the VOLTTRON platform for DER management through the testing of the VOLTTRON Testing Tool Kit. VOLTTRON is a US Department of Energy funded open source platform intended to provide a software base for integrating management of energy demand in buildings, distributed energy resources, and the electrical grid. The tool kit expands the VOLTTRON platform beyond its original set of developers and encourages adoption by other organizations and private entities. By lowering implementation costs and adding additional features such as simulation test suites and debugging tools, the tool kit promotes wider use of the VOLTTRON platform.	3/8/2017	Yes	Demand-side Management	$70,000	$70,000	$50,400	N/A	$50,400	$28,501	$805,000	None	$0	0.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-032 Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Façade, Lighting and Plug Loads	Technology Demonstration and Deployment	The project team is demonstrating and validating new retrofit package solutions from laboratory pre-testing through field demonstrations in existing government-owned commercial buildings. The solution sets, dubbed "INTER", are comprised of shading products from Rollease Acmeda and lighting and plug load systems and integrated controls, including HVAC systems, from Enlighted. The technologies can be combined and customized to suit a variety of building types and spaces, resulting in an estimated whole building energy reduction of 20 to 32 percent. Beginning in the Los Angeles basin, the team is leveraging existing market connections to increase and accelerate market adoption of these retrofit solution sets to maximize the potential energy and carbon savings, first in the region and ultimately, throughout California.	3/8/2017	Yes	Demand-side Management	$4,981,000	$4,981,000	$120,000	N/A	$120,000	$1,767,847	$0	Southern California Edison; United States Department of Energy; TRC Engineers, Inc.; Enlighted Inc.; Rollease Acmeda, Inc.; Delos	$1,725,500	25.7%
2015-2017 Triennial Investment Plan	CEC	EPC-16-033 Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	Technology Demonstration and Deployment	This project develops and evaluates a pre-commercial energy management system at CSU Long Beach. The research demonstrates energy efficiency technologies with controls utilizing the internet of things (IoT), and optimizing load operation, load leveling, and peak shaving. The advancements in monitoring and controls from this project will enable deployment of similar systems at academic facilities in California.	3/8/2017	Yes	Demand-side Management	$2,509,946	$2,509,946	$0	N/A	$0	$402,014	$0	Regents of the University of California, Riverside Campus; CSU Long Beach Research Foundation; Enlighted Inc.; ControlWorks, Inc.	$1,072,958	29.9%
2015-2017 Triennial Investment Plan	CEC	EPC-16-034 Automated Cloud-Based Continuously Optimizing Building Energy Management System	Technology Demonstration and Deployment	The Automated Cloud-based Continuously Optimizing Building Energy Management System (ACCO-BEMS) overcomes limitations of existing energy management systems by automating optimized control of building systems and devices. The technology overcomes limitations of existing energy management systems and eliminates the need for expensive reprogramming needed to implement optimization measures. As such, the technology can co-exist with existing systems in retrofit applications, or it can be implemented as a new installation.	3/8/2017	Yes	Demand-side Management	$2,500,000	$2,500,000	$236,660	N/A	$236,660	$552,488	$0	Zero Net Energy (ZNE) Alliance; MelRok, LLC	$1,184,891	32.2%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-035 High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	Applied Research and Development	This project develops a next generation manufacturing tool for low-cost, high-performance copper patterning on solar photovoltaic cells using technologies from printed circuit board manufacturing, reducing costs by up to 35%, and increasing cell efficiency by 15%.	4/12/2017	Yes	Generation	$2,430,000	$2,430,000	$1,071,594	N/A	$1,071,594	$730,620	$9,540,309	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-036 Thermoelectric Generator Application and Pilot Test in a Geothermal Field	Applied Research and Development	Thermoelectric Generator (TEG) technologies have the potential to produce geothermal electricity without as much infrastructure (turbines, steam piping, etc.) thus making small scale production and geothermal powered micro power grids both practicable and affordable. Small (<5 MW) geothermal projects could provide consumers with the same distributed power flexibility provided by solar and wind production with the additional benefit of being a more reliable baseload source of electricity. TEG technologies can also allow geothermal heat to provide balancing and grid support. This project is scaling up a TEG from the watt-level in the lab to a 20 kW unit for demonstration in a geothermal reservoir.	4/12/2017	Yes	Generation	$1,280,000	$1,280,000	$10,964	N/A	$10,964	$433,153	$0	Leland Stanford Junior University; AltaRock Energy, Inc.	$118,095	8.4%
2015-2017 Triennial Investment Plan	CEC	EPC-16-037 The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	Applied Research and Development	The goal of this project is to design, test, and demonstrate a 417 kW in-conduit Pelton turbine runner at an existing Pressure Reducing Station (PSR) site located in Ione, California. The project will demonstrate the ability to maximize the wasted energy captured at the station using an improved design of a higher-efficiency Pelton turbine runner specifically designed for small, in-conduit hydroelectric applications to contribute in the integration of in-conduit small hydropower into the existing state energy mix.	4/12/2017	Yes	Generation	$750,000	$750,000	$0	N/A	$0	$0	$0	NLine Energy, Inc.; Amador Water Agency	$1,115,000	59.8%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-038 Use of Indoor Rearing for Head-Starting Desert Tortoises	Applied Research and Development	The project conducts experimental releases of juvenile desert tortoises raised since 2011-2013 to evaluate the trade-offs of head-start duration on post-release survival of desert tortoises. The recipient is dividing hatchlings into two cohorts, raising half of them exclusively outdoors and the other half under a combination of indoor/outdoor rearing, releasing them as 2 year olds, and comparing their post-release survival. Data on the growth and survival of animals in this study provides guidance on the minimum duration of outdoor head-starting and whether indoor head-starting should be pursued in future head-starting programs for desert tortoises. Ultimately, the results of the proposed study can inform the extent to which head-starting both indoors and outdoors is a viable solution for mitigating localized impacts to tortoise populations affected by development for solar energy production facilities.	4/12/2017	Yes	Generation	$493,089	$493,089	$0	N/A	$0	$77,924	$0	The Regents of the University of California, Davis Campus	$61,119	11.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-039 A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	Applied Research and Development	This project investigates whether flow batteries are a viable option for providing grid energy storage at the large scale, either in place of or alongside lithium-ion battery technology. A life-cycle based characterization of the environmental impacts and resource usage associated with three chemistries of flow batteries (Vanadium Redox (V2O5), Zinc-Bromide (ZnBr), and Iron-Sodium (FeNa)) are being examined. Specifically, the materials use, energy use, and toxic waste outputs of the life-cycle phases of each flow battery type - including materials extraction, manufacturing, use, and disposal or recycling as applicable - are being investigated.	4/12/2017	Yes	Distribution	$600,000	$600,000	$0	N/A	$0	$98,142	$0	The Regents of the University of California, Irvine	$186,219	23.7%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-040 Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling	Applied Research and Development	This project measures PM2.5 and PM10 across the spray drift plume from two power plant cooling towers that use fresh water and brackish water. These measurements are used to develop and validate a model of power plant PM2.5 and PM10 emissions. The end result is a model that power plant operators can use to minimize the PM2.5 and PM10 effects of brackish water use in cooling towers.	4/12/2017	Yes	Generation	$700,000	$700,000	$0	N/A	$0	$108,004	$0	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-041 Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	Applied Research and Development	This project will develop test procedures for alternative refrigerants for flammability and energy savings characterization and to develop a "favorability" index of end-use market segments and equipment types based on potential GHG savings impact and commercial feasibility and adoption.	4/12/2017	Yes	Demand-side Management	$500,000	$500,000	$0	N/A	$0	$221,625	$0	Institute for Governance & Sustainable Development	$500,000	50.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-042 Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	Applied Research and Development	This project is developing a cost-effective mid- to high-temperature range (400-800C) p-type thermoelectric material for waste heat recovery using silicon nanowire arrays. The intent is to surpass technologies implementing an organic Rankine cycle or similar processes by having low parasitic losses, compact, and able to be modularized for a broad scale of distributed applications. To achieve the goal, the project will advance the state of the art in nanowire characterization; demonstrate an optimized process for the production of Si-nw arrays and a process to produce a freestanding array of aligned nanowires; characterize the thermoelectric and mechanical properties of these arrays and single Si-nw; optimize the fabrication of Si-nw arrays; and integrate into devices capable of heat-to-power conversion. The results of device performance will be used to evaluate the techno-economic impacts of this technology. Taken together, the project will move silicon nanowire technology's Technology Readiness Level (TRL) from 2 to a prototype technology demonstration in a relevant environment (TRL5).	4/12/2017	Yes	Generation	$2,000,000	$2,000,000	$0	N/A	$0	$440,167	$0	Alphabet Energy, Inc.	$3,487,686	63.6%
2015-2017 Triennial Investment Plan	CEC	EPC-16-043 Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	Applied Research and Development	This project aims to scale in-canal hydropower retrofits by lowering project footprint and civil works costs. As most drop structures in irrigation canals have a consistent design, the goal is to design and implement a modular powerhouse and standard plant design that can be replicated across irrigation drops in California. Using a more simple and more easily scalable design will support the installation of the system to scale across the low-head sites identified across California with in-canal potential.	4/12/2017	Yes	Generation	$954,715	$954,715	$15,793	N/A	$15,793	$0	$0	Natel Energy	$954,715	50.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-044 Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling	Applied Research and Development	This project is developing an economical and efficient configuration for large scale integration and adoption of highly efficient liquid cooled permanent magnet motors, and fully integrated, liquid cooled motor controls. The goal is to use these technologies in the development of a smart pump motor unit that can quickly be commercialized and adopted statewide.	4/12/2017	Yes	Demand-side Management	$2,311,050	$2,311,050	$126,685	N/A	$126,685	$99,350	$0	Terzo Power Systems, LLC.; Ansync Labs, Inc.	$145,689	5.9%
2015-2017 Triennial Investment Plan	CEC	EPC-16-045 Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates	Applied Research and Development	This project will result in the development of a smart irrigation control system that improves and expands on current remote irrigation pump switching technology. The technologies developed provide growers with the ability to automate their preferred load control strategies in response to new time-of-use electricity rates. Beyond that basic capability, the systems facilitate automated response to utility and system operator demand response signals, enabling participation in current and future demand response and reliability programs. The system is being deployed and tested on multiple farms in PG&E service territory in the Fresno area.	4/12/2017	Yes	Grid Operations/ Market Design	$2,884,912	$2,884,912	$258,055	N/A	$258,055	$0	$0	Polaris Energy Services Inc.	$649,485	18.4%
2015-2017 Triennial Investment Plan	CEC	EPC-16-046 Pilot Testing of Isothermal Compression	Applied Research and Development	Gas Technology Institute (GTI) and Carnot Compression LLC (Carnot) are developing and field testing a novel, near isothermal air compressor which will enable improved efficiency, maintenance and reliability. The unit will be tested at an industrial facility in southern California. This project hopes to reduce the energy consumption in industrial, water, agricultural, and commercial applications that require compression of air and other gases. This project demonstrates a more efficient compressor that will use less electricity to meet the same performance metrics of existing air and gas compressors. If successful this project could improve the energy efficiency of compressed air/gas systems which are prevalent in all industrial processing facilities.	4/12/2017	Yes	Demand-side Management	$2,570,946	$2,570,946	$199,209	N/A	$199,209	$628,022	$0	Carnot Compression LLC	$238,700	8.5%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-047 California Biopower Impact Project	Applied Research and Development	This project develops an attributional life cycle assessment framework for various biomass-to-electricity supply chain and end-use scenarios that are specific to California. The research effort quantifies on a fine geospatial scale amount of technically recoverable forest and agricultural biomass residue material in California considering future impact projections from different climate change scenarios and fire risk probabilities under various harvest and land management scenarios. Based on the estimates, a detailed life cycle inventory - disaggregated by parcel, supply chain, and end-use characteristics will be developed. Results will support development of the California Residual Biomass-to-energy Carbon Accounting Tool (CARB-CAT) that will be made available to public and could inform policy makers regarding their decisions on the role of biomass residues in California's energy portfolio.	4/12/2017	Yes	Generation	$1,000,000	$1,000,000	$50,170	N/A	$50,170	$247,784	$0	Humboldt State University Sponsored Programs Foundation; Sierra Institute for Community and Environment	$131,575	11.6%
2015-2017 Triennial Investment Plan	CEC	EPC-16-048 Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant	Applied Research and Development	This project is pilot testing and demonstrating an air-cooled, low-charge ammonia refrigerant-based, integrated package closed cooling system for an industrial food processing application. The project is demonstrating the effectiveness of a water-saving innovation with the use of a micro-channel, air-cooled condenser. The project is demonstrating the expected energy savings of 20% compared to a chiller using hydrofluorocarbon (HFC) refrigerant for similar end use at the same site. This system eliminates the need for water for cooling. The entire system can be prepackaged and factory charged, and brought to site as an integrated package which simplifies field installation and makes it cost effective.	4/12/2017	Yes	Demand-side Management	$2,406,054	$2,406,054	$0	N/A	$0	$804,238	$0	Electric Power Research Institute (EPRI); TAKARA SAKE USA	$605,000	20.1%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-049 Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	Applied Research and Development	This project leverages a multidisciplinary system approach to investigate the energy recovery potential of dual-mode piezoelectric generators to create roadway piezoelectric energy harvesting systems with ultra-high power density and efficiency. The goal is to design and test a piezoelectric roadway energy harvesting system, consisting of multi-layer stack generators and power electronics, to capture over 50% of the compression mechanical energy as electricity from passing vehicles. This project will demonstrate electric power generation, in the laboratory and on a 95 feet x 12 feet section of a road at the UC Merced campus, and will determine feasibility for future large-scale demonstrations on highways and streets with piezoelectric under-pavement.	4/12/2017	Yes	Generation	$1,270,000	$1,270,000	$0	N/A	$0	$310,100	$0	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-050 Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	Applied Research and Development	Recent advances have pushed the solar conversion efficiency, making perovskites one of the most efficient solar technologies in existence. This project will use a scalable large-area manufacturing approach for fabrication of the perovskite solar absorber, the solar cell's transport and contact layers, and the encapsulation of the solar cell modules. The project will also include bifacial module design, where light enters from both front and back.	4/12/2017	Yes	Generation	$1,450,000	$1,450,000	$50,145	N/A	$50,145	$184,540	$0	The Regents of the University of California, San Diego	$146,050	9.2%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-051 Increased Energy Efficiency via Programmable Irrigation and Fertigation	Applied Research and Development	PowWow Energy, in collaboration with WiseConn Engineering, West Hills College Coalinga (WHCC) and UC Santa Barbara (UCSB), are developing an automated, programmable irrigation management system that integrates cutting-edge technologies to increase the energy efficiency of irrigation (defined as using less energy to achieve the same level of crop production). Pilot-scale tests of the integrated technology platform will be conducted at two sites on commercial farms located in disadvantaged communities: an almond orchard near Delano (AgWise Enterprises, SCE territory) and a field with a rotation of row crops (tomato, garlic, etc.) near Huron (Woolf Farming and Processing, PG&E territory).	4/12/2017	Yes	Demand-side Management	$2,992,660	$2,992,660	$180,748	N/A	$180,748	$341,285	$0	Environmental Studies Program & Bren School of Environmental Science & Management - UC Santa Barbara; PowWow Energy, Inc.; Aduro Accounting & Consulting, LLC; TBD Professional Services; WiseConn Engineering; West Hills College Coalinga; Mamala Research, LLC	$350,547	10.5%
2015-2017 Triennial Investment Plan	CEC	EPC-16-052 Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	Applied Research and Development	The project develops, designs and installs a multitude of pavement-embedded devices to demonstrate energy harvesting from overpassing motor vehicles on the road in smart pavement covering 36 feet x 6 feet. The system consists of materials that exhibit the piezoelectric effect and results in generating an electric charge.	4/12/2017	Yes	Generation	$1,000,000	$1,000,000	$43,256	N/A	$43,256	$234,596	$0	Pyro-E, LLC	$100,007	9.1%
2015-2017 Triennial Investment Plan	CEC	EPC-16-053 Habitat Influences on Desert Tortoise Translocation Success	Applied Research and Development	The recipient is determining if habitat characteristics of the release sites can improve survival of smaller juveniles to equivalent rates of the animals that have reached the desired size target. Careful measurement of resources that may help tortoises avoid predation or meet nutritional requirements will allow investigators to differentiate excellent habitat from merely adequate habitat. They are also studying the effects of outdoor rearing on juvenile desert tortoise behavior and health, and size-age relationships to survival in the wild upon their release. The project will generate quantitative, defensible information about the most cost-effective husbandry and release methods during and following a head-start program for this threatened species.	4/27/2017	Yes	Generation	$499,605	$499,605	$0	N/A	$0	$32,237	$0	Zoological Society of San Diego dba San Diego Zoo GIobal	$390,528	43.9%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-054 Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	Applied Research and Development	This project will develop a "3-in-1" smart inverter, charging station, and building management system. The project focuses on defining and developing control algorithms to implement vehicle-to-grid (V2G) and vehicle-to-building (V2B) with minimal impact to the plug-in electric vehicle (PEV) battery life. This project develops and demonstrates an off-vehicle, V2G power conversion and control algorithm that can be applied to residential and small commercial applications. The system integrates a bidirectional direct-current (DC) PEV charger, photovoltaic inverter, and stationary storage battery, with an integrated local energy and power management system for power and energy management, grid communications, and ancillary services.	4/27/2017	Yes	Demand-side Management	$1,500,000	$1,500,000	$0	N/A	$0	$370,849	$0	Electric Power Research Institute (EPRI); Oak Ridge National Laboratory; National Renewable Energy Laboratory (NREL); Flex Power Control, Inc.	$2,341,001	60.9%
2015-2017 Triennial Investment Plan	CEC	EPC-16-055 Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers	Applied Research and Development	The project enables day-ahead and real-time pricing for DC fast charging by developing an integrated hardware and software platform to reduce demand charges from DC fast charging and address intermittency and renewable energy over-generation issues. The site controller and network-based platform advances smart and efficient charging by managing four multi-port fast charging to minimize grid impact and lower the cost of operating fast chargers, evaluates suitability of DC fast charging to participate in demand response programs, and develops and evaluates advanced technologies to efficiently integrate second-life PEV batteries for demand management with DC fast charging. By addressing intermittency and renewable energy over-generation issues, the project will reduce grid impact and increase renewable penetration in the grid by aggregating four DC fast charging stations with stationary battery storage from second-life PEV batteries.	4/27/2017	Yes	Demand-side Management	$826,250	$826,250	$90,919	N/A	$90,919	$0	$0	Zeco Systems dba Greenlots	$302,008	26.8%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-056 Performance Evolution, Specification and Verification of Building Control Sequences	Applied Research and Development	The project develops IT based component technologies to enable more efficient building operations and reduce costs. The project is expected to reduce the time to specify, implement and verify the proper operation of control sequences and make a strong business case for designers, controls contractors and controls manufacturers to adopt the new technology.	5/10/2017	Yes	Demand-side Management	$1,000,000	$1,000,000	$0	N/A	$0	$473,633	$2,170,000	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-057 Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	Applied Research and Development	This project develops the Smart Charging Infrastructure Planning Tool (SCRIPT) to enable predictive smart charging of Plug-In Electric Vehicles (PEVs) and performs cost-benefit analysis for investment in charging infrastructure. SCRIPT will determine daily predictive smart charging strategies that foresee the future travel needs of drivers and grid conditions. SLAC will study the role of different charging infrastructure investment strategies in the effectiveness of EV smart charging techniques to accommodate state level renewable penetration goals in California. SLAC will test the tool using real-time charging data to determine the maximum amount of solar generation that can be absorbed by the vehicles through smart charging. SLAC will also study the trade-offs between investing in new charging infrastructure compared to better management of existing infrastructure via smart charging.	5/10/2017	Yes	Demand-side Management	$1,500,000	$1,500,000	$660,641	N/A	$660,641	$328,945	$0	UC Santa Barbara; ChargePoint, Inc.	$94,193	5.9%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-058 Advanced Transit Bus VGI Project	Technology Demonstration and Deployment	This project addresses critical real-world needs to commercialize and scale electric transit fleets with robust grid-serving energy services. Leveraging Santa Clara Valley Transit Authority's plan to purchase up to 35 all-electric buses to electrify its 500-bus fleet, the four-year project builds on the strategies, technologies and partnerships from existing vehicle-grid integration (VGI) efforts to implement a world-class electric transit fleet showcase. This Agreement will drive down the costs of responsive grid assets and deliver lower cost energy services; b) improve the business case of e-buses, including reducing cost via advanced management, establishing revenue generation opportunities, and addressing commercial fleet management needs; c) address the need for deep understanding on the potential for transit e-bus VGI and strategies for scaling through a statewide roadmap; and d) ensure benefits reach all communities by delivering VGI enabled e-bus transit to underserved communities.	5/10/2017	Yes	Demand-side Management	$1,899,199	$1,899,199	$0	N/A	$0	$0	$0	Santa Clara Valley Transit Authority; Proterra Inc.	$1,035,018	35.3%
2015-2017 Triennial Investment Plan	CEC	EPC-16-059 Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	Applied Research and Development	This project demonstrates an automated control system for a fleet of plug-in electric vehicles and repurposed second-life batteries that reduces the overall cost of ownership by maximizing battery lifetime, shifting load to reduce electricity and demand charges, and providing V2G and V2B services, including those supporting the use of onsite solar generation. The demonstration is adding a stationary second-life battery installation to the existing PEV fleet site at Los Angeles Air Force Base.	5/10/2017	Yes	Demand-side Management	$1,500,000	$1,500,000	$701,533	N/A	$701,533	$407,071	$0	None	$0	0.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-060 Adaptive Chargers for Delivery Customers Demonstrating California Advances in Charging	Technology Demonstration and Deployment	Motiv Power Systems is developing both a smart charger solution and a bi-directional charger solution to enable vehicle-grid integration (VGI) with electric fleet vehicles. This technology is being demonstrated with AmeriPride Services delivery trucks in Fresno, Bakersfield, Merced, and Stockton. Motiv is developing both a software-only smart charger solution as well as a bi-directional on-board charger solution for vehicles that can be easily purchased as an option for installation on existing vehicles. This solution will fit within a scalable and modular powertrain already used in a variety of vehicle applications, thus allowing VGI solutions to fit within a variety of emerging markets and be supplied to vehicle builders from a variety of delivery trucks, work trucks, shuttle buses, and school buses. This allows VGI to fit both within goods movement and freight plans as well as clean transit and zero-emission bus plans.	5/10/2017	Yes	Demand-side Management	$4,529,956	$4,529,956	$0	N/A	$0	$818,672	$0	Motiv Power Systems, Inc.	$1,513,524	25.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	Technology Demonstration and Deployment	This project is deploying vehicle-grid integration (VGI) technology with unidirectional and bidirectional power flow capabilities using light fleet and consumer vehicles. These vehicles will provide local grid support by controlling the charge rate based on energy and power capacity available locally, controlling the voltage, and providing grid-wide support by participating in frequency regulation or adjusting the reactive power. The mix of services provided will be optimized within a campus laboratory setting with the goal of expanding this technology into a real-world setting.	6/14/2017	Yes	Distribution	$4,200,000	$4,200,000	$0	N/A	$0	$0	$0	The Regents of the University of California, San Diego; Strategen; Nuvve Corporation; FleetCarma	$3,697,744	46.8%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-062 Advancing Demand Response in the Water Sector	Applied Research and Development	This project is developing a demand management system to optimize energy use and operations at the Moulton Niguel Water District. By better optimizing its system, the water utility will be able to reduce its energy bill by participating in demand response and load shifting incentive programs. The demand management system uses real-time energy analytics to: (1) reduce and/or shift peak energy loads, (2) account for different energy tariff structures, and (3) balance the grid's intermittent renewable load generation. The project will optimize load for the potable and recycled water systems at Moulton Niguel.	5/10/2017	Yes	Demand-side Management	$2,984,983	$2,984,983	$0	N/A	$0	$282,171	$0	Moulton Niguel Water District; Helio Energy Solutions	$105,765	3.4%
2015-2017 Triennial Investment Plan	CEC	EPC-16-063 Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	Applied Research and Development	This project develops new and better ways of merging the two approaches, using both weather forecast models (more generally called dynamical models) and inferences from past history (statistical models). The combined method is called a hybrid dynamical-statistical approach for inferring fine-resolution climate information from the coarse-resolution global climate models. Ideally, the hybrid approach will be able to capture many of the physical processes simulated by the costly weather forecast models, but with the reduced expense of statistical models. The hybrid approach will be applied to three key areas of California's climate that have important implications for the state's ratepayers: wind, clouds, and hydrology: wind, clouds, and hydrology.	4/27/2017	Yes	Grid Operations/ Market Design	$1,399,888	$1,399,888	$0	N/A	$0	$192,928	$0	None	$0	0.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-064 Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	Applied Research and Development	The recipient is exploring the behavior of attraction by birds to solar facilities, particularly in relation to the "lake effect" hypothesis. Specifically, they are studying 1) the ability of birds to detect potentially attractive visual cues associated with solar facilities (e.g., polarized light, irradiance); 2) the corresponding change in flight behavior characteristic of movement toward solar facilities; and the 3) mortality and natural history of birds that actually occupy solar facilities. First, the recipient is examining the sensory basis of attraction through field and lab experiments. Second, radar and thermal imaging are used to measure the degree to which birds alter their flight paths to settle at solar facilities. Data on behavior and mortality from multiple solar facilities are gathered to inform a statistical model to determine what characteristics of solar facilities and species' natural history together explain variations in mortality exhibited across sites.	5/10/2017	Yes	Generation	$499,785	$499,785	$0	N/A	$0	$177,072	$0	United States Geological Survey; Western EcoSystems Technology, Inc.; Humboldt State University Sponsored Programs Foundation; NRG Energy, Inc.; NextEra Energy; Bard College; 8minuteenergy Renewables, LLC; First Solar; Recurrent Energy	$740,251	59.7%
2015-2017 Triennial Investment Plan	CEC	EPC-16-065 California E-Bus to Grid Integration Project	Technology Demonstration and Deployment	The California E-Bus-to-Grid Integration Project represents the integrated demand side management of EVs. It couples smart charging with smart driving, and places an equal emphasis on the three pillars of change management: technology, people, and process. Just as California's loading order emphasizes energy efficiency, demand response, and renewable resources first, before using fossil fuel, this project focuses on improving fuel economy (i.e., vehicular energy efficiency) in conjunction with the design and implementation of novel VGI services. The fuel economy improvements that come from smart driving result in operational cost savings and more effective smart charging by reducing the frequency and duration of in-route charging. By reducing the likelihood that several/all E-Buses will be charging at once, the smart charging platform provider (Olivine) will achieve greater flexibility to mitigate demand charges and provide grid services achieving customer benefits.	5/10/2017	Yes	Grid Operations/ Market Design	$3,327,953	$3,327,953	$21,612	N/A	$21,612	$0	$0	Antelope Valley Transit Authority	$3,729,000	52.8%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-067 Robust Super Insulation at a Competitive Price	Applied Research and Development	Heating and cooling represents the greatest energy consumption in buildings. This agreement develops thermal building insulation material with high R-value at a cost competitive to conventional insulation materials. The expected result provides a significant increase in energy efficiency for retrofitting buildings.	6/14/2017	Yes	Demand-side Management	$100,000	$100,000	$0	N/A	$0	$42,679	$1,700,000	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-16-068 Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	Applied Research and Development	This project demonstrates the feasibility of using an integrated community-scale solar plus storage system, sited at a low income multi-family disadvantaged community in Willowbrook, CA, as a distribution asset. The technology solution balances a combination of grid-connected distributed energy resources (DER), including advanced solar PV, energy storage, smart inverter, demand response, and load management. The project team is working with Southern California Edison to study the distribution grid impacts that the DERs can mitigate, realizing cost savings and enabling increased PV penetration. It is also investigating innovative business strategies to maximize the value of DER to both end-users and the utility. Another objective of the project is to demonstrate a cost-effective solution to achieving Zero Net Energy (ZNE) within an affordable housing community to realize California's 2020 goal for new sustainable and scalable ZNE communities.	6/14/2017	Yes	Demand-side Management	$2,976,991	$2,976,991	$0	N/A	$0	$821,664	$0	Electric Power Research Institute (EPRI); Southern California Edison; OhmConnect, Inc.; Chai Energy; E-GEAR; EPC Power; Nextek; Prism Solar	$1,002,900	25.2%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-069 Demonstrate the Phase III functions of a PV smart inverter and a storage inverter with a communications gateway.	Applied Research and Development	Demonstrate the Phase III functions of a PV smart inverter and a storage inverter with a communications gateway. This project will test and validate the Phase III functions of a PV smart inverter and a storage inverter with a communications gateway to support higher penetrations of solar on the grid at the South Coast AQMD Headquarters in Diamond Bar, California. This agreement will test, validate, and demonstrate all eight Smart Inverter Working Group (SIWG) Phase III functions in a system composed of a PV smart inverter, a bi-directional storage inverter, behind-the-meter solar and storage, and a communications gateway. This will increase circuit hosting capacity for solar and decrease distributed PV integration costs.	6/14/2017	Yes	Distribution	$2,729,943	$2,729,943	$0	N/A	$0	$594,333	$0	South Coast Air Quality Management District; Advanced Microgrid Solutions, Inc.; Nemaste Solar	$2,173,382	44.3%
2015-2017 Triennial Investment Plan	CEC	EPC-16-070 Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting	Technology Demonstration and Deployment	The purpose of this Agreement is to fund demonstration and research of an integrated, interoperable, cost-effective, and scalable solution that integrates distributed front-of-meter energy storage with smart PV inverters and solar forecasting to address grid readiness limitations and enable multi-tiered value stacking for DER.	6/14/2017	Yes	Demand-side Management	$1,832,770	$1,832,770	$0	N/A	$0	$0	$0	Electric Power Research Institute (EPRI); Craig Wooster Engineering	$591,438	24.4%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-073 Valencia Gardens Energy Storage	Technology Demonstration and Deployment	The purpose of this project is to utilize distributed energy storage as part of an optimized local energy system that both increases the ability of the distribution grid to support more local solar, while improving overall grid operations and economics. This project will provide a replicable model for California by deploying local energy storage in front of the meter that achieves multiple uses: interoperability with normal grid operations, including participation in existing wholesale market opportunities; enhanced interconnection hosting capacity to accommodate far more local solar; and indefinite solar-driven backup power for prioritized loads. Additionally, this project will recommend advancements in policy, interconnection processes, and market mechanisms that maximize and recognize the full value of local energy storage deployments that are interconnected in front of the meter.	6/14/2017	Yes	Demand-side Management	$1,994,687	$1,994,687	$37,463	N/A	$37,463	$0	$0	PATHION, INC	$620,470	23.7%
2015-2017 Triennial Investment Plan	CEC	EPC-16-077 Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	Applied Research and Development	The project deploys a 100 kW high-performing solar PV system, a 150 kW/150 kWh li-ion battery energy storage system, and an advanced energy management platform (smart inverter) to demonstrate the advancement of these technologies compared to standard commercially available products. These components will be integrated to optimize flexibility in demand side energy management through Load Shifting, Solar PV Self-consumption, Emergency Back-Up, Demand Response, and Ancillary Grid Services. The proposed system will be able to autonomously meet demand response and energy management requests while critical loads at the building are maintained, minimizing operational impacts.	6/14/2017	Yes	Demand-side Management	$2,110,657	$2,110,657	$0	N/A	$0	$332,995	$0	LINC Housing Corporation; Regents of the University of California, Riverside Campus; Pacific Energy/Masters Electric; EnSync Energy Systems	$411,509	16.3%

