The Office of Sustainability and Commuter Services

Solar Parking Project

Feasibility Study to Install Photo Voltaic Structures at the University of Utah

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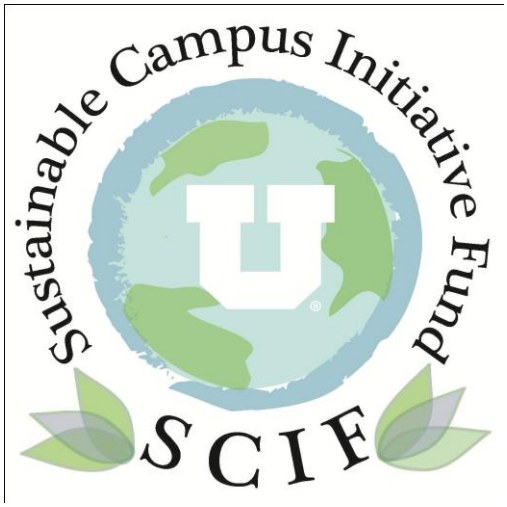

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LETTER OF ACKNOWLEDGEMENT

During the course of this project a number of outside as well as inside sources were consulted with. These sources provided key information for this study without which a final product would not be possible.

Our most sincere gratitude is expressed to those whose involvement was paramount namely Rick Lake, Director of Finance and Faculty Advisor for the project. His regular presence at meetings combined with his influence was a significant asset when dealing with matters of bureaucracy within the University. His unwavering dedication to the project and the project team was a major determinant in the success of the project for which we are very much in his debt.

In addition to Rick's help, we are very grateful to Alma Allred in Commuter Services at the University of Utah; Angel Moreno in Energy Management at the University of Utah and to Myron Wilson and Jen Colby in the Office of Sustainability at University of Utah. Each of these individuals was very generous with their time and knowledge providing key information and resources necessary to accomplish the specified objectives.

Throughout the project information was also gathered from a number of other sources listed as follows:

- Alma Allred - Director, Commuter Services , University of Utah
- Angel Moreno – Energy Manager, Plant Operation, Energy Management, University of Utah

- James Steed – Utility Analyst, Plant Operations, Energy Management, University of Utah
- Sara Baldwin and Kevin Emerson - Utah clean energy
- Renee Zollinger -Sustainability Office of the Mayor
- Kimberly Barnett – Environmental Coordinator for Peter Caroon
- Ron Barness – Project Developer, Bella Energy
- Jen Colby – Sustainability Coordinator, Office of Sustainability, University of Utah
- Martin Shain – Consultant, Office of the Attorney General
- Sophia Mello - Sustainability Research Analyst, Office of Sustainability, University of Utah
- Scott F. Jefferson – Project Manager, Campus Design and Construction, University of Utah

Each of the above individuals demonstrated a profound commitment to their respective field which is both acknowledged and admired by the Solar Parking Project team. Our most sincere gratitude along with our profound respect is expressed to those who were willing and eager to meet with us and serve as an outside knowledge base.

I. EXECUTIVE SUMMARY

"We are in the middle of one of those rare moments when the right thing to do it also the economically smart thing to do."

Kathleen Schatzberg [1]

The Office of Sustainability approved that a feasibility study be conducted by a group of MBA students regarding the installation of photovoltaic structures and parking stalls on the University of Utah campus. This document along with the attached CD contains the completed results of our research, suggestions and conclusions about this project.

When determining the feasibility of installing photovoltaic parking stalls we included environmental, social and financial perspectives. The authors felt that it would not be appropriate to do a feasibility study simply based on financial considerations, environmental ramifications, or social appeal. To determine the best course of action the project must be looked at from all angles.

After carefully considering the Triple Bottom Line of the proposed project, we concluded that a limited installation of 20-40 photovoltaic parking stalls is immediately justified. A much larger installation will be financial, environmental and social viable in 2013.

[1] Kathleen Schatzberg is President of the Cape Cod Community College and ACUPCC Leadership Circle Member

II. INTRODUCTION

The purpose of the filed study was to elaborate a cost-benefit analysis of installing solar panel structures on the parking lots at the University of Utah from the triple bottom line: Social, Environmental and Financial. The analysis presented provides decision management tools and criteria used in determining whether to install solar parking structures at the University, in accordance with the President's Plan Commitment and the Solar PV guidelines provided by the Energy and Environmental Stewardship Initiative: 2010 Climate Action Plan.

The project is not an isolated effort, but part of a biggest vision fostered by six hundred and seventy seven higher education entities through the "American College & University Presidents' Climate Commitment" (ACUPCC). President Michael Young joined by signing on behalf of the University of Utah in 2008.

The President's Climate Commitment is a combined effort of high education entities in the USA "to reduce the global emission of greenhouse gases in order to avert the worst impacts of global warming."[2] Some of the benefits derived from this commitment is the belief that "colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities.[3]

To implement this initiative, the University of Utah has founded the Office of Sustainability which purpose is "to create a balance between environmental care, economic

[2] The American College & University Presidents' Climate Commitment
[3] American College & University Presidents' Climate Commitment http://www2.presidentsclimatecommitment.org/html/commitment.pdf

development, and social responsibility by introducing and expanding programs such as increased energy efficiency, sustainability-focused curricula, renewable energy production, " [4]

An important tool to integrate these efforts is "The Energy and Environmental Stewardship Initiative: 2010 Climate Action Plan (EESI)" [5] which contemplates the creation of a "pilot program and develop financing strategies with Commuter Services for a special parking permit to install PV parking structures"; this is a part of the focus of our research.

[4] The Energy and Environmental Stewardship Initiative:2010 Climate Action Plan (EESI), p. 4.
[5] This plan builds on the University of Utah's 2008 Campus Master Plan and extends the University's leadership by integrating the principles of social, economic, and environmental sustainability into campus planning, design, operations, administration, curriculum, and community engagement. This plan represents the desire, ability, and commitment of students, staff, faculty, and administration to dramatically reduce our greenhouse gas (GHG) emissions and achieve carbon neutrality as rapidly as practicable.

III. ANALYSIS FROM THE SOCIAL, ENVIRONMENTAL AND FINANCIAL PERSPECTIVES

The traditional conception of management in the occidental culture encourages managers to do business according to the best interest of the shareholders, which is usually measured in financial gain. As Milton Friedman summarized in 1970 "The Social Responsibility of Business is to Increase its Profits"[6]

This obligation to increase profits creates pressure on managers to reduce costs and maximize profits that can be measured and shown in a financial statement. Usually costs have been reduced, not necessarily creating more efficient operating systems, technologies, human resource skills, or waste recycling systems, but transferring several of these costs to the society through products of inferior quality for consumers, inferior working conditions for employees, or transferring costs to the environment through waste disposal and other harmful environmental actions.

This scenario of events is fast becoming a method of the past. Today's consumers and companies are more acquainted with the social aspects of doing business: climate change and degradation of living conditions on planet earth. Managers are required to be concerned not only about the shareholders' financial benefit, and government regulations, but also for the unregulated areas in which there are stakeholders who have any social or environmental interest or would be affected in the production process.

[6] Milton Friedman, The Social Responsibility of Business is to Increase its Profits. *The New York Times Magazine*, September 13, 1970. At **http://www.colorado.edu/studentgroups/libertarians/issues/friedman-soc-resp-business.html**

A. SOCIAL

Social benefits can often be difficult to quantify. Indeed the triple bottom line philosophy gives no tangible method for doing so. As such it is essential to detail the social benefits that the University of Utah could obtain if photo-voltaic parking stalls were placed on campus.

According to the ACUPCC, colleges and universities that demonstrate climate leadership will reap many benefits, but these benefits would require an additional marketing effort from the University of Utah in order to create, claim, and measure the value of the benefits provided by the PV parking structures. Some of these benefits are:[7]

- Recruiting more and better students
- Attracting the next generation of leading faculty
- Appealing to alumni, trustees, and other stakeholders
- Securing important partnerships with and funding from the private sector and government agencies
- Receiving high levels of public, private, and governmental support for the institution's mission
- Fulfilling their teaching, research, and service missions
- Leading the scientific and technology race to find global warming solutions and contribute to community and nationwide efforts
- Operating more efficiently and effectively
- Generating cost savings, as many campuses have demonstrated

[7] The American College & University Presidents' Climate Commitment (ACUPCC) Power point presentation http://www.presidentsclimatecommitment.org/about/mission-history

- Stabilizing long-term operating costs
- Increasing capacity for better long-range planning
- Creating more attractive, convenient, and productive campuses

In order to validate some of these ideas applied to our project, the authors organized a survey that provided us useful insights not only about the social, but also the environmental and financial perspectives.

1. Survey Discussion

To gain an understanding of the campus communities' opinions about installing photo voltaic structures on the parking lots, and their willingness to pay for PV parking stalls, we conducted a survey that was distributed to more than 30,000 faculty, staff and students at the University. There were 4,581 respondents to our survey, which results gave the authors an intimate view of the social aspect of the project. The survey also influenced the assumptions used in the environmental and financial models.

The survey was distributed through e-mail using the University of Utah's listserv. In order for the survey to be distributed we needed to gain approval from various Vice-Presidents at the University. We experienced some opposition but were successfully able to gain the support of 2 of the 3 Vice-Presidents who are gate-keepers for the listserv.