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2015-2017 Triennial Investment Plan	CEC	EPC-16-079 Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	Applied Research and Development	This project will comprehensively evaluate the SIWG Phase III functions. The process will include computer modeling of California distribution circuits, implementation in multiple inverter brands, laboratory testing, and field pilot testing. The integration will include communication and control via a commercial aggregation system and utilization and assessment of the IEEE 2030.5 communication protocol. The analysis will utilize Sky Imager data to extrapolate the results of the study and will determine effective control strategies for Phase III functions to achieve a 25% increase in PV hosting capacity. An economic analysis will build on the technical findings, identifying the impact to the asset owner, performing an economic valuation of these impacts, and providing guidance regarding potential compensation. A comprehensive cyber security assessment of the communication system will be performed and public key infrastructure will be established to support the cyber security needs in California.	6/14/2017	Yes	Grid Operations/ Market Design	$2,935,822	$2,935,822	$33,447	N/A	$33,447	$0	$0	Electric Power Research Institute (EPRI); SunSpec Alliance; Sunrun	$1,659,077	36.1%
2015-2017 Triennial Investment Plan	CEC	EPC-17-001 Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	Technology Demonstration and Deployment	This project optimizes and simplifies control upgrades to demonstrate energy savings while improving occupant comfort. This demonstration uses automated fault detection and diagnostics and continuous commissioning with the use of advanced measurement and verification procedures. The agreement includes recommendations for strategies, tools, and initiatives to address market barriers and promote large scale market adoption.	7/12/2017	Yes	Demand-side Management	$2,966,716	$2,966,716	$0	N/A	$0	$932,257	$0	Trane U.S., Inc.; United States Department of Energy; Automated Logic Corporation; Siemens Corporation, Corporate Technology; Kaiser Permanente Medical Center; Enlighted Inc.; Delos; KGS Buildings; Alerton	$2,773,750	48.3%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-002 Scaling Solar+ for Small and Medium Commercial Buildings	Applied Research and Development	The research team is designing, implementing, operating, and evaluating a Solar+ system in a pilot scale application for convenience stores. The project is designed to innovate across three key priority areas necessary for technology scale-up: hardware design guidelines, integration software, and site targeting. Filling these knowledge gaps will help move the deployment of Solar+ technologies forward, thereby bringing substantial benefit to individual building owners, as well as opening opportunities to provide service to the broader distribution and bulk power systems. This project focuses on the convenience store/fueling station SMB sector, but lessons learned and products developed can likely be extrapolated to other SMB sectors.	7/12/2017	Yes	Demand-side Management	$1,500,000	$1,500,000	$0	N/A	$0	$413,443	$0	Southern California Edison; Humboldt State University Sponsored Programs Foundation; Tesla Motors, Inc.; Serraga Energy, LLC at Blue Lake Rancheria	$345,242	18.7%
2015-2017 Triennial Investment Plan	CEC	EPC-17-003 Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	Applied Research and Development	This project provides CAISO with an improved next-minute to day-ahead high resolution, system-wide, probabilistic power production forecast for all California PV systems. The comprehensive forecast includes both behind-the-meter and utility-scale PV systems. The project is quantifying the costs and benefits of these improvements. The team uses mid-term DER adoption forecasts adapted from the IOUs; DRPs to project distribution of DERs into the future. The team is combining the result with the improved PV forecast to integrate results into CAISO load forecasts using Itron's load forecast engine.	7/12/2017	Yes	Generation	$750,000	$750,000	$0	N/A	$0	$176,606	$0	State University of New York at Albany; Clean Power Research, L.L.C.	$320,000	29.9%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-004 Enhanced Modeling Tools to Maximize Solar + Storage Benefits	Applied Research and Development	This research is developing a solar + storage optimization tool to evaluate the dispatch and operations and value proposition, for integrated solar + storage systems. The tool is capable of evaluating distributed solar with storage and an array of advanced controls and dispatchable DER technologies, and evaluates optimal dispatch for a wide range of customer programs and incentives. The tool is designed to integrate into the California Public Utility Commission (CPUC) Distributed Resource Planning (DRP) process and is used to evaluate the range of solar + storage systems being supported by the Energy Commission.	7/12/2017	Yes	Demand-side Management	$987,379	$987,379	$29,863	N/A	$29,863	$457,030	$0	San Diego Gas & Electric Company; Southern California Edison; Energy and Environmental Economics, Inc. (E3)	$108,655	9.9%
2015-2017 Triennial Investment Plan	CEC	EPC-17-005 Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	Applied Research and Development	At a brownfield site, this project, with an established load profile and a real economic use (Wholesale Coffee Roasting) in a Disadvantaged Community, is designed to add technologies sized together to maximize benefit while minimizing costs. To develop the DER integration framework and platform in this project, EPRI has created a team which, collectively, has decades of experience in Commercial building EMS and DER integration.	7/12/2017	Yes	Distribution	$1,491,764	$1,491,764	$0	N/A	$0	$360,079	$0	Electric Power Research Institute, Inc.	$271,090	15.4%
2015-2017 Triennial Investment Plan	CEC	EPC-17-006 Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	Applied Research and Development	The purpose of this project is to develop an improved forecasting system for solar irradiance in California, with a particular focus on fog and stratus conditions, through targeted deployment of instrumentation. The improved forecasts will be integrated into operational tools for use by the California Independent System Operator (CAISO) and utilities. This project utilizes a targeted instrumentation network, consisting of existing and new sensors, to improve the models used for forecasting fog and stratus conditions. The Recipient will design and deploy this network with the aim of improving the forecasts that are most important to CAISO and/or utility operations.	7/12/2017	Yes	Grid Operations/ Market Design	$749,740	$749,740	$0	N/A	$0	$632,032	$0	Electric Power Researcl	$324,830	30.2%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-007 Integrated Community Solar and Storage at a Low Income Mobile Home Park	Applied Research and Development	The Center for Sustainable Energy (CSE), in partnership with Kisensum and Horizon Solar Power, is applying high efficiency solar and storage technologies to create an integrated community solar and storage energy system at a low income, mobile home park in Bakersfield, California. The project illuminates operational strategies for storage to provide clear value propositions to end-use customers with existing tariff structures and demonstrate alternate structures and additional value streams that can increase the value of storage to the end customer while better achieving distribution system operational goals.	7/12/2017	Yes	Grid Operations/ Market Design	$2,005,923	$2,005,923	$0	N/A	$0	$0	$0	Resident Owned Parks,	$340,905	14.5%
2015-2017 Triennial Investment Plan	CEC	EPC-17-008 Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores	Technology Demonstration and Deployment	This project demonstrates the impact of an integrated suite of pre-commercial energy efficiency technologies in a large, existing, retail building located near a disadvantaged community. One of the technologies that comprise the installation package includes a novel supervisory controller to provide system-wide optimization, to reduce electricity consumption across numerous building subsystems, including lighting, refrigeration, and heating, ventilation, and air-conditioning (HVAC). This could enable site electricity savings of greater than 20%.	7/12/2017	Yes	Demand-side Management	$2,824,685	$2,824,685	$0	N/A	$0	$686,589	$0	Southern California Edison; Robert Bosch LLC; Integrated Comfort; Software Motor Corporation; Walmart; Apana, Inc.; Transformative Wave; SmartGreen	$759,984	21.2%
2015-2017 Triennial Investment Plan	CEC	EPC-17-009 Bundle-Based Energy Efficiency Technology Solutions for California (“BEETS for California”)	Technology Demonstration and Deployment	This project demonstrates three innovative bundles of pre-commercial technologies. The technology bundles were strategically developed through a systems-level approach to address the most energy-intensive areas in commercial buildings. These include: (1) Chilled Water Plants: Optimized all-variable-speed chilled-water (CHW) plants utilizing alternative refrigerant chillers. (2) Office and Exterior Space LED fixtures with integrated advanced controls, advanced building management system (BMS), and plug load controls controllable for demand response (DR), and off-grid, exterior, LED lighting in the parking lot, and lastly (3) Advanced laboratory ventilation, fume hood exhaust, and direct current (DC) lighting systems.	7/12/2017	Yes	Demand-side Management	$3,994,256	$3,994,256	$4,618	N/A	$4,618	$875,037	$0	Trane U.S., Inc.; ASWB Engineering; Willdan Energy Solutions; Aris Wind	$2,382,225	37.4%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-010 Integrated Heat and Moisture Calculation Tool for Building Envelopes	Applied Research and Development	This agreement develops a new tool that integrates moisture and thermal analysis. By integrating these two properties the optimal strategies can be determined for improving envelope design for new construction and retrofit applications. This agreement provides building professionals with a user-friendly engineering software tool at no cost.	8/9/2017	Yes	Demand-side Management	$125,000	$125,000	$0	N/A	$0	$59,000	$0	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-17-011 Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	Technology Demonstration and Deployment	The purpose of this project is to develop, demonstrate, and operate an innovative, state-of-the-art anaerobic digestion facility designed to convert organic waste from San Luis Obispo County into renewable electricity. The community-scale bioenergy system will convert food waste and green waste into renewable electricity, compost, and liquid fertilizer. In cooperation with waste haulers, the feedstock will be locally sourced from cities, communities, and unincorporated areas of San Luis Obispo County. Food collection and distribution programs will also be incorporated into the project to ensure recoverable food is used for human consumption before being disposed of at the facility. Electricity will be sold and exported to the grid, while compost and liquid fertilizer will be sold and distributed by a local farming supply company.	8/9/2017	Yes	Generation	$4,000,000	$4,000,000	$0	N/A	$0	$0	$0	HZIU Kompogas SLO Inc.	$5,278,373	56.9%
2015-2017 Triennial Investment Plan	CEC	EPC-17-012 Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	Applied Research and Development	The project tests and evaluates three different energy pathways for conversion of woody biomass to electricity. The three pathways tested with the pilot-scale gasifier system are: 1) clean fuel gas production for baseload power generation, 2) syngas to Fischer-Tropsch liquid production for storage and flexible power generation, and 3) direct bio-crude production for storage and flexible power generation. Results from the three pathways will be compared and an optimal pathway will be identified for extended testing. After performing extended testing of the optimal pathway the technical, environmental, and economic performance of a full-scale facility will be evaluated.	7/12/2017	Yes	Generation	$1,499,000	$1,499,000	$21,824	N/A	$21,824	$254,980	$0	None	$0	0.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-013 Small Scale Forest Waste Power System	Applied Research and Development	This project develops a pilot-scale modular biomass power system called Altex Forest Power Technology (FORPOWER) that uses biomass from forest management as fuel to generate renewable electricity. FORPOWER, which is based on an indirectly fired gas turbine technology that separates the fuel combustion products from the clean gas turbine working fluid by using a novel heat exchanger, uses forest slash as a renewable fuel while meeting criteria pollutant requirements, reducing greenhouse gas emissions, supporting renewable energy goals, and improving forest sustainability. The Altex FORPOWER will cost effectively convert forest slash to electric power and interconnect with the grid at distributed locations within IOU regions that are close to forest resources.	7/12/2017	Yes	Generation	$1,499,994	$1,499,994	$151,936	N/A	$151,936	$768,611	$0	Altex Technologies Corporation; The Avogadro Group, LLC	$161,728	9.7%
2015-2017 Triennial Investment Plan	CEC	EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Technology Demonstration and Deployment	This project deploys APMD technology over a large sample size, at approximately 55,000 computer workstations at several Community Colleges, and focuses on integrating the technology with facility operations to ensure that they meet the needs of the sites and staff. Key features of the proposed project include outreach and individual education programs to California Community College Districts, evaluation of sites for participation in the project, purchase and installation of APMDs at approved sites, measurement and verification (M&V) activities both pre- and post-APMD implementation at the selected demonstration sites, and stakeholder satisfaction information from demonstration facilities staff and APMD end-users through interviews and surveys.	8/9/2017	Yes	Demand-side Management	$5,000,000	$5,000,000	$0	N/A	$0	$181,567	$0	Ibis Networks; Embertec	$2,422,770	32.6%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-015 Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)	Technology Demonstration and Deployment	This project is demonstrating a novel single axis solar PV tracking system. The innovative tracking system which can fit on sloped and rolling terrain will help solar developers build projects on lands closer to load centers and interconnection points that typically would not be considered, creating more site options. The construction costs are dramatically reduced by eliminating the need for grading soil with reduced environmental damage and mitigation costs. The new tracker was developed through a DOE award and a full-scale system is under testing at a rolling terrain near Davis. This Energy Commission grant is funding improvements and testing of the various tracker components in an effort to find cost-cutting opportunities to update the product design and optimize it for full-scale manufacturing.	8/8/2017	Yes	Generation	$999,822	$999,822	$0	N/A	$0	$76,846	$2,999,364	None	$0	0.0%
2015-2017 Triennial Investment Plan	CEC	EPC-17-016 An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	Applied Research and Development	This project develops a decision support system that will reduce the soft costs of estimating and planning new bioenergy power plants that consume woody biomass from sustainable forest management activities. The open-source facility siting tool will be hosted online and allow users to quickly evaluate economic feasibility and environmental performance potential of particular locations for development as a wood-based biomass power plant. The research team will perform case study analysis to understand feasibility and barriers to develop biopower facilities in high risk hazard zones.	8/9/2017	Yes	Generation	$1,222,284	$1,222,284	$0	N/A	$0	$203,977	$0	Regents of the University of California (University of California, Davis)	$28,523	2.3%
2015-2017 Triennial Investment Plan	CEC	EPC-17-017 The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	Applied Research and Development	This project supports the development of the Powertainer+, (PT+) a multi-modal power and products platform designed to generate low-cost renewable energy, process thousands of tons of forestry waste derived from California's unprecedented tree die-off, and sequester large amounts of carbon. The Powertainer+ will include a combined heat and power module, increase the power capacity (from 150kW to between 210-250kW) and increase the forestry waste processing capacity to up to 2200 (twenty-two hundred) bone dry tons per year.	10/11/2017	Yes	Generation	$1,500,000	$1,500,000	$0	N/A	$0	$0	$0	Humboldt State University Foundation, Schatz Energy Research Center; All Power Labs, Inc.; Anderson Biomass Complex	$750,000	33.3%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-018 Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units	Technology Demonstration and Deployment	This project assesses the potential for a highly standardized and rapidly deployable decentralized AD solution as a compelling alternative to large-scale centralized AD facilities. By implementing on-site AD at locations where food waste is generated and electricity demand exists, it is possible to reduce/avoid 1) the consumption of non-renewable electricity, 2) the transmission and distribution (T&D) losses associated with the delivery of electricity across long distances on the regional grid, and 3) the transport costs (inclusive of the monetary, environmental, and public health costs) of hauling food waste long distances to feed larger AD generators.	9/13/2017	Yes	Generation	$2,411,007	$2,411,007	$0	N/A	$0	$171,649	$0	UC Davis; Biodico, Inc.; SeaHold, LLC	$756,133	23.9%
2015-2017 Triennial Investment Plan	CEC	EPC-17-019 Burney-Hat Creek Bioenergy	Technology Demonstration and Deployment	This project seeks to bring West Biofuels gasification technology, a technology funded by EPIC under an applied research and development program grant (EPC-14-024), to full commercialization. The West Biofuels gasification solution is designed to utilize forest derived biomass and is ready for scale up demonstration and deployment. To advance its commercial readiness, this project is developing and demonstrating a community-scale forest biomass facility in the Burney-Hat Creek region that is designed to address the need for increased markets for forest biomass resources. The bioenergy facility will be consistent with the requirements of the BioMAT Category 3 and obtain a power purchase agreement at a financially viable price. The plant will consume about 22,000 BDT of forest sourced feedstock per year, generate 2.88 MW of renewable energy at full rated capacity, and have a capacity factor that is greater than or equal to 75%.	9/13/2017	Yes	Generation	$5,000,000	$5,000,000	$0	N/A	$0	$0	$0	Hat Creek Bioenergy, LLC	$5,000,000	50.0%

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2015-2017 Triennial Investment Plan	CEC	EPC-17-020 Demonstration of Vehicle-Grid Integration under Non-residential Scenarios	Technology Demonstration and Deployment	This agreement will demonstrate vehicle-grid integration in non-residential facilities to show the flexibility of smart charging, build and validate EV physical models as well as data-driven models that incorporate usage patterns, quantify the impacts of EV charging; develop controls to manage the smart charging to minimize grid impacts and utility costs, and calculate the value streams and costs associated with realizing those value streams.	9/13/2017	Yes	Distribution	$2,340,000	$2,340,000	$0	N/A	$0	$0	$0	UC Santa Barbara; Google.Inc; Kisensum; ChargePoint, Inc.; Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)	$597,593	20.3%
2015-2017 Triennial Investment Plan	CEC	EPC-17-022 Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities	Technology Demonstration and Deployment	The project will construct and demonstrate an innovative technology to pretreat organic wastes prior to anaerobic digestion at a wastewater treatment facility to enhance operational efficiencies and increase biogas production. The pretreatment technology will be constructed as skid-mounted mobile units for processing source-separated organic wastes and biosolids and will have cogeneration capabilities, thereby further increasing the energy generation from the wastewater treatment system.	11/8/2017	Yes	Generation	$1,589,163	$1,589,163	$0	N/A	$0	$0	$0	GHD, Inc.; Lystek International Limited; Design2Operate	$493,075	23.7%
2015-2017 Triennial Investment Plan	CEC	EPC-17-023 High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	Applied Research and Development	This project aims to develop and test a reinforced concrete additive manufacturing (RCAM) technology for building low cost ultra-tall wind turbine towers onsite at a wind plant. Taller wind turbine towers capture more wind energy from faster winds aloft, but are constrained by transportation size and weight. The key goal is to develop a RCAM technology that can be used to fabricate a hybrid wind turbine tower on-site in one day at half of the cost of conventional steel towers, and reduce the levelized cost of wind generated electricity in a low wind speed site by 11%.	11/8/2017	Yes	Generation	$1,249,982	$1,249,982	$0	N/A	$0	$1,078,363	$0	RCAM Technologies	$30,000	2.3%
Active Projects in 2017		**project count**	**268**					**$527,851,760**	**$527,851,760**	**$132,668,673**	**$0**	**$132,668,673**	**$99,041,718**	**$62,045,376**		**$256,166,767**	

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2012-2014 Triennial Investment Plan	CEC	EPC-14-004 Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	Applied Research and Development	The project aimed to build, validate, thermally cycle, and pilot test a modular 75 kW, 6 hour (500 kWh) molten salt thermal energy storage (TES) system, using standard shipping containers and commercially available tanks and insulation. The project leverages a novel cascaded tank arrangement and high-volume manufacturing and factory assembly, to significantly reduce the installed cost of TES for concentrating solar power (CSP).	12/10/2014	No	Generation	$1,500,000	$1,500,000	$377,870	N/A	$377,870	$283,080	$0		$19,038	1.3%
2012-2014 Triennial Investment Plan	CEC	EPC-14-019 Validated and Transparent Energy Storage Valuation and Optimization Tool	Applied Research and Development	This project developed, tested, and validated a publicly available computer model for the CPUC's energy storage use cases that determines the most optimal energy storage systems. This software model successfully assesses costs and benefits and guides energy storage projects with respect to location, size, and type. The software is publicly released as a cloud-hosted tool.	3/11/2015	No	Grid Operations/ Market Design	$1,000,000	$1,000,000	$1,000,000	N/A	$1,000,000	$482,416	$0		$901,944	47.4%
Closed Projects as of 2016		**project count**	**2**					**$2,500,000**	**$2,500,000**	**$1,377,870**	**$0**	**$1,377,870**	**$765,496**	**$0**		**$920,982**	
All Projects 2014 - 2017		**project count**	**270**					**$530,351,760**	**$530,351,760**	**$134,046,543**	**$0**	**$134,046,543**	**$99,807,214**	**$62,045,376**		**$257,087,749**	
Terminated Projects with no Funds Spent (Not included in project count.)																	
2012-2014 Triennial Investment Plan	CEC	EPC-15-011**** Isothermal Compressed Air Energy Storage with Solar and Load Forecasting Integration	Applied Research and Development	LightSail Energy, along with its partner, the University of California San Diego (UCSD), will design build, operate, monitor, and analyze an I-CAES system on the Eliot Field PV station owned by UCSD. The energy storage system will be a pilot unit for testing the capabilities and performance potential of I-CAES for load following and ancillary services, as well as renewable integration. The project will also gather data needed to reduce the cost of I-CAES, increase its efficiency, and support its incorporation into the California electric grid. The installed energy storage system will be capable of charging from both the installed PV on site and the electric grid (operated by SDG&E) and will be capable of 200kW of discharging power and will store up 800kWh of energy.	12/9/2015	No	Distribution	$1,200,276	$1,200,276	$0	N/A	$0	$102,846	$0		$779,400	39.4%

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date: Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($)*****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
2012-2014 Triennial Investment Plan	CEC	EPC-15-017**** Utilizing Waste Heat to Increase Efficiency of Isothermal Compressed Air Energy Storage in a Smart Microgrid Environment	Applied Research and Development	LightSail Energy will install and pilot test a 200kW I-CAES system at the UCI campus in Irvine California. The storage unit will be operated in conjunction with UCI's 1,000kW solar PV array and 300kW advanced natural gas turbine, all interconnected through an advanced "smart" microgrid. The I-CAES system will use waste heat from the gas turbine to increase round-trip efficiency. This is possible because I-CAES uses large water tanks as thermal storage, capturing and storing the heat of compression for use when the system is expanding air and producing electricity. The waste heat from the gas turbine will be captured and stored in the I-CAES thermal storage tanks and later converted into electricity. This project will provide the state's first real-world data on the operation and performance of an isothermal compressed air energy storage system and its ability to utilize waste heat for increased efficiency.	1/13/2016	No	Grid Operations/Market Design	$1,085,125	$1,085,125	$0	N/A	$0	$89,979	$0		$811,645	42.8%
* JLBC authorization is automatic 60 days following notification.																	
** Six Projects include funds from EPIC Plan 2012-2014 and EPIC Plan 2015-2017. There is a total of 270 projects.																	
***The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.																	
**** Two projects were approved at an Energy Commission Business Meeting in 2015 and 2016, but later terminated in 2016 by the recipient Lightsail Energy; however, no work was done on these projects and no funds were spent: Lightsail Energy EPC-15-011 and EPC-15-017 (Not included in project count).																	
*****Funds Expended to date: Reporting of In-house Expenditures is required of the IOUs, but not the Energy Commission per CPUC D.13-11-025 page 51 and ordering paragraph 20.																	
Note: Each amendment to a project is listed on a separate row.																	

Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
Contract-Interagency agreement	Pre-existing intellectual property identified in agreement 300-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Non-competitive	N/A (non-competively selected)	The Regents of the University of California, Merced	N/A (non-competively selected)	N/A (non-competively selected)	12/21/2015	Yes; Calif Based Entity	Prior studies of the trade-offs between cost-effective electricity generation and environmental protection have been based on unrealistic studies that do not take real-world policy constraints, such as legal and regulatory limitations into account. The models produced by this research will for the first time create "quasi" optimization models for hydropower generation that can take into account changes in precipitation and runoff due to a warming climate while sustaining downstream environments. These tools will inform decision-making in the context of trade-offs of electricity generation and environmental protection under a changing climate and relevant legal and regulatory constraints.	2a, 3a, 3f, 4d, 5c	This project is part of the U.S.-China Clean Energy Research Center for Water-Energy Technologies (CERC-WET), co-funded by the Department of Energy and the Government of China to partner on water-energy studies. This EPIC funded project Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions is one of three research endeavors addressing sustainable hydropower under a warming climate. Work on the project was delayed due to contract negotiations over terms and conditions. Efforts to develop an optimization model that will take into account different climate scenarios have begun, but have been delayed due to personnel changes.
Contract-Interagency agreement	Pre-existing intellectual property identified in agreement 300-15-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Non-competitive	N/A (non-competively selected)	The Regents of the University of California, Irvine	N/A (non-competively selected)	N/A (non-competively selected)	12/21/2015	Yes; Calif Based Entity	The advancement of tools for hydropower scheduling/prediction will facilitate power exchanges in the electricity markets, reduce unnecessary consumption of non-renewable energy sources, and increase the reliability of energy generation. California will be the study region so that the utility companies in California have the necessary support in their decision making process.	3f, 5c	The research team established connections to UCLA and JPL to discuss how to improve PERSIANN output and use satellite data to generate more accurate precipitation/aerosol forecasts. The team published a peer-reviewed article about reservoir inflow forecasts with two case studies: one of which focused on California. The Energy Commission was acknowledged in the article (tp://onlinelibrary.wiley.com/doi/10.1002/2017WR020482/epdf).The recipient is collecting aerosol data to begin to identify relevant PERSIANN outputs for regions of interest in California. The team will prepare and submit a manuscript to develop an enhanced artificial neural network as a modeling framework for the uses of (1) bias correction PERSIANN output, (2) developing short-term hydrometeorology forecasts, and (3) supporting reservoir and hydropower system decision making and management.
Contract-Interagency agreement	Pre-existing intellectual property identified in agreement 300-15-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Non-competitive	N/A (non-competively selected)	The Regents of the University of California, Los Angeles	N/A (non-competively selected)	N/A (non-competively selected)	12/21/2015	Yes; Calif Based Entity	Research conducted will develop flexible, integrated approaches to reduce energy use and costs associated with the use of non-traditional waters, and minimize the volume of waste water produced from their treatment. In addition, the contract will provide guidance on the "best-fit" technologies for California based on geographic area, energy resources and water quality available. Additional research will provide reliability benefits include improving water forecasting scenarios pertaining to recycled water for electricity generation and snowpack forecasting for hydropower operations.	1f, 1h, 3a, 4a, 4c, 4d, 5a, 5c	A stakeholder workshop was held in August 2017 with both DOE and all the UC/LBNL project managers associated with the CERC-WET (China Clean Energy Research Center for Water-Energy Technologies) project. Work continues to progress after a temporary delay due to uncertainty around federal funding. There are ongoing internal webinars to provide project status updates to DOE and the Energy Commission project managers.

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Contract	Pre-existing intellectual property identified in agreement 300-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5	California Clean Energy Fund dba CalCEF Ventures	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	CalSEED addresses a critical gap in the early technology development phase where small amounts of funding can have a significant impact in bringing new ratepayer-beneficial innovations to market by providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough clean energy solutions.	2a, 3e	The CalSEED Initiative was launched in January 2017 to provide seed grants of up to $150,000 for early-stage clean energy projects. Grants totaling $4.2 million have been awarded to 28 entrepreneurs this year for a range of research projects including a new lithium extraction process, a high-efficiency electric power grid control device, and a membrane that removes CO2 while reducing HVAC load.
Contract	Pre-existing intellectual property identified in agreement 300-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5	California Clean Energy Fund dba CalCEF Ventures	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	CalSEED addresses a critical gap in the early technology development phase where small amounts of funding can have a significant impact in bringing new ratepayer-beneficial innovations to market by providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough clean energy solutions.	2a, 3e	The CalSEED Initiative was launched in January 2017 to provide seed grants of up to $150,000 for early-stage clean energy projects. Grants totaling $4.2 million have been awarded to 28 entrepreneurs this year for a range of research projects including a new lithium extraction process, a high-efficiency electric power grid control device, and a membrane that removes CO2 while reducing HVAC load.
Contract	Pre-existing intellectual property identified in agreement 300-15-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5	Itron, Inc., dba IBS	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is analyzing the most critical RDD&D gaps that need to be addressed to achieve California's goals of zero net energy buildings for all new construction of residential buildings by 2020 and commercial buildings by 2030. Results of the analyses will be used to strategically target future EPIC investments in a manner that provides optimal benefits to IOU electric ratepayers, and maximizes the use of public research and development investments.	3e	After completing a comprehensive literature review of zero net energy research, the recipient conducted a stakeholder survey designed to understand the research needs surrounding ZNE technology. The survey received over 550 responses the largest ZNE focused survey ever conducted. Stakeholders felt that technologies such as battery storage and grid integration merited technology research much more than lighting or appliance efficiency. As the project continues, more granular detail about the performance and cost targets will be identified. For more information, visit: http://zneroadmap.researchenergy.net/

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Contract	Pre-existing intellectual property identified in agreement 300-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	3	Navigant Consulting, Inc.	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Recommendations resulting from this agreement will help the Energy Commission better direct EPIC Program technologies towards addressing customer needs and becoming widespread, commercial products.	2a, 3e	The project team has five work authorization projects: 1. Market Research on Microgrids- review commercial viability of microgrids in California without government support. 2. Benefits Methodology for the Regional Energy Innovation Clusters- evaluate the benefits accomplished by the Regional Energy Innovation Cluster agreements. 3. Needs Assessment for an online portal to support the Energy Innovation Ecosystem- define priorities for an online platform to support the Energy Innovation Ecosystem agreements. 4. Investing in DACs (in progress)- recommend strategies that have been piloted to overcome barriers to mass deployment of DER in existing buildings in DACs. 5. DER Innovations in California's Food Processing Industry- identify and recommend technologies that will reduce costs, increase efficiency, and reduce emissions for California's food processing industry.
Contract	Pre-existing intellectual property identified in agreement 300-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	3	Navigant Consulting, Inc.	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Recommendations resulting from this agreement will help the Energy Commission better direct EPIC Program technologies towards addressing customer needs and becoming widespread, commercial products.	2a, 3e	The project team has five work authorization projects: 1. Market Research on Microgrids- review commercial viability of microgrids in California without government support. 2. Benefits Methodology for the Regional Energy Innovation Clusters- evaluate the benefits accomplished by the Regional Energy Innovation Cluster agreements. 3. Needs Assessment for an online portal to support the Energy Innovation Ecosystem- define priorities for an online platform to support the Energy Innovation Ecosystem agreements. 4. Investing in DACs (in progress)- recommend strategies that have been piloted to overcome barriers to mass deployment of DER in existing buildings in DACs. 5. DER Innovations in California's Food Processing Industry- identify and recommend technologies that will reduce costs, increase efficiency, and reduce emissions for California's food processing industry.
Contract	Pre-existing intellectual property identified in agreement 300-15-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	3	Energetics Incorporated	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is analyzing the most critical RDD&D gaps in the industrial, agricultural, water and bioenergy sectors that need to be addressed to achieve California's goals for doubling energy efficiency by 2030. Results of the analyses will be used to strategically target future EPIC investments in a manner that provides optimal benefits to IOU electric ratepayers, and maximizes the use of public research and development investments.	2a, 3e	After completing a comprehensive literature review on technologies and strategies in the industrial, agricultural and water sectors, the recipient conducted a stakeholder survey designed to understand the research needs surrounding IAW technology. The survey was distributed to over 200 individuals and will help inform a series of 19 webinars designed to illicit further stakeholder input.