There were 4,581 individuals who completed our survey. The relationship of these respondents to the University of Utah is below:

#	Answer		Response	%
1	Undergraduate Student		691	15%
2	Graduate Student		488	11%
3	Faculty		621	14%
4	Staff		2,714	59%
5	Other		67	1%
	Total		4,581	100%

While the vast majority of the respondents chose to categorize themselves as Staff of the University, there are still a good number of respondents who categorize themselves as Undergraduate Students, Graduate Students and Faculty. 67 individuals did not categorize themselves as any of the above. We suppose that these individuals are no longer directly affiliated with the University of Utah.

Our goal in creating this survey was to get a good idea of how people feel about sustainability efforts on campus, particularly how they feel about the creation of photovoltaic covered parking stalls. The survey was exploratory in nature. We did not approach the survey with the goal of proving or disproving any specific hypothesis. Our primary purpose was to get an idea of how much people would be willing to pay extra for access to a covered parking stall.

Forty-one percent (41%) of the respondents indicated that they would like to see covered parking stalls closer to central campus. We then asked these individuals, "How much would you be willing to pay extra per month for a reserved covered parking space closer to central campus?" Their responses are below:

#	Answer		Response	%
1	Zero		707	37%
2	$5-20		827	44%
3	$21-40		229	12%
4	$41-60		81	4%
5	$61-80		19	1%
6	$81 or more		33	2%
	Total		1,896	100%

It is apparent that 63% of the respondents to this question are willing to pay at least $5.00 additional dollars per month for the opportunity to park in a covered stall. It is also surprising that 2% of the respondents indicated that they were willing to pay $81.00 dollars or more per month.

We also wanted to get an idea from our respondents regarding how the community would feel if the University were to install photovoltaic covered parking stalls. Respondents were asked the following question: "How do you feel the community would react to the University of Utah installing covered parking stalls that have solar panel arrays on the roof that will generate renewable solar power?"

#	Answer		Response	%
1	Very Displeased		41	1%
2	Displeased		135	3%
3	Neutral		857	19%
4	Pleased		2,171	49%
5	Very Pleased		1,209	27%
	Total		4,413	100%

Although it is not possible to monetize the happiness that executing this project would produce on the university community, it is possible to use surveys and other metrics to evaluate the fulfillment of some of the points shown in the list above. For instance, based off survey results conducted among the University of Utah's faculty, staff, and students we were able to conclude that there is a market for solar parking on the University of Utah's campus.

Forty percent (40%) of our respondents indicated they would have a willingness to pay $5.00 - $20.00 a month extra to park under shaded solar parking structures. This being noted, we believe that it is reasonable to ask for an extra $150.00 annually (or $75.00 per Fall/Spring semester) for the exclusive rights and recognition of the parking under the shade of the solar parking panels.

2. Conclusion and Suggestions from the Social Perspective

According to the survey, we can affirm that the community would react positively to the installation of covered parking stalls that would generate renewable solar power, and also would be willing to pay an additional fee for this project, which would allow the creation of "green" permits as a new category of parking permits.

To promote the "green" permits, we suggest the creation of two new groups of parking permits: the "A Green" permits and the "U Green" permit. These two groups of permits will display a "green stripe" at the bottom of the parking permit. This green stripe will allow the owner to park in any location that the U or A permit is usually permitted to park, but also allows the owner to park under the covered spaces that are generating solar electricity.

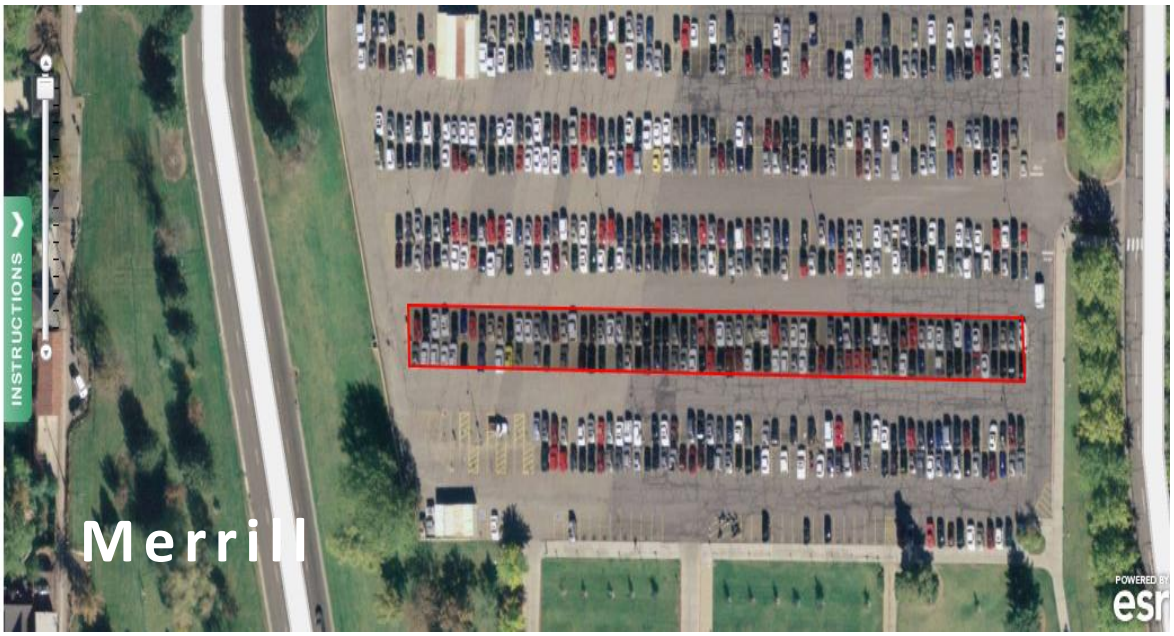
The "green stripe" located at the bottom of the parking passes will identify its owner as someone who cares about sustainability and the environment. The extra money generated by these permits could be considered gifts to the University, and could potentially be written off as a tax deduction. The owners of the "U Green" and "A Green" permits are socially responsible, and are employing steps to help the future generations enjoy a cleaner world.

If the "U Green" and "A Green" permits did not sell well in the first few years, there is a large potential market for making these spots into "R" permit spots, as 50% of "A" permits said they would consider upgrading to an "R" permit if they were guaranteed a covered parking spot. We believe it would be justified and fair to charge an additional $15.00 per month for the "R Green" permit if that option were to be exercised.

Parking tickets are usually a $15.00 penalty. We suggest that the fine for parking under a "green" spot be increased perhaps to $25.00. The additional money ($10.00) could go to the Office of Sustainability to increase sustainability efforts on campus. Signs would be posted at the parking structure notifying people of the fine. We feel many students would choose to pay a $15.00 parking ticket during a snow storm to park under covered parking rather than walk in the snow. These same students however, might hesitate if they knew the fee was $25.00.

We would suggest that these "green" permit spots be available in the Merrill Engineering and Humanities lots and that a prototype be created in the Union pay lot as this lot is most visible to those visiting campus for the first time. The Union pay lot would be the most visible and "PR" friendly spot for the structures to be located. We feel that the Union pay lot would be an ideal

spot for a small pilot project consisting of 20-40 stalls. This pilot project would show students, prospective students, faculty, prospective faculty, staff and visitors to the University that we are taking our commitment to become a more sustainably University seriously. The benefits to the pilot project are mostly non-quantifiable; however, we feel they are quite real.



B. ENVIRONMENTAL

With the signing of the 2008 Climate Action Plan, the University of Utah committed itself to improving the environment and social impact of the University. With the installation of PV panels the University is able to capitalize on several key environmental and social benefits. These include the reduction of greenhouse gases, reduction of heat island effect, and increase goodwill among neighboring communities, students, faculty, and staff.

1. General Benefits

According to the ACUPCC, colleges and universities that demonstrate climate leadership will reap many benefits such as:[8]

- Anticipating state and regional energy mandates
- Gaining competitive advantage over institutions that choose to wait
- Minimizing risk and maximize expertise in long-term carbon management
- Capitalizing on the expanding carbon trading financial market

2. Specific Benefits

Other benefits that we can identify in this project are:

a. Reduction of CO2, NH4, and N20 emissions:

The most significant effect of PV parking spots is the reduction in carbon dioxide (CO2) emitted by the University. For each covered parking space it is estimated the University will save 2.5 metric tons of CO2 emissions per year. Along with the CO2 emission reductions in methane

[8] The American College & University Presidents' Climate Commitment (ACUPCC) Power point presentation http://www.presidentsclimatecommitment.org/about/mission-history

(NH4) and nitrous oxide (N2O) of .1 metric tons and .03 metric tons will also occur. These chemicals are known to cause acid rain and to increase global warming. By installing the PV parking the University of Utah will be able to produce electricity with close to zero emissions; meaning no CO2, NH4, or N2O produced. With zero emissions the University of Utah contributes to better air quality over Salt Lake City. The better air quality leads to a reduction of the particles known to create "bad air" days during winter inversions.

b. Goodwill with the community:

The production of power on the University for the University's use will create goodwill among neighboring communities. The neighborhoods surrounding the University of Utah have complained about the large and significant number of power lines crossing through their neighborhoods. Although the power being transmitted through the power lines is used by the neighborhoods, there is a perception that the majority of the power is only going to the University of Utah. By installing PV parking the U can create goodwill with the neighboring communities through its use of power generated on the University campus. This could lead to a more positive perception of the existing power lines in the neighborhoods and a realization that the power the lines also provide the community with electricity.

c. Transmission System Improvement:

A study conducted by the Department of Energy (DOE) determined that the existing electricity transmission system needs significant improvement and upgrading within the next decade to maintain the current electricity usage[9]. Without improvement or upgrading, the system could fall short of supply and costs for consumers would increase. With the installation of PV

[9] http://www.oe.energy.gov/transmission.htm

panels the University of Utah addresses two concerns of DOE. The first is the issue of transmission line loss. In 2008 it was estimated that 6.14% of electricity in the US was lost due to transmission. With PV panels the University only encounters a minimal line loss of electricity from the transport of energy produced by the panels.

The line loss in PV panels is only incurred between the panels and the grid, while the current line loss associated with the University occurs with the transmission of power from coal generated facilities in Wyoming and southern Utah. The use of PV panels would result in a decrease in the amount of line loss associated with the University. Since the University would be using the PV panels for some power, less power would be needed from the transmission lines and less power would experience line loss. The use of less power needed from the transmission lines means less power would be needed from coal generated power plants. The less power needed from coal generated power plants the less CO2 emitted into the atmosphere.

d. Reduction of Heat Island Effect:

Another environmental benefit of installing PV panels on parking lots at the University of Utah is the reduction of the heat island effect. The heat island effect is described as being areas that are hotter than nearby areas. Heat islands can lead to increased summer peak energy demands and greenhouse gas emissions. The installation of PV panels would help to reduce the heat island effect by covering the parking lots and instead of heat being absorbed by the pavement to create higher temperatures, heat is absorbed by the PV panels to create energy for the University. The more heat absorbed by the solar panels, the cooler the parking lots will remain and the heat island effect is mitigated. Since the heat island effect is most pronounced

during summer peak power demands the use of PV panels to mitigate is also beneficial for the amount of power produced by the PV panels. The PV panels will be able to produce the most power during the summer peak demand period.

Based on the results of the survey, we know that of 71% of respondents use vehicles to get to campus for various reasons. Although driving may not be the most environmentally efficient way to commute to and from campus, we believe there are ways to counteract some of the negative environmental impacts by implementing solar covered parking on campus to generate electricity that can be used on campus.

Not only will these covered parking stalls help the environment, but there is a huge opportunity for the University of Utah to gain positive public relations surrounding the University's dedication to the environment and the President's Climate Action Plan.

According to the survey, 81% of all respondents believed that sustainability efforts such as recycling, LED lights, and alternative transportation to campus were either very important or extremely important. Even though alternative transportation was listed as important, the majority of respondents (49%) said they drive to campus 16 or more times a month.

e. Support to Electric Vehicles:

With the rising cost of fossil fuels, many people are seeking hybrid and electric vehicles as saving alternative. One problem with electric vehicles is that they would require "plug-ins" to

keep their batteries charged. The structures we are researching would offer "ports" where drivers could charge their vehicles while they are parked on campus.

These structures could be built to easily support additional future additions of charging stations. This course of action is supported by survey responses wherein approximately 1/3 of the "R" permits and 1/4 of the "A" permit owners said they were considering purchasing an electric car in the next five years.

R Permit Holders:

Are you considering to buy an electric car in the next five years?

#	Answer		Response	%
1	Yes		55	29%
2	No		79	41%
3	Undecided		58	30%
	Total		192	100%

A Permit Holders:

Are you considering to buy an electric car in the next five years?

#	Answer		Response	%
1	Yes		302	23%
2	No		596	46%
3	Undecided		388	30%
	Total		1,286	100%

Since the electric cars are an emerging technology, we believe that it would be possible that one of the major automobile manufacturers might be interested in donating or sponsoring these ports. Thus, the automobile manufacturer would be able to gain some positive publicity around the building of the structures.

Both the University of Utah and the auto manufacturer would benefit from the social rewards associated with the manufacturing of the covered parking structures through the publicity generated by the building of the structures. Both the University of Utah as well as the auto manufacturer would also have the opportunity to gain more clientele (customers, students, staff and faculty) through their efforts to create a greener future for our world.

f. Promote the Study of Clean Energy Solutions:

With the current nuclear crisis in Japan and the environmental risk that implies to build nuclear plants in seismic zones, it is clear that now is the time to reevaluate energy consumption and investments in such. The technology is available for alternative energy and, while it may be slightly more expensive now it will be less expensive in the long run considering the possibility of natural disasters and fossil fuel depletion.

g. Gain National Attention and Recognition:

Furthermore, investment in sustainability would generate national attention as well. The Association of the Advancement of Sustainability in Higher Education (AASHE) has a self-reporting sustainability framework called STARS (Sustainability Tracking Assessment and Rating System). The University of Utah has the chance to join the STARS program and track their movement towards sustainability.

The STARS program aligns very well with the President's Climate Commitment, as all the Universities participating are graded, praised, and recognized for their achievements. They are also given guidance from AASHE on how they can best use their efforts to achieve their

goals. This information would be available to the public and other interested parties to read. We suggest that there be a link on the University of Utah's homepage so anyone interested in the University was able to see the endeavors the University was utilizing to become a more responsible campus.

h. Financial Support:

In our survey we asked, "How would you feel to pay $2.00 additional dollars with your tuition to support the sustainability efforts on campus?" The student respondents' results are as follows:

#	Answer		Response	%
1	Very Displeased		57	5%
2	Displeased		48	4%
3	Neutral		224	20%
4	Pleased		332	29%
5	Very Pleased		477	42%
	Total		1,138	100%

Seventy-one percent (71%) of the respondents to this question were in favor of using a portion of their tuition money to assist in campus sustainability efforts.

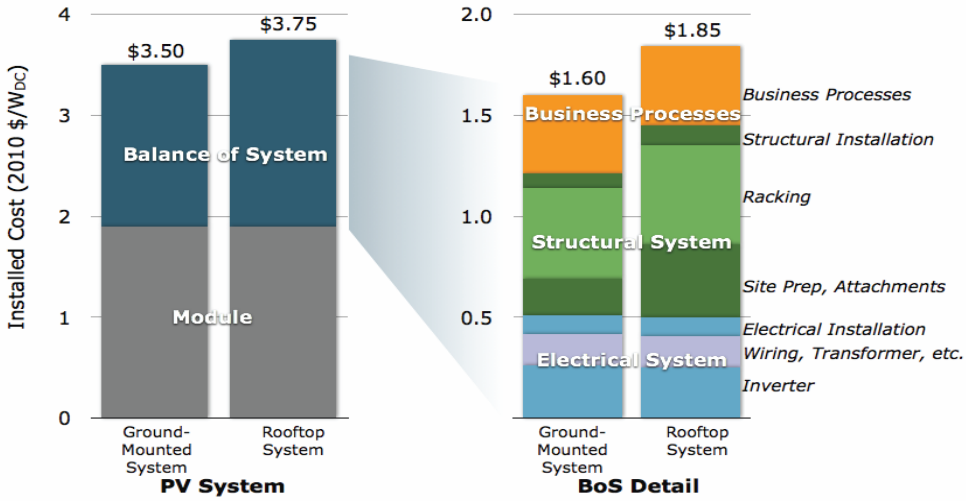
The environmental aspect of this project also provides additional financial gain that is shown in the financial section.

C. FINANCIAL

The mind of the superior man is conversant with righteousness; the mind of the mean mind is conversant with gain.

Confucius[10]

The financial projections presented are the result of numerous assumptions and estimates. While these estimates were made based on the best available information, they are subject to changing market conditions. This consulting group does not intend to provide updates to these projections.



The estimation of a photovoltaic system's value, from a financial perspective requires careful consideration of the system's costs and benefits over its lifetime. In this section of the report, we will attempt to explain both sides of the equation, along with the equation itself.

The costs of a photovoltaic system begin with the planning, hardware and construction costs. While these costs are estimated, both currently and into the near future, the final word rests

[10] Confucius, The Analects, Bk. IV, Chpt XVI.

with the best bidders for a project. Below is a breakdown of these costs for "best in class" systems developed in 2010.

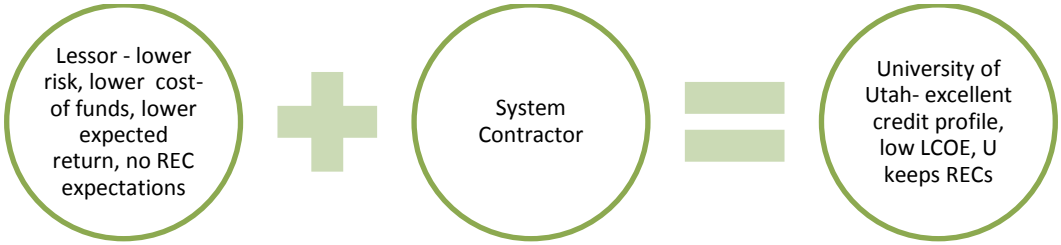
These costs are expected to decline rapidly over the next few years, and the University may be able to derive incremental savings using its own resources, particularly in the business process phase. Additional costs for the system include: depreciation, maintenance, inverter replacement, insurance, property tax and finance costs. All of these costs are accounted for in our estimates, but recent developments in system finance options require special note.