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Contract	Pre-existing intellectual property identified in agreement 300-15-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	4	ADM Associates, Inc.	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Micro Business, Calif Based Entity	The Commercial End-Use Survey and saturation study activities will provide a more disaggregated sampling of the state's end-uses in the commercial sector, than was historically collected. This level of granularity will lead to more accurate energy forecasts which can assist in keeping rates low as forecasts are used to determine infrastructure needs in long term procurement planning by the CPUC. Furthermore, the data can assist the state in achieving the energy efficiency reduction goals outlined in Senate Bill 350 by supporting the identification and accurate characterization of opportunities for demand-side management, energy efficiency program planning, load shifting, and demand response.	1c, 2a, 5c	The contractor has had many challenges recruiting the California electric investor owned utilities' (IOUs) participation in providing customer billing data necessary to conduct the survey. The contractors began with an initial survey sample in the San Diego Gas & Electric service territory and expect to expand to the other IOU service territories within the next six months.
Contract	Pre-existing intellectual property identified in agreement 300-15-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5	ADM Associates, Inc.	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Micro Business, Calif Based Entity	DER technology has advanced significantly over the past decade and current load shapes used to inform the Energy Commission's demand forecast do not account for the current and future deployment of demand-side innovations. Developing improved load shapes will provide an accurate assessment of the contributions of clean energy technologies to reducing peak demand, integrating renewable energy, and maintaining electricity system reliability as the deployment of clean energy technologies and strategies increases over time. This information will be used to improve the Energy Commission's demand forecast and analysis, and identify and target opportunities for future EPIC research funding to further reduce cost, improve safety, and improve reliability.	1c, 5c	This project was approved at the June 2016 Business Meeting and received approval from the Department of General Services in August 2016. The Recipient and Energy Commission staff has begun the first technical task of examining available data that can be used to develop the baseline load profiles. In 2017, the project is expected to finish collection of all necessary data and begin development of baseline load profiles and the impact of different scenarios.
Grant	Pre-existing intellectual property identified in agreement EPC-14-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18	Itron, Inc., dba IBS	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project reduces resource scheduling uncertainty for California utilities and CAISO by improving solar forecasts, integrating those forecasts into enhanced net-load forecasts, and implementing the forecasts to quantify specific improvements and cost savings. Currently, the CAISO uses a Baseline Load Forecast Model to calculate measured electricity loads of 15 minutes ahead to 10 days ahead, without measuring either in real time or ex post BTM solar PV generation. This project evaluates alternative model approaches for extending the California ISO load forecast framework for incorporating BTM solar PV to improve the load forecast accuracy of the California ISO's existing load forecast models.	1c, 4a, 5c	Researchers evaluated three alternative model approaches for extending the CAISO load forecast framework and present the alternative load forecast frameworks for incorporating BTM solar PV forecasts. The study Improving Short-Term Load Forecasts by Incorporating Solar PV Generation is available in the Energy Commission publication database. Furthermore, the project team has integrated irradiance measurements to improve aerosol optical depth and cloud albedo aspects of the solar forecasting model, incorporated near real-time metered PV generation data to fine-tune fleet forecasts of both grid-connected and BTM PV solar and implemented regional PV fleet forecasting model improvements. Currently, Itron is investigating forecast errors and quantifying their costs, and developing a neural network with machine learning algorithms to identify the best forecasts to use in a specific time.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18	Geysers Power Company, LLC	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Integrated computer model simulations along with actual field testing at a geothermal well will identify the effects and risks of flexible operation and the management and mitigation strategies needed to cost-effectively operate the Geysers to provide the flexible capacity needed to integrate renewable energy onto the grid. Costly turbine redesign are avoided through appropriate strategies corresponding to the degree of curtailment, i.e. from small load to extreme curtailment, such as the combination of throttling of steam flow, controlling steam production, and use of a bypass system to directly vent steam to the atmosphere.	2a, 4a, 5a, 5b	In late 2016 the agreement was amended to extend the project term by 12 months in response to the disruption by the September 12, 2015 California wildfire, known as the Valley Fire. The project activities were resumed with the modified schedule. On March 7, 2017, a combined CPR and TAC meeting was held on site to discuss the project progress. At the meeting, the Recipient's technical staff presented and discussed several modeling scenarios that were performed to determine how the constraints at the wells impact the generation flexibility. With the modeling phase of the project now complete, the focus is currently on Turbine Bypass work together with installing instrumentation in the steam field for pilot testing. An article on the project was featured in the September-October GRC Bulletin.
Grant	Pre-existing intellectual property identified in agreement EPC-14-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18	University of California, Los Angeles	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	None	This project will develop a low-cost thermal storage fluid, elemental sulfur, which enables overall low system costs, long lifetime, and scalability for a wide range of concentrating solar power applications.	2a, 3a, 3b, 3h, 4a, 4b	The project has made significant progress including performing detailed heat transfer modeling and simulation, laboratory-scale material compatibility experiments, and laboratory-scale thermal battery testing. Results from the laboratory-scale (10 kWh capacity) system were very promising. The system was successfully operated at high temperature (600 degrees Centigrade) over multiple thermal cycles and demonstrated higher energy density and faster dynamic response (amount of time to charge and discharge) compared to conventional molten salt technology. Future work will design, build, and field test a pilot-scale (30 kWh capacity) thermal battery system at a concentrating solar power facility. Testing the system in a real-world environment is critical to proving it can work with actual solar energy input.
Grant	Pre-existing intellectual property identified in agreement EPC-14-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18	The Regents of the University of California, San Diego	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The uncontrollable generation of renewable energy sources, such as solar photovoltaics poses numerous challenges to the electric grid. The large growth of electric vehicles (EV) has potential to exacerbate those challenges due to increases in load, especially at inopportune times. However, the flexibility of scheduling EV charging around forecasted PV production provides a solution to this problem. Furthermore, the project aims to improve solar energy forecast accuracy by 45% over the existing persistence forecast method to optimize the operation of distributed energy resources. It will mitigate the concerns of electric operations over the variable nature of solar power that contributes to net load variability, causing voltage issues affecting service quality and reliability.	1c, 4a, 5c	Results of the intra-hour and ramp solar forecasts using a sky imaging network demonstrated that fisheye cameras can be applied as low-cost primary instrumentation for irradiance and forecasting purposes over wider geographical areas with limited loss of measurement accuracy and forecasting skills. Furthermore, researchers investigated and quantified the value of using solar forecasting to optimally schedule EV loads within a real microgrid. A total of 49 EVs with realistic arrival and departure periods were scheduled every day, considering realistic day ahead PV forecasts. The whole market sale use case was economical only during periods of extreme price peaks and low charging load. The results showed that accurate forecasts of PV production combined with flexible loads has the potential for improved system health and reduced costs.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18	University of California - Davis	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	None	Improvements to accuracy of short-term (3-15 hours) and very short-term (0-3 hours) wind ramp forecasting would reduce generating reserves scheduled by grid operators, with corresponding decreases in grid operating costs and greenhouse gas emissions, and, simultaneously, increased grid reliability.	1c, 3b, 5c	The project team has completed the measuring program that included sodar, ceilometer, radiometer, radar wind profiler, and radio acoustic sounder measurements scattered over six sites and completed a forecast sensitivity study of wind ramping behavior based on suite of physics-based predictive models versus observed sodar data, including obtaining results for a sensitivity study of observed bias of mean absolute error of 0-15 hour energy forecast for Tehachapi wind resource area.
Grant	Pre-existing intellectual property identified in agreement EPC-14-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18	The Regents of the University of California, San Diego	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project introduces a new generation of forecasting methods that fill in a technology gap in prediction DNI, POA irradiance and solar power generation from PV tracking and CSP. This critical need is evident by the relative scarcity of DNI forecasting algorithms discussed in scientific literature and the absence of DNI information from the majority of NWP models. The development of a network of low-cost sensors for distributed monitoring at California Valley Solar Ranch (CVSR) provides a solution to the need for high-density ground telemetry at low cost. The devices provide an unprecedented level of irradiance sensor density, which will be used to develop a new generation of solar forecasting methods. Short-term forecast using sky imagers and distributed data from sensor network improves forecasted data and prepares CVSR for the California ISO intra-hour market.	1c, 4a, 5c	Researchers assessed the performance of the forecasting models using common error metrics as a function of the forecast horizon (intra-hour, intra-day, day-ahead) and found that the increased ground data results in substantial forecast accuracy improvements. Forecast accuracy improvement intra-hour are 10.2% DNI and 34.1% POA. The resource-to-power models developed and validated for Ivanpah will be implemented in real-time and will use forecasted DNI. Furthermore, the surface wind forecast developed for Ivanpah prevents the heliostats from proper alignment and determines how far a cloud can move in a given time. These two models will also be implemented for CVSR. Additionally, a network of low-cost sensors has been installed for distributed monitoring at the California Valley Solar Ranch (CVSR) power plant. The devices provide a solution to the need for high-density ground telemetry.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	The Regents of the University of California on behalf of the Berkeley campus	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Radiant systems can be an integral part of ZNE and other advanced high performance buildings and reduce energy and peak energy use and cost compared to conventional HVAC systems.	1e, 1f, 1h, 4a	The project team has developed a simulation platform to allow fast simulation of a radiant system coupled with arbitrary control logic sequences to conclusively identify the most appropriate control strategies for thermally massive radiant systems, and to inform field study implementations. Field studies at three different sites are under way, and the field study reports are expected mid- and late-2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Lawrence Berkeley National Laboratory	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project is advancing scientific knowledge by quantifying the potential benefits of cool walls, assessing the performance of existing and prototype cool wall technologies, and developing innovative cool wall solutions. High wall albedo can be attained with a reflective coating (e.g., paint or stucco) or cladding. Cool wall products available today include light-colored paints that reflect up to 80% of sunlight when new, but may lose reflectance as they soil; and darker & cool colored; paints that come in a wide palette, but typically reflect less than 50% of sunlight when new. The purpose of this project was to evaluate the direct and indirect energy and environmental benefits of solar reflecting walls, assessing and advancing available and emerging cool wall technology	1e, 1f, 1h, 4a, 5d	The project is on track on all tasks. The project team met on October 25, 2017 with their project partners and technical advisory committee members to present research results and outline the project's next steps. The project is nearing completion; lab and field studies have been completed, as have the simulation and modeling projects to estimate impacts under different conditions. Also nearing completion is the task of developing the metrics, tools and resources to support creation of a cool walls advisory organization similar to the Cool Roofs Rating Council that would oversee independent testing and rating of commercial products in support of potential building standards. Remaining tasks include completion of the final report
Grant	Pre-existing intellectual property identified in agreement EPC-14-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Regents of the University of California, Davis - California Lighting Technology Center	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project could improve understanding of metrics and test procedures associated with LED quality and performance, increase lamp manufacturer's ability to comply with future energy codes and standards and produce good quality LED products and increase consumer acceptance and satisfaction of LED lamps.	1f, 1h, 4a	Project is on track and expected to complete all deliverables on time and within budget. Researchers completed the selection process for products in the lamp characterization study using the test methodology selection guidelines. The recipient completed the lighting performance and function experiment, over 20 participants from all ages were included in the experiment. Preliminary results of the lamp characterization study and the performance and function experiment is posted on the California Lighting Technology Center website https://cltc.ucdavis.edu/. In addition, the research team is working with multiple lighting manufacturers interested in collaborating on new LED lamp development such as optics, quality and architecture.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Lawrence Berkeley National Laboratory	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will lead to technological advancement by offering alternative construction techniques for sealing and insulating attics, compared to conventional methods. The alternative technique involves the use of sealed attics and could lead to electricity savings and peak demand savings when compared to conventional duct systems, and also increase occupant comfort. The recipient is working with building developers on these new techniques which will contribute to achieving ZNE goals for new construction. The techniques can also be applied to home retrofits with HVAC equipment.	1f, 1h, 4a	Recipient has completed over one year of monitoring at a new ZNE home in Fresno and one summer of monitoring at an existing home that is 30% better than Title 24 in Clovis. Data collection will continue through 2018. Over 100 sensors were installed per home, monitoring temperature, relative humidity, heat flux, surface condensation, moisture and HVAC energy use. An improved version of a sophisticated and mature model called Register Capacity (REGCAP) will be validated. Once validated, this model will be used to extend results to all of California's 16 climate zones. The second technical advisory committee meeting and the second critical project review were held in September 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-14-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	The Regents of the University of California on behalf of the Berkeley campus	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Air movement in buildings impacts comfort and ventilation, air quality, occupant health and safety, and is responsible for about half of the energy used in HVAC (11 percent of California's total energy). Currently, airspeed and airflow in buildings cannot be effectively measured due to the expense, power draw, directional sensitivity, and fragility of existing sensors. Communicating wirelessly with the building's control system, these low cost anemometers facilitate more efficient operation of building HVAC systems, resulting in an anticipated savings of 183 GWh/yr and 52,000 metric tons CO2e/yr.	1f, 1h, 2a, 3a, 4a	As of December 2017, the research team has tested both the 4-sensor spherical room anemometer prototype and the dual wand duct anemometer in laboratory test beds to assess signal processing. The tests revealed impacts from light, temperature and humidity on velocity readings. Both designs were revised, including adding special shaping mechanisms or "horns" to focus and amplify sound from certain angles; the room anemometer uses an omnidirectional horn, and the duct flow anemometer's horn is bidirectional. A TAC meeting was held in May, and the team met separately with a company potentially interested in commercialization. The anemometer prototypes were presented and demonstrated at the CBE Industry Advisory Board meeting in late October. In December, the team gave three research partners anemometer prototypes, user interfaces and associated hardware to test in their facilities.
Grant	Pre-existing intellectual property identified in agreement EPC-14-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Lawrence Berkeley National Laboratory	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The potential energy savings and interoperability advantages of DC and AC-DC hybrid systems are estimated to be significant, especially for zero net energy (ZNE) buildings that integrate on-site renewable energy with battery storage and electric vehicle (EV) charging. Prior research estimates energy savings potential of 10% to 30% for DC-powered ZNE buildings that incorporate storage and or EV charging. This project will help accelerate the adoption of DC and AC-DC hybrid applications by compiling existing knowledge, identifying standards and technology gaps, designing tools and identifying a path forward to help ensure successful outcomes for DC and AC-DC hybrid applications in key market segments from which these systems can scale.	1f, 1h	As of January 2018, the project is on budget and ahead of schedule. A paper titled "DC Appliances and DC Power Distribution: A Bridge to the Future Net Zero Energy Home", based on project findings, was presented at the 2017 EEDAL Conference. A stakeholder workshop was held to solicit input on market and technology assessment, concluding: DC power can save energy; despite increasing activity and interest, DC power in buildings is relatively immature; and a systems approach to DC in buildings that encompasses all potential energy and non-energy benefits is lacking. Additional activities include completion of a DC schematic designs review meeting, the project's final technical advisory committee meeting, and a briefing of Energy Commission Title 24 staff on relevant findings that could impact future standards. Technical tasks are complete and final project deliverables are being drafted.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	BIRA Energy	Group 3: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Micro Business, Calif Based Entity	Methods to improve the efficiency of building envelopes have included sealed, insulated attics as well as standard vented attics but are in limited use in the market today. However, these approaches add considerable cost to builders under current practices. The research team is employing new and novel installation methods and materials that have the potential for energy savings on par with ducts in the conditioned space, but at a cost similar to current construction practices.	1f, 1h, 4a	The researchers completed all of the laboratory research and have submitted the corresponding reports entitled "Attic Moisture Management", "Air Sealing Junction of Exterior Wall and Attic", and "Optimize Insulation and Guidelines for Netting Permeance in Sealed Insulated Attic." The researchers have procured monitoring equipment for the project field test, and installed monitoring equipment in the attics of four new homes in Rio Vista in the Fall of 2017. One of the homes is a Title 24 energy code compliant control home that will serve as a baseline. A draft research plan has been prepared and the researchers are working with their builder partner to coordinate the construction, instrumentation and monitoring phases.
Grant	Pre-existing intellectual property identified in agreement EPC-14-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Lawrence Berkeley National Laboratory	Group 1: Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The research focus is on low cost sensing and distributed intelligence that will enhance energy efficiency because it will enables distributed points of controls that will result in greater energy savings and more accurate energy reporting. The research will design and develop a new innovative desk lamps with localized sensing and user control of overhead ambient lighting. This innovative technology alters the lighting retrofit landscape by inexpensively enabling highly granular lighting control at the occupants fingertips (previously only zone-level control existed), to control overhead lighting. In addition, this technology can be enhanced with sensors to measure occupants Circadian lighting exposure to enable system control to ensure human health and productivity is optimized while maximizing energy efficiency attributes.	1f, 1h, 4a	As of the last technical advisory committee and critical project review (CPR)meetings, the project is on track to complete all deliverables on time and on budget. Standard data models for connected lighting systems were developed. Communication protocols, methodologies, metrics and control testing for the outcome-based lighting systems are still in progress. FlexLab testing is still monitoring Enlighted's networked lighting control system and comparing reported data types. Draft proposed content for user interface standards was circulated to industry for comments. The second and last CPR is scheduled for April 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Electric Power Research Institute (EPRI)	Group 1: Ranked # 8	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will develop a climate optimized HVAC system that includes advanced energy efficiency features. The technology could reduce electricity use, demand and costs, enhance occupant comfort, and allow the use of alternative refrigerants that reduce the potential for global warming.	1e, 1f, 1g, 1h, 4a	The recipient completed its second round of lab testing and shared the results in the second Critical Project Review, held on October 16, 2017. The final phase, field testing, has already begun. There are three test sites for this project, one in each electric IOU territory. Equipment will be installed into these test homes by the end of 2017. Data collection for a year is underway.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	ABEC #3 LLC, dba Lakeview Farms Dairy Biogas	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will significantly reduce methane emissions and generate renewable electricity helping to achieve the State's GHG emission reductions and renewable electricity goals. Demonstrating the effectiveness of the innovative hub and spoke model could lead to the development of more California dairy digester biogas-to-electricity and biogas-to-fuels projects. The improved digester design will decrease dairy operating costs and provide valuable co-products, such as nutrient-rich, more absorbable irrigation water.	3a, 4a, 4e	The project is progressing and broke ground in fall 2016 and construction is complete. A TAC was held in October 2017 followed by a CPR in November. The project accepted a PG&E 20-year Power Purchase Agreement and began testing in fourth quarter 2017 with full operation and data collection to commence in the first quarter of 2018. A ribbon cutting event is scheduled for February 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35	Eos Energy Storage, LLC	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	Eos is the only company offering a Zinc Hybrid Cathode Battery, under the trademark name Znyth. This is an aqueous, zinc-based battery technology that is inherently safer than competing technologies. This technology is non-flammable and non-toxic. In addition to being backed by UL- and ISO-certified quality assurance and control, the manufacturing process involves no toxic or hazardous materials. This demonstration will provide information and data to assess the value and cost savings of utility-scale battery energy storage when interconnected to the grid.	1c, 1i, 2a, 4a, 5b	A test plan and determination of interconnection requirements was completed. A survey and review of utility industry criteria interconnection needs and best practices was completed. The inverter and system specification as well as the interconnection checklist were completed. The battery system was installed late in 2017 and system testing has begun.
Grant	Pre-existing intellectual property identified in agreement EPC-14-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	West Biofuels, LLC	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is driving innovation in the bioenergy market for forest residue conversion to renewable grid power by advancing the modular gasification technology system design and integration with a high-efficiency lean-burn engine. The modular system has the potential to reduce the cost and increase the benefits of forest fuel reduction projects in high fire risk regions of the state.	1a, 1c, 4a	Researchers examined the biomass availability, harvest, processing, and chemical properties that impact the availability and cost of utilizing forest-sourced feedstock for a community-scale modular biomass-to-electricity system. West Biofuels conducted a number of test runs and measured and analyzed gasifier performance. The tests included thirteen plant startups and shutdowns and the production of over 1500 kW of producer gas, and were performed on raw gas and conditioned gas from representative forest biomass feedstock. Preliminary results showed that the productivity of the system is related to the air input, and the gas produced has sufficient energy content to satisfactorily perform in an engine application, with a higher heat value of 6.29 MJ/kg and a gas composition of 26.59% carbon monoxide and 15.47% nitrogen.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Sunfolding Inc.	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The PV solar tracking technology tested and validated in this project will result in ratepayer benefits of reduced cost of energy and increased energy supply reliability. The air driven trackers not only reduce the direct product cost to the customers, but it simplifies every step in the project lifecycle from development, to construction, to operation. The reduced cost of energy will be achieved by demonstrating a solar tracking technology that adds 20-40% more power over fixed tilt systems at a cost that is well below the cost of current solar trackers. The increases in energy supply reliability will be achieved by delivering additional power that occurs in the late afternoon to the grid.	2a, 3b, 4a	The process of building and commissioning the air driven trackers led to the creation of additional installation tools to simplify that process, including a module installation toolkit. All trackers were instrumented with sensors, cameras, and data collection equipment to test and verify the 300 kW PV tracker in the field. Data on tracker performance, weather, and environmental conditions, such as wind, UV, and temperature data, is being collected. The distributed position sensors are gathering temporal positioning and providing tracker consistency data, and the air pressure sensors are deployed to assess pneumatic performance. The ongoing tests evaluate the environmental conditions, characterize the tracker performance, and evaluate different product configurations. Preliminary results have substantiated prior simulation work and enhanced the understanding of the system behavior.
Grant	Pre-existing intellectual property identified in agreement EPC-14-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	The Regents of the University of California, Berkeley	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (De Leon, 2015) set energy efficiency targets for 2030 and allowed for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project team recommended designing future residential energy efficiency programs that target low-income customers in hot climate zones, and account for time-of-use rates in California. Key findings that led to these recommendations were that hot climate zone was a huge factor in getting customers to participate in this HVAC program, low-income households experienced greater savings because existing household appliances were usually less efficient and more noticeably improved, and that energy savings, due to participating in the program, were the greatest between the hours of 3-9 pm in the months of August and September due to peak demand rates.	2a, 5c	The project team submitted its Final Report in March 2017, and had its final meeting in July 2017. Project findings suggest that: climate is the strongest variable for customer participation in t SCE&'s Quality Installation Program (participants in hot areas saved ~1100 kWh annually, compared to 300 kWh in warm areas and 0 in mild areas), savings were higher for lower income homes than for high income homes but lower income homes participated less frequently, the most significant hours for achieving energy savings were shown to be 3-9 pm, and that future energy efficiency programs should be focused on increasing participation of low-income homes in hot areas.
Grant	Pre-existing intellectual property identified in agreement EPC-14-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35	Regents of the University of California, Los Angeles	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Compressed air energy storage may be a viable solution for long-term and large-scale storage applications. HTH-CAES potentially has lower capital and maintenance cost and less geographic restrictions than other storage technologies. In the HTH-CAES technology, compressors are used to convert inexpensive off-peak electric power into compressed air and thermal reservoirs.	1c, 1i, 2a, 4a, 5b	The design of a 74kW HTH-CAES system was completed and is ready for a future demonstration. The final report includes a description of the piping and instrumentation, the mechanical/thermal design of the energy storage, and the completed 3D layout of the plant. All major components for construction were purchased, several patents were developed and journal articles were published. The final report is being prepared for publishing on the Commission website.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	InnoSepra, LLC	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project is advancing an innovative gas cleanup system based on temperature swing adsorption concept that adsorbs carbon dioxide and other contaminants while letting methane pass through and that regenerates the adsorbent bed leading to lower cost of operation. Converting biogas to high purity biomethane enables its use in premium efficient devices for power generation thereby helping reduce the cost of electricity. This technological approach will help meet renewable electricity goals at a lower cost and will enable use of marginal biogas sources for power generation applications using conventional natural-gas fired prime movers.	1a, 1b, 3g, 4a, 4b	One of the project host sites requested that Innosepra mount its gas conditioning skid on a trailer that could be parked at the facility so as to minimize permitting risk to the host. The scope of work did not preclude trailer mounting, however a budget reallocation to shift funds to equipment and materials to accomplish this was required. The amendment was executed in May, 2017. Since then, Innosepra has completed designs, released an RFP to California fabricators and is currently accepting bids from qualified vendors.
Grant	Pre-existing intellectual property identified in agreement EPC-14-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	ABEC #2 LLC, dba West Star North Dairy Biogas	Group 3: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project demonstrates an improved digester design with the double cell lagoon for greater biogas storage and on-demand generation potential and, if successful, establishes dairies as competitors for storage contracts. The improved system will decrease dairy and digester operating costs while also enhancing the protection of groundwater. Other important benefits include: lowered manure handling costs and valuable co-products, such as nutrient rich, more absorbable irrigation water.	3a, 4a, 4e	The project broke ground in fall 2016 and construction is complete. A TAC was held in October 2017, followed by a CPR in November 2017. The project accepted a 20-year PG&E BioMAT Power Purchase Agreement and will begin data collection and full operation commencing in the first quarter of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Lawrence Berkeley National Laboratory	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This analysis (1) identifies high-priority areas within California and feedstock types for further public deployment funding, (2) highlights promising geographic areas or available technologies to encourage increased investment in waste biomass DG by the private sector, and (3) improves efficiency and reduces environmental burdens by helping to minimize biomass transportation distances and maximize the efficiency of power production and waste heat utilization.	3c, 4a	The researchers are developing 2020 (near term) and 2050 (long term) scenario projections for waste biomass supply in California. Four TAC meetings were held to identify the scope and scale of waste heat and waste heat-generated cooling for customers in the domestic, commercial, and industrial process markets. The project has developed a county-level monthly wet and dry California biomass inventory, assessed the energy generation potential from food waste in California and identified counties where new anaerobic digestion capacity is needed. The researchers estimated energy demand density and identified areas with district heating/cooling potential by using building stock turnover model along with energy use intensity factors. During next few months, the project will be matching biomass types and evaluating costs associated with relevant energy generation technologies.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	University of California, Irvine	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project will demonstrate and deploy a novel gradual oxidation system in conjunction with a gas turbine that is capable of converting low-grade, and otherwise unusable, landfill biogas into renewable electricity.	1a, 1c, 3a, 3h, 4a, 4b	This project was presented at the December 2015 EPIC Innovation Symposium in the "Bioenergy and High Fire Risk Areas" session. Site engineering, site drawings, and permitting requirements were completed in early 2016. An interconnection study with two supplemental reviews was completed by Southern California Edison in late 2016. The study identified the need for substation upgrades and an interconnection cost which far exceeded the budgeted amount. Consequently, the project sought a new landfill host site to demonstrate the novel gradual oxidation technology. A new site (with an existing interconnection agreement) was found and confirmed in mid-2017. The project is currently completing revised site engineering, site drawings, and permitting requirements at the new host site and plans to install and operate the system in early 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Inova Energy Group, LLC	Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of the Hispanic subpopulation that discourage or prevent their participation.	1f, 1h, 5c	This project was completed in 2017. Key findings show that participants' energy-related behaviors were heavily influenced by family and community. For example, extended family members living under the same roof lead to variances in energy behaviors. More subtle implications include the use of energy to prioritize comfort for elderly family members. The study also found that participants did not tend to focus on the technical capabilities of energy-efficiency equipment or home envelope improvements, instead the focus was on behavior. For example, participants reported manually turning on and off their air conditioners rather than relying on the thermostat. The final report also contains recommendations for energy program administrators, policy- and decision-makers, and other researchers to increase Hispanic participation in energy efficiency programs.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	The Watershed Research and Training Center	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	The combination of a commercial-ready gasification technology that has not been previously demonstrated in California, along with the producer gas cleanup system, automation and control, and optimized operation will prove distributed, renewable, woody biomass fueled electricity as economically feasible and capable of operating for 7000 hours/year. The project will be grid-connected and will provide immediate benefits including increased renewable generation capacity, expanded technical resources, and community environmental, wildfire, and economic development benefits.	1a, 1c, 2a	Permitting work is mostly completed and ground preparations and construction have started. The system was expected to be operational by June 2017 but equipment has not been delivered to the site and site preparations halted due to financing problems with project partners. A Stop Work Order was put in place on 9/18/2017 and will remain until the recipient provides documentation showing the financing is secured, the equipment is delivered on site and construction has resumed. As of 11/2017, Phoenix made public that they obtained a PPA with PG&E, however, they are still negotiating with the bank to secure the New Market Tax Credit grant of $800,000 which they plan to use for equipment delivery. Construction/installation is expected to resume in January 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Interra Energy, Inc.	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	If successful, this project could help stabilize the grid, improve service reliability, and reduce the risk of forest fire. Advanced bioenergy systems that produce useful co-products can also reduce the cost of renewable energy procurement and mitigate the GHG impacts of energy generation.	1c, 4a, 4b	The project faced serious technological challenges and Interra Energy was unable to demonstrate progress towards meeting the project requirements. The Energy Commission determined that results from the bioenergy system are not satisfactory and the interim reports are technically deficient. As a result, the Energy Commission staff terminated the agreement at the August 2017 Business Meeting.
Grant	Pre-existing intellectual property identified in agreement EPC-14-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Lawrence Berkeley National Laboratory	Group 4: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will advance a breakthrough technology that is scalable across investor-owned utility territory leading to well coordinated and managed high-density PV installations and ratepayer benefits of greater reliability, lower costs and increased safety.	1e, 2a, 3c, 3d, 3f, 4a, 5b	The PV array has been installed, energized and generating power. Different PV penetration scenarios were simulated. In mid-2016, the first micro synchro-phasor measurement unit (uPMU) was installed at the building feeder, and by August 2017 two other uPMUs were installed. Data for these units are being collected. Python scripts to download, query and analyze statistical data within the uPMU database were tested. The tasks of interfacing various hardware components of FLEXGRID (the facility encompassing solar PV, storage, uPMU, and load and grid simulators), and grid-event triggers were completed. A first test plan for baseline data collection was developed which will involve bi-weekly setup changes between no PV support, and standard PV support test cases.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	SunSpec Alliance	Group 3; Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project addresses critical gaps impeding high penetration of solar PV and DER beyond current IEEE limits (15% total circuit penetration) while improving grid stability and increasing cost effectiveness though development of CA Rule 21 test framework, compliance testing of smart inverters, and deployment of integrated PV and energy storage systems, and helping create cost-effective and mass-produced smart inverters that can be integrated into diverse grid systems through standard communications.	1b, 3d, 3f, 4a, 5b	Smart inverter testing is continuing and anticipated to conclude by December 2017. The participating inverter manufacturers are working with SunSpec to meet the new test standards specified in UL 1741 SA. SunSpec is also working directly with the developers at the inverter companies to bridge any gaps in understanding of the UL requirements for CA Rule 21 compliance to avoid any further delays. The planned start of the field test with SCE and Tesla (a.k.a. SolarCity) has been delayed until April/May 2018 due to design changes to the Tesla Powerwall and changing priorities in the Tesla business overall. However, Tesla has increased its activity and has promised a reevaluation of the schedule.
Grant	Pre-existing intellectual property identified in agreement EPC-14-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Center for Sustainable Energy	Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of the Hispanic subpopulation that discourage or prevent their participation.	2a, 5c	CSE's analysis of 704 records sample revealed that using brochures with imagery of modest houses and families that appeared Hispanic (as opposed to imagery of large homes and non-Hispanic, Caucasian families) had a positive impact on audit sign-up rates in census tracts with a high concentration of Hispanics. Despite this increased number of audit sign-ups, phone interviews with 30 self- identified Hispanic audit participants found few had completed or planned major upgrades based on the audit recommendations, though minor upgrades such as weather-stripping or light bulb replacements were more common. These results highlight the importance of tailoring outreach materials for energy efficiency programs, and the efficiency potential that can be accessed through improved program outreach.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Indicia Consulting	Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	None	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of various subpopulations that discourage or prevent their participation.	1f, 1h, 5c	The project is proceeding on schedule. The project team has overcome initial difficulties in obtaining utility data and have been able to identify and collect data from survey recipients and interview participants in order to implement Task 2 (Document/Analyze emerging attitudes) and Task 3 (Identify drivers of cybersensitives). Deliverables have been completed on schedule and the team is working on the Task 5 (Develop Critical Insights for Supporting Residential Engagement) and Task 6 (Recommend an Alternative Energy Efficiency Potential Model).
Grant	Pre-existing intellectual property identified in agreement EPC-14-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	TRC Engineers, Inc.	Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project provides program developers information on how social, cultural, and behavior aspects of multi-family building tenants impact participation in utility efficiency programs. The findings in the survey will help design utility efficiency programs to better engage customers in multifamily units to increase participation and achieve greater energy savings.	2a, 5c	This project was completed in December 2017. The project surveyed energy use in multi-family units in the Bay Area and the Central Valley. The project found that the differences between load profiles are also correlated with demographic and cultural factors such as race/ethnicity of the occupants as well as the amount of plug loads they use. These are second order effects though to the weather-dependent energy use such as use of cooling energy in the hot Central Valley versus relatively mild coastal areas. The multivariate analysis shows that no single demographic or cultural factor (nor interactions with others) by themselves explain the differences more than or as much as the effects of location and climate. The initial finding of the TRC survey were presented at the BECC Conference on October 17, 2017 in Sacramento, CA.
Grant	Pre-existing intellectual property identified in agreement EPC-14-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Glint Photonics, Inc.	Group 4: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Glint technology has the potential to capture 1% of the future potential rooftop solar market (153 MW). Glint Photonics anticipates a product introduction to the market in 2018, with penetration of the rooftop market to grow in the 2020s. If the anticipated performance can be realized, the company anticipates 1 MW of panels installed by the end of 2020, with significant potential for additional capacity and cost savings in future years.	1a, 4a	Researchers have completed the fabrication of the GEN 1 prototype module and prototype tracking mechanism. This improved prototype has been characterized in laboratory testing and direct sunlight. Laboratory testing indicated optical efficiency that closely matched simulations, indicating that there are not unexpected deficiencies in the optical components. Preliminary results have shown that the efficiency for stationary panels meet the target of a >15% power conversion efficiency. Additionally, a preliminary cost performance analysis identified that the modules can achieve the LCOE target of 3.5 ¢/kWh for high direct normal irradiance (DNI) locations. Research indicates that the CPV market is interested in the coarse single-axis trackers, rather than on coarse two-axis trackers.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Biogas & Electric, LLC	Group 3: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The technology being deployed is a low cost NOx and SOx reduction wet scrubbing technology called NOxRx (a registered trademark) which can be used in conjunction with all biogas engines and anaerobic digesters in the market today. NOxRx has a patented method of utilizing the effluent stream from an anaerobic digester to reduce emissions from biogas engines. Unlike SCR, it does not produce N2O and does not require H2S removal or biogas conditioning prior to combustion. Therefore, NOxRx represents a significant cost savings over competing NOx reduction solutions. The goal of this project is to demonstrate the commercial viability of NOxRx for biogas-fired lean burn engines to comply with CARB NOx and SOx standards, and SCAQMD Rule 1110.2.	1a, 1c, 1f, 3a, 3b, 4b, 4e	Biogas and Electric was unable to demonstrate its emission reduction system at the Palm Springs site, hence requested an amendment to the agreement to change the host site to a wastewater treatment facility in Escondido, San Diego County and extend the term. The amendment is pending approval.
Grant	Pre-existing intellectual property identified in agreement EPC-14-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Lawrence Berkeley National Laboratory	Group 3: Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will provide valuable insight to identify optimum pathways that overcome barriers for large-scale deployment of biomass conversion technologies. The research will focus on overcoming barriers for urban stakeholders, including odor, access to the utility grid, and improved utilization of waste heat.	2a, 3g, 4a	Researchers measured NOx emissions during several flaring events to establish primary NOx formation pathways, which may include thermal, fuel, and prompt NOx formation. The team performed air emission measurements and modeling to minimize odors and greenhouse gases from anaerobic digestion and the composting facility. Researchers are updating the Life Cycle Assessment model to identify opportunities for improved economic and environmental performance by quantifying the life-cycle cost, energy demand, and the GHG impacts of the existing ZWEDC facility and paths to scale-up. ZWEDC has interconnected to PG&E grid and enrolled in CAISO to enable sale of net electricity.
Grant	Pre-existing intellectual property identified in agreement EPC-14-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Taylor Energy	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project researches, develops, and verifies thermal catalytic gasification technology that will overcome technical and economic barriers preventing the use of refuse derived biomass (RDB) as an energy resource in California. Completion of the current gasification/reforming test program enables future scale-up to 30-ton/day RDB-to-energy (1-MWe scale), in preparation for commercial scale design at 300-ton/day, generating 10-MW of electricity with costs of less than $3,750/kWh of installed capacity.	2a, 4a, 4e	Design and fabrication of the Process Development Unit and equipment layout work at the host site is complete. Major equipment, consisting of PDU, Reformer, gas-flare and gas conditioning equipment was installed. Testing of the gasification system has started. One TAC meeting and two CPR meetings were held to review project progress towards achieving goals and objectives. Initial startup of the gasification was performed using 8 lbs of wood pellets, and then refuse derived biomass. The pulse burner operated at 900 degrees C and produced 9.47% char by weight. Startup testing started in June 2017 and is scheduled to be completed during next four months, ahead of schedule. The rate of char conversion will be increased by a modification to the gasifier that allows char particles to stay in the gasification zone. This modification will also result in increased syngas production.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Kennedy/Jenks Consultants	Group 3: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will result in reliable and cost effective energy production by producing bioenergy from waste water treatment plants (WWTP) through the addition of locally available food waste and restaurant fats, oil, and grease (FOG). Though there is some seasonal variation, the supply of wastewater, food waste and FOG are very reliable.	3a, 4a, 4e	The researchers completed benchmark digester performance for digester operations without the addition of food waste and Fats, Oils and Grease (FOG) at two sludge loading conditions. A FOG preprocessing unit is installed and is fully operational. The first test loading FOG to sludge is completed, and the second test is ongoing. Installation of the Organics Extrusion Press (OREX) for extracted food waste and polishing unit is completed, along with the initial characterization of OREX. The system is expected to be ready for operation by April 2018. Initial results from the study were presented at the Water Environment Federation's Residuals & Biosolids Conference in April 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-14-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Southern California Gas Company (SoCalGas)	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	None	This project will develop and demonstrate a new bioenergy pathway which utilizes hydrothermal processing and concentrating solar power to convert dairy manure into bio-crude and renewable natural gas that will enable dispatchable and low emissions renewable electricity.	1a, 1i, 2a, 3g, 4a, 4b, 4e	The project has made significant progress since its inception. Redesign of the CSP receiver was completed by NREL in early 2016, and fabrication of the receiver was completed in 2017. Design of the Genifuel hydrothermal processing (HTP) unit with input from the Pacific Northwest National Laboratories (PNNL) was completed in late 2016 and a fabricator was chosen in early 2017. As of late 2017, construction of the HTP system is near completion and the Hyperlight CSP facility is being expanded to a half acre in size using redesigned collectors and receivers. The system will be commissioned in early 2018 with testing will take place throughout the year.
Grant	Pre-existing intellectual property identified in agreement EPC-14-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Gridscape Solutions, Inc.	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Minority Owned	The fire stations are vulnerable to earthquakes, so having local, renewable generation decreases their dependence on outside electricity sources. This is the first implementation of microgrids for several fire stations in the region which creates a great opportunity for proof of concept to overcome risk and knowledge barriers for adopting high penetration solar PV system. The microgrids will demonstrate their ability to improve energy efficiency by optimizing power generation and loads using advanced, automated microgrid control. Local, renewable photovoltaic generation and energy storage may provide increased energy security during utility power outages and reduce carbon dioxide emissions. The microgrids will help reduce grid congestion and increase grid reliability.	1e, 1h, 4a, 5a	Gridscape has successfully completed design, procurement, construction, interconnection, and commissioning of the microgrid at the first fire station (#11). This microgrid has been operational since September 2017, and Gridscape has started the data collection process. The remaining two microgrids at the fire stations #6 and #7 are expected to be completed by March 2018. There were several barriers in this project involving liquefaction zones at the sites as well as utility interconnection issues. Those issues have been resolved; however, they resulted in a delay of 12 months. Gridscape was granted a 12 month time extension to complete the project. Gridscape has also presented this project at several conferences and is expected to commercialize this technology by end of 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	All Power Labs, Inc.	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project, built entirely of technology designed and manufactured in California, will develop and demonstrate a higher capacity, and currently unavailable in the market, mobile conversion system capable of cost-effectively converting forest biomass near where it is sourced into renewable, on-demand energy to help address a myriad of issues associated with climate change, including drought, fires, and the need for more renewable energy.	1a, 1c, 4a	During the integration and assembly of subsystems into a fully assembled Powertainer (PT), researchers experienced technical challenges in some subsystems, such as the ash removal system, char candle filter performance, fuel flow from hopper, and layout and transportation. The gasifier and related components are being prepared for testing of the improved ash removal system. Preliminary tests on the gasifier measured a producer gas composition stable and within the expected range. The average composition of carbon monoxide and nitrogen was 28% and 20%, respectively, with a heat value equal to 7.0 MJ/m3. The ongoing activities are focused on the readiness of the fully assembled PT for performance and emission testing at the demonstration site. Data generated during those tests will be applied in market based models to determine the value and optimal locations for mass deployment.
Grant	Pre-existing intellectual property identified in agreement EPC-14-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Organic Energy Solutions	Group 3: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will demonstrate the use of electrical generation powered by digester gas to provide reliable power to a critical facility during outages on the grid. The electricity from this project will be exported to the SoCal Edison distribution grid through SB 1122 Bioenergy Feed-in Tariff. The system will also be equipped with islanding capability to support the critical facility during an interruption in the grid.	1b, 1c, 2a	Since the project kicked-off in August, 2016, OES has completed design and equipment specifications for the project and initiated procurement for long lead-time equipment. CleanWorld, a major subcontractor to this project is currently fabricating the anaerobic digestion processing skid in anticipation of its installation beginning in March 2018. CleanWorld has also completed the hot water skid for maintaining process temperatures and is currently holding it at its plant for delivery to the demonstration site when construction begins. Other system components, including mechanical and electrical controls are also in the process of being assembled at CleanWorld. OES is currently seeking a 10 month no-cost time extension to ensure the project is completed during the grant term.
Grant	Pre-existing intellectual property identified in agreement EPC-14-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Robert Bosch LLC	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will demonstrate the feasibility and benefits of a commercial-scale DC building microgrid that uses multiple direct current technologies to provide reliable power to the loads on DC circuits, resilience during grid outages, increased energy efficiency and renewable energy utilization with lower losses.	1e, 1h, 4a, 5a, 5d	The energy storage partner filed for bankruptcy and forfeited their contract. Bosch evaluated and brought on another storage vendor. Bosch then worked out the final battery design with the new partner to finalize the interconnection approval and provided revised construction drawings to obtain permits from the City of Chino and the Chino Fire District. Bosch worked to finalize the DC lighting fixture specifications with the lighting manufacturer. Information necessary for a training program curriculum is being collected and will include the ongoing work of installation and inspection of the solar, lighting, fans, and the fork lift charger system. Bosch continues to monitor the existing facility energy usage for future analysis.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Humboldt State University Sponsored Programs Foundation	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will measure customer energy and cost savings benefits and demonstrate the benefits of microgrids using renewables for vulnerable communities. The microgrid will have the ability to disconnect from and operate without the larger electric grid by managing and balancing a portfolio of distributed energy resources.	1e, 1h, 4a, 5a, 5d	In January 2017 the microgrid was operational, with the secondary SEL 700GT+ relay control system handling all transitions between grid-connected and islanded states. Offsite testing of the primary controller, the Siemens microgrid management system, was completed at Idaho National Laboratory in February of 2017 and microgrid operators participated in a control system training. In March 2017, onsite testing occurred along with a pre-parallel inspection. All protection and controls systems passed inspection except for seamless transitions events. PG&E granted Conditional Permission to Operate for Testing Purposes Only, which allowed the project team to fix the seamless transitions. Final Permission to Operate was granted on July 31, 2017. The primary microgrid control system has been fully operational since that time, and system monitoring is ongoing.
Grant	Pre-existing intellectual property identified in agreement EPC-14-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Chabot-Las Positas Community College District	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project identifies and measures the benefits of microgrids for customers that shift peak energy use to coincide with peak solar production and for distribution utilities and the California ISO by demonstrating the resource capability of microgrids. This project will measure the microgrid's benefits by using existing retail rates as well as simulating a market in which all microgrid benefits can be monetized.	1e, 1h, 4a, 5a, 5d	The year's activities were the continuing development of the system by vendors with relatively new products: UniEnergy Technologies with their 100kW/500kWh vanadium flow battery, and GELI with their microgrid controls. These vendors worked together to integrate their products into a complete microgrid system. The infrastructure was designed and installed, including equipment pads, electrical switchgear, and power and data wiring. The system began operation and entered the measurement and verification project phase by year end. The team shared project information through presentations at national microgrid conferences at Boston in April, Washington DC in June, and a national Educational Public/Private Partnership conference in San Diego in October. The team will present at the annual California K-12 Facilities conference in February 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Regents of the University of California, Los Angeles	Group 3: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Most current electric vehicle service equipment (EVSE) provide uncontrolled charging without using smart algorithms, software, or standard network technologies. This project is demonstrating a pre-commercial PEV infrastructure that uses a control center, communicating over a wireless communication network, to control the charging operations of the EVSEs using smart charging algorithms. The pre-commercial infrastructure (WINSmartEV TM) developed by UCLA will be advanced so that it is able to determine optimized charging and/or vehicle to grid services based on PEV profiles, user preferences, grid-related events, and grid capacities.	1h, 3f, 4b	The UCLA team developed EV charging algorithms with demand response capability. The team also developed and tested a phone application and an EV user web application. The researchers are continuing development and integration of an IEC 61850 standard compliant gateway. Several EV chargers were installed in the City of Santa Monica Public Parking Building and on the UCLA campus. Possible solutions for control and V2G operations were explored, and the team also tested the bi-directional fast chargers during the past year.
Grant	Pre-existing intellectual property identified in agreement EPC-14-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Lawrence Berkeley National Laboratory	Group 3: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project developed an aggregation system for smart charging PEV vehicles to provide demand response, mitigate demand charges, and leverage time of use rates. A charging control system was applied to a fleet of vehicles owned by Alameda County and to charging stations that are used by both county vehicles and the public. The project added systems for intelligent prediction of PEV loads and control algorithms to create a flexible, modular, and scalable solution for smart charging county fleet and public PEVs. The managed charging control system will enable growth in PEV adoption without straining current grid infrastructure.	1g, 1h, 2a, 3f, 4a, 4b, 5b	The project is successfully operating with the Alameda County fleet of vehicles in the Alameda County parking garage. Researchers have successfully recruited volunteers for public participation and will be incorporating information on public EV charging into the study. The EV drivers are using a phone application to communicate with the chargers in the garage for scheduling their charging sessions. Researchers have begun quantifying the savings from smart charging and there is evidence of a reduction in demand due to the smart charging. Lawrence Berkeley National Laboratory participated in the last three Annual Vehicle-Grid Integration public workshops hosted by the CEC to share the progress, results, and findings of this project.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Trane U.S., Inc.	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will demonstrate that a microgrid at a wastewater treatment plant can operate without compromising water quality or negatively affecting plant operations, can deliver reliable ancillary services to the grid, and can reduce the need for new peaker or load-following generation resources by providing ancillary services. The EPIC funds greatly accelerate the commercialization timeline by demonstrating a functional microgrid that addresses challenges with integrating energy storage, on-site generation, and control components to allow the wastewater treatment plant to bid curtailable loads to the CAISO market while improving resilience and earning revenue.	1e, 1h, 4a, 5a, 5d	The microgrid is in the construction phase. The project team also completed work on formal hardware/software specifications, methods of data storage and integration, and microgrid controller architecture. The project team successfully executed a City Agreement with Santa Rosa, allowing the team to perform construction activities. Permit applications and construction plans were developed for components, including on-site photovoltaics, energy storage, and selective catalytic reduction equipment.
Grant	Pre-existing intellectual property identified in agreement EPC-14-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	San Diego Gas & Electric Company	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project proposes to demonstrate and measure improved grid resiliency from using a microgrid. The project will use a microgrid controller/energy management system to attempt to make greater use of locally available renewable energy while avoiding adverse grid impacts.	1e, 1h, 4a, 5a, 5d	The focus for 2017 was on the testing and commissioning of the Spirae Distributed Energy Resource Management System (DERMS) software controller, upgrades to existing assets, upgrades to the system protection and automation settings, development of the Energy Education Center in Borrego Springs, and the preparation of the test plan for the oscillation mitigation controller. The team began testing the DERMS controller on all three circuits at the 69 kV bus with the NRG 26 MW solar array in December. The battery system was upgraded to 550 kW, and the system controller was updated to allow the battery system to be the island master and have black start capabilities. A new 250 kW ultra capacitor to assist with voltage and frequency regulation was installed and will be commissioned in Q1 2018. The project will undergo outage testing in early 2018 to assess how well the microgrid performs.
Grant	Pre-existing intellectual property identified in agreement EPC-14-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	U.S. Geological Survey (Forest and Rangeland Ecosystem Science Center - FRESC)	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will develop and apply a unique combination of stable isotope analysis and demographic modeling to characterize the wildlife population of interest affected by fatalities at renewable energy facilities in California and by novel application of techniques that evaluate statistical models to improve forecasting of wildlife fatality rates and mitigation outcomes. The approach will be high-tech, scientifically innovative and ultimately subject to peer-review via publication in scientific journals. Implementation of this set of tools will benefit ratepayers by streamlining permitting and reducing costs of energy development and electricity.	2a, 3a, 4f, 4g	As of fall 2017, the project is transitioning from the data collection to the analysis phase. The research team has compiled close to 300 environmental impact and monitoring reports and about 3,000 carcasses that are being prepared for isotopic analysis to distinguish local resident birds from regional migrants. Together with experts, the research team developed a list of 34 species of five types on which to focus. Each type will be modeled with the most appropriate kind of demographic model using data from other parts of the project. The team has also shared sample material from carcasses found at renewable energy facilities with the team from EPC-15-043 to increase their database for genetic analyses.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	University of California, Riverside	Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will highlight a pathway for water and wastewater agencies in California to increase energy efficiency and reduce their peak energy consumption with no decrement in service or reliability by overcoming communication challenges with different vintages and vendors of control equipment. Better pump and other equipment management will reduce energy costs; especially during peak demand periods when energy costs are most expensive.	1e, 1h, 4a	The installation of and testing of software/hardware configurations for test sites to transmit energy data to SCADA operators is complete. These systems have been reviewed by the research team to insure their accuracy in transmitting energy use data in real time. Historical energy use at these sites has been customized in displays so that it can be used for operators to conduct peak load shaving to avoid historical peaks and thus lower energy demand charges. Discussions are taking place with M&V contractors to integrate their independent evaluation into the project design.
Grant	Pre-existing intellectual property identified in agreement EPC-14-063 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	Porifera, Inc.	Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own	The project includes technological advancements in membrane development and module design in forward osmosis to address cost and performance issues. The demonstration projects are located at a winery, frozen food facility and a soap company. Each demonstration is documenting energy savings and potential for this technology to purify, concentrate and reuse challenging wastewaters that contains high levels of contaminants. This technology has the potential for application in the food and beverage, oil and gas, and other industrial sectors.	1f, 1h, 4a, 4c	Porifera has finished collecting the data from the Jackson Family Wines project site and is analyzing the data. They also have changed the Wawona Frozen Foods site to Ale Industries as they determined that the PFO Recycler will yield more savings and be better suited to meet Ale Industries needs. They have started operations at Ale Industries and begun collecting data.
Grant	Pre-existing intellectual property identified in agreement EPC-14-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Regents of the University of California, Riverside Campus	Group 3: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The results of this project are expected to improve the management of hydropower units which should reduce overall electricity generation costs and assist with adaptation under a changing climate.	1c, 4a, 5c	The research team has set up the computer models and tested them against observed data to make sure their performance is adequate. The researchers are now working with Southern California Edison (SCE) and using a SCE model designed to optimize the operation of their hydropower units. The researchers are testing the hypothesis that using their forecasts can improve substantially the operation of the SCE hydropower units.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	Porifera, Inc.	Ranked # 7	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own	The technology uses forward osmosis and reverse osmosis in an energy efficient way to achieve the equipment performance of an evaporator and, in addition, generates purified water streams for reuse. When designed and implemented correctly, the technology can save energy and money.	1f, 1h, 4a, 4c	Porifera is working on regulatory approval for food contact with the PFO Concentrator at Los Gatos Tomato and have begun testing at the facility. They are finalizing plans for installation at Anheuser-Busch and have prepared the M&V plan.
Grant	Pre-existing intellectual property identified in agreement EPC-14-066 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Lawrence Berkeley National Laboratory	Group 1: Ranked # 10	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Almost all fenestration products offered on the market today address a narrow, component-oriented set of performance goals often set by prescriptive codes, e.g. a U-value, with only a limited consideration of the broader tradeoffs possible in the context of whole-building performance. This project uses an integrated systems approach to technological advancement. The fenestration solutions include improvements to the cost and performance of highly insulating (Hi-R) windows, energy recovery-based envelope ventilation systems, and dynamic daylight redirecting systems. Supporting tools, data, and design methods are also being developed to enable widespread, reliable, cost-effective deployment throughout California. These solutions could lower energy use and demand in buildings due to reduced HVAC and lighting loads while also reducing building owner operating costs.	1e, 1f, 1h, 2a	Design and prototypes are being evaluated for a light-weight, triple-pane window. Designing and early stage prototyping of a perimeter ventilation system that maximizes use of natural ventilation in mild California climates to offset mechanical cooling. Designing, prototyping, and initial field testing of a dynamic daylight-redirecting system that increases daylight up to 40 feet from the window. Improving tools for modeling innovative, optically-complex daylighting systems and prototyping/testing advanced model predictive control systems that will help optimize building electric loads.
Grant	Pre-existing intellectual property identified in agreement EPC-14-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	The Regents of the University of California, Berkeley	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project provides improved predictive planning and scheduling tools to manage hydroelectric resources that are needed to adapt to increasing vulnerabilities and uncertainties of a changing climate. This project specifically targets powerhouses operated by PG&E.	2a, 3a, 5c	The research team completed hardware installations for three project sites in 2016: Grizzly Ridge, Kettle Rock, and Buck's Lake. Installations on the fourth project site at Humbug were completed in August 2017. The team got hydrologic data from three out of the four sites for water year 2016. The team will collect hydrologic data for the 2017 water year from all 4 project sites. Discussions with PG&E established a prioritized list of data to analyze. The research team will examine methods for extrapolating temperature measurements as well as the relationship between temperature and solar radiation, which is currently highly simplified in the Precipitation Runoff Modeling System. In January 2017, the team presented a poster on Water Sensor Networks at the California Climate Change Symposium. By January 2018, the team will prepare a first manuscript and submit it to a peer-review.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Energy and Environmental Economics, Inc. (E3)	Group 5: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity	This project developed options for improving electricity planning methodologies, such that they better incorporate knowledge of how the electricity system will need to evolve over the next 15 to 30 years. The analysis includes a better understanding of how current policy choices will impact long-term climate outcomes, providing critical policy-relevant information to state energy agencies that will be implementing the Governor's energy and climate goals over the next 15 years.	3f, 4a	The researchers improved their models and data sets, for example, improving the linkage between the E3 model of the electricity system and their PATHWAY model. E3 briefed Chair Weisenmiller and the Policy Advisory Committee in November 2017. The final project report is published on the Energy Commission website and available to the public. Key findings of the long-term energy scenarios research include: 1- renewable power generation needs to exceed the current RPS requirement of 50% set for 2030 if the 2030 emissions reductions goal is to be met; 2- to meet California's 2050 goal of 80% emissions reductions relative to 1990, the electricity system must comprise 85% to 95% zero-carbon electricity by 2050; 3- consumer behavior is the lynchpin to meeting 2030 targets; and 4- additional RD&D is needed to chart a path for hard-to-electrify end-uses (e.g., heavy-duty trucks, industry).