In order for the University, as a non-profit entity, to capture the Federal Investment Tax Credit, it must finance the project through a for-profit third party which will then act as owner of the system for at least the first five years of the system's operation. Power purchase agreements (PPAs) are the most popular solution, but every agreement is different, which effectively clouds the purchaser's ability to compare bids. The agreements themselves are sometimes so convoluted that it is even difficult to value a system within the terms of an agreement. A possible alternative is a lease agreement originated from a bank. This arrangement may result in lower financing costs, while allowing the University to keep the Renewable Energy Certificates created by a system (an unlikely event in a PPA arrangement). Copies of a public domain PPA arrangement and of a sample lease agreement are both included in the CD package for illustration. The following illustration compares the options with similar assumptions.

1. Why Leases may Cost less than PPA's

An important variable in a return-on-investment calculation is financing cost. PPA arrangements are based on the PPA provider's high cost of funds and high investment return expectation. The University pays for both.

A lease arrangement can take advantage of a bank's lower cost of funds and the University's excellent credit profile. The University accepts maintenance responsibility and additional system performance risk, but is protected by contractor, inverter and panel warranties.



In the scenario illustrated in exhibit 1 in the appendix, using the same assumptions, a PPA produces an LCOE of $.27, while a lease agreement produces an LCOE of $.15 (Refer to LCOE explanation on page_).

A final note on system cost regards the source of funds used to pay for a system: If the University directly or indirectly obtains access to external funds that can only be used for the purpose of renewable energy system construction (e.g. Federal and State ITCs, depreciation tax benefits, Rocky Mountain Power blue sky funds), it is appropriate to deduct the amounts from the cost of the system. If however, the University obtains funds that may be used in a number of different ways, (e.g. Federal development grants) the University must weigh the value of this money against possible alternative uses.

The University should receive three direct sources of income from PV system constructed on a shaded parking structure: the value of electricity generated by the system, the revenues generated by higher parking fees and increased revenues from the Student Sustainability Fund fee. We expect a fourth direct source of income to be derived from the sale of Renewable Energy Certificates REC's[11] in future years. A brief review of our assumptions for REC value follows this section of the report. The value of electricity generated by a PV system depends on many factors, so an extensive explanation follows the REC review.

2. Renewable Energy Certificate Value

The potential value of RECs created by a PV system depends primarily on future Federal and State legislative action. PacifiCorp's view on the value of RECs follows:

> *"Absent either a RPS compliance obligation or an opportunity to bank unbundled renewable energy certificate (RECs) for future year RPS compliance, PacifiCorp has*

[11] A REC (pronounced: rĕk) represents the property rights to the environmental, social, and other nonpower qualities of renewable electricity generation. A REC, and its associated attributes and benefits, can be sold separately from the underlying physical electricity associated with a renewable-based generation source. http://www.epa.gov/greenpower/gpmarket/rec.htm

historically relied on an assumption that a renewable project may generate $5 per megawatt-hour for five years from the sale of unbundled REC's. Unbundled REC sales have helped mitigate the near-term cost differential between new renewable resources and traditional generating resources. However, once greenhouse gas emissions are regulated, surplus unbundled REC sales would cease. PacifiCorp assumes if an unbundled REC is sold, then the underlying power (aka "null" power) would likely have a carbon emissions rate imputed upon it by regulatory authorities, thus obligating PacifiCorp to purchase either allowances or carbon offsets sufficient to cover the imputed carbon emissions. By selling an unbundled REC, PacifiCorp may generate revenue, but risks incurring a new carbon liability. Once greenhouse gases are regulated—and until the unbundled REC and carbon markets are reconciled—PacifiCorp plans to cease selling unbundled REC's."[12]

In the same analysis, PacifiCorp's midpoint projection for a 2013 carbon tax is $45 / metric ton. Clearly, PacifiCorp places a present value on RECs that is higher than the existing unbundled $5.00 per MWh price. Market prices for solar RECs in states with stringent RPS compliance standards range from $205-$675 per MWh, 2-6¢ / kWh.[13] It is unlikely that federal mandates would drive REC prices to the high end of this range, as REC trading for national standards would by very liquid.

For purposes of analysis, we will assume a 2013 value of $45 / metric ton discounted at 10% to a present value of $37. Using a WECC Northwest non-base load conversion rate of 1.33

[12] Pacificorp 2008 Integrated Resource Plan, vol 1, p 52. http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Education_and_Safety/Transmission_Projects/Integrated_Resource_Planning_13.pdf

[13] Cory, Charles Coggeshall, Jason Coughlin, and Claire Kreycik. Solar Photovoltaic Financing: Deployment by Federal Government Agencies

lb / kWh[14], today's avoided tax value should be reflected in REC value at 2.2 ¢ /kWh. The RECs may have additional significant RPS value. Please refer to Cornell University's discussion of the potential range of REC values.[15]

REC ownership also allows the University potentially valuable future flexibility. The University might, for example, gain many of the public relations and marketing benefits from Renewable Energy Certificates over the first few years of a project's life. The University could then determine whether it is more beneficial to apply the RECs to the University's own goals, or to sell them to a second party. Although the current market value of Utah solar RECs is insignificant, we urge decision-makers to carefully consider the potentially very significant value of future RECs when negotiating any contract.

3. University of Utah's PV Energy and Demand Charge Value

The University currently pays a "blended" rate of about $.066 / kWh. This is not the appropriate rate to use when calculating the financial benefit of electricity produced by a PV system at the U. A large component of blended rate consists of peak power usage charges that may or may not be reduced by a PV system. Considerable controversy exists over the value of photovoltaic's (PV) value as a generation source, partly because of the common belief that PV

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[14] "Most users of the Equivalencies Calculator who seek equivalencies for electricity-related emissions want to know equivalencies for emissions **reductions** from energy efficiency or renewable energy programs. These programs are not generally assumed to affect baseload emissions (the emissions from power plants that run all the time), but rather non-baseload generation (power plants that are brought online as necessary to meet demand)." http://cfpub.epa.gov/egridweb/ghg.cfm, http://www.epa.gov/cleanenergy/energy-resources/refs.html

[15] ENERGY STRATEGIES, LLC, FINANCIAL EXPOSURE TO U.S. CLIMATE ACTION POLICY, JANUARY 6, 2009. http://www.sustainablecampus.cornell.edu/climate/docs/Internalized_Carbon_Costs_10.pdf

systems do not contribute significantly to peak demand. The problem is obscured by complicated rate schedules, the limited predictability of utility demand charges and the reliance on variable insolation of PV performance.

Recent research supports the value of PV power both as a source of peak power and in its effect on demand charges. The following is an excerpt from a 2010 National Renewable Energy Laboratory (NREL) Report:

> *"One of the more attractive features of solar technologies is their general correlation with peak demand (Denholm and Margolis 2007). In most parts of the United States, peak demand occurs during the afternoon of summer weekdays. Because of the high cost of peak power generation, common TOU electric rate structures charge users higher rates for use at peak times. As a result, PV becomes very attractive because it can provide a peak-shaving impact during the first few hours of the afternoon peak, offsetting expensive electricity from the grid."*

PV systems may offset a customer's load by providing electricity during high demand hours. However, because demand is often measured in 15-minute intervals, if a PV system's output is reduced as a result of clouds or maintenance during this peak load period, the actual benefit of PV on demand reduction can be substantially reduced. For buildings under a demand ratchet, this effect may be amplified. Additionally, peak building demand often occurs later in the afternoon, whereas PV output generally peaks at noon (standard time), depending on longitude. In these cases, PV systems cannot reduce peak loads by their full rated capacity, but rather a percentage of their capacity.

Table 4 lists the capacity values of all PV systems studied. Here, the capacity value is defined as the total monthly peak demand reduction as a percentage of the PV systems' rated capacity. The capacity value allows us to assess the actual impact on the monthly demand charge bill. Capacity values are highest during the summer months, averaging 38% between June and August compared to 6% between December and February.

On average, peak PV production and peak demand occurs three hours apart for all months. On a clear day, PV systems can provide between 44% and 69% of rated capacity three hours from solar peak in December and June respectively. This sets a fundamental limit on the capacity value, which is dependent on the peak demand coincidence. Due in part to this limit as well as cloud cover and other hours of high demand, the capacity values approach a maximum of 40% during the summer and averages 21% for all months" [16]

Table 4: Average Capacity Values and Peak-Solar to Peak-Demand Difference for all Buildings compared to PV Systems Studied across the Ten Climate Zones Used in this Analysis. [17]

Month	PV Capacity Values	Hours between Peak Solar and Peak Demand
January	4%	3
February	10%	3
March	15%	3
April	21%	3
May	30%	3

[16] Sean Ong, Paul Denholm, and Elizabeth Doris, The Impacts of Commercial Electric Utility Rate Structure Elements on the Economics of Photovoltaic Systems, p 8-9, *Technical Report*, NREL/TP-6A2-46782, ,June 2010; http://www.nrel.gov/docs/fy10osti/46782.pdf

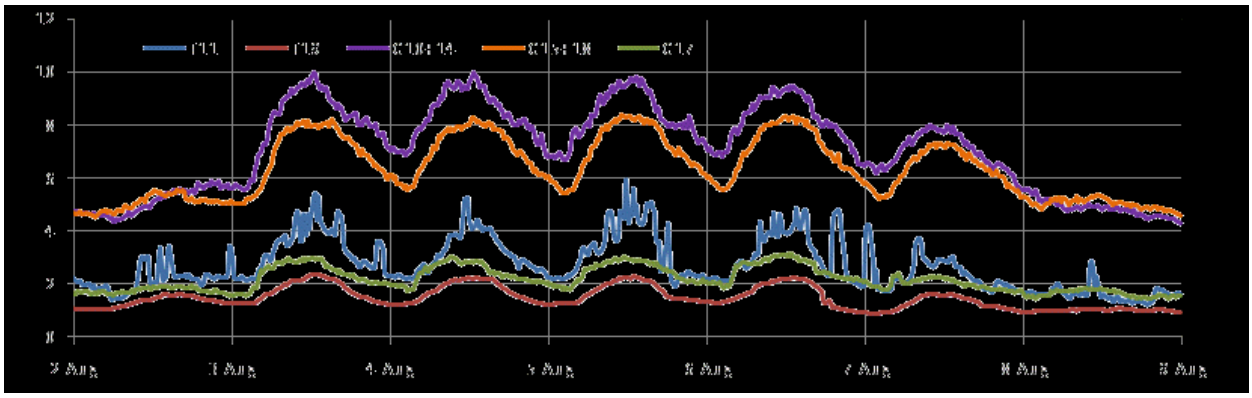
[17] Sean Ong, Paul Denholm, and Elizabeth Doris, The Impacts of Commercial Electric Utility Rate Structure Elements on the Economics of Photovoltaic Systems, p 8-9, *Technical Report*, NREL/TP-6A2-46782, ,June 2010; http://www.nrel.gov/docs/fy10osti/46782.pdf

June	40%	3
July	38%	3
August	35%	3
September	30%	4
October	13%	3
November	8%	2
December	3%	3
Average 21%	21%	

To reiterate, these are the national average reductions in demand charges expressed as a percentage of a PV system's rated DC output (We will refer to this table later in this section of the report).

Peak demand requirements vary geographically, by business type and by building type. A recent Salt Lake City study highlights the potential similarity between commercial demand and PV production:

A sample of 5 Salt Lake City commercial transformer peak patterns, August:



Exploration of PV and Energy Storage for Substation Upgrade Deferral in SLC, Utah Second Progress Report for Rocky Mountain Power and Utah Clean Energy Abraham Ellis, Mark Ralph, Garth Corey, Dan Borneo Contact: aellis@sandia.gov October 4, 2010

In order to estimate the true effect of a PV system on the University's electric bill, the following must be considered:

- Local insolation patterns
- System technology
- System orientation
- The hourly delivery of power against the University's energy rate structure
- The hourly delivery of power against the University's peak power events

These are broken out into three parts: system performance, energy charges and power charges:

4. System Performance

System performance consists of many factors, but can easily be estimated given the covered parking design constraints. The hypothetical system used for these estimates is a 1 megawatt DC / 850 kilowatt AC crystalline silicon system oriented due south at a 30° tilt. The final results however, will apply to a similar system of any size. Local insolation patterns were sourced from the Department of Energy's National Renewable Energy Laboratory (NREL). Historical insolation data consists of Salt Lake City hourly results over the 1962-1989 time periods. NREL's PVWATTS 2 simulator returned the following results:

Monthly Simulated PV kWh Output

Station Identification		Month	Solar Radiation	AC Energy
City:	SLC		($kWh/m^2/day$)	(kWh)
State:	Utah	1	3.07	82088
Latitude:	40.77° N	2	4.24	101160
Longitude:	111.97° W	3	5.06	130342
Elevation:	1288 m	4	5.74	139158
PV System Specifications		5	6.86	167134
DC Rating:	1000.0 kW	6	6.97	156841
DC to AC Derate Factor:	0.85	7	7.32	165978
AC Rating:	850.0 kW	8	7.19	166489
Array Type:	Fixed Tilt	9	6.39	149046
Array Tilt:	30.0°	10	5.33	131881
Array Azimuth:	180.0°	11	3.68	90814
		12	2.52	66455
		Year	5.37	1547386

5. Energy Charges

Approximately 90% of the University's power is billed at RMP schedule 9. This power arrives at three main transformers, through various feeds which have different peak demand patterns.

ROCKY MOUNTAIN POWER ELECTRIC SERVICE SCHEDULE No. 9 [18]

Energy Charge:
Billing Months - May through September inclusive
3.5858¢ per kWh for all On-Peak kWh
2.2518¢ per kWh for all Off-Peak kWh
Billing Months - October through April inclusive
2.6963¢ per kWh for all On-Peak kWh
2.2518¢ per kWh for all Off-Peak kWh
On-Peak: October through April inclusive
7:00 a.m. to 11:00 p.m., Monday thru Friday, except holidays.
On-Peak: May through September inclusive
1:00 p.m. to 9:00 p.m., Monday thru Friday, except holidays.
A 4.65% increase was approved in January, 2011.

NREL hourly output estimates based on historical hourly insolation averages for each month were then applied to the University of Utah Energy Rate Schedule. Annual estimated

[18] Electric Service Schedule No. 9 – Issued by authority of report and order of the public service commission of Utah docket No. 09-035-23; FILED: June 3, 2010 EFFECTIVE: June 8, 2010; http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/About_Us/Rates_and_Regulation/Utah/Approved_Tariffs/Rate_Schedules/General_Service_High_Voltage.pdf

production was totaled for each rate and a blended annual rate was determined. The three-rate structure, the time of day, the month and weekend generation at off-peak rates were all accounted for in the following table:

Annual PV Production Simulation and U of U Energy Rate Schedule

Average of "AC Power (W)"	Column Label												
Row Labels	1	2	3	4	5	6	7	8	9	10	11	12	Grand Total
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00	0	0	0	0	28	55	9	0	0	0	0	0	8
07:00	0	0	3	1,376	16,784	13,445	4,478	818	157	2	0	0	3,107
08:00	0	797	32,738	133,365	201,921	190,082	175,755	156,415	131,618	79,398	17,082	0	93,753
09:00	58,194	129,980	236,196	319,206	398,218	358,096	358,279	356,024	335,564	278,748	174,398	44,286	254,481
10:00	224,149	320,362	422,607	449,439	551,541	495,560	522,747	526,685	504,370	455,667	319,874	204,130	416,933
11:00	350,633	429,051	509,400	568,049	657,474	600,393	604,423	662,083	611,099	582,980	418,419	327,816	527,374
12:00	408,102	558,731	576,780	609,391	720,041	646,252	673,077	708,616	684,129	634,249	494,043	342,869	588,040
13:00	413,343	554,539	610,537	598,394	705,055	707,363	688,800	702,731	688,173	639,348	490,406	389,222	599,116
14:00	411,094	558,032	565,370	576,195	674,166	636,802	694,152	662,426	647,784	579,321	454,746	327,445	565,545
15:00	403,312	484,627	522,942	548,985	586,335	580,305	609,281	597,156	565,660	504,907	348,457	309,998	505,270
16:00	280,258	358,723	400,572	439,766	430,952	488,270	499,352	501,130	463,922	338,299	236,318	175,565	384,390
17:00	97,932	193,620	252,156	281,660	289,422	331,466	334,058	336,387	265,613	158,860	73,391	22,385	219,760
18:00	992	24,406	75,225	112,133	150,486	171,659	179,916	158,534	70,087	2,442	1	0	79,165
19:00	0	0	41	650	8,988	8,236	9,751	1,617	30	0	0	0	2,465
20:00	0	0	0	0	5	45	42	0	0	0	0	0	8
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0
24:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	110,334	150,536	175,190	193,275	224,642	217,835	223,088	223,776	207,009	177,259	126,131	89,321	176,642

2010 Schedule 9 rates:		**Percent total generation**
kWh Generated at $.035858	10,318,685	19.4%
kWh Generated at $.026963	21,836,246	41.0%
kWh Generated at $.022518	21,053,358	39.6%

2010 Blended energy rate	$0.027
Adjusted for 2011 rate increase	$0.028

6. Demand Charges

PV system effect on demand charges has been heavily discounted by many, including local professional developers. As charges are based on the highest kW demand in any 15 minute period over the course of one billing cycle (month), there is considerable skepticism that a PV

system will actually be contributing at that time. A casual observer however, will note that as long as the peak period occurs during daylight hours, the PV system is likely to reduce the peak charge by some percentage of the system's rated power. The capacity factor outlined by Ong et al. appears inevitable, as long as peak demand generally occurs during daylight hours. Following this logic, we determined to test the demand effect at the University of Utah. Demand (Power) charges for the University are as follows:

The University's demand charges, a.k.a. Facilities and Power charge rates as of June 2010 follow (a 4.65% rate increase has been approved for 2011):

ELECTRIC SERVICE SCHEDULE NO. 9 June 2010

Customer Service Charge:
$200.00 per Customer
Facilities Charge:
$1.71 per Kw
Power Charge:
Billing Months - May through September inclusive
On-Peak: $10.76 per kW
Off-Peak: None
Billing Months - October through April inclusive
On-Peak: $7.30 per kW
Off-Peak: None
On-Peak: October through April inclusive
7:00 a.m. to 11:00 p.m., Monday thru Friday, except holidays.
May through September inclusive
1:00 p.m. to 9:00 p.m., Monday thru Friday, except holidays.
Off-Peak: All other times.[19]

[19] ROCKY MOUNTAIN POWER ELECTRIC SERVICE SCHEDULE NO. 9,STATE OF UTAH, General Service - High Voltage
http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/About_Us/Rates_and_Regulation/Utah/Approved_Tariffs/Rate_Schedules/General_Service_High_Voltage.pdf

The University Energy Office provided a complete 2010 (15 minute interval) power history for two separate feeds from the University Stadium transformer. We analyzed the history in order to determine the peak event times for each month for both feeds.