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Grant	Pre-existing intellectual property identified in agreement EPC-14-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	Wexus Technologies, Incorporated	Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The Wexus platform uses site data and electric and water utility data to estimate how energy is used on-farm. The data is translated into reports and informs the farmer when to turn off equipment in order to participate in demand response programs. The technology could save farmers about 10% in energy and water bills.	1e, 1f, 1h	The project team has deployed the software and hardware solution to four sites and has started engaging the farmers in effective ways to manage on-site energy and water usage for their operations. Project team has started the baseline energy (and water where possible) use. Project team has completed the M&V report for the second quarter of 2017 (April - June), percent total change in energy (and related changes in GHG and cost) with respect to the baseline period for the Wexus farms include: a 3.2% decrease for the Berry Grower, a 75.7% increase for the Dairy Farmer, a 4.1% decrease for the Row Crop Grower, and a 9.8% decrease for the Winery.
Grant	Pre-existing intellectual property identified in agreement EPC-14-071 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Frontier Wind	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will create the wind industry's first bat impact deterrent system that can effectively prevent fatal bat interactions with wind turbines. Success of the project has potential to yield a transformational impact on the field of bat impact mitigation. An effective, practical, cost effective system design and test can enable commercialization and broad deployment of this technology. As a system that can be retrofitted into existing turbines and installed in new wind turbines, this technology could materially overcome a significant challenge of the wind power industry by reducing bat fatalities and injuries from turbine strikes.	2a, 3a, 4g	Researchers completed the design stage for the system and tested it in their lab. The full system was installed on twelve turbines at Hatchet Ridge in 2016. Bat fatality surveys were conducted on the test turbines and control turbines during the Fall 2016 bat migration season. Power supply problems disrupted the field testing, limiting the amount of useful data. Problems with the power supplies have been diagnosed and are being resolved. The system should be fully operational for the 2018 migration season, and it is anticipated that enough bat fatality data can be collected to give a statistically robust estimate of the effectiveness of the system to reduce fatalities.
Grant	Pre-existing intellectual property identified in agreement EPC-14-072 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Lawrence Berkeley National Laboratory	Group 5: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The researchers developed a stochastic version of their electricity model to explore issues such as path dependences. The preliminary final results indicates, among other things, that achieving the 2030 GHG target will be extremely difficult with a high percentage of natural gas appliances still in operation. However, this target can be met if California starts electrifying energy services and decarbonize power generation at a fast rate. The electrification of the industrial sector will be difficult even though the electrification technical potential is high. This is mostly due to the costs associated with electrification of the industrial sector. The use of PVs in disadvantages communities may not substantially improve local air quality or public health.	2a, 3f, 3h, 4a	LBNL and UC Berkeley have developed several long-term energy scenarios for California. The team attempted to harmonize assumptions with E3 and UC Irvine. These two entities performed similar analyses (long-term energy scenarios) than LBNL/UCB, but using different tools. The LBNL/UCB team is modeling the entire Western Electric Coordinating Council (WECC) to investigate if a changing of geographical coverage can affect the long-term energy scenarios. They also used a more granular model of the electricity system both in space and time with, for example, several load centers in the WECC instead of representing California as one block.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Lawrence Berkeley National Laboratory	Group 7: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Research improves on-the-ground benefits from urban heat island (UHI) mitigation by verifying relationships between the UHI effect and land use/land cover; using these measurements to calibrate and validate models that estimate benefits of mitigation measures; establishing a baseline of today's UHI effect against which the efficacy of future UHI mitigation (cool community) programs can measured; and leaving in place a set of research-grade monitors that can be used to track changes in the UHI effect.	4a	The team leveraged prior analyses of land-use, land-cover, and historical weather observation data and modeling efforts to identify good sites for urban heat island monitoring. The team selected sites in the Los Angeles air basin where the urban heat signal is conducive to research efforts, specifically, where the urban heat signal was sufficiently clear to enable new empirical understandings and model improvements. After extensive negotiation with the LAUSD, the team installed on-site weather stations. The team also developed a mobile monitoring platform and performed several mobile transects to collect data that assist in analysis of local determinants of the UHI effect as well as model calibration and validation. The Advisory Committee continued to engage key stakeholders as well as scientists.
Grant	Pre-existing intellectual property identified in agreement EPC-14-074 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	The Regents of the University of California, Irvine	Group 5: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project helps to define areas of technological need in order to fill future gaps in the electricity grid, created by climate impacts. Knowledge of those gaps can then be used by the Energy Commission and others to target funds for the most needed technologies to reach specific energy and climate goals.	2a, 4a	The modeling work for the research is complete as of Fall 2017 and the researchers are analyzing the results. The researchers have also met with a high level policy advisory committee led by Chairman Weisenmiller in Spring of 2016. They received feedback requesting an increased focus on environmental justice communities. In response throughout 2016 and 2017, the researchers connected with environmental justice advocates and area experts to highlight areas of importance to be attentive to in their analysis of project results. Throughout the life of the project, the research has also provided climate impact data for two other teams working on developing long-term energy scenarios for California's electricity sector.
Grant	Pre-existing intellectual property identified in agreement EPC-14-075 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	The Regents of the University of California, Berkeley	Ranked # 8	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The Lightapp technology takes an innovative approach by relating electricity use and operating measurements to the production outputs of specific facility systems. This project will monitor the compressed air systems over time, looking at both the supply side (the compressor) and the demand side (production). The software tool then identifies anomalies and makes recommendations to lower the overall energy intensity of production and save energy and money. This project demonstrates the operational effectiveness and financial viability of deploying a more developed version of the technology in California industries. This project focuses on optimizing electricity consumption in compressed air systems, a common system in many industries.	1f, 1h, 4a	As of October 16, 2017 the recipient has released 592 facility names for recruitment and has signed 68 facilities to participate. To date, 33 software installations were completed and energy savings data continues to be gathered.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-076 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	Kennedy/Jenks Consultants	Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project uses cloth depth filtration (CDF) for raw wastewater filtration to reduce the organic load on the secondary wastewater treatment step, which is the most energy intensive step in the treatment process. This breakthrough treatment using CDF has never been tested nor implemented at wastewater treatment plants. The technological breakthrough is proving the effectiveness and technical and economic feasibility of filtering raw wastewater for removal of biosolids before any other wastewater treatment step occurs. A reduction in biosolids loading before the primary and secondary treatment can lead to 35 percent reduction in secondary aeration energy use that will help these plants meet the state's SB 350 goals. The project team includes engineers, consultants end users and others who will work collaboratively to overcome barriers for market acceptance of the CDF technology.	1f, 1h, 4a	The project team has finalized the design for the first deployment site and anticipates construction to be completed and startup of the full system by the fourth quarter 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-14-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Center for Sustainable Energy	Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Had the project been successful, this project would have advanced the adoption of an open protocol that enables large amounts of new, low cost flexible capacity on the grid. The open protocol could potentially minimize stranded investments in less cost effective forms of flexible grid resources, maximize renewable and PEV integration, and promote a safer, more reliable low carbon future.	2a, 4a, 4b	CSE was unsuccessful in completing this project to develop, test and demonstrate an open-source Demand Clearing House (DCH). CSE experienced numerous project delays due to the loss of a major subcontractor and subsequently their demonstration site. CSE and the Energy Commission determined that the project could not satisfactorily complete before the grant funds expired. These delays ultimately led to the termination of this grant agreement. The only deliverable brought to completion was the DCH Server Specifications, which detail the design capabilities and functionality of the DCH. Work progressed on the DCH software, but was only completed up to 25%. The Server Specifications and "work in progress" software are available to the public for use and continued development.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-078 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	ChargePoint, Inc.	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will lower or defer costs in upgrading local distribution infrastructure by providing a mechanism for demand management for local distribution networks, specifically managing PEV charging with input from PEV customers, vehicles, and utility signals. The results from this project would allow the utility to optimize a residential customers night time charging while still satisfying the driver mobility needs. The driver will have the same driving experience, generation and transmission resources can be optimized, and the grid costs and emissions can be reduced. Quantitative benefits are being determined through the pilot study data.	1g, 1h, 2a, 3f, 4a, 5b	ChargePoint completed 15118 testing on the Daimler vehicle to send charging schedules to the vehicle and receive them back from the station. The 3 month pilot demonstration with 30 residential customers was completed and ChargePoint will analyze the results of the pilot to analyze how the residential customers behaved in the controlled charging schedules. ChargePoint will also work with LBNL to analyze the grid impacts of this kind of controlled charging. The project will continue to implement the 15118 standard into a charging station and test communication between that station and a vehicle.
Grant	Pre-existing intellectual property identified in agreement EPC-14-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Electric Power Research Institute (EPRI)	Group 3: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	A key benefit of this project to California IOU ratepayers is to find the upper limits of solar PV hosting that may be achieved using smart inverters and naturally occurring products, thereby providing insight into the necessity and timing in which such additional DER devices may be required in addition to lower costs and greater electricity reliability.	1b, 3d, 4a, 5a, 5b	All of the controllable load devices have been identified and some have been procured. The lab test setups have been designed and are partially complete. The control devices and initial algorithms were developed and implemented. Field test sites are being identified and recruited. Delays in the availability of UL-certified remotely controllable PV inverters have delayed the project progress. A CPR meeting was held on September 21, 2017 to mitigate the impacts of these delays and the Energy Commission decided to adopt the Recipient's proposal to split the project into two parallel tracks. The revised plan will retain the original project end date and budget, fully achieve all project objectives that do not require reliable remote control of inverters, and incorporate reliable full function inverters into the project as they become available.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-080 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Charge Bliss, Inc.	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Micro Business, Calif Based Entity	This microgrid will demonstrate reduction of utility energy usage by greater than 350,000 kWh per year, decreased peak monthly site demand by 100kW, regulation and improvement of site power quality to achieve greater load item efficiencies, and the ability to "island" to support life and safety functions for three hours or longer to supplement existing backup generation tools and improve the energy reliability of hospitals in crisis situations. In collaboration with the governing agency Office of Statewide Health Planning and Development (OSHPD), the CEC and Charge Bliss are forging new methods and standards to support the resiliency and autonomy of critical healthcare facilities. This will lead all healthcare stakeholders to reconsider current policies and procedures for energy supply and to evaluate additional redundancies to protect hospital operations.	1e, 1h, 4a, 5a	This project is demonstrating the ability of a microgrid to support and sustain the functions of a healthcare facility and to overcome barriers to its deployment. The Charge Bliss team successfully designed, engineered, procured, constructed, and commissioned the microgrid systems and began operations in the summer. The Team overcame diverse obstacles including hospital operations constraints for shutdowns, while meeting the requirements for regulatory oversight (OSHPD) and interconnection with the PG&E. The Team developed a novel microgrid controller to execute demand management and power quality regulation, which has been deployed. Ground-breaking interconnection to hospital Life and Safety systems was completed in November, 2017. Data collection for validation of system performance is ongoing and will be completed by the summer of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-081 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	PowWow Energy, Inc.	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity	Reduced irrigation techniques have not been adopted by growers because of perceived risks associated with lower crop yield and quality, and lack of equipment and labor to measure water consumption. This project is developing a unique software tool for measuring groundwater extraction and water application, by leveraging smart meter data, as well as existing water data in the cloud and at the farm sites. The tool is unique because it uses smartmeter data to measure water volumes from pumps without installing hardware devices on site. The tool also communicates with the farmer and irrigator to optimize crop yields and water applications.	1f, 1h, 4a, 4c	The Recipient has begun deploying the software (and hardware) at each deployment site and engaging the growers to optimize their irrigation plans for the year based on crop needs. Project team is working to finalize the results of the 2017 growing season and has begun to write the final report for this project.
Grant	Pre-existing intellectual property identified in agreement EPC-14-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16	Sierra Institute for Community and Environment	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will link emerging technology with new, innovative opportunities to advance renewable energy, distributed generation, and create clean energy jobs. The first-of-its-kind project combines a biomass-fired boiler with an Organic Rankine Cycle electric generator that diverts waste heat to source heat pumps supplying economical heat and power to a community-scale entity currently experiencing high energy costs. The project will help sustain a market for locally-sourced, sustainable forest biomass, providing jobs to the community and helping to reduce the risk of catastrophic wildfires that threaten transmission infrastructure and public safety. The project will serve as a template for other rural communities as how to combine emerging technologies in unique ways to address local energy needs using local fuels and reducing their need for grid electricity and fossil fuels.	1f, 1h, 4a, 4b	The project scope and budget were decreased as of September 2017. Feather River College, formerly a project partner, will no longer be taking waste heat from the project's organic Rankine cycle power plant, hence the scope and budget were reduced accordingly. In the new configuration, the system will generate 35 kW electrical and 400 kW thermal to serve load at the Plumas County Health and Human Services Center. Construction is currently underway, with system start-up anticipated for the first quarter of 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16	Sierra Institute for Community and Environment	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will link emerging technology with new, innovative opportunities to advance renewable energy, distributed generation, and create clean energy jobs. The first-of-its-kind project combines a biomass-fired boiler with an Organic Rankine Cycle electric generator that diverts waste heat to source heat pumps supplying economical heat and power to a community-scale entity currently experiencing high energy costs. The project will help sustain a market for locally-sourced, sustainable forest biomass, providing jobs to the community and helping to reduce the risk of catastrophic wildfires that threaten transmission infrastructure and public safety. The project will serve as a template for other rural communities as how to combine emerging technologies in unique ways to address local energy needs using local fuels and reducing their need for grid electricity and fossil fuels.	1f, 1h, 4a, 4b	The project scope and budget were decreased as of September 2017. Feather River College, formerly a project partner, will no longer be taking waste heat from the project's organic Rankine cycle power plant, hence the scope and budget were reduced accordingly. In the new configuration, the system will generate 35 kW electrical and 400 kW thermal to serve load at the Plumas County Health and Human Services Center. Construction is currently underway, with system start-up anticipated for the first quarter of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-083 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16	Prospect Silicon Valley	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	If successful, this project was projected to result in a 10% reduction in utility demand charges for the College of San Mateo campus in addition to saving another 8% in energy charges from peak demand reduction and efficient energy management measures. In addition, the PV and energy storage system was to be designed in a modular fashion by housing the Energy Storage System and Power Conversion System in a standard 20-foot container enclosure that was being produced to dramatically reduce balance of system costs.	1a, 1b, 1e, 1f, 1h, 1i, 2a, 3a, 3e, 4a	The College of San Mateo released an RFP for construction and installation of the project in February 2017 and selected Opterra in April 2017, but the project experienced several delays related to equipment sourcing and legal requirements. In late July 2017, the College of San Mateo decided to withdraw from the project, because the perceived risks were too great, and they did not believe that the full scope of the agreement could be completed within the agreement term. As the College of San Mateo was providing the demonstration site for the project as well as the majority of the match funds, Energy Commission staff and PSV decided to mutually terminate the project. The Energy Commission issued a Stop Work Order to PSV on August 7, 2017, and the Commission formally terminated the agreement at the October 11, 2017, business meeting.
Grant	Pre-existing intellectual property identified in agreement EPC-14-084 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16	ABEC #4 LLC CE&S Dairy Biogas	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project represents a significant advance in dairy energy management by combining renewable generation with waste heat collection and cooling to increase energy efficiency of the existing dairy by an estimated 10% or more, while also reducing peak grid power demand. The project benefits include substantial reductions in greenhouse gas emissions, lower manure handling costs, and generation and distribution of technical and economic data on community scale power production.	3a, 4a, 4e	The project broke ground in fall, 2016 and construction is complete. A TAC was held in October, 2017 followed by a CPR in November. The project accepted a PG&E BioMAT Power Purchase Agreement and began testing in fourth quarter 2017 with full operation and data collection beginning in first quarter 2018. Monthly invoicing and progress reports are being submitted and the project is expected to complete as planned.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16	UC Davis	Group 2: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The combination of advanced PV and energy management systems will result in significant reduction in annual grid electricity consumption - estimated at over 80% or a cost savings of roughly $29,000 per year with associated greenhouse gas reductions of about 250 tons per year. Furthermore, the success of this project will provide follow-on benefits to California's large wine industry by proving that winemaking can be an environmentally-friendly process.	1b, 1e, 1f, 1h, 2a, 3b, 4a	Due to the hazards associated with lithium ion batteries, battery storage was moved to a container outside the building where it was supposed to be installed. Moving the battery storage resulted in a delay due to redesign of the power distribution and control layout, and the plan of the new installations of conduit and concrete pads. The new location of the batteries drives the space conditioning and fire suppression requirements of the storage container. Additional delays were encountered after the loss of the key PV supplier (Solexel Inc.). Although the project suffered from construction delays as result of the change in location and redesign efforts, the project is now back on track.
Grant	Pre-existing intellectual property identified in agreement EPC-14-086 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Electric Power Research Institute (EPRI)	Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	PEVs with integrated V2G systems have the potential to simultaneously improve air quality, reduce vehicle operational costs and to reduce grid stress and increase grid reliability and stability. Monitoring at the transformer level with control of V2G provides enhanced local situational awareness and real-time responsiveness to distribution grid conditions. The developed management and monitoring system will have awareness of load, power, temperature, current, voltage, frequency, and PEV customer constraints-information to be utilized to determine need for V2G resource. This approach provides a potentially significant solution for integration of a viable energy efficient energy storage technology into a decentralized grid structure, and with the ability to operate as a unified distributed energy resource aggregation system.	1c, 1e, 2a, 3f	EPRI is developing an end-to-end capable V2G system that demonstrates grid condition awareness in a safe and outage-immune method. Aerovironment and Kitu have completed integration and assembly of J3072 and SEP 2.0b software into the 10 demonstration EVSEs. The research team is currently developing the on-board V2G communication module for the PEV that will be demonstrated at UCSD. EPRI is preparing the UCSD demonstration site for testing in late 2017/early 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-14-088 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	Asetek USA, Inc.	Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	If successful, the project will validate the performance, reliability, cost savings and payback of a data center efficiency technology that could reduce cooling costs while being able to be installed as a retrofit. This could lead to overcoming barriers to adoption by minimizing operational disruptions and costs compared with conventional installations and retrofits.	1f, 1h, 4a	At one of the demonstration sites, Lawrence Livermore National Lab, Phase 2 testing is being conducted after completing the demonstration and the M&V plan. At the second demonstration site, Lawrence Berkeley National Laboratory, site designs have been completed, and now the bidding for the installation is being conducted.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16	The Regents of the University of California - Riverside	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This system will result in greater electricity reliability, lower electricity costs, reduced peak energy demand and avoidance of failures and outages. The project is scalable in both size and quantity. Therefore, this effort will demonstrate the commercial feasibility to deploy many megawatt hours of dispatchable energy integrated in a photovoltaic/battery storage configuration.	1e, 1g, 1h, 2a, 3f, 4a, 5a	UCR continued to work on finalizing a purchase order for 30 kW SunPower P-Series Modules (SPR-P17-340-COM) and 60 kW SunPower E-Series Modules (E20-435-COM). UCR also assisted the Chemehuevi Realty Department in preparing subcontracts with the different industry partners, contractors, and vendors. The carport construction subcontractor EcoForce Solutions has completed carport structure design, ordered fabrication steel and received building permit to complete construction in 2017. A ribbon cutting ceremony is being planned for January 22, 2017. The interconnection agreement is expected to be completed before the ribbon-cutting ceremony. The project was also featured in UCR Today at the link below: https://www.solarpowerworldonline.com/2017/04/ensync-chemehuevi-solar-installation/
Grant	Pre-existing intellectual property identified in agreement EPC-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Electric Power Research Institute (EPRI)	Group 1: Ranked # 9	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The technology advancement is the intelligent HVAC controller that processes signals from building sensors and system feed-back to maximize system efficiency while also synchronizing operation of the VRF and IEC to reduce energy use and peak energy demand and maximize occupant comfort. The innovative control system utilizes cloud based optimization using weather, grid conditions and occupancy (CO2) as inputs to optimally operate a VRF and the IEC system to reduce both energy and water use. The IEC will be set up as a dedicated outdoor air system and incorporate variable speed blower and heat recovery ventilation. These subsystems will also be intelligently controlled by the building controller. For commercial HVAC equipment, this project will also evaluate and provide systems designs that use alternative refrigerants that have zero ODP or low GWP.	1f, 1h, 4a	Three test sites have been approved. The test sites are located in Davis, Mission Viejo and San Diego. The Davis and Mission Viejo sites will add indirect evaporative cooling and the San Diego site will add a new variable refrigerant flow loop. The recipient is collecting data at each test site to establish baseline conditions prior to equipment installation. The alternative refrigerant work is underway and the Recipient continues to work on the EnergyPlus model and control system.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	ICF Incorporated, L.L.C.	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Detailed SLR inundation modeling that builds on previous studies is used to identify the SDG&E infrastructure that will be exposed to coastal flooding and assess how the electricity system could be affected. Impacts of coastal inundation and possible adaptation measures are determined using literature reviews, interviews with key experts, modeling, and workshop elicitation. Potential direct and indirect impacts are used at an asset-by-asset level and through system-wide assessment, including power flow modeling to support a "value of lost load" analysis.	5a, 5d	Working closely with SDG&E, the research team first collected information on specific infrastructure assets and operations, and identified potential climate impacts. The climate impact vulnerabilities of the electricity system were then identified and discussed with the utilities. A matrix of assets and electricity service categories was developed in 2016. The research team collected information on electricity system adaptation measures and presented them to the utilities at a series of workshops to obtain feedback in summer and fall of 2017. The utilities are using some of the results from this study for adaptation planning.
Grant	Pre-existing intellectual property identified in agreement EPC-15-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	Lawrence Berkeley National Laboratory	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will lead to maintenance of grid reliability and safety while adapting to the challenge of changing climate and wildfire risk. Researchers will apply a unique methodology to measure wildfire risk, allowing them to relate an evolving wildfire probability over time with an evolving electricity grid. The methodology will reveal grid adaptations for minimizing the risk and cost associated with future wildfires.	2a, 5a, 5d	The researchers obtained the maps of future burned area being used for California's Fourth Climate Change Assessment as the basis for their study of future risk to the transmission and distribution system. They mapped current and future exposure of operationally significant segments of transmission paths to wildfire. They used land use projections of urban expansion from the Fourth Assessment as a proxy for the extension of the distribution grid for modeling its wildfire risk. Then they used the PLEXOS model to estimate the cost of fire-caused outages with and without wildfire forecasts, such as the change in generation costs as other power plants are dispatched to replace the stranded generators during the outage. The team is drafting the paper to be included in California's Fourth Climate Change Assessment in 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	The Regents of the University of California, Los Angeles	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project is integrating a set of models in a novel way to link new results on extreme heat events in Los Angeles County with electricity demand projections that respond to these events and then to model how these climate impacts would affect the vulnerability of electricity supply and of transmission and distribution networks. Doing so will create a greater level of understanding on where the grid is most vulnerable, which neighborhoods each circuit serves, and what types of adaptation measures need to be taken by the utility as well as state, regional, and local actors. The project can equally help guide investments in distributed generation that could alleviate pressure on the conventional electricity generation system.	1e, 2a, 5a, 5d	The research team has modeled temperature projections to the end of the century for Los Angeles County and extracted data on the increased number of extreme heat days for each 2km grid cell. They developed a model relating monthly energy usage at the building level to temperature and building characteristics. They are completing the projections of peak demand in response to increased air conditioning load due to climate change under a range of assumptions. They are also working on modeling the vulnerability of distribution grid circuits to the projected increases in demand. The team is planning an extensive outreach effort to inform utilities, local governments, and ratepayers. The report will be part of California's Fourth Climate Change Assessment due in 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12	The Regents of the University of California, Berkeley	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Cal-Adapt provides integrated tools that directly support electricity sector decision making with regard to infrastructure planning and management. Moreover, Cal-Adapt 2.0 coheres with the Governor's Office of Planning and Research's adaptation guidelines and is a key resource for accessing the data prescribed by those guidelines. Use of Cal-Adapt 2.0 to plan for climate resilience contributes multiple benefits to California's electricity ratepayers by helping to stabilize the grid, improve service reliability, and reduce financial losses associated with power outages.	5a, 5d	The research team released version 2.0 of Cal-Adapt, which includes more powerful visualization tools, new datasets, improved access to data, and a public platform for development of custom tools. New data include higher-resolution projections of temperature and precipitation designed to capture extremes as well as a hydrodynamical dataset for exploring potential inundation associated with sea level rise along the entire California coast, and the Bay Area and Sacramento/San Joaquin Delta. The Cal-Adapt team also developed several aggregation and data download options, as requested by the Technical Advisory Committee, which includes utilities and CAISO. Pursuant to a User Needs Assessment Workshop to capture electricity sector needs, Cal-Adapt launched a stream flow tool and improved existing tools (e.g., "quick stats" and historical modeled data download) to support IOU analyses.
Grant	Pre-existing intellectual property identified in agreement EPC-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	4	California Homebuilding Foundation (CHF)	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The California Energy Code now requires new homes to be constructed with high performance walls and attics to meet energy efficiency standards. This project helps overcome market barriers for high-performance walls and attics by providing the construction industry with access to on-the-job training and tools on the best available technologies, techniques, and practices for complying with the new requirements.	1c, 1e, 1f, 1h, 2a, 3c, 4a, 4b	The team continues to actively engage with the building industry giving training and technical support for the new HPA/HPW code requirements. Builder participation in hands-on trainings was slow so the team focused on subcontractor trades and building officials but will continue to pursue builders. Resources such as product guidelines, short videos, and other materials were developed to share success stories, lessons learned, and options for code compliance. These materials are posted on the project's online public clearinghouse: www.wisewarehouse.org. A curriculum on the new HPA/HPW requirements is being developed for a statewide high school building and technology program, as well as third-party verification requirements and training certification for insulation installers. Finally, independent measurement and verification activities will assess forthcoming installation trainings.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	4	Center for Sustainable Energy	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The California Energy Code was updated in 2013 to require lighting systems in large buildings to be capable of receiving and automatically responding to at least one standards-based messaging protocol which enables demand response. This project is helping ensure a workforce that is trained in the proper installation and maintenance of AutoDR communications equipment exists to meet California Energy Code requirements for commercial buildings.	1e, 1g, 1h, 2a, 3f	Subcontractors ASWB and UC Davis's CLTC finalized the academic workbook, lab workbook, and instructor's guide to start development of online coursework for course. The online version of the course was launched by the Joint Apprenticeship Training Centers in early November of 2017. In an effort to assist in reaching new apprentices, the project has established a project website where facilities and contractors can explore resources, incentives, and more at: http://energycenter.org/demand-response
Grant	Pre-existing intellectual property identified in agreement EPC-15-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 pha	Kennedy/Jenks Consultants	Ranked # 9	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Nationwide there are over 100 microfiltration/ultrafiltration treatment plants and there are over 100 reverse osmosis facilities in California using membranes. Membrane treatment for wastewater treatment is very energy intensive due to fouling of membranes over time. This project could overcome the barriers to use of membrane treatment by demonstrating a technology that can detect colloidal particles in membrane feed water. This can facilitate an optimal pretreatment process for their removal and reduce membrane fouling and energy costs.	1f, 1h, 4c	Bench scale studies have been performed at Orange County Water District to develop preliminary relationship between coagulant dose and colloidal particle removal. The Recipient has started coordination with Malvern Instruments. Both the microfiltration and reverse osmosis pilot units have been refurbished at the demonstration site. On-site safety training was completed and the health and safety plan and chemical handling plans were developed. Instruments and chemicals for initial testing have been procured. The recipient has completed feedback loop for coagulant dosing in response to colloidal particle count in the feed water, and also started testing and optimizing activities.
Grant	Pre-existing intellectual property identified in agreement EPC-15-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	The Regents of the University of California, Berkeley	Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project focuses on controlling the charging of plug-in electric vehicles PEVs at residential and small commercial settings using a novel and flexible open-source, open-architecture charge communication and control platform. This XBOS-V platform is embedded in the context of overall utility and residential/business electrical and building automation systems, lending itself to potential broad implementation by commercial interests. This integrated project also focuses on the development of the open-source platform including assessment of user needs and grid operation and ratepayer benefits, grid security considerations, and the potential for PEV charge control to lead to increased ability to accept intermittent renewable energy for California's electrical grid. The platform is flexible to adoption/inclusion of several communication protocols.	2a, 3h, 4a	The project team completed the participant focus groups to assess market drivers and decision points for adopting PEVs. The team also interviewed building energy managers to assess their needs and barriers to implementing a building management system with integrated vehicle charging. The project team also installed the Wi-Fi enabled smart-charger and completed initial integration of the software/code to communicate with the charger through the XBOS-V platform. Project work is currently focusing on simulation of added PEV charging loads in the context of a simulated distribution feeder that is based on an actual multi-nodal grid section of the PG&E network. The research team continues to extend the current grid load projects to better understand larger VGI grid benefits of aggregating building loads with PEV charging.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25	Andromeda Power, LLC	Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project enables the harmonization of V2G services, removing the communication barrier between PEVs of different standards and the grid. The communication interface enables Smart Demand Side Management with the possibility of using PEVs as distributed energy storage and controllable load. Local PEVs can be used to store onsite renewable energy and deliver to the grid on demand. The additional smart charging incentive can accelerate PEV adoption to achieve the targeted 1.5 million ZEVs on the road by 2025. Using PEVs as an energy storage resource can reduce energy demand and stress of the grid, making the load predictable and more manageable.	1g, 2a, 4a, 5b	The project team designed and prototyped two models of Level 2 chargers (ORCA InCISIVE, Strada and Zen) capable of demand response according to the V1G (managed charging) use cases defined by SCE and PG&E. The Andromeda VGI EVSE design includes smart inverter designs to accommodate Rule 21. The EVSEs will be installed in the field for durability tests. The EVSEs (Level 2 and Level 3) will also be integrated in a microgrid with 110 kW solar panels to demonstrate the feasibility of the InCISIVE system in mitigating renewable energy overgeneration.
Grant	Pre-existing intellectual property identified in agreement EPC-15-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35	Amber Kinetics, Inc.	Group 2: Ranked # 7	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is building on developments that the Amber Kinetics flywheel engineering team has made in the areas of improved materials processing for better strength and longer life, as well as improved rotor geometries to maximize energy storage density, thus reducing the cost of the system.	1c, 1i, 2a, 4a, 5b	Amber kinetics completed their commercial readiness tests of more than 25,000 operating hours. Also, they are continuously performing the safety validation with burst tests that are used to analyze and improve the flywheel containment design. For grid connection using multi-unit arrays, Amber Kinetics developed communication protocols, multi-array connectivity, charge and discharge operations, and control algorithms for coordination of multiple flywheels. This information was documented in a delivered technical report. They continue to collect flywheel operational data under real world conditions to prove the design robustness, reliability, round trip efficiency, and the ability to balanced power and control the state of charge.
Grant	Pre-existing intellectual property identified in agreement EPC-15-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35	Eos Energy Storage, LLC	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	None	This project aims to validate the safety, reliability, and performance of a new aqueous, zinc-based battery technology to support customer adoption in behind-the-meter energy storage markets and applications. Behind the meter DER application of energy storage has been identified as a major commercial market for energy storage. Detailed field performance data on the application of energy storage in these behind the meter DER opportunities is critical to the state to open up this market for new and emerging energy storage technologies.	1c, 1i, 2a, 4a, 5b	Eos submitted the Site License Agreement and Payment to UC San Diego for battery storage system installation and testing. The test plans and the engineering designs for both the commercial as well as the residential systems were completed. Battery production has begun. The inline design for the residential system integration with AC inverter has begun. Fully integrated batteries will be delivered to the UC San Diego campus in January 2018 for installation and the residential storage system testing will begin.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Regents of the University of California (University of California, Davis)	Group 1: Ranked # 12	Funds were awarded to passing proposals in rank order.	N/A	None	The project facilitates the market for high efficiency GCHPs by evaluating and testing an innovative method to reduce the cost of GHE, whose cost has been a barrier to more GCHP installations. Cost savings are associated with use of common, locally available drilling equipment for shallow bores as compared to deep drilling rigs that often must be transported from out of state, and the use of the helical coil GHE technology. In addition, this technology will be made ready for commercialization by developing tools needed to properly design, size and evaluate energy savings and to facilitate use with California Title 24 standards compliance tools.	1e, 1f, 1h	In 2017 the team collaborated with the author of an existing capacitance resistance model to study the optimization of the GHE design. The team developed a new computational fluid dynamics model that was used to validate the existing capacitance resistance model which will enable the study of variable soil properties. The existing model for a conventional U-tube GHE was validated by comparing ground thermal response generated by the model with those reported in literature. Three residential field sites were instrumented and field monitoring was completed. The results were used to validate the helical GHE model and a new model was developed to calculate the thermal behavior of helical GHE designs for use in building energy simulation software. A TAC meeting was held in December 2017. The project is on schedule and on budget.
Grant	Pre-existing intellectual property identified in agreement EPC-15-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 pha	Electric Power Research Institute (EPRI)	Group 1: Ranked # 11	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project bridges a technology connectivity gap in low-income and senior communities. Current smart thermostats are expensive, and a lack of broadband internet access makes these devices a bad fit for the low-income market. Developing a low-cost, internet-independent device creates opportunities to expand smart grid infrastructure and capture energy savings associated with automated controls in hard to reach building sectors.	1f, 1g, 1h, 3a, 4a	The team recently conducted interviews and surveys with property managers and residents to inform outreach and education strategies. Surveys were completed in Q4 of 2017. The recipient has hosted several connected devices working council sessions to gain feedback from manufacturers and other industry stakeholders. Hardware for the thermostat has been procured and software development is well underway. Currently the team is working on embedded software for Bluetooth connectivity for the thermostat.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	AGGIOS, Inc.	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Micro Business, Calif Based Entity	This project is advancing a methodology guideline to help plug load manufactures develop energy efficient plug load devices. The recipient is conducting detailed technical analysis on new software, hardware and power management design and verification methodology, conducting tests on virtual prototypes, verifying energy savings, and developing reference designs, in the form of design guidelines. This information will be made available to the plug load device manufacturers and their suppliers to help accelerate the adoption of mobile efficiency practices across multiple product categories in the shortest time and the lowest costs. As many current plug load devices in the market lack any power management capabilities, similar to those in smart phones, this project will pave the way for plug load manufacturers to advance those capabilities into other plug load devices.	1f, 1h	The recipient has completed the development of virtual prototypes for each plug load device that is being tested such as gaming console, computer, television, and set-top box. These virtual prototypes represent all of the components and power states defined in the specification of each device. These prototypes help identify the methodology for design space exploration and optimize energy efficiency before developing hardware and software components. The recipient completed the IEEE P2415 standard to support the newly developed unified design methodology. This standard is being reviewed for adoption. The recipient participated in the Energy Commission's Plug Load Collaborative in which they shared their current progress, results, and findings to other plug load projects. Staff conducted a site visit in early 2017 of the recipient's headquarters to evaluate the testing facility.
Grant	Pre-existing intellectual property identified in agreement EPC-15-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	The Regents of the University of California, Irvine	Group 1: Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The Recipient will develop and test a new user interface designed to facilitate and encourage greater utilization of low-power modes by computer users. The interface design will incorporate lessons from the fields of human-computer interaction and behavior theory. The field test will provide data that will improve understanding of user behavior toward computer power management.	1f, 1h	UCI has produced a fully functional draft of the software prototype. They have conducted pretests of the software and selected survey questions and made revisions to the questionnaires and software based on pretesting results. They are conducting the field test of the software on university staff desktops, and have more than 300 participants so far.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Lawrence Berkeley National Laboratory	Group 1: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will advance the design of energy efficient of video gaming computers and consoles by demonstrating system designs that are significantly more efficient than current market offerings. The research results could spur component and integrated system manufacturers and game developers to bring more energy efficient video game computers and consoles into the market without sacrificing the gaming experience. The project could also identify potential opportunities for codes and standards improvements and/or utility incentives. California ratepayers could benefit by having lower energy use and costs associated with their gaming systems without compromising their video game choices and experience.	1f, 1h	The research team has built all the video gaming computers and procured the video gaming consoles. Each video game device was evaluated with baseline testing of energy use and different power states. The team has recruited beta testers to come and record their video gaming playing time. The team evaluated the energy use for each device as testers are playing different games. The testing team implemented different efficiency measures on the gaming computers and evaluated the energy savings potential. The testers were surveyed on whether or not the game quality has differed once the measures have been implemented. The goal of the project is to demonstrate efficiency measures without compromising the game quality. Staff conducted two site visits in 2017. The first site visit was to participate in the Technical Advisory Committee meeting. The second visit was to evaluate the testing lab.
Grant	Pre-existing intellectual property identified in agreement EPC-15-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Lawrence Berkeley National Laboratory	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Standby power use is the electricity consumed by almost every electrical consumer device plugged in to an electrical outlet. Standby power is responsible for roughly 5% of California's residential electricity use. This project will develop an innovative family of zero-standby technology solutions and will enable the next generation of electrical devices to draw zero standby power while providing the full range of functionality that are desired by consumers.	1f, 1h, 4a	The project is on track to meet all its deliverables. The researchers are reviewing technologies for energy harvesting and energy storage in order to identify those most suitable for pairing with a power supply. They are also working on identifying energy efficiency technologies to integrate into selected plug loads that take into account human behaviors and device functionalities. The first TAC meeting was conducted in October of 2017. An abstract paper by Alan Meier, the principal investigator of the project on "Zero Standby Power Supply" was submitted to ACEEE for consideration, and was also presented at the 2017 EEDAL International Conference on Energy Efficiency in Domestic Appliances and Lighting.
Grant	Pre-existing intellectual property identified in agreement EPC-15-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Home Energy Analytics	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Micro Business, Calif Based Entity, Woman Own	Idle load is a new concept to most residential energy users and includes appliances and equipment in the off or standby mode but still drawing power. The recipient has developed an innovative smart phone app called Dr. Power which provides residents with information about their idle loads, provides ideas and a plan to reduce the idle loads, and correlates any energy saving actions with smart meter data. This simple to use app tests the theory that if accurate information about energy use is provided to consumers, they will be more likely to engage and take action. This technology has the potential to advance consumer knowledge and overcome barriers to reducing idle loads that could hinder the State's goal of doubling energy efficiency by 2030 and/or achieving zero net energy buildings in the future.	1f, 1h	The project is on track to meet or exceed all its deliverables on time and on budget. The research team is continuing development of the iPhone application version, and continuing work on the Plug Load Data Base (PLDB) interface and the Reduce Your Plug Load (RYPL) server for the text-based inventory of home devices. The application, Dr. Power, was launched successfully for both Apple and Android mobile operating systems. Feedback on the application is being collected to ensure accuracy; early feedback is very encouraging. The team is also working with Southern California Edison to resolve issues with the Green Button Connect features.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Lawrence Berkeley National Laboratory	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Building operators and end users do not have a clear or accurate tally of the plug load devices in their buildings, how much energy is used or how they could be better controlled to save energy. The Recipient is developing inexpensive, proprietary-free technologies that can acquire energy use data for networked plug load devices and make them available to building owners. The technologies will be able to identify abnormally large plug load energy use and enable building owners to react to its energy use. The technology could be incorporated directly into California's building codes and other energy efficiency standards.	1f, 1h, 3a, 4a	The project team has identified several devices and protocols, and have demonstrated energy reporting capabilities. The project team held a TAC on October 27, 2017 and received positive feedback. The team will continue to identify more devices and protocols for testing. The project is on budget and schedule.
Grant	Pre-existing intellectual property identified in agreement EPC-15-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Fisher-Nickel, Inc.	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project advancement is to bridge the knowledge gap and support the accelerated adoption of advanced appliances and controls by better understanding operator behavior and operational changes that can be made to successfully use new lower energy appliances. The results of this effort will be used to develop real world case studies of successful implementation of next generation plug load appliances, and provide training to food service operators to maximize energy reduction potential for food service equipment. In addition to food service operators, the research results will assist equipment manufacturers in further product development of energy efficient food service equipment and help justify development of utility incentives for purchasing and installing energy efficient foodservice equipment.	1e, 1f, 1h	The recipient has collected baseline data and installed new equipment at several restaurants in California. Plug load meters were installed at each of the test sites to determine baseline electrical consumption. Depending on logistics and site flexibility, between two weeks and three months of baseline data was collected. The field data thus far showed that commercial foodservice plug load equipment has a wide range of energy intensity, based on the operation type and hours. Cumulative energy savings for all plug load equipment can be substantial. The appliance with the highest average daily energy use, the conveyor toaster, used more than 20 times the energy on average than the appliance with the lowest average daily energy use, the soup warmer.
Grant	Pre-existing intellectual property identified in agreement EPC-15-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Electric Power Research Institute, Inc.	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	The analysis of health and air quality benefits alongside costs of electrification under this agreement is forming the basis for new cost-benefit metrics that can be used to assess the economic viability of breakthrough technologies. Cost-benefit analyses of this sort can be used to make evidence-based decisions regarding technology financing and deployment.	1f, 1h, 2a, 4a, 4b	The researchers for this project met with the three research teams (UC Berkeley with LBNL, E3, and UC Irvine) that are developing the long-term energy scenarios for the electricity sector in Spring 2016. Those scenarios are informing this research by providing electrification pathways. The researchers from EPRI are also involved as Technical Advisory Committee members on the long-term energy scenarios in order to facilitate integration between results and include salient metrics for environmental justice benefits in this project and the long-term energy scenario work. EPRI is also coordinating work by Ramboll, its subcontractor, to model air quality changes from switching fuels to electricity.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Black & Veatch Corporation	Group 5: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This agreement created a prototype, public tool (http://dg-solar.org/) that enables DG PV site selection by providing users both environmental and engineering geospatial data. Having proven the concept in Lancaster, CA, the tool may be expanded to other areas of California with similar data. Making information more comprehensive and accessible at the DG level will improve market functioning, while also enabling better DG infrastructure planning that incorporates environmental conservation.	2a, 4f	The research team designed the technical specifications of the planning tool, developed the web-based application, and compiled and processed spatial data. They revised the tool in response to TAC feedback. The tool combines solar resource, environmental sensitivity, cost, and interconnection spatial data layers in a single GIS application. The format of the tool allows user-entered values for a variety of screening parameters that may be of interest to developers, local planners, and government officials. The tool returns maps and lists of parcels that match the user-entered criteria and then generates reports. The completed tool at http://dg-solar.org/ went live in 2017. Members of the TAC from Los Angeles County and Power are interested in incorporating the tool's functionality into their own planning process and using the tool to guide future development in Lancaster, respectively.
Grant	Pre-existing intellectual property identified in agreement EPC-15-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6	Cleantech San Diego Association	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project will help advanced the goals of SB 350 (2015) by accelerating the commercialization of new smart grid technologies that can enable the integration of high-penetrations of renewables and distributed energy resources. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	Cleantech San Diego has accepted over 15 companies in the San Diego Regional Energy Innovation Network (SD-REIN).

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Grant	Pre-existing intellectual property identified in agreement EPC-15-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6	Cleantech San Diego Association	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project will help advanced the goals of SB 350 (2015) by accelerating the commercialization of new smart grid technologies that can enable the integration of high-penetrations of renewables and distributed energy resources. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	Cleantech San Diego has accepted over 15 companies in the San Diego Regional Energy Innovation Network (SD-REIN).
Grant	Pre-existing intellectual property identified in agreement EPC-15-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Electric Power Research Institute (EPRI)	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	In order to reduce plug load energy use and increase the energy efficiency of buildings, this project advances flexible energy management systems coupled with smart power outlet technology to control plug load use. The project will also enhance integrated strategies for operating different plug load types to achieve energy efficiency and demand response. The results of this project can potentially reduce electricity use in commercial buildings, particularly during low-occupancy times and in user-assigned spaces, thereby achieving lower electricity costs for the ratepayer.	1e, 1f, 1h	The project team holds regular Technical Advisory Committee (TAC) meetings to seek input and evaluate the plug loads that are being monitored at their Stanford and AP+ Design test sites. The project team and the TAC continue to evaluate the effectiveness of the measures for reducing impacts from plug loads. The most recent TAC was held in December 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-15-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6	Activation Energy, Inc.	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will help advance the goals of Senate Bill 350 (De Leon, 2015) by accelerating the commercialization of clean energy technologies, including energy efficiency, demand response, renewable generation, energy storage, and smart-grid integration. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	In 2017, Activation Energy launched the EPIC funded track of the Cyclotron Road program. Up to seven entrepreneurs will be selected to receive access to Lawrence Berkeley National Lab to develop their innovations, and a suite of support services including business model development, customer discovery, and investor matchmaking. Activation Energy also developed a resource library for use by the public that provides resources and examples of best-practices on technology development, team building and management, and attracting capital. Activation Energy also received two DOE grants - one will develop a standardized partnership agreement that reduces the time and complexity of forming partnerships between large industry corporations and early- stage technology developers; the other will build a fund that provides early investors with technology testing data rather than company equity.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6	Activation Energy, Inc.	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will help advance the goals of Senate Bill 350 (De Leon, 2015) by accelerating the commercialization of clean energy technologies, including energy efficiency, demand response, renewable generation, energy storage, and smart-grid integration. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	In 2017, Activation Energy launched the EPIC funded track of the Cyclotron Road program. Up to seven entrepreneurs will be selected to receive access to Lawrence Berkeley National Lab to develop their innovations, and a suite of support services including business model development, customer discovery, and investor matchmaking. Activation Energy also developed a resource library for use by the public that provides resources and examples of best-practices on technology development, team building and management, and attracting capital. Activation Energy also received two DOE grants - one will develop a standardized partnership agreement that reduces the time and complexity of forming partnerships between large industry corporations and early- stage technology developers; the other will build a fund that provides early investors with technology testing data rather than company equity.
Grant	Pre-existing intellectual property identified in agreement EPC-15-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Regents of the University of California, Davis	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The agreement provides information on indoor air quality and energy usage in classrooms with current HVAC systems throughout different parts of California. The project then evaluates next generation HVAC system retrofits with regards to energy efficiency and indoor air quality performance. The results will enable energy savings without impacting indoor air quality in classrooms. The study is the first large field study to examine the energy efficiency upgrade and indoor air quality impacts after the implementation of Prop. 39.	4b, 5d	By fall of 2017, the research team collected indoor air quality monitoring date, ventilation and energy usage data from 104 classrooms in 11 schools that use current HVAC systems. The characteristics of the classrooms and schools include locations, district sizes, grades, free/reduced lunch percentage, and equipment types. A teacher survey on usage of the HVAC system in classrooms was also completed with an excellent response rate. In November, the technical report was submitted to the Energy Commission and the technical advisory committee for review. As of December 2017, the research team is working on installing and commissioning two next generation HVAC systems on two demonstration schools.
Grant	Pre-existing intellectual property identified in agreement EPC-15-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Public Health Institute	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This report establishes a public health research roadmap aimed at anticipating and preventing potential unintended health impacts of emerging electricity generating, storing, and distributing systems (EES). Research recommendations were prioritized and presented in this roadmap.	4b, 5d	In 2017, the research team held 22 meetings with 34 experts throughout the energy, life cycle assessment, health, labor, and environmental justice field for total for over 30 hours. The team also created a growing database of peer-reviewed and grey literature. As of December 2017, the database houses 165 documents on Emerging Electricity-Generating Systems and related health and equity topics. Workshops were conducted in spring and summer of 2017 to obtain inputs. The research roadmap was published in fall 2017.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Lawrence Berkeley National Laboratory	Group 7: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This study is producing needed fundamental information about the type and quantity of energy used for pumping groundwater. That information can be used to increase the efficiency of the energy used in the water sector, inform demand side management strategies, and decrease greenhouse gas emissions. Although previous estimates have been made for energy in groundwater pumping, both studies by the Energy Commission and contracted by the California Public Utilities Commission note that they likely grossly underestimate the amount of energy used for pumping. Because of changes in data disclosure regulation for water resources, LBNL is able to combine a new methodology with better data to produce more accurate estimates of energy used for groundwater pumping.	1f, 2a, 4c	The kick-off meeting for this project occurred on October 13, 2016. Although some data collection was delayed due to lengthy negotiations between LBNL and PG&E, the team has obtained a significant portion of the spatial and temporal data needed to develop geographical and time-varying relationships between groundwater pumping and energy use. With this information, the team has been building its model and is investigating options to test the skill of the model. The options will be selected in early 2018. Results are anticipated in 2019. The first technical advisory committee meeting was held in December 2017. Members of the Water-Energy Team of the Climate Action Team ("WET CAT") have expressed interest in this study and are supporting it through representation in the technical advisory committee.
Grant	Pre-existing intellectual property identified in agreement EPC-15-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Eagle Rock Analytics	Group 10: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is unique in its use of sea surface temperatures to create a probabilistic forecast of long-term weather conditions in California. The project aims to determine, for example, the likelihood of California experiencing consecutive days above 105 degrees F in a given year.	5c	The research team has successfully developed a seasonal forecast model using Linear Inverse Modeling. The model now predicts monthly minimum and maximum temperatures across California, 1-9 months in advance. The team has also performed experiments demonstrating the maximum potential predictability of the Pacific Ocean upon California's seasonal climate. As part of this effort, the team is presently performing sensitivity analyses to understand how the choice of model domain, time steps and datasets play in the success or failures of the model. The team has also engaged with IOU stakeholders to learn what specific climate variables and the forecast lead times will have the greatest impacts on operations.
Grant	Pre-existing intellectual property identified in agreement EPC-15-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Lawrence Berkeley National Laboratory	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This work builds on efforts of the past decade that have facilitated dynamic ventilation approaches. The project uses informed simulation approaches to determine how energy, IAQ, demand, and comfort can be optimized using smart ventilation. The results from the project will help consumers identify effective smart ventilation strategies and provide important information that advise the development of ventilation standards.	4b, 5d	In summer 2017, the research team completed building energy simulation test plan and a literature review for smart ventilation. The literature review was submitted for journal publication. In November 2017, the team conducted the critical project review. As of December 2017, the simulation of single-zone technology evaluation is underway.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6	California State University, Fresno Foundation	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will help lead to technology advancements by providing and coordinating key services, assistance, resources, and infrastructure needed by entrepreneurs and researchers to create and develop advanced energy technologies that will help the state meet the targets set by Senate Bill 350 to increase both renewable electricity generation and energy efficiency to 50 percent by 2030.	2a, 3e	Overall, BlueTech Valley (BTV) has accepted and supported 56 companies into their program (49 companies in 2017), has received $2,995,000 in additional private capital funding in 2017, and has received a $500,000 grant through the Regional Innovation Strategies i6 Challenge and Seed Fund Support Grants competition. In May 2017, for the first time BTV joined UC Davis in putting on the UC Davis Big Bang! Business Competition (UCD BBBC) event, which allowed the event to expand and reach a broader audience. This competition awarded over $50,000 in funds to promising startups (https://gsm.ucdavis.edu/news/2016BigBangWinners).The second UCD BBBC, with BTV, was kicked off in October 2017.In November 2017, BTV with UC Berkeley Law's New Business Practicum, hosted a Legal Advice Workshop webinar on intellectual property, as part of a series focused on legal aspects of operating a business.
Grant	Pre-existing intellectual property identified in agreement EPC-15-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6	California State University, Fresno Foundation	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will help lead to technology advancements by providing and coordinating key services, assistance, resources, and infrastructure needed by entrepreneurs and researchers to create and develop advanced energy technologies that will help the state meet the targets set by Senate Bill 350 to increase both renewable electricity generation and energy efficiency to 50 percent by 2030.	2a, 3e	Overall, BlueTech Valley (BTV) has accepted and supported 56 companies into their program (49 companies in 2017), has received $2,995,000 in additional private capital funding in 2017, and has received a $500,000 grant through the Regional Innovation Strategies i6 Challenge and Seed Fund Support Grants competition. In May 2017, for the first time BTV joined UC Davis in putting on the UC Davis Big Bang! Business Competition (UCD BBBC) event, which allowed the event to expand and reach a broader audience. This competition awarded over $50,000 in funds to promising startups (https://gsm.ucdavis.edu/news/2016BigBangWinners).The second UCD BBBC, with BTV, was kicked off in October 2017.In November 2017, BTV with UC Berkeley Law's New Business Practicum, hosted a Legal Advice Workshop webinar on intellectual property, as part of a series focused on legal aspects of operating a business.
Grant	Pre-existing intellectual property identified in agreement EPC-15-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	The Regents of the University of California, Berkeley	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The proposed research is determining the impact of large solar arrays on the carbon storage of desert soil ecosystems. Results provide data and modeling results that give insights into the most effective ways to design and manage solar production facilities for maximum net carbon benefits.	2a, 4f	Sensor installation has been completed at the six desert sites in Mojave Desert. Real-time meteorological data and CO2 flux data are being collected. Soil sampling was conducted in soil trenches excavated at each of the six sites. Completed physical and chemical soil analyses will include: soil water retention curves, soil porosity, soil water permeability functions, organic C/N content and isotopic composition, carbonate content and isotopic composition, radiocarbon dates. In November 2017, the team finalized an agreement allowing access to a solar PV facility and evaluated short- and long-term impacts of land use and climate change on the soil carbon cycle. The team also prepared a first project manuscript in November 2017. In addition, the team presented results from the first year of the project at the American Geophysical Union annual meeting in New Orleans in December 2017.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Zoological Society of San Diego dba San Diego Zoo Global	Group 6: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will increase the effectiveness of conservation actions designed to mitigate renewable energy impacts on burrowing owls. This will be achieved by evaluating the relative effectiveness of primary translocation methods in an experimental framework. Improvements to the effectiveness of existing translocation methods will also be tested experimentally. Long-term GPS tracking of individuals in the active and passive relocation groups and a control group will provide the critical, previously missing, information to judge the effectiveness of each method.	2a, 4f, 4g	The research team has captured the first year's set of burrowing owls at development sites and released the active translocation group of owls at conservation areas. They have conducted the tracking and monitoring of the first year's set of owls during 2017. In collaboration with their technical advisory committee, they have refined the study design and research protocols. In addition, they have tested GPS units and modified their design for use with burrowing owls. In Fall 2017, they identified new sites for owls in the next non-breeding season. They have shared sample material from captured owls with researchers in EPC-14-061 and EPC-15-043 to extend the data used for isotopic and genetic analyses in those projects.
Grant	Pre-existing intellectual property identified in agreement EPC-15-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Prospect Silicon Valley	Group 5: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project implements a cost-effective energy efficiency upgrade strategy that uses existing and new technologies. The project includes extensive refrigeration system improvements, such as re-piping and re-configuring of the refrigerant lines to increase energy efficiency, changing to a lower global warming potential refrigerant, and installing a high-efficiency variable frequency drive compressor. These types of improvements pose challenges to grocery stores due to limited space and existing configurations. However, documenting cost, savings and benefits could influence the grocery market to make similar future upgrades. The project also includes variable air volume air distribution system, a solar air preheat (to preheat outside air) and an electric heat pump water heater. These solutions and design approaches hope to achieve near zero net energy for a grocery store.	1e, 1f, 1h, 4a	The overall project remains on track. The recipient is developing construction drawings. The recipient has calibrated the model and conducted comprehensive energy analysis of the energy systems in the grocery store and developed a final list of efficiency measures. Additionally, the technical advisory committee met in June and in September concurred with the recommendations.
Grant	Pre-existing intellectual property identified in agreement EPC-15-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	California Homebuilding Foundation (CHF)	Group 6: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Working closely with the builder and subcontractors, technology costs will be evaluated and will include a real-world perspective by providing actual time and labor spent to install and commission each of the new technologies versus only the technology cost. By providing this data and analysis on the approximate 50 homes being constructed, this project will serve as a roadmap toward the most effective ways to implement ZNE homes. The information gathered will be disseminated through various project participants such as California Building Industry Association (CBIA) events and member newsletters in efforts to promote the potential for cost-effective ZNE to the builder community.	1f, 1h, 3b, 4a	The new project site is located in Marina, CA. The project has started construction on the first phase of ZNE Homes. Draft reports addressing ZNE market acceptance and prioritization of energy features to be used during phase 1 construction have been complete. Work is ongoing with HVAC consultants to address challenges with heat recovery ventilation (HRV) and HVAC duct design strategies. Additional measures are still being explored for energy savings such as home energy management systems and battery storage. These additional measures present the unique challenge of there being no existing modeling capabilities available in the existing CBECC (California Building Energy Code Compliance) software.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Regents of the University of California, Los Angeles	Group 6: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project harnesses the power of genomic data to develop genetic assays for quick, low cost screening of thousands of individuals. Researchers are creating high-resolution maps of population structure and migration routes and applying this information to assess population-level impacts by screening carcasses collected from renewable energy facilities. Genoscape maps can be merged with existing spatial data of energy potential to make siting recommendations for new facilities in areas with minimal impact on wildlife.	2a, 4g	The research team collected samples from the selected set of birds (Common Yellowthroats, Burrowing Owls, and American Kestrel plus others being studied with match funds) and completed genetic analysis to identify populations. Some of the Burrowing Owl samples were shared from EPC-15-040, "Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy." In Fall 2017, they developed maps and schedules of the migration routes (genoscape maps) relative to renewable energy sites. They collected samples from bird carcasses from solar and wind facilities (some shared from EPC-14-061, "Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings") to use the genetic methods to determine which population the dead birds belonged to. They developed their approach for prioritizing migratory hotspots with input from the TAC and others.
Grant	Pre-existing intellectual property identified in agreement EPC-15-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23	Electric Power Research Institute (EPRI)	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will accelerate availability of products and systems that allow California ratepayers to install and operate as much grid-tied solar generation as they wish and to ensure their purchases remain compatible with value-added opportunities over their service life. The open-source software will enable $1-2 million of cost savings per DER manufacturer by eliminating the need to develop, test, integrate and certify proprietary software.	1a, 1h, 1i, 2a, 3a, 5a	Work on the IEEE 2030.5 software and certification procedure is well underway. The delayed approval schedule for the IEEE 2030.5 standard revision has affected the project timeline, but the team has taken action to mitigate the impacts. Additionally, a report "Standard Communication Interface and Certification Test Program for Smart Inverters" was recently published, and elements of this project will build upon the report's findings.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Electric Power Research Institute (EPRI)	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project demonstrates the potential for a variety of different loads and customer types to respond automatically to a real-time proxy pricing signal. This could advance the potential of DR being a demand side or a supply side resource for the State.	1c, 1d, 1e, 1f, 1g, 1h, 3c, 3e, 3f, 3h, 4a, 5a, 5b	The recipient conducted the first Technical Advisory Board (TAB) meeting on October 10 and solicited feedback from the members on the work completed to date. Based on comments from Energy Commission staff, the recipient is making revisions to the draft report on the Transactive Load Management (TLM) System, Price, and Signal Design. After review by Energy Commission staff, the draft will be sent to technical advisory committee and TAB members for comments. The reference design for the TLM signal is being finalized for implementation in early 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-15-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23	Siemens Corporation, Corporate Technology	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Highly automated and efficient grid operation is required to achieve California's energy goals, in particular with respect to the Clean Energy and Pollution Reduction Act of 2015 (Senate Bill 350) that strives to reach 50 percent renewable energy resources. This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating the potential of semantic technologies for increasing electrical grid automation. This will allow control interventions to happen at much faster speed and further automate routine and non-routine engineering and maintenance tasks that are performed on substations. By making the complex smart grid more accessible for operators, it will permit faster resolution of outages, thereby making the grid more maintainable and resilient.	3a, 3d, 5f, 5h	The recipient created an intuitive dashboard for easy visual classification of data. This allows operators to apply a statistical classifier to the data to categorize the incoming data streams. The categorized data will be analyzed by software in charge of monitoring anomalies and undesired behavior on the grid. This software consists of knowledge models that are continuously enhanced and updated during the project.
Grant	Pre-existing intellectual property identified in agreement EPC-15-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23	SLAC National Accelerator Laboratory	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Several significant Powernet system innovations would be developed under this proposal: (i) the integration of control, optimization and power electronics would enable novel functionality; stable connect/disconnect from the grid, local and global power sharing and grid services including demand response; (ii) the layered structure of the system will enable the operator to utilize Powernet for a variety of different grid purposes or service offerings with the assurance that those are always done on top of an economically optimal operating point every second; (iii) the system would be robust and secure by design; and (iv) the system would adopt open source standards and establish an open protocol (OpenDER) for the platform to enable scalable engagement of devices in the future.	1g, 2a, 3a, 3d, 3f, 5f, 5h	The project team made progress in the following areas: 1) the site location was finalized at Vista Ridge Housing Unit in San Diego; 2) equipment (batteries, appliances, etc.) was installed at the Lab in Stanford and the solar and storage components were built at SLAC; and 3) the architecture and the components for testing were developed by SLAC and testing was initiated at the Lab in Stanford. SLAC is working with Lincoln Military Housing group to start final recruitment of the individual homes and installation of measurement devices as well as thermostats. Two labs are being prepared for the project: one at Stanford and the other at SLAC. The two labs will act like two different housing units and the technology being developed will focus on optimization of the individual units as well as the optimization of the neighborhood. A demonstration at the Stanford Lab began in November.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Alternative Energy Systems Consulting, Inc.	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The key advancement in this project will be the knowledge gained from testing this innovative residential energy management system in actual homes. If proven successful through field testing, this system could achieve widespread deployment throughout the state which could significantly reduce peak demand, reduce annual energy costs, and improve grid operations.	1e, 1h, 2a, 4a	Progress to-date includes development of Technical Advisory Committee (TAC), coordination with San Diego Gas and Electric to select test homes and explore potential incentive structures, DER energy management system optimization, and exploring specific DERs to include in project.
Grant	Pre-existing intellectual property identified in agreement EPC-15-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Antelope Valley Water Storage, LLC	Group 11: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project conducts feasibility analyses of Aquifer Pumped Hydro and Peak Hour Pumped Storage for energy storage purposes, hydropower generation, and demand response potential if implemented at a groundwater bank. Potential barriers are identified and economic analysis conducted to identify types of implementation with the highest value. The project is developing a set of tools other water banks can use to conduct similar assessments. Based on preliminary review, these tools could be very useful for all water banks in California.	1e, 3f	The research team conducted technical feasibility analysis and preliminary field testing of two pumped storage systems: Peak Hour Pumped Storage (PHPS) and Aquifer Pumped Hydro (APH) storage at Willow Spring Water Bank. Hydropower generation and demand response potential of groundwater banking projects were assessed. The results show low efficiency and revealed water quality issues as a potential barrier for implementation for the APH system. The demand response during a dry hydrologic year has the highest value based on analysis. The project also created tools for other groundwater banks in California to conduct similar analysis. The project was completed as planned in September 2017 and the final report is published.
Grant	Pre-existing intellectual property identified in agreement EPC-15-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Regents of the University of California, Davis	Group 2: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project focuses on full-scale technology demonstrations of two water and energy saving technologies for the wine industry. The water treatment and reuse system uses reverse osmosis to treat water to potable standards for barrel washing. It's estimated to reduce water use at the facility by 90 percent. The second technology reduces the amount of energy used to stabilize the white wine.	1f, 1h, 2a, 4a, 4c	This project is in the water quality testing and monitoring phase, prior to installation of the water reuse equipment. Jackson Family Wines is in the process of obtaining the installation permit from the City of Windsor. The team is also finalizing the design of the wine-to-wine heat exchanger equipment.
Grant	Pre-existing intellectual property identified in agreement EPC-15-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Lawrence Berkeley National Laboratory	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will advance intelligent, network controls to become dynamically controlled, dispatchable grid resources. The advanced controls developed will ease building participation in Auto-Demand Response (DR) programs and improve grid reliability and resiliency, improve user interfaces for lighting systems to reduce energy waste and cost, and enable IOUs and others to geographically target DR deployments as a cost effective means to transmission and distribution infrastructure upgrades.	1e, 1f, 1h, 5b	The project is on track to successfully complete all deliverables on or before March 2018. A critical project review meeting and a technical advisory committee meeting were held in October 2017. The research team has developed commercial lighting load profiles, and continues to work on quantifying the costs and benefits from automated demand response enabled systems such as initial installation cost, operating costs, financing costs, energy cost savings, revenue savings, and how Title 24 requirements impact these costs. None Energy Benefits (NEB's) are identified with all supporting methodologies versus quantification metrics and values. Preliminary results of the research project were presented at the Emerging Technologies Coordinating Council, Quarter 1 meeting in Ontario, CA.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	ZipPower, LLC	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	SB 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings in existing buildings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project was approved at a Business Meeting on May 17, 2016. Work is expected to begin June 2016.
Grant	Pre-existing intellectual property identified in agreement EPC-15-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Electric Power Research Institute, Inc.	Group 5: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	None	The project provides new data, analysis, and designs for cost-effective integrated demand side management retrofits such as advanced HVAC, smart thermostats, plug load controls, LED lighting, and heat pump water heats for residential communities.	1f, 1h, 4a, 5b	The research team has begun to install the efficiency measures at each site. The team has hired a subcontractor to be in charge of installing new appliances, lighting, HVAC, and envelope measures. Project measures selected include: hand-sealing for air leakage, insulation, LED interior lighting, LED exterior lighting, mini-split heat pump, smart thermostat, and low-flow showerheads and faucets. All measures provided by the agreement are all electric. Installations of these measures will be made at each site and monitoring and verification to follow. Staff has conducted 2 site visits in 2017. The first site visit was to evaluate the current technologies installed at the sites. The second site visit was to tour the facility and view the existing and proposed retrofit technologies during the 2017 ET Summit.
Grant	Pre-existing intellectual property identified in agreement EPC-15-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Universal Devices, Inc.	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity	This project will advance the ability of customers to participate in Demand Response (DR) markets. The technology developed will apply customer preferences to automate energy management and response to energy market and rate variations using off-the-shelf equipment and a simple technology platform and two-way subscription tariff design that is retail price responsive, simplifies settlement activities, and facilitates integration of behind-the-meter Distributed Energy Resources, without the need for complicated measurement, verification, and baselines. This technology will reduce barriers to low cost, anytime responsiveness from millions of customers and their devices by solving the significant cost and complexity of current DR participation options.	1c, 1e, 1f, 1g, 1h, 3f, 4a	The project is on schedule, required deliverables have been provided, and the level of engagement by utilities and other partners is expanding the project impacts beyond what was initially anticipated in the agreement. SCE has provided additional funding to support expansion of the research in the Moorpark substation area (a Disadvantaged Community also at risk for reliability issues). In addition, Amazon has been working with the team to evaluate its Echo technology as a platform for hosting the transactive client and Google has been in talks with the team to do the same with its Google Home technology.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Charge Bliss, Inc.	Group 4: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Micro Business, Calif Based Entity	SB 350 (2015) sets a 50 percent renewable energy standard by 2030 and a doubling of energy efficiency savings in buildings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting financing, and engineering approaches and tools to help improve the business case for IDER adoption at the community-scale.	3b, 3e	The project team has worked with the City of Carson, SCE, and other stakeholders to select the best public buildings and parks to install energy storage, an extensive electric vehicle charging network, photovoltaic, and smart control technology. They further established the amount of PV to place at each site, as well as the quantity and level of charging that would be available at each site keeping in mind impacts to the grid, ZNE status, and cost. The next step for the project is to conduct engineering design and present a final package to the City for approval.
Grant	Pre-existing intellectual property identified in agreement EPC-15-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Natural Capitalism Solutions, dba Clean Coalition	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	None	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments are playing a critical role in achieving this goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project is piloting innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project is finalizing a scalable suite of tools, policies, and programs to enable communities to accelerate their progress towards affordable, resilient power systems that combine energy efficiency, local renewables, electric vehicle charging stations, energy storage, and monitoring, communications, and controls. The project has finalized an electric vehicle master plan for Redwood City, and has submitted a draft proposal for an interconnection pilot with PG&E in the San Mateo region. The project team have created a project-specific page on their website, which can be seen at: http://www.clean-coalition.org/our-work/peninsula-advanced-energy-community/.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	The Regents of the University of California (CIEE)	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	None	This project could overcome the cost of installing energy efficient equipment by providing a software solution that is open source with an open architecture enabling platform. The eXtensible Building Operating System (XBOS/DR) can interface with multiple hardware devices from different vendors as well as include software applications from various vendors. With its ability to create a virtual building management system for small commercial buildings by networking thermostats and other controllers, XBOS/DR can provide large and small commercial customers with a variety of choices for DR capability. The open architecture can foster technical innovation by third-party vendors and other manufacturers in providing energy services.	1c, 1e, 1g, 1h, 4a	The Pilot Test Plan for Large Commercial Buildings, which describes how to integrate the XBOS software with existing building automation systems, was prepared in May of 2017, as well as the Software Architecture Memo, which describes the XBOS software and includes interfaces to hardware devices, security, and integration of the user interface. The project team continues to build out and implement the XBOS platform in small-medium commercial buildings and developing control algorithms. A CPR was held in November of 2017. The project is on time and on budget.
Grant	Pre-existing intellectual property identified in agreement EPC-15-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	The Regents of the University of California, Berkeley	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	SB 350 (De Leon, 2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Deploying customer-side of the meter technologies at scale will help meet this goal, but will require new innovations to how local jurisdictions design, plan, finance, and manage energy upgrades at the community level. This project is developing sustainable financing structures, clear owner-operator responsibilities, and streamlined planning and permitting processes, which are critical to successfully deploying community-scale energy retrofits throughout the state.	2a, 3b, 3e	In 2017, the project team completed an EcoBlock design that includes 27 houses and 2 multi-family buildings in Oakland, CA. The project team completed their analysis on the existing energy and water infrastructure of the block, and developed scenarios for potential energy generation and water conservation systems. The energy system plan combines efficiency upgrades at the building-scale with a flywheel storage system to create a AC/DC microgrid. The water conservation plan proposes different methods to utilize, recycle, and conserve potable, sewer, storm and rain water. In 2018, the project team will synthesize their research results and add an analysis on different owner-operator and finance models that may be applied to the EcoBlock, as well as provide the City of Oakland with recommendations on ways to streamline their planning and permitting processes for block-scale developments.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Regents of the University of California, Davis	Group 6: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will provide methods to decrease adverse environmental impacts of solar energy facilities and enhance the ability to predict and overcome costly invasions of non-native plants in early stages. This research will also advance the effectiveness of mitigation measures, reduce impacts, and overcome barriers to facility siting and design by studying species responses in different conditions within a solar array and the changes in species interactions.	2a, 3a, 4f	The project team has refined the study design and set up the field experimental sites. They completed the first year of data collection on microhabitat factors and experimental results in 2017 and are analyzing these data for the interim task reports.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Regents of the University of California, Los Angeles	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Local governments can play a critical role in achieving the State's SB 350 (2015) building energy efficiency goals by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) for energy efficiency. This project is piloting innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	The project team has proposed an AEC system design that will include 5.9MW of solar PV and 4.7MWh of energy storage capacity. The project team is currently working with Los Angeles County and Bassett Unified School District to evaluate county sites and school campuses for siting of solar PV generation and storage. LACCE will begin delivering retail electricity the first quarter of 2018, and the project team is working to secure approval from LACCE to act as the Load Serving Entity since they will have the authority to create and administer their own VNEM tariff. The project team is also focused on the recruitment of local Energy Ambassadors, who will agree to opt in to the AEC and receive training on the project. The idea is these Energy Ambassadors will become a trusted source of knowledge and provide transparency to the local community in order to promote participation in the AEC.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	The Regents of the University of California, Irvine Advanced Power and Energy Program	Group 11: Ranked # 8	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The NOx sensor is based on ceramic solid-state electrochemical sensor technology, similar to the automotive oxygen sensor. Solid-state NOx sensors have been developed for direct in-situ measurement of exhaust to meet stringent on-board diagnostic requirements for self-diagnosis and reporting, including required sensitivities down to parts-per-million. The NOx sensor combines existing commercial NOx sensors with newly developed electronics for use in applications including dispatchable distributed generation like micro-turbines. Compared to other NOx sensors, the sensor is a simple solid state device, with a single cell and no internal diffusion chambers (electrodes directly in the flow). This gives it faster responsiveness, making it more robust and easier to manufacture.	2a, 3f, 4b	In summer 2017, the research team completed sensor robustness testing. Two types of NOx sensors were tested. Based on the result from the test, the team made a selection. In the fall of 2017, the team worked on integrating the selected sensor information into the engine system.
Grant	Pre-existing intellectual property identified in agreement EPC-15-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Prospect Silicon Valley	Group 5: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project site represents a test case for many of the complex challenges facing zero net energy retrofits of multi-unit, mixed-use buildings and is relevant to a state-wide greenhouse gas emission and energy efficiency goals such as AB 32, AB 758 and SB 350. The approaches and other zero net energy design process innovations are to be packaged for broad dissemination to the design community.	1f, 1h, 4a	On July 23, 2017, the recipient informed staff that a significant construction obstacle was encountered and would require a major electrical service upgrade. This was not taken into account when the original budget was submitted, and may impact the energy efficiency measures selected for upgrades. A Critical Project Review (CPR) meeting was held on September 22, 2017 where the recipient presented a new energy efficiency package strategy that took into consideration the service upgrade. A CPR report was submitted to the Energy Commission on November 15, 2017 with new project recommendations and the report is undergoing review.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Office of Energy and Sustainable Development, City of Berkeley	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments are playing a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project is piloting innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	In 2017, the project team synthesized their research to develop a viable business model, implementation roadmap, and model design of the microgrid in Downtown Berkeley, creating a roadmap for future projects looking to develop AECs in dense urban areas, and for those projects looking to develop microgrids that cross the public right of way. The project has so far identified that ownership of the generation and storage assets would be the most beneficial option of local governments, while optimal microgrid operation structure involves utility and municipal or private operations, supported by CCE tariffs and special rates. The team has also identified a need to better calculate the monetary value of community resilience for determining the cost-benefit of microgrid deployment. https://building-microgrid.lbl.gov/projects/berkeley-energy-a
Grant	Pre-existing intellectual property identified in agreement EPC-15-066 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Groundwork San Diego-Chollas Creek	Group 4: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community scale.	2a, 3b, 3e	Staff attended an EPIC Community Launch and Media Event sponsored by Groundwork San Diego- Chollas Creek at the Groundwork San Diego-Earth Lab Station. Regional Stakeholders were present and spoke on behalf of the "Chollas Eco-Village" which will be created into a Zero Net Energy Community.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Local Government Commission	Group 3: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	SB 350 (2015) sets a 50 percent renewable energy standard by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and energy storage. This project will pilot innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	3b, 3e	The project team has worked with the City of Fresno and other stakeholders including builders and financers to develop a portfolio of projects that can be built out in a way that integrates advanced energy technologies such as energy storage, renewable energy, and building energy management systems. The recipient collected information from developers, advanced energy technology providers, financers, and city officials and used the information to create a tool that dynamically organizes and prioritizes projects based on the projects attributes and the user's preferences. The tool also includes information on how each site can be financed by stacking eligible grants, loans, bonds, incentives, and many other sources of capital.
Grant	Pre-existing intellectual property identified in agreement EPC-15-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Lawrence Berkeley National Laboratory	Group 11: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will help overcome a key barrier to long-term wind energy investment that can help California meet its 50% renewable energy goal and climate change mitigation goals. Improving the characterization of uncertainty in wind resource magnitude and variability in the context of climate change can help reduce risk in future wind energy investments in California. Technological advancement will be realized through use of a next-generation variable-resolution coupled atmosphere-ocean global climate model that is capable of simulating climate and climate change at relatively high spatial resolution (7km to 14km) over California. This is the first time that a variable-resolution climate modeling system will be utilized for a specific energy application.	2a, 5c	The research team has developed its modeling product for the variable-resolution community earth system model and validated it with historical wind observations and reanalysis data for California. Based on the analysis of future wind projections, the team has predicted that the majority of the state will experience an increase in wind power during summer, and a decrease during fall and winter, based on significant changes at several wind farm sites. This study improves the characterization of uncertainty around the magnitude and variability in space and time of California's wind resources in the near future. The rest of the analyses are nearing completion as of late 2017. Two journal articles are in preparation, and the team will be drafting the final project report in early 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Zero Net Energy (ZNE) Alliance	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Local governments can play a role in achieving California's demand reduction goals by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community scale.	2a, 3b, 3e	This project is in the final stretches of creating a scalable suite of tools, policies, and programs to enable communities to accelerate their progress towards ZNE. The team is currently in talks with potential technology vendors, and plans to have finalized partnerships and signed agreements with initial customers in the next few months. The project team has also evaluated the various use cases for the microgrid planned in connection with the Avenue I affordable housing project. Once the tract map is approved, they will recommend microgrid component sizing, technical schematics, and controls that will be incorporated into the architectural and construction documentation.
Grant	Pre-existing intellectual property identified in agreement EPC-15-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Altostratus, Inc.	Group 11: Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity	This project will add fine-resolution, intra-urban climate detail to coarse-scale, regional-level probabilistic or deterministic forecasting, thus allowing for more accurate, area-specific characterizations and forecasts for the electricity system and better apportionment of electricity generation.	1e	In spring 2017, the researcher identified target databases and downloaded a large amount of weather data. During summer 2017, several scripts and codes were written to handle the analysis of large observational datasets. Hourly data was read and analyzed at each monitoring area (Greater San Francisco Bay Area, Fresno-Bakersfield region, and the Los Angeles Region). In fall 2017, the researcher configured the Weather Research and Forecasting (WRF) atmospheric model, so the fine-resolution simulation results generated by the model can be compared with the observational data.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-071 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Biodico, Inc.	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	SB 350 (2015) sets a 50 percent renewable energy standard and a doubling of energy efficiency savings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, and demand response. This project will pilot innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	The draft Master Community Design has been completed that identifies resources available at the selected farm and advanced energy technologies (for energy generation, storage, etc.) that can help make the site a Zero Net Energy Farm, which includes solar, wind, anaerobic digestion, gasification, vehicle to grid (V2G) systems, energy storage with smart batteries, and smart street lamps. This Master Community Design describes the associated planning, permitting, and financing mechanisms that can be used to build out the site, which are supported by the Project Management Application (PMA) that uses a Geographic Information System (GIS). The PMA enables one to estimate the cost and energy generation of various advanced energy technologies for a given farm in California This draft plan was presented to the public at the Zero Net Energy Farms (ZNEFs) Summit on November 3, 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-15-072 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	The Regents of the University of California, Davis Campus	Group 11: Ranked # 9	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Although recent regulations will dramatically reduce greenhouse gas emissions, fossil fuels will remain fundamental to the California energy infrastructure for decades. Carbon capture can reduce the greenhouse gas emissions from power production facilities and other large industrial processes that rely on combustion of fossil fuels as an energy source.	2a, 4a	This project was kicked-off and the Technical Advisory Committee was formed in August 2016. The researchers initiated simulation and optimization of candidate carbon capturing molecules in Chem3D Pro and completed a demo of computational chemistry software packages. The recipient purchased software for computations, Aspen Plus. In November 2017, the Recipient began studying plant process modeling using Aspen Plus and continued building the database of candidate molecules using Chem3D Pro. In the first quarter of 2018, the recipient will purchase Gaussian software to start running computational chemistry on candidate molecules.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Regents of the University of California, Los Angeles	Group 2: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will test the effectiveness of innovative design strategies for residential demand response providers and analyze different segments of the residential population including various socioeconomic groups and residential customers with photovoltaics and electric vehicles to see what incentives, messages and energy use information motivates reliable participation in utility demand response programs. This information will expand knowledge in this area so that utility companies and regulators can build new and modify existing demand response programs to increase effectiveness. Accurate and reliable forecasts of participation in these programs will enable better utilization of existing generation resources and deferral of system capacity upgrades thereby lowering consumer electricity costs.	1c, 1d, 1e, 1h	Work is ongoing to recruit participants in the study by Chai Energy and early generation treatments are being analyzed for their effect on customer/participant behavior(s). About 3,200 customers have been signed up for participating in the project which is less than the ultimate target of at least 7,000. A video has recently been produced, and supplemented strategies to enhance recruitment are being considered . UCLA has randomly assigned participants to one of 6 test groups to compare with the control group. 6 treatments have been delivered to the 3,200 customers based on the assigned group they are in and the data is being analyzed.
Grant	Pre-existing intellectual property identified in agreement EPC-15-074 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Center for Sustainable Energy	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project could lead to technological advancement and innovation by developing and testing strategies that customers, demand response (DR) aggregators, scheduling coordinators, and policy makers can implement to expand both participation in and the benefits of DR markets. The project provides comprehensive recommendations on how to overcome technical, institutional and regulatory barriers to facilitating DER participation in supply-side markets.	1c, 1d, 1e, 1f, 1g, 1h, 3e, 3f	The project is on schedule. Agreements with Tesla (formerly Solar City) to engage and operate the K-12 school sites equipped with solar PV, storage, and load management control capabilities have been finalized and operational testing in preparation for market participation is proceeding on schedule. Installation of monitoring and control equipment at the hotel sites has been completed and audits, data collection, and operational testing are already yielding recommendations for efficiency improvements. The data are being analyzed for the purpose of developing effective DR strategies