FEED #1											
Jan#1	Feb#1	March#1	April#1	May#1	June#1	July#1	Aug#1	Sept#1	Oct#1	Nov#1	Dec#1
14:00	13:45	18:15	15:15	15:45	17:15	14:15	14:30	14:00	16:15	10:15	2:30

FEED #2											
Jan#2	Feb#2	March#2	April#2	May#2	June#2	July#2	Aug#2	Sept#2	Oct#2	Nov#2	Dec#2
8:00	8:30	7:45	7:45	10:30	13:15	10:45	13:15	16:15	20:45	10:00	18:45

All peak events occurred on weekdays, but as illustrated in the table, Feed #1 experienced a relatively normal commercial peak cycle while Feed #2 experienced considerable variability.

Peak events were then matched against hourly production estimates in order to determine the capacity values, then factored by power charge rates (850 kW AC system).

	FEED #1											
2010	Jan#1	Feb#1	March#1	April#1	May#1	June#1	July#1	Aug#1	Sept#1	Oct#1	Nov#1	Dec#1
Percentage of rated AC power	14:00	13:45	18:15	15:15	15:45	17:15	14:15	14:30	14:00	16:15	10:15	2:30
delivered during demand peak	48.4%	65.7%	8.8%	69.0%	50.7%	39.0%	74.9%	71.7%	76.2%	39.8%	37.6%	0.0%
Demand Charge	7.3	7.3	7.3	7.3	10.76	10.76	10.76	10.76	10.76	7.3	7.3	7.3
Demand Charge Savings	$3,001	$4,074	$549	$4,280	$4,637	$3,567	$6,852	$6,556	$6,970	$2,470	$2,335	$0

	FEED #2											
	Jan#2	Feb#2	March#2	April#2	May#2	June#2	July#2	Aug#2	Sept#2	Oct#2	Nov#2	Dec#2
Percentage of rated AC power	8:00	8:30	7:45	7:45	10:30	13:15	10:45	13:15	16:15	20:45	10:00	18:45
delivered during demand peak	0.0%	15.3%	3.9%	15.7%	64.9%	83.2%	71.1%	82.7%	54.6%	0.0%	37.6%	0.0%
Demand Charge	7.3	7.3	7.3	7.3	0	10.76	0	10.76	10.76	7.3	0	0
Demand Charge Savings	$0	$949	$239	$974	$0	$7,611	$0	$7,561	$4,992	$0	$0	$0

Total demand charge savings were divided by annual system output in order to determine a per kWh power charge effect (850 kW AC system). The $ / kWh figures are adjusted to the 2011 rate.

	Annual Demand Charge Savings	**Demand value/ kWh AC**
Feed #1	$45,290	$0.031
Feed #2	$22,326	$0.015

This simulation illustrates two important points regarding demand charges. First, they may be very significant. Feed #1 savings would have been greater than energy charge savings. Secondly, consideration must be paid to the connection point for the PV system. Each feed

history should be analyzed in order to determine the appropriate expected demand savings from a planned PV system.

The energy value and demand value sum as follows (adjusted to 2011 rate):

Total kWh value Stadium Feed #1	**$0.058**
Total kWh value Stadium Feed #2	**$0.043**

These are the expected $/ kWh 2011 savings that should be realized by a PV system connected at these feeds, based on 2010 demand patterns and depending, as illustrated, on the system's connection. These numbers are meant to be factored by the expected AC rated annual output of a PV system to determine system value. Because of the variability exhibited by peak demand times and by PV output, they should be viewed as averages and will vary over short periods of time. The values should increase over time along with increases in electric utility rates.

7. Expected Electric Utility Rate Increases

Over the last decade, Rocky Mountain Power electric rates in Utah have risen by about 4% annually.[20] Four factors conspire to raise that growth rate over the future:

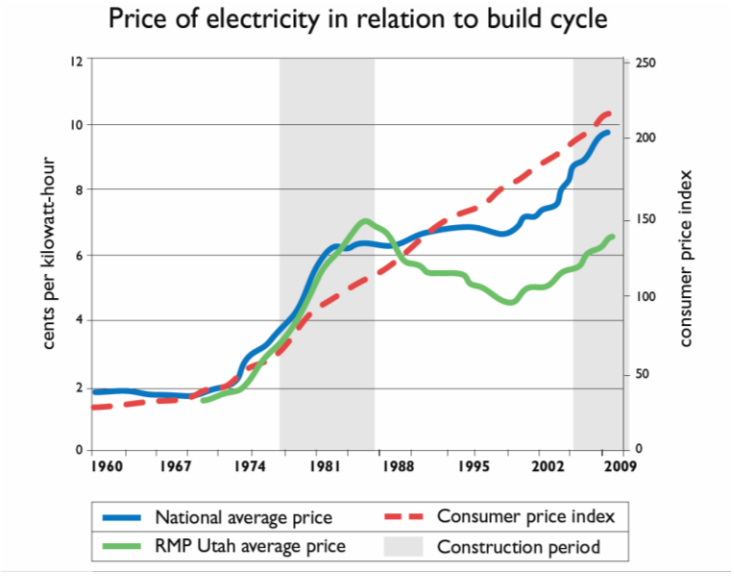
- Utah has benefited over the last decade by a pause in RMP's construction cycle. Imminent capacity replacement with cleaner coal-fired plants will come at higher costs.

[20] http://www.psc.utah.gov/utilities/electric/RateChangesElectricFeb2010.pdf

- Because of Utah's high peak power requirements, the percentage of natural gas fueled generation capacity will increase. This capacity has twice the cost per kWh of older capacity.
- Because of environmental concerns, the percentage of wind-generated capacity will rise considerably. This capacity has twice the cost per kWh of older capacity. As illustrated in the Carbon Dioxide Cost exhibit, this factor may significantly affect the cost of all power generation.
- Public pressure to further separate generation resources from population centers has placed increasing pressure on transmission resources, prompting significant capital spending on the Gateway transmission project.

8. Capacity Construction Cycle Price Pressure

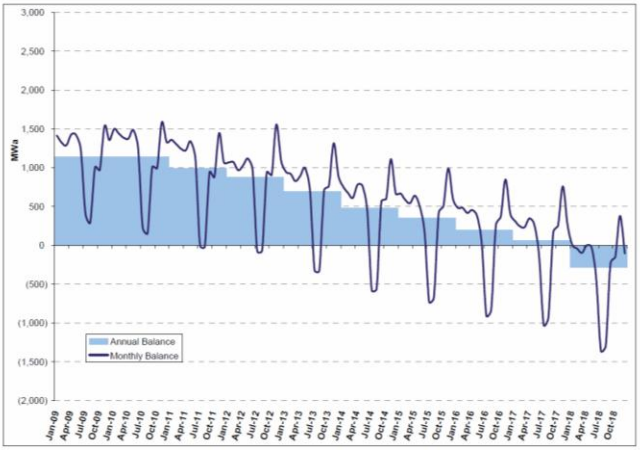
Utah's electric rates are artificially low due to a high percentage of aging, low-cost capacity.



Peak Demand Capacity Costs

The following graph illustrates PacifiCorp's expectation for increasing peak demand generation capacity, to be provided primarily by high-cost gas generation facilities:

On an energy basis, the system begins to experience summer short positions by 2012 as indicated in the following chart that shows the gap between available energy and load obligations.



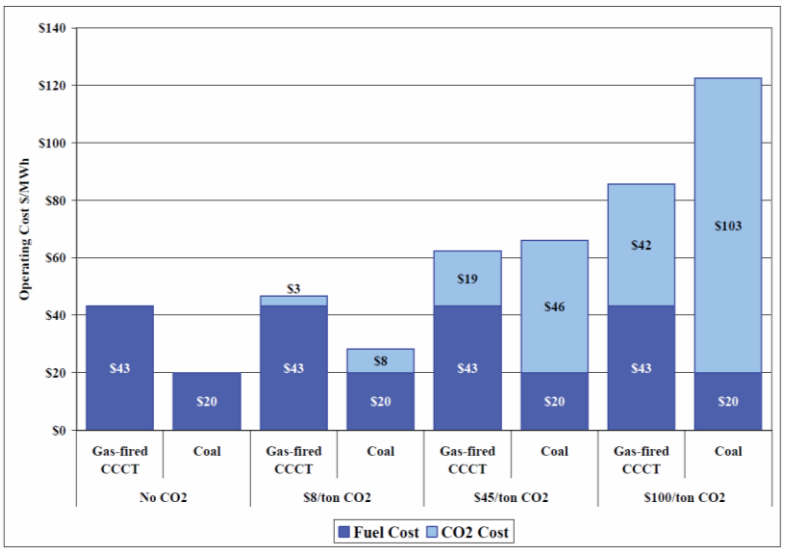
[21]

9. Greenhouse Gas Costs

A comprehensive PacifiCorp 2008 resource plan makes a midpoint projection of a $45 / ton CO2 tax by 2013. The effects on operating costs are illustrated in the following chart. We believe that the resulting cost shift between generation sources may be realized in a change in the value of REC's, as explained in the REC Value exhibit.

[21] Pacificorp 2008 Integrated Resource Plan, vol 1, p 5. http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Education_and_Safety/Transmission_Projects/Integrated_Resource_Planning_13.pdf

Figure 3.3 – Green House Gas Cost Implications for Electric Generators



[22]

These factors are cited as the drivers behind RMP's 13.7% 2012 rate increase request. As RMP is currently earning a lower-than-allowable return on equity, and considering that capital expenditures have exceeded profits by $900 million over the last five years,[23] we consider an expectation of a 6% annual increase in electric rates over the project life to be reasonable. Assuming a 1% increase in national average rate increases to 4.8% per year, as utilities nationwide shift to cleaner, more expensive generation, Utah's price per kWh would still be lower than the national average 25 years from now (31.9¢ vs. 34.1¢).

10. The Calculation-Levelized Cost of Electricity (LCOE)

LCOE is the electric power industry standard measurement for the cost of a generating system. LCOE combines the discounted capital costs and lifetime operating costs of a system,

[22] Pacificorp 2008 Integrated Resource Plan, vol 1, p 33. http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Education_and_Safety/Transmission_Projects/Integrated_Resource_Planning_13.pdf

[23] Rocky Mountain Power, Planning for Utah's electricity Needs, http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/About_Us/Newsroom/Media_Resources/Planning_for_Utah_Electricity_Needs.pdf

along with expected lifetime output, to derive a cost / kWh that is used by utility and power plant developers worldwide. It is meant to fairly compare the real costs of various electric generation proposals. “Years-to-payback” is not generally used by the industry to make investment decisions.

LCOE calculated is as follows:

$$= \frac{\text{Initial Investment} - \sum_{n=1}^{N} \frac{\text{Depreciation}^n}{(1+\text{Discount Rate})^n} \times (\text{Tax Rate}) + \sum_{n=1}^{N} \frac{\text{Annual Costs}^n}{(1+\text{Discount Rate})^n} \times (1-\text{Tax Rate}) - \frac{\text{Residual Value}}{(1+\text{Discount Rate})^n}}{\sum_{n=1}^{N} \frac{\text{Initial kWh/kWp} \times (1 - \text{System Degradation Rate})^n}{(1 + \text{Discount Rate})^n}}$$

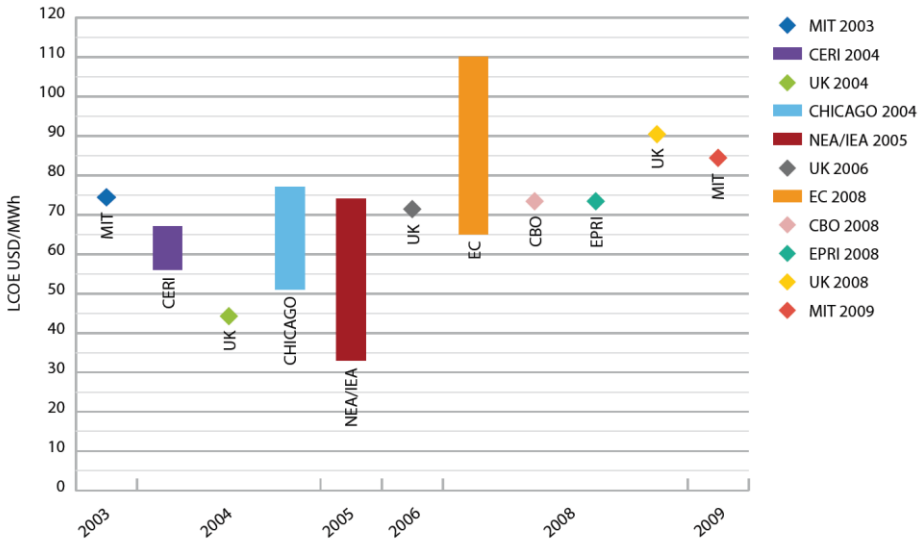
We have various resources to help with the calculations, but various financing options complicate the situation considerably and tend to obscure the true cost. Remember that these costs do not reflect the environmental costs. LCOE is relevant to the investor, not to the community.

LCOE calculations are just estimates, which rely on many assumptions, including:

- System component, installation, connection and land costs
- Lifetime operating and fuel costs
- Profit margin
- Finance costs
- Discount Rate
- Capacity Factor
- System performance degradation
- Tax effects

Changes in any of these assumptions can have large effects on the final LCOE.

Because no two groups will agree on all of the assumptions, no two calculations will yield the same LCOE. Following is an example of the wide range of estimates between professional groups for the LCOE of nuclear power.