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Grant	Pre-existing intellectual property identified in agreement EPC-15-075 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	Electric Power Research Institute (EPRI)	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project could provide California ratepayers methods to control their energy cost using low cost off-the-shelf technologies, and to adopt PV by providing a platform to manage their energy cost as the tariff structures evolve to account for grid costs of distributed generation. This platform enables the technology innovation without additional and expensive requirements of hardware for grid integration.	1c, 1d, 1e, 1f, 1g, 1h, 5c	The project is on track. The team is continuing to fulfill the requirement of Task 2, Developing Project Requirements by working with their key development partners to leverage the demand response scheduling interface with the CAISO market. The recipient continues to make progress on the Task 3 Energy Data Warehouse and customer user interface requirements in anticipation of beginning testing of the messaging across all platforms in early 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-15-076 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Zero Net Energy (ZNE) Alliance	Group 3: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This agreement was adopted at an Energy Commission Business Meeting on May 17, 2016. This agreement was signed and executed on June 8th, 2016. A group kick-off meeting with all Advanced Energy Community award recipients was held in September 2016.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	The Regents of the University of California, Irvine Advanced Power and Energy Program	Group 4: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving this goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	The project team completed the development of two new tools: the Smart Community Microgrid Energy Management Model as well as the AEC Design and Planning Tool, used to simulate and evaluate impact and performance characteristics of a suite of clean energy technologies in order to determine the most optimal measures and technologies for the Oak View AEC. The team is currently exploring different innovative financing models and working with the city of Huntington Beach to develop a streamlined permitting plan and continues to actively engage with the community on outreach activities. Additionally, the project team is working with the local community college organization to develop a workforce development program to recruit residents of Oak View to help install solar PV in the community.
Grant	Pre-existing intellectual property identified in agreement EPC-15-078 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	The Regents of the University of California, Berkeley	Group 8: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Researchers are developing methods to account for risks, plan for resulting adaptation, and account for the barriers that might exist in the system. The results of research are intended to improve on the general knowledge of framing climate-related policies under uncertainty and to examine all aspects of the adaptation planning process: decision-makers involved, stages of decision processes, and the institutional contexts where the decision-makers develop the decision processes. The results can inform technology choice investment and deployment, to the extent that those choices are made with consideration of climate risks.	1e, 2a, 3e, 3h	The research team's efforts to interview and survey key stakeholders in California's electricity sector has been challenging due to active involvement of key IOU stakeholders in developing institutional positions coupled with ongoing regulatory work in the area of electricity sector adaptation. However, review of administrative documents filed with the State of California has proven a rich source of material for providing input to model development related to adaptation barriers, metrics to gauge resilience, and system-wide performance of adaptation measures. Additionally, ongoing surveys of ratepayers' impressions of climate adaptation measures and costs are providing data to the research team for use in the modeling effort.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Victor Valley Wastewater Reclamation Authority (VVWRA)	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project demonstrates an advanced battery storage and control system coupled with on-site renewable energy generation and its ability to control rapid changes in on site power demands. If successful, this project could reduce grid power demand and reduce energy costs to wastewater treatment plants and alleviate disruptions in recycled water production due to high variability of on-site power loads which can cause partial treatment shutdowns. The project results could be applicable to other wastewater treatment and industrial plants in California.	1h, 3c, 4c	As of October 16, 2017, the recipient is designing the control system and awaiting delivery of the flow battery storage system. Current issues being evaluated include design of proper control modes to accommodate for battery maintenance cycles and the data transmissions systems regarding the power control software.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-080 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Thalassa Research & Consulting, LLC	Group 11: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	None	The research will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by addressing challenges in the state's largest metropolitan area -- the study of societal teleconnections. Societal teleconnections are human-created linkages that connect activities, trends, and disruptions across large distances such that locations can experience negative impacts from far away places. This study is producing new tools and techniques to assist communities to incorporate climate impacts that are non-local in origin into their traditional climate adaptation and hazard planning. This is the first time that a systematic approach to exogenous risks is being taken for an urban area.	2a, 3a, 3e, 3g, 4a	This project held its first multi-stakeholder workshop in late 2016 to assess the vulnerabilities of multiple interconnected sectors. It conducted individual interviews with area experts and energy managers; collected data from those interviews, conducted in spring and summer 2017, and the first workshops were then used in summer 2017 to create a complex map modeling the interconnections, vulnerabilities, and adaptive capacity across the energy, water, transportation, telecommunications, and emergency response sectors in the Los Angeles region. Based on this model, further analysis of resilience options is ongoing.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-081 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	Ghoulem Research	Group 11: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Woman Own	Results improve the state's ability to estimate timing of technology penetration and accrual of benefits, and costs of desirable residential sector technologies. These results are key to improving the performance of efficiency measures outlined in AB 758 and the California Energy Code. They also support goals of CPUC's Energy Efficiency Strategic Plan, and inform updated estimates of timing and benefits as appropriate. Results portraying penetration and performance of key technologies (e.g., A/C) are expected to be of direct use in the scenario development and demand forecasts used in the Integrated Energy Policy Report.	5c	The research team convened in-depth discussions with members from the Energy Commission's Demand Analysis Office, Supply Analysis Office, Building Standards Office, and Research Division to ensure that their modeling and historical energy transitions efforts address needs in those areas. The research team also developed a first-cut implementation of a "Simulation Sandbox", or prototype model to enable exploration of impacts of a number of human dimensions (e.g., behavior, policy, trends in AC adoption) on residential air conditioning demand. Finally, the team has been in conversation with two utilities regarding possible partnerships involving data sharing.
Grant	Pre-existing intellectual property identified in agreement EPC-15-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45	The Regents of the University of California, Merced	Group 11: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project provides an improved understanding of how various operating parameters affect the conversion efficiency of microplasma array reactors for conversion of biogas to synthesis gas. The production of hydrogen from biogas will advance California's ability to produce clean energy from renewable resources by consuming greenhouse gases, thereby reducing the impact of electricity generation on climate change, the environment, and public health.	2a, 4a	The low temperature microplasma reactor was installed and tested using a mixture of inert gases, such as Argon and Nitrogen. In November 2017, the reactor was tested using a mixture of carbon dioxide and methane. Staff conducted a site visit to evaluate the performance of the reactor on November 9, 2017.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-083 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	OhmConnect, Inc.	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project provides policymakers and regulators with information to develop the policies and limitations for a third-party demand response market. In addition, a solution for residential telemetry is proposed to empower prosumers to interact effectively with the grid, allowing them to supply electricity and save money.	1c, 1d, 1e, 1f, 1g, 1h, 3e	This project is on track. The recipient completed the work to incorporate numerous different transactive signals, including the utility, the CAISO, and EPRI. The recipient has completed the preliminary data modeling process to be used for testing and has successfully completed testing the transmission of telemetry data to EPRI's ftp site at 5-minute intervals. The team also began building the automation required to participate in the CAISO's day-ahead markets. UC Berkeley, the evaluation subcontractor, published results of their initial analysis of customer participation showing that reductions in the program were reliable, had little rebound effect, and were greater for participants using automation than those not using automation.
Grant	Pre-existing intellectual property identified in agreement EPC-15-084 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	BMW of North America, LLC	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will help the state advance the flexibility of electric vehicle charging as a flexible grid resource and vehicle charging cost savings to the driver. Optimal charging load patterns will be identified that can capture grid benefits using a variety of grid price signals. The project will pioneer technology advancement of not only the temporal benefits of controlled charging, but also the possible benefits that can be derived from being able to influence the location of charging.	1g	BMW identified seven use cases to test during their pilot demonstration project. 383 participants were enrolled into their pilot and received home area network devices to collect their vehicle charging and meter data. The team has also engaged in discussions with EPRI to implement the transactive energy signal into this pilot. Kevala (subcontractor) completed the analysis of the Locational Marginal Price data to identify grid efficiency improvement opportunities. The analysis was used in a developed tool to estimate cost savings from shifting charging times at night, during the day, or over multiple days.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Center for Sustainable Energy	Group 5: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Combining energy efficiency and building automation with solar photovoltaics and storage systems can result in an integrated approach capable of meeting the State's energy efficiency goals and providing demand response to provide grid flexibility. As the commercial sector, and local governments in particular, are risk averse, being able to demonstrate an integrated approach and document performance and benefits and costs without disrupting municipal operations is key to encouraging greater adoption of the technologies. The successful implementation of the technology will help other local governments and the commercial building industry budget, plan and prioritize these types of projects for existing building ZNE upgrades ahead of the state's 2030 requirements.	1e, 1f, 1h	The recipient (CSE) was awarded a Master Services Agreement with the City of San Diego at their August 2017 City Council Meeting. CSE has also finalized their agreement with the subcontractor, Sustainability Matters. CSE continues to evaluate the libraries and develop a preliminary list of efficiency measures. They anticipate baseline monitoring to begin in Spring of 2018 with installation of the efficiency measures to follow.
Grant	Pre-existing intellectual property identified in agreement EPC-15-086 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23	Advanced Power and Energy Program (APEP) - University of California, Irvine	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This Agreement will lead to technological advancement and breakthroughs by developing a control strategy to manage high penetrations of distributed energy assets (including generating resources, energy storage and controllable loads) as a single unit through the modification, implementation and simulation of a Generic Microgrid Controller (GMC) at a substation. The GMC will manage dispatchable loads and generation, reducing stress on the grid by shedding unnecessary loads and dispatching generation as required. The GMC also includes an economic dispatch feature that determines the least expensive solution to serve all the loads.	1g, 3a, 3f, 5f	The recipient purchased and commissioned OPAL-RT hardware and software to model a substation and two 12kv distribution circuits feeding homes previously part of the Irvine Smart Grid Demonstration (ISGD) project. Models of the two circuits were developed and load flows were run. Additionally, the development of more detailed residential distribution energy resources were modeled for integration into the 12kv distribution circuit models. The recipient documented the approach and lessons learned from setting up the OPAL-RT hardware and software and developing and verifying the model (including the substation and circuits).
Grant	Pre-existing intellectual property identified in agreement EPC-15-087 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Electric Power Research Institute (EPRI)	Group 2: Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Non-chemical water treatment has the potential to reduce water use, improve quality of water discharged to wastewater stream, reduce scaling in condenser water piping, and increase energy efficiency of chilled water plants. The Vortex technology removes calcium carbonate from recycled cooling water and improves viscosity. By removing calcium carbonate physically it reduces the amount of chemicals used in calcium removal methods.	1f, 1h, 4c, 4d, 4e	Staff met with the recipient and conducted a site visit to AMGEN, one of the demonstration sites, on November 8, 2017. The recipient provided cooling tower drawings and utility data for the demonstration sites. Upcoming tasks include preparing site specific equipment designs.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-088 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Kennedy/Jenks Consultants	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Biofiltration as an advanced primary treatment method could reduce the aeration electrical energy needed for secondary treatment, increase energy production in the anaerobic digester from the removed organic material and increase existing secondary treatment capacity and forestall the need for future treatment plants. Based on pilot studies outside of California, Biofiltration has shown the potential to decrease aeration power by 45 to 60 percent, increase gas production from 25 to 40 percent and increase treatment capacity by 50 percent.	1f, 1h, 4c	Kennedy/Jenks is competitively bidding the installation of the demonstration system at Linda County Water Department's Wastewater Treatment Plant and has begun the evaluation of the baseline conditions.
Grant	Pre-existing intellectual property identified in agreement EPC-15-089 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23	Electric Power Research Institute (EPRI)	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	By updating the DNP3 protocol the California grid capability will be advanced through enabling greater flexibility on the grid in the form of greater utilization of energy storage systems. Increased grid flexibility with the addition of energy storage systems overcomes a major barrier that will allow the utility's infrastructure, operations, and energy security to move toward the State's energy goals.	1a, 1h, 1i, 2a, 3a, 5a	In 2017 the team reviewed where communications protocols were limiting the capabilities of energy storage systems and developed solutions with industry stakeholders. They received input from a 150+ person international advisory group representing utilities, manufacturers, and researchers. Gaps were identified by the team, shared with major stakeholder groups, and solutions determined jointly. The result is that all communication protocols for solar and storage systems will realize these benefits in future updates to these standards enabling greater flexibility on the grid. The project team then focused on the protocol used by utilities to control large scale storage systems (DNP3) and applied these changes. The published update is expected by end of 2017. In 2018 the team will streamline the adoption of this update to DNP3 through tech transfer, open source tools, and compliance testing.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-090 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23	The Regents of the University of California (UC Riverside)	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State's statutory energy goals by designing a three-state decentralized distribution system control framework to create virtual generators by aggregating distributed energy resources. There aggregated virtual generators are capable of providing energy shifting, frequency regulation, and flexible ramping services to mitigate the uncertainties brought by renewable generation outputs. Therefore, the Integrated Distributed Energy Resources Management System (iDERMS) has great potential in increasing renewable penetration potential, reducing GHG emissions and making energy storage systems cost competitive with centralized power plants.	1g, 3a, 3f, 5a	The project team continued to work on developing a market coordination model. The team completed studies on the rules, design, and operational elements of a Distribution System Operator managed electricity market. The team is now working on adding distribution system operations to the model. This analysis includes evaluating computational strategies to develop optimal solutions to distribution system operations.
Grant	Pre-existing intellectual property identified in agreement EPC-15-091 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Electric Power Research Institute (EPRI)	Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Currently, crops are irrigated on a set schedule regardless of whether water is needed or not needed. In this project, the technology being demonstrated precisely detects when crops need water, triggering irrigation only when needed. Delivering less water reduces pumping and the associate energy use, lowering GHG emissions. Expanded deployment to other California perennial fruit crops has the potential to save significant amounts of energy and water, moving the state closer to its energy goals.	1f, 1h, 3g, 4a, 4c	In 2017 the contract with primary subcontractor Fruition Sciences was executed. Site-analysis measurements were conducted at all three vineyards where the PlantAware technology is being demonstrated to determine fitness for the project and to enable equipment selection. Assessment technologies included spacial and physiocap measurements that assess shoot quantities and diameters. The project team met with vineyard personnel to get a basic understanding of each general vineyard plot layout and operations approach, and to identify specific plots allocated to the project. M&V equipment was identified and ordered. PlantAware sap sensors were installed and initial measurement data were collected. As of year end, all water meters are installed and water use measurements are being taken to establish background water use. A TAC meeting was held in conjunction with a site visit in Napa County.
Grant	Pre-existing intellectual property identified in agreement EPC-15-092 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Tomorrow Water dba BKT United	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Minority Owned	The project is anticipated to offer a lower energy alternative for treatment of the most common contaminants preventing use of ground water resources in California. The project could enable the development of new water supplies in many of the drought challenged regions of the State. Local treatment of impaired groundwater will provide additional energy benefits by eliminating the cost associated with transporting clean water from distant sources. The BioFiltration treatment technology has the potential of efficiently treating contaminated water in an energy efficient manner while generating no waste brine.	1f, 4a, 4d	The Recipient has finished design, assembly and installation of the Bio-Filtration Vessel system. The system is undergoing commissioning before operation with the full flow of influent planned for the demonstration. The project's Monitoring and Verification Plan has been finalized. The Recipient has met with State Water Resources Control Board to size the filtration and disinfection unit for future Conditional Permit Acceptance.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-093 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Water Energy Innovations, Inc.	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity, Minority Owned, Woman Own	This project will develop a comprehensive regional drought resilience plan that will match high potential energy and water efficiency technologies with potential adopters. This will lead to greater reliability and drought resiliency while reducing agricultural energy demand.	3e, 4c	The recipient is finalizing a baseline water-energy profile for Tulare County. Once this is completed, the recipient will be able to make targeted recommendations from a portfolio of residential and industrial water technologies that meet site specific needs while saving water and energy. Additionally, stakeholders including SCE, water agencies, and local governments are currently engaged with the project to look for opportunities for streamlined permitting and innovative uses of these technologies.
Grant	Pre-existing intellectual property identified in agreement EPC-15-094 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Electric Power Research Institute (EPRI)	Group 6: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This research will provide new methodologies for integrating occupant and technology needs into a cost effective and scalable zero net energy (ZNE) strategy. The project will analyze and define the savings and market barriers in residential communities and provide new, valuable performance data and models from the demonstrations. The products from this research will be essential to identifying the successes and barriers to meeting the ZNE goals for residential communities.	1f, 1h, 2a, 4a	In 2017 subcontracts with BIRAenergy and UC Davis were executed. Home design plans were developed for Net Zero communities in Clovis and Irvine. The first TAC meeting was held and was attended by all CA IOUs, DoE, EPA and multiple homebuilders. A new greenhouse gas emissions methodology was developed and provided to Energy Commission Efficiency Division staff as part of the evaluation of TDV vs. GHG metric for the 2022 building code. The project team also provided input to Energy Commission Codes and Standards staff for the 2019 Title 24 codes on grid harmonization, factoring project work into new grid harmonization metrics. ZNE packages that are less than 4% above cost for standard single family homes were developed. As of December 2017, the project scope is being revised to focus solely on demonstration sites paying prevailing wage.
Grant	Pre-existing intellectual property identified in agreement EPC-15-094 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Electric Power Research Institute (EPRI)	Group 6: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This research will provide new methodologies for integrating occupant and technology needs into a cost effective and scalable zero net energy (ZNE) strategy. The project will analyze and define the savings and market barriers in residential communities and provide new, valuable performance data and models from the demonstrations. The products from this research will be essential to identifying the successes and barriers to meeting the ZNE goals for residential communities.	1f, 1h, 2a, 4a	In 2017 subcontracts with BIRAenergy and UC Davis were executed. Home design plans were developed for Net Zero communities in Clovis and Irvine. The first TAC meeting was held and was attended by all CA IOUs, DoE, EPA and multiple homebuilders. A new greenhouse gas emissions methodology was developed and provided to Energy Commission Efficiency Division staff as part of the evaluation of TDV vs. GHG metric for the 2022 building code. The project team also provided input to Energy Commission Codes and Standards staff for the 2019 Title 24 codes on grid harmonization, factoring project work into new grid harmonization metrics. ZNE packages that are less than 4% above cost for standard single family homes were developed. As of December 2017, the project scope is being revised to focus solely on demonstration sites paying prevailing wage.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-096 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	American Water Works Company, Inc.	Group 2: Ranked # 7	Funds were awarded to passing proposals in rank order.	N/A	None	This project will advance the technical knowledge of detecting and preventing underground water leaks and estimating the energy savings associated with the water leak detection/prevention strategies. As a substantial amount of water is loss through leaks, identifying and demonstrating tools to help water agencies monitor, assess and manage their water distribution systems conserves water resources, increases water system reliability, lower emergency and repair costs and reduces water and electricity costs for ratepayers. These benefits will be quantified through the volume of water saved and the embedded energy in the saved water.	4c	At the Duarte site, Utilis and Echologics have begun operations in detecting leaks and repairing them. At the Ventura site, flow monitors are being installed in various locations. At the Coronado site, the flow monitoring has detected a broken partially opened zone valve.
Grant	Pre-existing intellectual property identified in agreement EPC-15-097 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Build It Green	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project demonstrates the technical and economic feasibility of zero net energy design for large multifamily projects and establishes design and installation best practices that minimize risks for developers. This includes documentation of best practices to ensure that energy and cost benefits of zero net energy are fully realized and identified, including the trade-offs between technology solutions, capital costs, operating and maintenance costs, environmental benefits and grid impacts.	1f, 1h	This project is on track. All monitoring equipment such as meters, data loggers and sensors are installed at the Calistoga and Cloverdale sites. Data on the performance, energy consumption, water usage, water temperature and other area are being collected and analyzed. The research team is working on installing all monitoring devices needed at the other two project sites in Atascadero and Sunnyvale.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Institute of Gas Technology (dba Gas Technology Institute (GTI))	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	The technological advancement in this project is utilizing innovative construction approaches that couple advanced energy efficiency measures with integrated project design and delivery (IPD) in a cost effective manner. The innovative approaches explored in this project aim to reduce structural framing for minimum heat paths through the walls, improve wall and attic insulation values, increase equipment efficiency, reduce air infiltration levels, and improve water heater and HVAC performance. The approaches will emphasize minimum energy use, excellent indoor air quality, robust and appealing architectural design, solid structural integrity, and practical, low cost construction. If successfully pilot tested, these innovative approaches could become standard construction practice leading to widespread deployment of affordable ZNE homes.	1e, 1f, 1h, 2a	Project achievements to-date includes assembling and meeting with Technical Advisory Committee (TAC), finalizing ZNE pilot test design details, initiating construction of homes, and developing a technology/knowledge transfer plan.
Grant	Pre-existing intellectual property identified in agreement EPC-16-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Lawrence Berkeley National Laboratory	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project identifies key cost-reduction opportunities to inform future policy decisions and includes development of cost data on photovoltaic cost reduction potential, building shell measures, and future end-use appliance costs and performance and estimates of cost sensitivities of various ZNE related issues. The latter includes offsite renewable energy procurement, climate impacts, and policy levers, such as mortgage tax credits and incentives.	1f, 1h, 4a	Preliminary energy modeling has been completed on single family and multifamily building prototypes for the 2019 Building Energy Efficiency Standards. A draft list of ZNE measures and costs for the modeled ZNE homes has been completed. The project has been given exempt status by the Human Subjects Committee and should further streamline survey data collection. The team has completed a draft report on community renewable resources, which will inform the scenario modeling. Lastly, the team has discussed future revisions for time-dependent valuation (TDV) numbers due to their impact on cost-effectiveness. New values have been proposed for future code implementation that feature updated energy prices and the CEC's PLEXOS production simulation case with updated inputs.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Regents of the University of California, Davis - California Lighting Technology Center	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Much energy is wasted by unnecessarily lighting and cooling indoor spaces which are unoccupied. Sometimes lighting sensors also misinterpret input and dim or brighten lighting because of occupant movements in a space. This project seeks to improve sensor-controlled lighting and air conditioning systems by integrating and sharing information from multiple sensors, resulting in better quality indoor spaces with reduced energy cost.	1f, 1h, 3e	The project team has identified the pilot-testing site. The testing site is the Energy Conservation Office on the UC Davis campus. The team will install the integrated control system at the site to test real operating conditions. Currently, the team is still testing the integrated control system in order to refine overall performance and identify elements that might lead to reduced system performance. Staff conducted a site visit in 2017 to evaluate the testing lab and to do a preliminary walkthrough of the pilot-testing site.
Grant	Pre-existing intellectual property identified in agreement EPC-16-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Lawrence Berkeley National Laboratory	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project develops and validates integrated whole building retrofit packages using pre-commercial underutilized technologies and controls with the goal of reducing energy use in small commercial offices by at least 50 percent. The project also aims to increase system reliability by reducing peak energy loads and potentially supporting AutoDR implementation. The energy efficiency and demand reduction components of the project provide a path towards meeting the State's energy efficiency and climate goals along with a means to replicate these strategies.	1e, 1f, 1h, 2a, 4a	Progress to-date includes securing a new test site, establishing the Technical Advisory Committee (TAC), and finalizing energy efficiency measures for pilot testing.
Grant	Pre-existing intellectual property identified in agreement EPC-16-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Regents of the University of California, Davis	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	To address the current issues with indoor air quality and energy efficiency in existing homes, this project will demonstrate and evaluate two residential retrofit packages that incorporate advanced technologies for achieving both of these goals. Better envelope tightness combined with a dedicated ventilation system and highly efficient evaporative cooler will increase indoor air quality, reduce energy use for air conditioning and reduce overall peak demand. Additionally, the project could increase comfort for building occupants and reduce energy costs for building owners.	1f, 1h, 2a	Baseline monitoring has begun at two sites and will be monitored for one year prior to the two similar but still different retrofit packages being installed. Both sites will receive aerosol sealing, and sub wet bulb indirect evaporative cooling with a fresh air vent system. Indoor air quality is also being measured and will monitor CO2 and PM2.5. A technical advisory meeting was held in July.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	ES Engineering Services, LLC	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project could result in an innovative way to treat water with high amounts of metal contaminants using a low energy treatment method to restore impaired drinking water sources. The hydrogel adsorption process offers benefits of being simple, with its minimal amount of equipment required and can save water that would normally be too difficult to treat. This treatment method is especially suitable for small inland treatment systems, where liquid backwash and brine disposal may be cost prohibitive or infeasible.	1h, 4c, 4d	ES Engineering is completing the design for the proposed treatment system and the test plan. They are now beginning to fabricate the parts for the demonstration system.
Grant	Pre-existing intellectual property identified in agreement EPC-16-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	Regents of the University of California, Davis	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will accelerate the adoption of cost-effective electricity saving/generation technologies, equipment, materials and construction practices in California multifamily and commercial buildings. The project will help overcome barriers by identifying and documenting the cost-effectiveness of available energy efficient technologies, equipment, materials and construction practices for multifamily and commercial buildings.	1f, 1h, 3e	The recipient has begun the technology review of high efficiency measures, updated the DOE reference model of Multi-Tenant Light-Commercial to Title 24 building efficiency standard and identified gaps in cost database that will need to be addressed to be able to estimate the cost of each measure being addressed. The recipient has assembled the Technical Advisory Committee and will hold its first meeting in Spring of 2018. The recipient has submitted the Technology Review Report.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	City of Santa Monica	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project pilots innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	The project officially kicked off in February and the team collaborated with the City Yards Redevelopment design team to develop a list of an owner's energy-use requirements for the planned microgrid. The project team continues to evaluate and model various distributed energy resources, including the feasibility of using gases from the landfill and solar PV, and different options for overcoming barriers related to the physical installation of the system when crossing rights-of-way with electrical (and possibly thermal) energy resources. Additionally, the city is assessing different ownership and financing structures such as benefits provided under a community choice aggregate, and a special tariff offered by Southern California Edison that would allow the city to share the net-export of power from the microgrid with other city-owned accounts.
Grant	Pre-existing intellectual property identified in agreement EPC-16-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Porifera, Inc.	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own	This project will demonstrate an energy efficient solution for direct potable reuse of municipal wastewater. The dprShield is estimated to use 65 percent less energy than State Water Project transfers, 75 percent less than desalination and more than 50 percent less energy than competing technologies for direct potable reuse of municipal wastewater, removal of contaminants from water and real-time membrane integrity monitoring.	1f, 1h, 4c, 4d	Currently the recipient is continuing with the dye testing, working on the pilot system design, and continuing experiments on the skid and optimization of element design and operation conditions. The working agreement with Stanford has been finalized. Work continues on the Pilot Plan.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Regents of the University of California (University of California, Davis)	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project advances management strategies for reducing thermal stress in dairy cows while also reducing energy and water use. There are two methods of reducing thermal stress in cows: (i) lowering the cows' heat exposure and (ii) increasing the cow's ability to get rid of excess body heat. Current practice includes use of evaporative cooling with water sprayed on the cows using feed-line soakers, and cooling is enhanced by convective heat transfer via large overhead fans. This project will test and demonstrate an innovative approach that seeks to optimize the cow's ability to remove excess body heat by utilizing more efficient cooling technologies, and introducing alternate strategies for when and where to cool the cows. By combining these two approaches this project has the potential to significantly change the way dairy cows are cooled.	1e, 1f, 1h, 4a, 4c	The project has successfully completed pilot stage testing at the UC Davis Dairy. Data and results from the pilot testing has been collected and the team is analyzing the test data to determine which energy and water savings technologies are most promising. The most promising of the two technologies will be demonstrated in a larger dairy in Tulare, CA
Grant	Pre-existing intellectual property identified in agreement EPC-16-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Kennedy/Jenks Consultants	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	A survey by the American Membrane Technologies Association (AMTA) indicates that there are approximately 100 microfiltration/ultrafiltration treatment plants with a total design capacity of approximately 400 MGD, eight nanofiltration facilities (30 MGD), and over 100 reverse osmosis (RO) facilities (400 MGD) in California. As membrane treatment is energy intensive due to fouling, this technology could reduce energy demand for membrane treatment processes while decreasing the water need for backwashing.	1f, 1h, 3a, 4a, 4c	The recipient has obtained a permit from City of Bakersfield to discharge Clean-In-Place (CIP) waste into the sanitary system. The project team has coordinated with the subcontractor to revise utility connection plans and developed the budget for installations. The project team is currently testing treatment of surface water and collecting data.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Altex Technologies Corporation	Group 1: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The hybrid cooling system is estimated to reduce fan power through low pressure drop characteristics and save water by only using water evaporation when ambient air temperatures are high. The system aims to improve efficiency in commercial and industrial refrigeration and air conditioning systems.	1f, 1h, 4a, 4c	The team has prepared a computer model to simulate heat exchanger performance. They are in the process of assembling the heat exchanger for full testing in early 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-16-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39	The Regents of the University of California on behalf of the Berkeley campus	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Smart ceiling fans integrated with smart thermostats represent the next generation of energy efficiency that provides space conditioning while minimizing the need for compressor-based air conditioning systems. This project advances the state of knowledge and practical applications of an integrated strategy to retrofit applications, addressing occupant thermal comfort and HVAC energy use through innovative hardware and software. Additionally, this project is a scalable energy retrofit solution for commercial and residential buildings. Installation does not require specialized training. Appropriately trained contractors or installers can easily perform the task. Operations are simple and do not need users to understand controls, set-points, or programming. Simple installation and controls with documented savings and no sacrifice on comfort could increase acceptance of this tech	1f, 1h, 3a, 3e, 4a	The recipient is conducting laboratory testing of the integrated thermostat system in a test facility on campus designed to be used as a mock up prototype demonstration space. Data loggers, sensors and other devices were installed in July 2017 at all sites. Ceiling fans and thermostat installations are scheduled for April 2018. Once all equipment and monitoring devices are installed, data will start to be collected.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27	Lawrence Livermore National Laboratory	Group 1: Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The FTE-CD technology has the potential of reducing the cost and energy use associated with desalinating water with low to moderate salt content and will represent an advancement over current RO technology. This can increase the potential to increase water recycling and reuse at the community or industrial level, which could reduce the need to procure and transport fresh water sources. Also, this advanced FTE-CD technology is small and flexible which means that it can be customized to the scale needed for each community or industry, thereby increasing a community's water reuse potential which can increase drought resilience for the state.	1f, 1h, 4d	The recipient has designed a new end plate that reduces mixing of water at the outlet. The overall cell resistance was studied with individual electrodes and four-probe test setups. The contractor has verified several assumptions about resistance and determined several configurations that should reduce the contact resistance and improve overall device performance and will demonstrate longevity of these methods in future months.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	2	Los Angeles Cleantech Incubator	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. The project will develop and provide resources to entrepreneurs that enable the entrepreneurs to scale their businesses within the Los Angeles region. This project will foster the clean energy economy in the Los Angeles region by creating successful businesses within the region, that will results in local job creation.	2a, 3e	The LA regional energy innovation cluster (named Energize CA) recently accepted its first cohort of portfolio companies to receive services. This cohort includes companies developing solutions in commercial/industrial HVAC, on-site solar, insulation, grid management software, and electric vehicle mobility infrastructure. This year, Energize CA reached a few milestones on the way towards achieving project goals, including: Received $1,440,500 from non-EPIC grant funding opportunities. Solidified outreach approach to incorporate investors, startups, academia, business development groups, accelerators and incubators into LACI's network of resources for their portfolio companies.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43	Hyperlight Energy	N/A***	The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.	N/A	Yes; Calif Based Entity	The project will lead to technological advancement and breakthroughs by advancing a low cost CSP collector to commercial availability. In addition to the value of demonstrating the collector through the physical installation, the front end design study and the availability of this low cost collector is intended to enable geothermal power plant owners to use this innovative system to boost the output of their plants and provide more renewable energy to the grid.	2a, 4a	Extensive optical, mechanical and thermal models were built that showed feasibility of technical targets. A prototype reflector of 20 feet by 50 feet was tested to 10,000 cycles representing a 30 year lifetime, and results of the testing showed minimal degradation. The project site preparation work has started and the pilot system is expected to be operating by spring 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-16-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	8	Silicon Valley Clean Water	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project has the potential to lower energy costs of wastewater treatment and water recycling. The advanced technology used in this project is the Staged Anaerobic Fluidized Bed Membrane Reactor (SAFBMR) which eliminates the aeration stage of wastewater treatment. The aeration stage is one of the most energy intensive steps in wastewater treatment. The SAFBMR also has the potential to reduce operation and maintenance costs because bio-solids waste, which typically requires off-site disposal, is reduced, and the effluent does not require the typical microfiltration pre-treatment step prior to the reverse osmosis systems.	1f, 1h, 4a, 4c, 4e	The agreement has been signed and the Kick-off meeting held, and work has commenced on the project. The team has established a technical advisory committee. The research team continues to gather data from literature and the demonstration site for the Benchmark Report. Approximately 90 percent of the preliminary design of the Staged Anaerobic Fluidized Bed Membrane Bioreactor system has been completed.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	8	BDP Technologies	Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The innovative BDP technology has the potential to provide substantial energy savings to wastewater treatment plants, including reducing 50 percent of the aeration required for secondary treatment, thus decreasing electrical energy requirements and greatly improves oxygen transfer efficiency to 48-52 percent compared to 20-30 percent in conventional technologies.	1f, 1h	As of October 17, 2017, the project is in the design phase (task 2) and the recipient is coordinating with the engineering firm to revise the design in order to reduce the construction costs. These construction costs are associated with the design of the retention basin. The recipient is on budget and schedule.. Securing the air and water permits are on schedule.
Grant	Pre-existing intellectual property identified in agreement EPC-16-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Regents of the University of California (University of California, Davis)	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	Through development of an innovative, real-time dispatch system for legacy turbines and implementation of a low-cost, robust form of remote communication and control, this agreement addresses the inability to efficiently and quickly on and off dispatch turbines when grid and market conditions demand. The project will deliver a low cost standardized communication and control system for aged turbines capable of remote on/off dispatch, and create a grid, market, and weather forecasting system to enable automated dispatching of turbines in response to oversupply and low/no wind conditions.	1c, 3a, 3f, 4a, 5c	A stakeholder workshop concluded that not all wind projects are exposed to negative pricing since the economic situation can vary from project to project. However, almost all projects are exposed to energy consumption and demand charges that erode their economics. Stakeholders expressed interest to determine a method for addressing negative price situations and energy consumption/demand charge reduction, and whether a solar PV and storage system could be a key element to reduce peak energy and demand charges. Researchers identified that communication systems currently used in wind farms demonstrate effectiveness to enable remote turbine dispatch and successfully integrate their radio communication solution into a legacy control panel equipped with relay equipment. However, there is a need of developing a cheaper radio communication solution.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	SRI International	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will lead to technological advancement by enabling co-production of power and high-value metals from geothermal resources. The co-production of metals will improve the economic viability of geothermal power production, therefore increasing the penetration of geothermal renewable energy.	2a, 3g	The project has finished testing sorbents using synthetic brines to characterize specific surface area, selectivity, capacity, and adsorption kinetics. They have also completed sorbent regeneration testing to determine the regeneration kinetics, sorbent stability, and the purity of the lithium carbonate product.
Grant	Pre-existing intellectual property identified in agreement EPC-16-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Lawrence Berkeley National Laboratory	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will lead to technological advancement and assist the continued growth of California's broad portfolio of renewable energy, by providing tools to help geothermal operations to be more productive. This project will demonstrate the advantages of a micro-earthquake imaging system that uses a dense network of seismic stations and automated processing to perform fast-turnaround, high-resolution imaging of fluid movement in producing geothermal reservoirs.	1c, 2a, 3a, 3b	The dense network design for the 5 km x 5 km area of interest at the demonstration site is almost complete. Development of the automated micro-earthquake data processing system is in progress. Installation of the micro-earthquake stations at the demonstration site is on schedule to take place in 2018.

Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
Grant	Pre-existing intellectual property identified in agreement EPC-16-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Lawrence Berkeley National Laboratory	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is designing, installing and evaluating integrated super high-efficiency solar panels with super high-efficiency pre-market energy storage batteries, along with low-cost control hardware to demonstrate the impact of an integrated community solar and energy storage system in a low-income community. The project is designed to demonstrate the impact of an integrated community solar and energy storage system in a low-income community, which is expected to reduce net energy consumption and reduce energy bills.	2a, 3a, 5a, 5f	The project was awarded at the July 2017 Business Meeting and a kick-off meeting was held in December 2017. The researchers aim to execute an agreement with the selected deployment site in the first quarter of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-16-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	San Gabriel Valley Water Company	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will recover wasted energy from an existing pressure reducing station, thereby addressing a key component of the Water-Energy nexus, an on-going proceeding at the CPUC and Energy Commission. The recipient estimates there to be about 120 similar-sized pressure reducing opportunities within California representing 9,000 kilowatts that will become economically viable if the project is able to meet its cost reduction goals.	1a, 1b, 2a	The project kicked of in April, 2017. The project team is currently developing the conceptual civil, mechanical and electrical plans and specification for the project. The current schedule calls for construction to begin in late spring of 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Stantec Consulting Services Inc.	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Newer in-conduit hydroelectric turbine technology research and development has not been adequately covered in any published guidebook. The available guidebooks do not include many of these novel technologies nor do they include performance information, associated equipment, siting criteria, civil, mechanical and electrical design considerations, costs or other relevant information that will assist California's stakeholders in determining which in-conduit hydroelectric technologies are best suited for a particular site.	1a, 3a, 3b	Researchers have collected 97 documents pertaining to in-conduit hydropower. The literature review identified several turbine technologies currently available in the market, compiled their technical specifications, limitations and benefits, applications, and corresponding manufacturers, and identified the potential applications of these turbines to various types of conduits such as diversion structures, canals, concrete-lined chutes, aqueducts, pipelines, and wastewater treatment plant output stream. Researchers prepared a preliminary questionnaire survey to be submitted to water purveyors to supplement the findings of literature review. The questionnaire will collect information on site selection, technology/process, feasibility study, selection of key performance indicators for operations, regulatory and permitting, energy production and grid interconnection, and cost and financing.
Grant	Pre-existing intellectual property identified in agreement EPC-16-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Electric Power Research Institute (EPRI)	Phase 1 Group 2: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project advances the adjustability of demand including fast ramping, ancillary service operating reserves, frequency regulation, and peak load reduction. Both test sites have built-in inherent storage---water storage in the case of water pumping and thermal mass in the case of frozen and refrigerated food-- that allows for fast and flexible demand response.	1g	A site visit to the refrigeration facility took place in October 2017 where baseline monitoring is underway. The team is currently designing the load control approach, with completion expected in Q2 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Irrigation for the Future, Inc.	Phase 1 Group 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	None	The agreement tests an irrigation management system that facilitates use of partial irrigation strategies, enabling flexible energy load control. This will allow irrigators to participate in utility demand response and time of use programs while providing flexibility to the grid.	1b, 1e, 1f, 1g, 2a, 4c	Water flow meters have been installed at the sites. Telemetry and calibration for the meter at each site has been completed, and the team is collecting baseline water use data. Recipient is in the process of developing water reduction algorithms to reduce energy costs through participation in utility programs.
Grant	Pre-existing intellectual property identified in agreement EPC-16-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Advanced Microgrid Solutions, Inc.	Phase 1 Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Woman Own	The project integrates several pre-commercial and commercial technologies into a platform that enables operational equipment and energy storage resources to respond automatically to energy price signals. The integrated approach promotes greater participation in demand reduction events, including the ability to participate without prior-day notice.	1e, 1f, 1g, 1h, 4a	This project began in November 2017. The recipient is currently analyzing and modeling the project sites to develop a tailored energy savings approach.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Antelope Valley Water Storage, LLC	Phase 1 Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project could lower peak demand on the electric grid during Summer months when power demand is at its highest levels. This will increase the reliability of the electric grid system, reduce the need to use high polluting peaker plants that operate on fossil fuels to meet system demand and operating margins, and lower Department of Water Resource's water transport costs by shifting electric demand to non-summer months when demand and energy rates are lower.	1e, 1f, 4a, 5b	The research team is undergoing a review of initial statistical assessment results describing the volumes of water deliveries that need to be re-scheduled to allow for elimination of Edmonston pumping during the summer peak months. HDR is preparing a sample water year graphic that shows the system characteristics. The team is analyzing average Dept. of Water Resources power costs for the State Water project.
Grant	Pre-existing intellectual property identified in agreement EPC-16-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Regents of the University of California, Riverside Campus	Phase 1 Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Data centers are a major consumer of electricity. In the PG&E service territory, peak demand of data centers is around 500 MW, representing 2.5% of peak load consumption. The energy use from data centers is expected to increase by 4% annually in the next 5-10 years. The development of agile energy efficiency solutions for data centers is needed. This project provides energy efficient technologies and software solutions to the data center industry, that has the potential of reduce electricity consumption by data centers by approximately 16 to 35% through deep sleep and dynamic voltage frequency scaling, peak efficiency scheduling and spatial workload scheduling.	1f, 1g, 2a	The project team is drafting the Technology/Knowledge Transfer Plan with ARC Alternatives and continuing the development of the peak efficiency algorithm. The server setup (OS installation, network connection from both institutions) is almost finished. Development of Coordinated Deep Sleep and DVFS algorithm has been completed
Grant	Pre-existing intellectual property identified in agreement EPC-16-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43	SLAC National Accelerator Laboratory	N/A***	The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.	N/A	Yes; Calif Based Entity	Communication of DERs with grid operators is critical for successful utilization of distributed energy resources. DOE developed the VOLTTRON platform to facilitate such communication. However, the platform is in its early stages and requires additional support and an expanded user base to become widely adopted. The VOLTTRON Testing Tool Kit provides new tools to confidently run a high qualify open source project. All knowledge gained and software written will be pushed to GitHub for open source use. With the testing tool kit, VOLTTRON becomes a more effective platform for DER management. This will enable higher utilization of DERs in support of the state's renewable energy and GHG reduction goals.	1d, 1e, 1f, 1g, 1h, 4a, 5b	The project is on schedule and within budget. In Q3 2017 the recipient hosted a VOLTTRON Learning Lab at Stanford University. The goal of the learning lab was to start building a user and developer community for VOLTTRON by providing an overview of VOLTTRON and the VOLTTRON Testing Tool Kit. The event included hands-on demonstrations and individual projects for participants to create an analytics agent.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 8	New Buildings Institute, Inc.	Phase 1 Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project creates a holistic, low-barrier integrated retrofit solution for significant energy savings. The scalable energy retrofit solution will be demonstrated in municipal government buildings but is also applicable to other commercial and residential buildings and to new construction and existing buildings. Installation does not require specialized training. The integration of technologies can produce higher savings than individual technologies operated in isolation. This solution will support California's statewide zero net energy and existing building goals.	1f, 1h	By January 2018, initial ground work for the retrofit of several buildings in disadvantaged communities in the LA-Basin will begin. Key steps have been taken to test the INTER system at LBNL's FLEXLAB. Accomplishments include meeting with manufacturers (Rollease and Enlighted) to obtain technical specifications and identify potential product tests and modifications, establishing FLEXLAB bench test methodology and priorities, creating selection criteria for demonstration sites including applicability of the technology packages, access to monitoring and verification and occupant feedback, and transferability of benefits to the larger California marketplace. The first Technical Advisory Committee meeting was held, potential demonstration site building owners in Santa Ana were engaged, and the kickoff benefits questionnaire and draft technology transfer plan have been submitted.
Grant	Pre-existing intellectual property identified in agreement EPC-16-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 8	CSU Long Beach Research Foundation	Phase 1 Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	None	The project aims to remove barriers to achieve widespread deployment of state-of-the-art energy management technologies. The project provides California IOUs, academic institutions (universities, including 22 CSU campuses), energy management technology developers, and other stakeholders with an IOT-based energy management platform. Additionally, the project provides a comprehensive assessment of the potential for large scale deployment, including technical considerations, building performance, energy savings, and non-energy benefits.	1f, 1g, 1h	The project began in April 2017 and the recipient is utilizing baseline data to develop its design plans. They are also mapping the lighting, HVAC, and plug load control potential for the project. The first TAC meeting was held in December 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-16-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 8	Zero Net Energy (ZNE) Alliance	Phase 1 Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Energy performance monitoring and fault detection diagnostics software is a key technology that must be further enhanced and deployed to overcome barriers to achieving ZNE buildings. A principal barrier to real-time management of energy systems is the many, often incompatible, protocols and interfaces used by energy devices and sensors. These have long represented a barrier to the integration of discrete systems, sensors and actuators necessary to automatically assess and control energy use. This project uses an internet of things gateway to concurrently communicate with virtually all discrete energy devices using their native protocol and interface. The platform uses machine learning to assess real-time building performance and automatically adjust individual devices. The technology eliminates building drift and negates the need for expensive reprogramming or optimization measures.	1f, 1h, 4a	The following milestones have been completed: 1) on-site audits of the project buildings, including mapping of points (chillers, boilers, VAVs, pumps, and cooling towers) and documenting the energy performance of the buildings prior to the installation of ACCO-BEMS; 2) developing the measurement and verification plan; and 3) enabling automated access to the energy management data.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43	Sunpreme, Inc.	N/A***	The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.	N/A	Yes; Calif Based Entity	The project is developing a next generation manufacturing tool for low-cost, high-performance copper patterning on solar photovoltaic cells using technologies from printed circuit board manufacturing. This new process will lower electricity-related greenhouse gas (GHG) emissions and improve solar cells' efficiency.	1b, 1c, 2a, 3b, 4a	Since the agreement started, the project team performed many tasks crucial for the establishment of a manufacturing lane for copper patterning on silicon photovoltaic cells. Among these tasks, the team ordered and installed exposure, developer, stripper, etcher, and laminator tools, and they modified a commercial laminator tool and developed a dual-sided exposure tool for high-throughput wafer patterning. Lamination process tests have demonstrated that wafer alignment, placement and immobilization meet the minimum requirements for high volume manufacturing (HVM). In the first quarter of 2018, the team will fabricate a minimum of 10 test cells and perform in-house reliability testing (e.g. damp heat, thermal cycling, humidity-freeze and light soaking) on the cell test modules. A minimum of 15 copper-metallized modules will be submitted for 3rd party testing.
Grant	Pre-existing intellectual property identified in agreement EPC-16-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 pha	AltaRock Energy, Inc.	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	None	This project will develop a means to expand use of low temperature and stranded geothermal resources by making small scale production both practicable and affordable.	1a, 1b, 1c, 2a, 3b	The thermoelectric generator test unit has been designed and built. Lab testing is in progress.
Grant	Pre-existing intellectual property identified in agreement EPC-16-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Amador Water Agency	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	None	The system developed under this project will recover and maximize the capture of wasted energy in Pressure Reducing Station (PRS) commonly used by the water agencies and industry; improve the efficiency, performance and cost of the Pelton turbine technology to capture wasted energy and provide a viable retrofit solution for degrading sites; and expand small hydropower deployment.	1a, 1b, 1c, 3a, 3b, 4a	The project kick-off meeting was held on July 14, 2017. The project is currently in the design phase and deployment is planned for late spring 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	Regents of the University of California (University of California, Davis)	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	None	The research will be the first to evaluate the trade-offs in duration of head-starting on post-release survival in the eastern Mojave Desert where numerous solar production facilities have been recently constructed. Because longer head-start periods cost more, finding the optimal head-starting duration will help develop more cost-effective head-starting programs. The research will also evaluate indoor-head-starting. If the increase in size also results in an increase in post-release survival compared to outdoor-reared animals, indoor head-starting could dramatically reduce the costs of rearing animals to releasable size and also increase production of head-starting facilities.	2a, 3a, 3b, 4f, 4g	The research team collected 61 tortoise hatchlings in 2017 and allocated them to either the indoor or outdoor experimental groups. All captive tortoises from 2017 and previous years were measured to track their growth rates in different treatments. The 2016 indoor rearing group have been transitioned to outdoor pens for the second year of their head-starting. The project team is collaborating closely with the complementary project (EPC-16-053) in several areas, such as using a common technical advisory committee.
Grant	Pre-existing intellectual property identified in agreement EPC-16-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	The Regents of the University of California, Irvine	Group 5: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project provides guidance for California policymakers and planning agencies for selecting emerging energy storage technologies that can facilitate the increased uptake of renewable resources and decarbonization of California's energy system in a way that minimizes the externalities of environmental and human health impacts. This study provides the knowledge base and understanding necessary to allow flow batteries to be deployed in a manner which alleviates or circumvents potential obstacles related to environmental and human health.	2a, 3e, 4b, 4c, 4d, 4e, 4f, 5d, 5e	The project kick-off meeting was conducted in July 2017. After the kickoff, the research team initiated formal exploration of flow battery manufacturing processes and material content in dialogue with the flow battery manufacturers. Researchers visited and toured two of the three flow battery manufacturing sites and explored patent literature to establish baseline understanding of material content. The researchers also started the foundation for the life cycle analysis for flow batteries, including the selection of software and methodologies. In November 2017, the recipient visited the third flow battery manufacturing site.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	The Regents of the University of California, Davis Campus	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Plume measurements from fresh and brackish water cooling towers will be utilized to develop a model of the droplet and particle size distribution changes in cooling tower plumes as a function of cooling water composition, meteorological conditions, and cooling tower operating parameters. The model will be based on first principles of chemistry and physics and validated using the measurement data. The model enables the use of brackish water instead of expensive fresh water, leading to decreased costs for electric utilities and ratepayers and frees up more fresh water for use in homes, industry, and agriculture in California.	1c, 2a, 3a, 4b, 4c	Since the kickoff meeting, the project team has been working on access to sites for field work. Thus far, the progress has been slow in gaining access to sites.
Grant	Pre-existing intellectual property identified in agreement EPC-16-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	Lawrence Berkeley National Laboratory	Group 7: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is advancing the knowledge of using alternative low global warming potential (GWP) refrigerants that will also result in higher energy efficiency for cooling equipment. This project will identify current barriers and technical issues, and assess the potential for an expanded set of products that could use low GWP A3 refrigerants. The project will incentivize manufacturers to develop product prototypes that could be tested at the recipient's facility. This can help equipment manufacturers and vendors with product development and lead to an increase in the supply of equipment with much lower lifetime GHG emissions. By transitioning to refrigerants with lower GWP refrigerants, the result will be lower GHG emissions in the 2030 and 2050 timeframes.	1f, 1h, 4a	The agreement is awaiting execution by all parties. The project was approved at the April 2017 business meeting.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 pha	Lawrence Berkeley National Laboratory	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will address principal barriers to the widespread application of current thermoelectric materials by providing a low-cost, reliable, affordable and mass-producible technology that can be ubiquitously applied to convert high-temperature heat that is currently wasted at the production and retail levels in California.	1h, 3h, 4a	The project kick-off was held on September 13, 2017. A company reorganization at Alphabet Energy, the major subcontractor responsible for manufacturing thermoelectric test articles, has led LBNL to hold off on expending project funds until Alphabet principals can organize an alternate structure for performing the work.
Grant	Pre-existing intellectual property identified in agreement EPC-16-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Natel Energy	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	None	Greater reliability will be achieved by enabling greater penetration at significant total megawatts of new, distributed baseload renewable energy with predictable generation profiles. The project will also significantly reduce the capital cost of installing small hydropower in existing irrigation drop structures by reducing the cost of construction and civil works by an estimated 50 percent when compared with installing custom designed works and equipment for each site.	1a, 1b	The project kicked-off in July 2017. The project team is currently in the design phase, focusing on site layout, civil works and initiating interconnection study for at least one of the proposed sites in Yolo County. The team has also determined that at least one of the pre-identified sites will result in an uneconomic project and requested three more sites in Calaveras County be added to its list of proposed sites at no additional cost to ensure at least two demonstrations can take place during the project term.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Terzo Power Systems, LLC.	Phase 1 Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project could reduce the operating cost for hydraulic power systems by integrating an efficient permanent magnet motor, efficient motor controller, and a combined liquid cooling loop. Hydraulic power systems are found in nearly all industrial facilities.	1f, 1h	As of October 17, 2017 the recipient has completed reports on the efficiency of insulated-gate bipolar transistor and metal-oxide-semiconductor field-effect transistor. Other tasks in progress include obtaining quotes on long lead time equipment, and research on selecting design components such as: lab equipment set-up and validation, preliminary component selection for pump motor unit sub-systems, and identifying/obtaining evaluation kits for component prototype validation.
Grant	Pre-existing intellectual property identified in agreement EPC-16-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Polaris Energy Services Inc.	Phase 1 Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	For many electrical utilities, agriculture is a significant component of their peak load. Collectively there are between 160,000 and 170,000 irrigation pumps in the Central Valley. This project addresses the direct electricity cost of irrigation for agricultural customers and the indirect cost to all electricity ratepayers of procuring sufficient resources to meet marginal peak demand, integrating variable renewable energy generation, and building sufficient infrastructure to support agricultural pumping load peaks. Developing control systems and operational strategies that minimize water use, optimize and coordinate pumping loads across large numbers of irrigation pumps, and can adapt to different rate designs, including dynamic and DR-program tariffs, could be financially beneficial to growers.	1c, 1d, 1e, 1g, 1h, 3f	The project is on track. The work began in May of 2017 and focused on the task of engaging customers, setting up the irrigation controls systems and developing recommendations for customer participation in the available utility demand response programs. As of December 2017, the recipient has quantified potential savings (as a percentage of energy charges) for 11 meters if they were exposed to market pricing during 2016 as represented by CAISO Day Ahead prices and the required number of hours shifted to consume the same amount of energy each week in the lowest cost hours. They have also deployed features of their customer relationship management system for agricultural DR management with a focus on efficiently acquiring utility settlement data and generating statements and payments in a semi-automated process.
Grant	Pre-existing intellectual property identified in agreement EPC-16-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Institute of Gas Technology (dba Gas Technology Institute (GTI))	Phase 1 Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	None	This near isothermal compressor, or Carnot Compressor, solves the heat of compression problem by using a working liquid to compress a gas, while actively removing the heat of compression throughout the compression process. By removing the heat throughout the compression step, the energy required to compress air from near atmospheric pressure to ~100 psig can be reduced by up to 50% compared to commercial air compressors, such as piston, screw, and scroll designs. These energy savings are expected to significantly improve the efficiency of industrial air applications.	1f, 1h	This project was kicked-off in April of 2017 and the project team is currently working on preliminary design of the isothermal compressor system.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	Humboldt State University Sponsored Programs Foundation	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project informs the state's Integrated Climate Adaptation and Resiliency Program, identifies the potential for biomass residues to meet SB 350 goals, clarifies potential pathways for meeting the state's Bioenergy Action Plan, and answers key questions that directly respond to the Governor's State of Emergency Proclamation on Tree Mortality.	2a, 3a, 3g, 4a, 4b	The project kick-off meeting was conducted in July 2017. After the kickoff, the recipient finalized subcontracting and formed the Technical Advisory Committee. The first TAC meeting took place in Arcata, CA in December 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-16-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	Electric Power Research Institute (EPRI)	Phase 1 Group 1: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	An air cooled, low-charge, ammonia refrigerant based integrated closed-packaged system with semi-hermetic motor/compressor seal that eliminates the mechanical seal between the compressor and the motor is not available in the U.S market today. As this is a packaged product, this breakthrough will make it much easier for customers to implement this new technology and reap the energy and water savings benefits from it.	1e, 1f, 1h, 2a	This agreement was executed in September 2017 and kick-off meeting was conducted on September 26, 2017. The subcontractor, Mayekawa, is assembling the chiller system in Torrance, CA.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 pha	University of California - Merced	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project aims to create a piezoelectric energy harvesting system with ultra-high density and efficiency. Using an award-winning piezoelectric technology with unique dual-mode and multi-layer generator design and under-pavement installation strategy for smooth drive of passing vehicles and pedestrians, this project will help the ratepayers in California by reducing cost of electricity and reducing emissions related to power generation.	1e, 3h, 4a	The project has completed design and fabrication of a batch of multi-layer piezoelectric generators and is currently conducting laboratory evaluation.
Grant	Pre-existing intellectual property identified in agreement EPC-16-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 pha	The Regents of the University of California, San Diego	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Currently, encapsulated perovskite cells degrade in several hundred hours even in controlled low-oxygen and low-humidity conditions. This project integrates materials innovations developed to date at UC San Diego in the perovskite absorber layer, the solar cell's contact layers, and the encapsulation of the module to make breakthrough advances in perovskite solar cell reliability and scaling. Combining these materials together in a module assembly with glass on top and bottom slows degration by a factor of 1,000. In addition, the bifacial design of module boosts its efficiency.	2a, 4a	The project team successfully transferred graphene atop perovskite layers, developed new electron transport layers, and are improving cell process by characterization and new absorber layer chemistry. The project team is starting to compare the unencapsulated perovskite against the graphene barrier layer encapsulated perovskite cells and expect to complete during next three months.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27	PowWow Energy, Inc.	Phase 1 Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity	This project integrates three new strategies for water and energy efficiency on farms (continuous pump testing with automated remote pump control, programmable irrigation for specific soil types and plant varieties, and management of water and fertility) with PowWow's software. If successful, this project could help individual farms realize energy, water and cost savings without affecting crop yield or quality.	1h, 4a, 4c	The recipient completed the first version of a model for continuous pump efficiency testing on single speed pumps, and the results look reasonable. In October 2017, the team continued validation of the model and developed a model for variable speed pumps. Project team is finalizing the 2017 summary reports for both pilot sites.
Grant	Pre-existing intellectual property identified in agreement EPC-16-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 pha	Pyro-E, LLC	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project demonstrates and assesses the potential of Regenerative Pavement technology, a roadway-embedded energy harvester that uses the untapped energy of car movements. The hardware devices developed using smart materials harvest energy from pavement deflections and vibrations under normal driving conditions. Simultaneously, energy performance data is collected to determine the technology's potential for widescale adoption in roadways and other surfaces.	1e, 2a	The project team completed basic design for the vibrational energy harvester, with a goal to maximize life under repeated impact and compression cycles from a vehicle. A batch of flexors, for converting vertical compression into horizontal extension, was fabricated and calibrated with force transducers and strain instruments to ensure proper specifications. A uniform subscale piezo-ceramic stack prototype will be fabricated and assembled during next three months to prevent stress concentrations under buckling loads.
Grant	Pre-existing intellectual property identified in agreement EPC-16-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	Zoological Society of San Diego dba San Diego Zoo Global	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will increase the effectiveness of conservation actions designed to mitigate renewable energy impacts on Mojave desert tortoises. This will be achieved by evaluating the relative effectiveness of head-start and release methods in an experimental framework. Improvements to the effectiveness of habitat management to encourage natural recruitment of juveniles will also be tested experimentally where possible.	2a, 3a, 3b, 4f	The project is just getting underway as of Fall 2017. Sites for the captive rearing at Edwards Air Force Base and Cadiz, Inc. have been identified and rearing pens are being constructed. The project team is collaborating closely with the complementary project (EPC-16-038) in several areas, such as using a common technical advisory committee.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Electric Power Research Institute (EPRI)	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will determine the strategies and methodologies for V2G to become a value-added distributed energy resource (DER) asset. Results will inform investor-owned utilities on how V2G/V2B can be a viable resource to meet the Assembly Bill 2514 Storage Mandate and the CAISO energy storage and distributed energy resource initiative. The project will enable validation of the most effective use cases and intelligently aggregate distributed energy resources to enable V2G/V2B charging and discharging profiles to alleviate constrained distribution system nodes.	1c, 1e, 2a, 3f, 4a, 5b	This project kicked off in July 2017. Activities and next steps for this project include advancing the system integrated DER (including V2G) communications and control technology to provide potential solutions for home and building Zero Net Energy and Community DER aggregation use case scenarios.
Grant	Pre-existing intellectual property identified in agreement EPC-16-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Zeco Systems dba Greenlots	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	The site controller will aggregate the DC fast chargers to optimize vehicle charging from either the grid or the stationary battery storage based on the day-ahead and real-time pricing data from the electric utility. This optimization will lower the cost of EV charging, directly translating into cheaper plug-in electric vehicle (PEV) charging for the ratepayers and increase PEV penetration.	1e, 1h, 2a, 4a	This project kicked off July 11, 2017. The project team is developing the demand charge reduction algorithm. The team completed the development, functional testing and regression testing of the DR notifications, multiple DR profiles and EVSE curtailment based on DR profile. Development is currently underway for defining the architecture to integrate DC fast charging, storage, and building load DR.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43	Lawrence Berkeley National Laboratory	N/A***	The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.	N/A	Yes; Calif Based Entity	This federal cost share grant with the US DOE, will develop open source tools that will enable verification of building control strategies and will rectify building controls with technologies that integrate active facade, lighting and HVAC with the smart grid to provide fast and slow demand response. A project breakthrough will be that designers can use pre-tested ASHRAE building control sequences or custom sequences, adapt and optimize, and test their impact on energy, peak power reduction, indoor air quality and thermal and visual comfort. The control sequences can be exported to the control vendor to obtain cost estimates and can be used by commissioning agents to verify that the original design intent is realized. This will enable accountability for controls performance between design and operation and is expected to have broad adoption and impact.	1f, 3a, 3b, 3f, 4a	The agreement had a kick off meeting in December 2017 and a CPR meeting is scheduled for the first quarter of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-16-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	There are significant benefits from workplace smart charging that may be shared with the vehicle owners. By exercising the flexibility of the vehicle charging in the workplace, commercial customers can save from energy and demand charge costs. Smart charging can decrease energy charges by up to 1.5% of the overall utility bill, and decrease demand charges by up to 24.7%. Further benefits can be achieved from adding PV to the distributed energy resource at a site, even without that addition, there is significant benefit to both the EV owner and workplace where the EV is being charged.	1e, 1f, 3a, 3f, 4a, 5b	The SLAC team has initiated the subcontracting process with project partners: E3, University of California, Santa Barbara, Chargepoint, and Gridmatic. A Script Design Document has been developed and outlines several scenarios for EV adoption and charging infrastructure investment strategies. The SLAC team will obtain and synchronize disparate data sources as part of the Data Ingestion task, that includes building the infrastructure to obtain and synchronize the current charging infrastructure status, historical charging data with 15 minute sampling rate of average and maximum power demand, and location of charging station from Chargepoint Inc. This data will be used to develop forecasts of EV load shapes. The team is working towards building an equivalent time-variant storage model for the flexible demand of EVSEs, the team will use this model to forecast EV flexibility.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Prospect Silicon Valley	Group 4: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will make the following advances: translate automotive VGI advancements to a commercial e-bus fleet, including retail and wholesale energy services; deliver advanced optimization of battery life and cyber security; integrate energy services and management with leading commercial fleet management tools; integrate key Energy Commission funded VGI platforms and provide a roadmap for statewide deployment	2a, 4a, 4b	The project kickoff was held in August. The recipient has developed the existing bus duty cycle to create a baseline and to assess the future potential for integration of electric buses.
Grant	Pre-existing intellectual property identified in agreement EPC-16-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Lawrence Berkeley National Laboratory	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is developing and implementing an optimization and control algorithm that includes impacts on battery health expressed as an economic cost, using models and parameters derived from actual battery measurements. These activities will help demonstrate PEV ownership lifecycle cost reductions, and will advance scientific knowledge of the impacts of V2G and V2B services on mobile and second-life PEV batteries.	1h, 3f, 4b	This grant agreement was executed in mid-October 2017. Data from a previous LA Air Force Base V2G demonstration project (Contract 500-11-025, supported by another Energy Commission program) will feed into and support this project. Activities are now underway to develop optimization and control strategies for V2G and V2B to maximize battery life, provide adequate PEV charge for mobility needs, and integrate on-site renewable generation.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Motiv Power Systems, Inc.	Group 4: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	A future-focused approach that enables zero emission vehicles (ZEV) to be more cost competitive than diesel by enabling VGI through an on-board charger technology has the potential to reach a higher percentage of the California vehicle market. Compared with a more costly VGI approach that puts the power processing on the charge station, this approach has a greater chance of capturing the future heavy-duty ZEV market that is being supported through policy mandates such as the ZEV action plan, Sustainable Freight Plan, AB32 and SB32 emission reduction goals, and SB 350.	1e, 1h, 2a, 3f, 4a, 4b, 5b	The kick-off meeting for this project took place on June 28, 2017. Motiv Power Systems is working on development of the bi-directional on-board charger.
Grant	Pre-existing intellectual property identified in agreement EPC-16-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Nuvve Corporation	Group 4: Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	None	This project is developing an advanced vehicle-to-grid integration technology to optimize the blend of one-directional "managed charging", bi-directional "vehicle-to-grid", and "vehicle-to-building" functions, for different real world grid applications such as frequency regulation, power quality, voltage control, and grid support. The project will show the value of EVs as distributed energy resources, with the ability to defer or eliminate the need for grid upgrades, address the "duck curve" and enable greater renewable energy penetrations.	1h, 3f, 4b	The project was recently approved and an initial benefit questionnaire was delivered along with the list of technical advisory committee members.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 6	Regents of the University of California, Davis	Phase 2 Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The development of a water system demand management tool to enable water utility participation in demand response and load shifting utility programs, along with marketing and communicating the technology benefits will inform other water utilities, and could result in increased use and acceptance. Given the impact of energy consumption by the water industry in California, widespread use of the proposed methodology could help achieve energy demand reduction needed to support the state's energy goals.	1e, 1g, 1h, 2a, 3h, 4a	The team has developed a hydraulic model of the Moulton Niguel Water District water system that will be used to develop and test energy management strategies. They are also refining data and inputs to the energy demand management system software, including gathering tariff and grid operation characteristics information from the utilities and California Independent System Operator. Water meters and other hardware are being installed in preparation for testing in Q2 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-16-063 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	University of California, San Diego Scripps Institution of Oceanography 0955	Group 6: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will include an extensive quantification/measurement (model validation) effort, which will be based on data from observed meteorological stations and existing coastal upwelling indices (for wind), satellite records of low cloudiness compiled by project members (for cloudiness and aerosols), and USGS stream-flow and groundwater observations (for the hydrologic modeling). The method under development could be used for California's Fifth Climate Change Assessment and future energy planning.	5c	This project started late in the summer of 2017. The research team assembled the Technical Advisory Committee and is finalizing sub-awards to UCLA and UC Riverside.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14	US Geological Survey	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project will be the first systematic study to determine whether birds are attracted to solar energy facilities and if so, to develop an understanding of the sensory basis and proximal response of birds to solar facilities in relation to the "lake effect" attraction phenomenon. Following from that new understanding, the project will identify potentially viable methods for deterring birds from approaching solar facilities and informing future siting decisions in ways that reduce the likelihood of birds encountering solar facilities.	2a, 3a, 4f, 4g	This agreement was approved at the May 2017 business meeting, but the agreement is still being finalized as of December 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-16-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Zero Net Energy (ZNE) Alliance	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Micro Business, Minority Owned	E-Buses have the technical and economic potential to rapidly displace diesel and CNG transit buses given current replacement cycles. Buses are being deployed with onboard telematics to understand the vehicle's operating health and parameters, and high-power wireless inductive charging is now a viable solution for in-route charging. Together, these technologies help overcome range limitations and uncertainty. However, while these technologies alone provide great value and overcome key adoption barriers, integrating them with analytics and distributed energy resource (DER) management platforms can unlock even greater value.	2a, 3f, 4a	This project has just started in August 2017. The team has begun to create a VGI valuation model and will apply different use cases to this model to identify the best revenue streams for the Antelope Valley Transit Authority E-Fleet.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43	Lawrence Berkeley National Laboratory	N/A***	The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.	N/A	Yes; Calif Based Entity	Currently, there is no thermal building insulation material that can cost-effectively be assembled with high R-values. The recipient will develop a manufacturing process to achieve a high R-value and decrease the installed thickness of the insulation, making retrofits easier because much less space will be needed to accommodate existing building wall assemblies.	1h	The first TAC meeting will be held in January and a CPR meeting is planned for March.
Grant	Pre-existing intellectual property identified in agreement EPC-16-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Electric Power Research Institute (EPRI)	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project includes high efficiency solar that can substantially assist commercial and multifamily buildings with roof area constraints, as well as the integration of solar and storage with smart inverters that include segmentation of storage for meeting multiple needs. The project also demonstrates a platform that can manage both loads and storage while integrating DC mini grids to eliminate conversion losses for solar PV.	1a, 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3f, 4a, 4b	The kickoff meeting for this agreement was held on September 20, 2017. In December 2017, EPRI began project preparation work by submitting site readiness verification documents and the draft measurement and verification plan. In the first quarter of 2018, EPRI will finalize the measurement and verification plan, complete the concept design, including the control systems architecture requirements, and begin to build and develop control interfaces and algorithms.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Advanced Microgrid Solutions, Inc.	Group 4: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity, Woman Own	This project will develop an advanced communications gateway and system controller to operate and demonstrate the use of Phase III functions for smart inverters and energy storage to enable greater operability of these distributed energy resources.	1b, 4a, 5b	The project has just started. Advanced Microgrid Solutions gave a presentation on the project at the EPIC Fall Symposium. A kickoff meeting will be scheduled now that the agreement is signed and in place.
Grant	Pre-existing intellectual property identified in agreement EPC-16-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Electric Power Research Institute (EPRI)	Group 6: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will demonstrate an interoperable solution that integrates front-of-the-meter energy storage with smart PV inverters and satellite-based solar forecasting to address grid readiness limitations. The idea is enabling PV as a grid asset through beneficial integration with storage, capacity management, and communications. To accomplish this, advanced modeling techniques will be leveraged including EPRI's existing tools for hosting capacity calculation and energy storage value simulation. Technological knowledge advancement that will result from this demonstration will enable aggregated DER control and optimization.	1a, 1e, 3a, 4a	The project was kicked off in late summer. The recipient is actively working on their interconnection application.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Natural Capitalism Solutions, dba Clean Coalition	Group 6: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	None	This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of California's statutory energy goals by utilizing energy storage as a local balancing and optimization solution on a circuit in the distribution grid. The project will demonstrate a combination of advancements and breakthroughs including, but not limited to an advanced local energy system that utilizes energy storage on a circuit to optimize local circuit balancing, increase PV hosting capacity, and provide CAISO ancillary services.	1e, 1h, 4a, 5b	The project kicked off in September. The recipient is actively working on the site readiness verification documents such as the lease agreement and the memorandum of understanding.
Grant	Pre-existing intellectual property identified in agreement EPC-16-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Regents of the University of California, Riverside Campus	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This Agreement will integrate energy storage and PV technology with advanced control algorithms and smart inverter autonomous functions. The solar+ system will use high efficiency solar panels DC coupled with Li-ion battery storage and demonstrate various smart inverter functions to provide autonomous grid services and energy management practices under a variety of operational conditions. The team will assess the impact smart inverter-provided grid services and solar+storage operation has on each other. The project provides BESS and PV technology integrated with EMS to support diurnal energy loads. This project will implement utility initiated DR functions and create an architecture that allows expansion to future power regulation and potential wholesale market participation.	1c, 1d, 1e, 1g, 1h, 2a, 3d, 3f, 3h, 5a	While the agreement was approved by Commissioners at the June 2017 Business Meeting, there were delays in finalizing the agreement package. Work on technical tasks will commence in early 2018, but the overall project timeline will not be impacted.

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Grant	Pre-existing intellectual property identified in agreement EPC-16-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Electric Power Research Institute (EPRI)	Group 4: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will help overcome three major barriers to achieving the state's energy goals by: 1) proving that CA Rule 21 Phase III functions can be deployed feasibly, safely and predictably via standardization; 2) demonstrating that grid penetration levels can be increased by 25% or more via use of the Phase III advanced control functions; and 3) enabling secure, scalable and affordable cyber security infrastructure that can be accessed by all Californians now and in the future.	1a, 1b, 5a, 5b, 5f, 5g	The project has just started. A kickoff meeting was hosted at Energy Commission on August 15, 2017. EPRI's cost benefit analysis (CBA) group has started working on the white paper titled "A Framework for Evaluating Economic Management of Real Power on Distribution Systems". The IEEE 2030.5 compliance test procedures for Rule 21 functions have been developed by SunSpec.
Grant	Pre-existing intellectual property identified in agreement EPC-17-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13	Taylor Engineering	Phase 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity	This project will help achieve the State's energy goals by scaling up the market adoption of control retrofits that result in significant energy savings in commercial buildings. The successful demonstration of the system as a scalable energy savings solution, and development of pre-tested, plug-and-play integrated packages to achieve energy savings will also allow commercial building owners and operators to maximize energy savings across large portfolios of buildings while reducing transaction costs.	1f, 1h	Project work started October 18, 2017. Work to-date includes finalizing subcontracts, assembling the Technical Advisory Committee (TAC), and estimating project benefits to California ratepayers.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Humboldt State University Sponsored Programs Foundation	Group 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will integrate DER, energy storage, and controllable loads to increase the value of Solar+ systems in the SMB sector. Optimized relative sizing of batteries to PV and flexible operations from MPC-enabled building automation will demonstrate how investment in an integrated system can save costs and create efficiency. The project will develop and demonstrate an open-source model-predictive control (MPC) algorithm with hierarchical control awareness of embedded and distributed control logic to manage building systems and improve load control. Improved hardware-software interfaces will integrate solar electric systems with localized energy storage and MPC-improved load control systems. This will allow SMB owners to optimize the benefits of distributed solar power and approach net-zero energy buildings while also supporting the larger grid power system.	1c, 1e, 1f, 1h, 1i, 2a, 3d, 3h, 5a, 5f	A kick-off meeting for this project was held on October 10, 2017. The team completed their site readiness verification documentation and a draft measurement and verification plan in December 2017. The team also plans to have an engineering plan set, specifications, and cost estimates 90% complete by March 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-17-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Clean Power Research, L.L.C.	Group 5: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project advances the state of PV forecasting in California by improving the accuracy of solar irradiance and PV forecasts, particularly rooftop solar, which is not currently well-understood. Participants in the Energy Commission's January 2017 forecasting workshop identified the lack of visibility into DER impacts on net load as a major barrier to generating accurate forecasts. Forecast inaccuracies cost California millions of dollars annually and result in the unnecessary curtailment of renewable generation.	1c, 2a, 3a, 5c	The kick-off meeting for this project was held September 22, 2017. After the kick-off, CPR worked on improvements to the accuracy of both the irradiance and PV forecast. CPR will complete the Final Irradiance Forecast Accuracy Improvement Report and hold its first TAC meeting in the first quarter of 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Energy and Environmental Economics, Inc. (E3)	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Small Business, Calif Based Entity	This project is developing a tool, in consultation with the three large IOUs, capable of simulating the operations of DER under different tariff and program designs and determining the new designs that will maximize the benefits of DER to ratepayers. Current planning tools do not consider how different tariff and program designs will affect DER locations and adoption rates that will affect system reliability and cost.	1a, 1b, 1c, 2a, 3b	The kick-off meeting for this project was held September 22, 2017. E3 worked on the draft of the Solar + Storage Tool, which it expects to submit to the Energy Commission in the first quarter of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-17-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Electric Power Research Institute (EPRI)	Group 2: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	For California to achieve its long term greenhouse gas reduction goals, there is a greater need for flexibility at all levels of grid operations. Periods of overgeneration and undergeneration, as well as evolving the distribution systems for two way power flows, are a substantial departure from today's one way power flows. Developing the capability for active and reliable control of customer owned loads and resources can reduce the cost of infrastructure improvements by reducing the need to build larger and more transmission, substations, feeder lines, distribution transformers and building wiring needed to account for the possibility of a couple hours a year of high generation with low loads.	1h	The project was awarded at the July 2017 Business Meeting and held a Kick-Off Meeting before the end of 2017. Project aims to execute an agreement with the selected deployment site in the first Quarter of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-17-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Electric Power Research Institute (EPRI)	Group 5: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The use of an advanced network of existing and new instrumentation to inform numerical weather and statistical model improvements will significantly improve the current state of solar forecast modeling in California. The holistic forecasts produced will showcase a combination of various aspects of the weather forecast value chain, not previously demonstrated, linking observation systems and advanced physical and statistical modeling for solar forecasting. The project's focus on fog and marine layer forecasts, which are traditionally challenging to predict, assures that these issues are well-understood in advance of increased PV penetration in the coming years.	1b, 2a	Researchers have selected five data collection sites to ensure the effective use of the equipment and instrumentation during the project. The data collection sites are located in Los Angeles, Ontario, Visalia, San Jose, and Benicia. The project team will add new radiometers in Ontario, Visalia (cool season only), and San Jose (warm season only). New Sodar will be added only in San Jose. New ceilometers will be added in Ontario, Visalia (cool season only), and San Jose. And a new surface metrology will be added in Benicia.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31	Center for Sustainable Energy	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project is designing, installing and evaluating integrated super high-efficiency solar panels with super high-efficiency pre-market energy storage batteries, along with low-cost control hardware to demonstrate the impact of an integrated community solar and energy storage system in a low-income community. The project is designed to demonstrate the impact of an integrated community solar and energy storage system in a low-income community, which is expected to reduce net energy consumption and reduce energy bills.	3h	The project was awarded at the July 2017 Business Meeting and a Kick-Off Meeting was held in December 2017. The project team aims to execute an agreement with the selected deployment site in the first quarter of 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-17-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13	Center for Sustainable Energy	Phase 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project demonstrates how pre-commercial energy efficient technologies can deliver cost-effective, deep electric savings in a big-box retail environment, while also showcasing the demand reduction potential of these strategies. To overcome barriers associated with the package, the team resolves and documents identified system integration and operational challenges. Additionally, rigorous M&V and extensive energy modeling quantifies beneficial technology synergies.	1f, 1h, 2a, 3a, 4c	The project team will begin to gather physical and operational data for the pre-selected big-box retail demonstration site. This information will be used to support baseline M&V planning and the development of the baseline site energy model. Staff and the project team will attend a walk-through of the site with store personnel to define operational schedules and develop an equipment inventory list for major HVAC, refrigeration, and lighting hardware components.
Grant	Pre-existing intellectual property identified in agreement EPC-17-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13	Willdan Energy Solutions	Phase 2: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	None	The demonstration project offers an innovative approach applicable to a range of commercial buildings. This strategy will accelerate adoption of energy savings technologies, contributing to reaching the state's energy efficiency and GHG reduction goals. By demonstrating this comprehensive approach in a real-world application this research has the potential to lead to further scale up and adoption of similar technology packages in other government and commercial buildings.	1f, 1h, 3b	The agreement is in place and work has begun. The team recently completed a report on best practices for permitting of the project technologies. The next phase is a technical feasibility study for each of the proposed technologies.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43	Lawrence Berkeley National Laboratory	N/A***	The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.	N/A	Yes; Calif Based Entity	The cost-effective modeling tool will enable improved envelope designs for new construction and retrofit applications, thus increasing building energy efficiency.	1f, 1h	Project is underway and the first TAC meeting will be in January.
Grant	Pre-existing intellectual property identified in agreement EPC-17-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	HZIU Kompogas SLO Inc.	Group 3: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	This project will benefit California ratepayers by demonstrating an innovative, state-of-the-art anaerobic digester facility. Once economical operation is proven, similar facilities can be replicated across California to provide similar benefits to other local communities.	1a, 1b, 1c, 2a, 3a, 3b, 3g, 3h, 4a	The project kick off meeting was held in December 2017 and work on the technical tasks is now underway.
Grant	Pre-existing intellectual property identified in agreement EPC-17-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	Taylor Energy	Group 1: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will test and evaluate new biomass-to-energy pathways which is critical to meeting several of California's energy goals and provides numerous economic, environmental, and safety benefits to California ratepayers.	2a, 3a, 3b, 3e, 4a	The project conducted its kickoff meeting in September 2017. The project team plans to complete system modifications and perform testing of the first pathway, clean fuel gas production for baseload power generation, by mid-2018. The project team will then perform system modifications required for the other two pathways, which it will begin testing by the end of 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	Altex Technologies Corporation	Group 1: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Integrating a low cost feedstock densification approach and innovative heat exchanger with gasifer and externally fired gas turbine to efficiently generate electricity from forest slash will provide multiple benefits to California IOU electricity ratepayers including reduced power cost relative to alternative approaches and improved electric power generation reliability while reducing the risk of forest fires and pollutant emissions and creating economic development opportunity near the forest region.	1a, 2a	This project started in September 2017. Progress was made on the woody biomass densification subsystem design, and acquisition of necessary equipment and feedstock. Work is also progressing on the design of the woody biomass to heat and liquid fuel conversion system component of the technology, which will produce 50% of the biomass energy in oil and 50% in non-condensable fuel gas and char. Additionally, design work is proceeding on the char feeder, as well as the microturbine based cyclone gasifier and downstream combustor coupled with a heat exchanger, for a two stage direct and indirectly fired combustion process applied to the biomass conversion products, to limit emissions.
Grant	Pre-existing intellectual property identified in agreement EPC-17-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13	Newcomb Anderson McCormick, Inc.	Phase 2: Ranked # 4	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Significant electricity consumption and cost savings will be delivered to the participating Community College Districts via the implementation of the APMD technology. These savings will begin to accrue as the devices are deployed in a phased approach, and be fully achieved once the EPIC project is complete. Following project completion, the APMD systems will continue to provide savings throughout their 8-10 year expected useful life. Successful deployment at participating Districts will then be leveraged to expand technology adoption throughout the remainder of the California Community College system.	1f, 1h, 2a	The project team has developed and finalized the guidelines for interfacing with District staff at each site, instructions and requirements for project tracking, and customized data collection approaches for each participating manufacturer. The team will meet with each participating site staff and develop a customized implementation plan for each site.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43	Nevados Engineering, Inc.	N/A***	The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.	N/A	Yes; Calif Based Entity	The project will lead to technological advancement by increasing the available land for installing solar power plants, and reducing the cost of the energy produced by reducing the costs of installing solar power plants and increasing the amount of energy generated by each solar module in those power plants. This will result in the ratepayer benefit of lower costs and enable faster adoption and installation of solar power throughout California.	1e, 2a, 3a, 3b, 4a	This grant agreement was executed in late October 2017. Since the kickoff meeting, the project focused on field testing of newly manufactured parts for the next-generation of the tracking system and sent some parts for final UL testing. The project team has also developed a quality/product management tool, and completed a prototype to run through the company's supply chain. The project team will complete testing of all components of the new system in 2017 in concert to work out any issues that remain, fine-tune the accuracy of the controls system, and compare the accuracy of the controls and software to high-accuracy testing equipment.
Grant	Pre-existing intellectual property identified in agreement EPC-17-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	The Regents University of California, Davis	Group 1: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will increase the cost competitiveness of biopower plant projects, resulting in expanded opportunities for utilization of biomass waste streams. The online and open application architecture will ensure that everyone has open, public and equal access to this resource.	1a, 1b, 1c, 3b, 3h, 4a, 5d, 5e	The project was approved at the August Business Meeting. The project kickoff meeting was held in December 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-17-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	All Power Labs, Inc.	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	Broadly, the goals of this project are to decrease the modular technology platform's Levelized Cost of Electricity, increase its forestry residue processing capacity, add new value streams in the forms of hot water and biochar production, and enhance the system's carbon sequestration capacity.	1a, 1f, 3g, 4a, 4e	This project was approved at the October 2017 Business Meeting and a kick-off meeting was held in December 2017. The researchers aim to execute an agreement with the selected deployment site in the first quarter of 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	The Regents University of California, Davis	Group 3: Ranked # 2	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by addressing the knowledge gap regarding the optimal scale for the deployment and utilization of AD technology to convert food waste into renewable electricity, heat, and fertilizer. To meet this need, researchers will perform techno-economic and environment assessments of increased deployment of micro-scale AD systems across the state. Researchers will also develop new information about the performance variability of micro-scale AD systems relative to fluctuating and heterogeneous food waste feedstock inputs.	1a, 1b, 2a, 3b, 3g, 4a, 4e	The agreement was approved at the September Business Meeting. A Kick-Off Meeting for the project was held in November 2017.
Grant	Pre-existing intellectual property identified in agreement EPC-17-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	Fall River Resource Conservation District	Group 2: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	None	The Burney-Hat Creek Bioenergy facility will be the first commercial deployments of West Biofuel's CircleDraft gasifier. Several other companies have developed larger community-scale projects in California, but have not been able to demonstrate their success due to environmental compliance and operating challenges. A current R&D funding with West Biofuels has taken a measured and strategic approach to designing a 500kW modular gasification system for forest materials, which brings the CircleDraft gasification technology from research to commercial operations and will represent a transformative point in the California market for community-scale biomass.	1a, 1b, 2a, 3g, 3h, 4a, 4b, 4e	This project was approved at the September 13, 2017 Business Meeting and the kickoff meeting conducted in November 14, 2017. At the kickoff meeting, the Recipient presented new information that must be evaluated by the staff. The project is on hold as of December 2017.

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Grant	Pre-existing intellectual property identified in agreement EPC-17-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29	Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)	Group 4: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	The project will develop and demonstrate advanced model-predictive control strategies that are more sophisticated than current state of the art technology. This project will demonstrate how to minimize electric vehicles charging impacts on the distribution system while analyzing EV fleet capabilities under non-residential scenarios by combining a wide variety of sites with diverse constraints.	1h, 3f, 4b	This project was awarded late in the year. The recipient is working on filing the application for interconnection, obtaining all permits, and developing a technical advisory committee member list.
Grant	Pre-existing intellectual property identified in agreement EPC-17-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 pha	Lystek International Limited	Group 3: Ranked # 3	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will combine the organic processes and anaerobic digestion that will yield greater biogas generation and utilization resulting in higher diversion of organic wastes while producing more renewable electricity than conventional digester systems. If successful, the combined technologies will provide wastewater treatment operators with greater confidence in working with organic generators and processors for accepting feedstock material suitable for co-digestion.	1a, 2a, 4a, 4e, 5b	The project was approved at the November 8, 2017 Business Meeting and technical work will begin in 2018.
Grant	Pre-existing intellectual property identified in agreement EPC-17-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19	RCAM Technologies	Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	Substantial recent investments and advancements in concrete additive manufacturing technologies for buildings make this an opportune time to use the RCAM technology for constructing tall wind turbine towers in California. Concrete additive manufacturing technologies are being developed by countries around the world; however, most development has been performed on concrete printing manufacturing methods for buildings that have little or no structural reinforcement necessary for highly loaded wind turbine towers. The project team will build upon the state-of-the art technology to develop innovative RCAM method that incorporates reinforcement in concrete printing for ultra-tall turbine towers.	2a	The agreement was approved at the November 2017 Business Meeting. A kickoff meeting for the project is expected to be held in January 2018.

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Grant	Pre-existing intellectual property identified in agreement EPC-14-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18	Halotechnics	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	None	The Halotechnics thermal storage system sought to improve system design and modularity and reduce the cost of molten salt energy storage by 25% by reducing the required storage volume. However, researchers found that the innovative storage technology would have to be very large to cost competitive with battery storage and, therefore, would not effectively reduce the cost of small CSP plants to make them competitive in the market.	1i, 2a, 3b	The project was approved at the December 10, 2014 Energy Commission Business Meeting and the project work was started in January 2015. The process design and the mechanical design of all major components were completed, along with specified control system requirements which included the use of three tanks, the minimum number prescribed to evaluate the operation and viability of a multiple tank system. Halotechnics terminated the project after 10 months prior to the procurement of any hardware due to insufficient commercial traction from customers in the concentrated solar power industry.
Grant	Pre-existing intellectual property identified in agreement EPC-14-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35	Electric Power Research Institute (EPRI)	Group 1: Ranked # 1	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This agreement developed a "first of its kind" publically available tool that determines the value of energy storage with respect to location, size, and type.	1c, 1i, 2a, 4a, 5b	The project successfully ended on December 30, 2016, and the final report was published. The final report can be seen at: http://www.energy.ca.gov/2017publications/CEC-500-2017-016/CEC-500-2017-016.pdf After project was completed, ongoing outreach activities continue. For example, the tool was presented to NYSERDA for testing, and a meeting was held between the CEC and CPUC staff to present the tool's capabilities and its potential adoption for future procurement decisions. Additionally, the California Energy Commission held a public workshop for the purpose of training and obtaining feedback for future refinement of the tool.
Grant	Pre-existing intellectual property identified in agreement EPC-15-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35	LightSail Energy	Ranked # 5	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	This project will provide California utilities with information that can be used in assessing the costs and benefits of I-CAES to reduce the capital, installation and operation costs of the system. This constitutes a step towards meeting the Energy Commission targets of $1,000/kW, $200/kWh, and 80% round trip efficiency for energy storage.	1e, 1i, 4a, 5b	This project was terminated. LightSail Energy Inc. closed its energy storage division. No work was completed and no funds were disbursed for this project.

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Grant	Pre-existing intellectual property identified in agreement EPC-15-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35	LightSail Energy	Ranked # 6	Funds were awarded to passing proposals in rank order.	N/A	Yes; Calif Based Entity	To meet California's statutory energy goals AB32, AB2514, and the RPS extensive penetration of low-cost, high efficiency energy storage is needed. This project will provide California utilities with valuable information that can be used in assessing the costs, benefits and identifying the highest value applications of I-CAES for the California grid.	1e, 1i, 4a, 5b	This project was terminated. LightSail Energy Inc. closed its energy storage division. No work was completed and no funds were disbursed for this project.