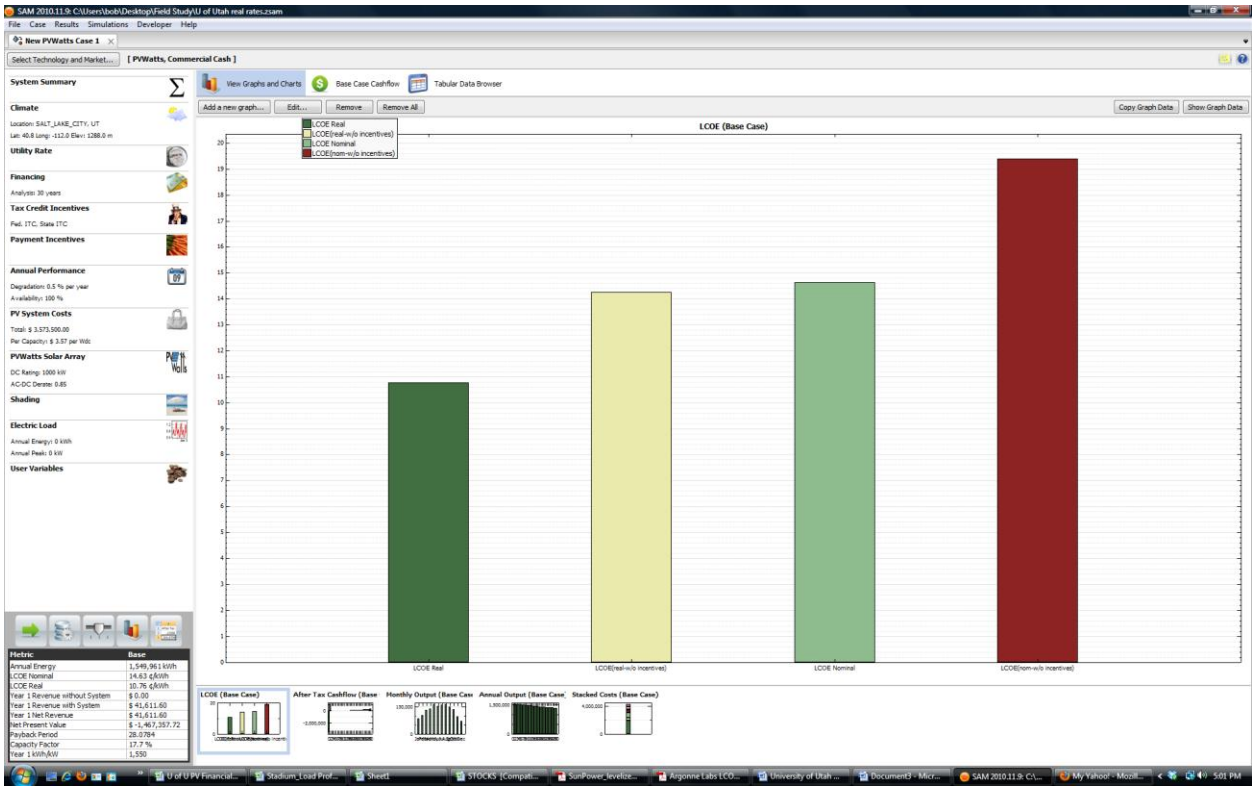


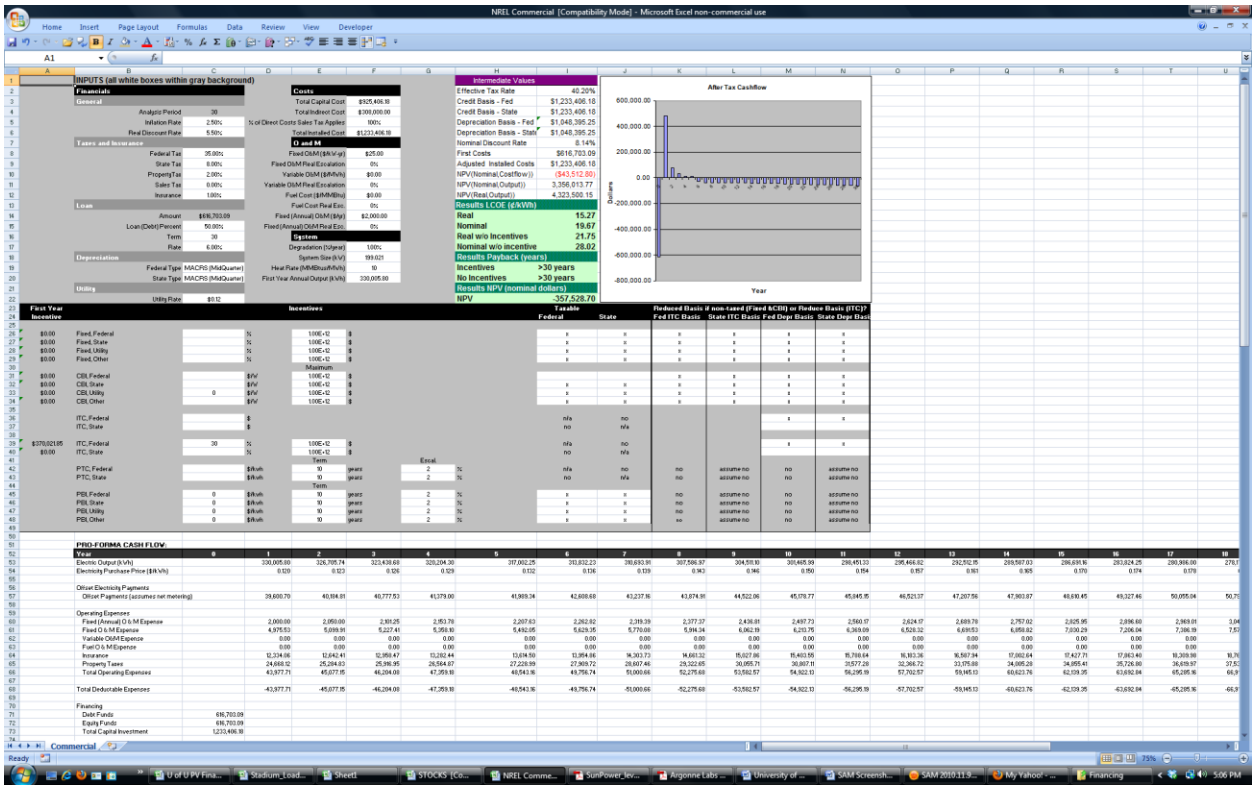
(Cameron, 2010)

As evidenced by the preceding example, it is critical that the University does not rely on LCOE estimates made by vendors (one PV vendor interviewed, for example, assumed a 50 year life for their equipment, vs. the standard 30 year life assumption). The University must calculate LCOE for each vendor, based on specific equipment specifications and standardized assumptions before making any decision between vendors.

An excellent tool for standardized comparisons between vendors is System Advisor Model (SAM), developed by the National Renewable Energy Laboratory of the Department of Energy. University of Utah kWh peak and off-peak rates, along with demand charge reduction effects can be applied to the program for realistic estimates of electric contribution value. While the input screens in SAM do not allow for all potential financing options, manual changes can be made to the underlying program spreadsheets in order to tailor the package to individual bids. A copy of SAM II loaded with a University of Utah scenario is provided in the CD package.

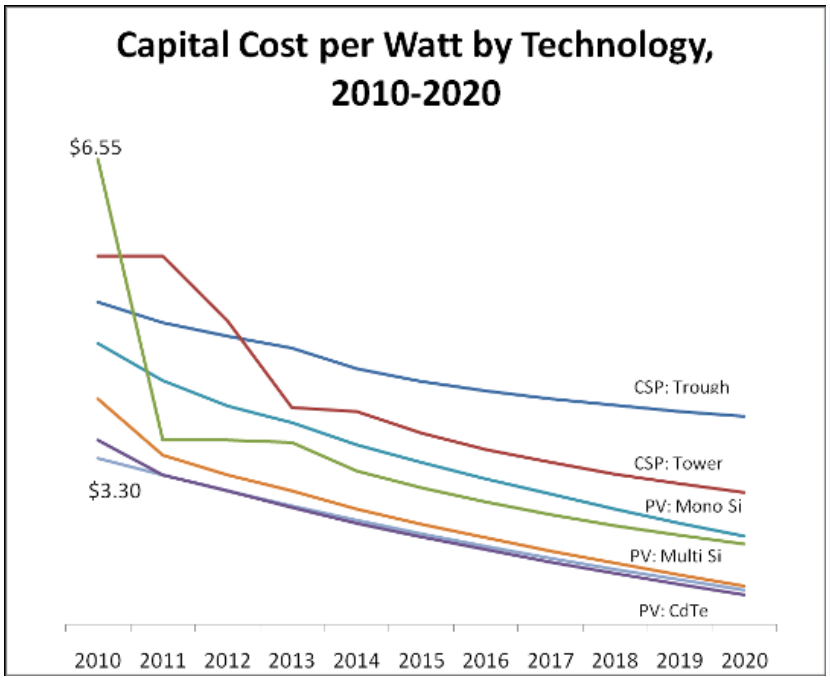
DOE NREL SAM Screenshots



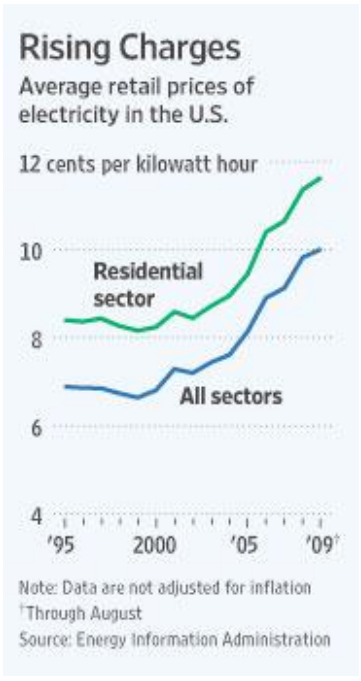


11. Grid Parity at the University of Utah

PV projects already offer good returns on investment in Germany, Italy, Spain, California, New Jersey and Arizona, affected by feed-in tariffs, tax effects, capacity factor and local electric rates. Investors are making high single and low double-digit returns on investment. When the LCOE is equal to the current cost of electricity, the project is said to have reached "Grid Parity". As the cost of PV falls (estimated to be about 20% in 2010 and more than 10% in 2011), and as electricity prices rise (estimated to be 4%-7% / year), PV should reach grid parity in many places around to world.

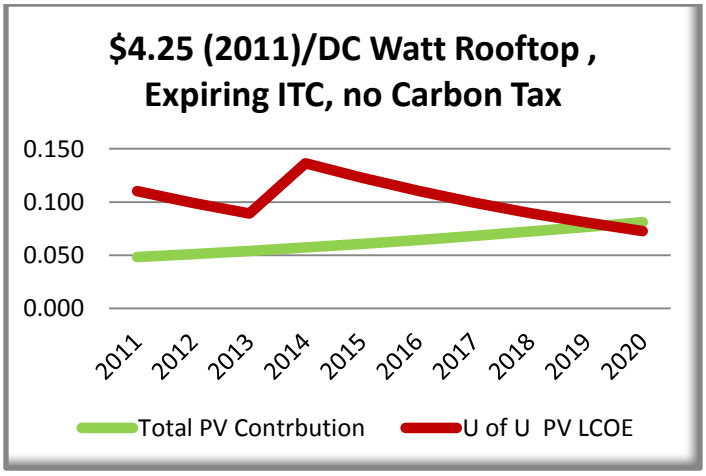


(Shyam Mehta, 2010)

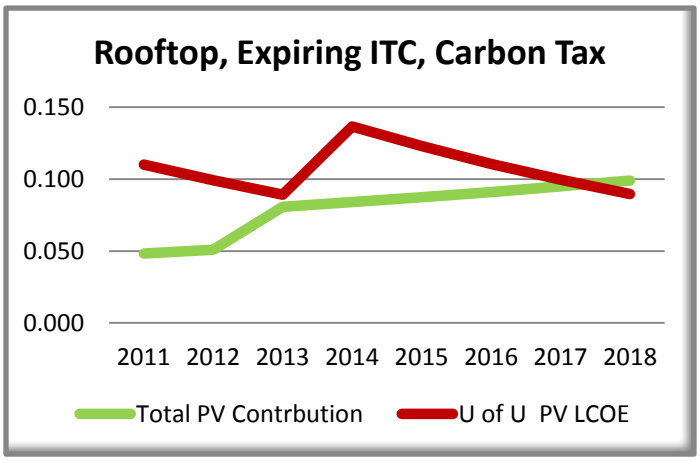


(Stein, 2010)

Another way to look at grid parity is in terms of return on investment. Grid parity, by definition, is the point at which an investment in a solar project becomes "reasonably" profitable, based on the discount rate used for the calculation. We have projected grid parity (including incentives) for the University of Utah to occur about 2019 for roof-top systems, assuming that the federal ITC expires and that no carbon tax is initiated before that point. The sharp rise in the LCOE line represents the loss of the ITC in 2014.



Should the US Government establish a carbon tax equivalent to the midpoint projection used in PacifiCorp's analysis, the PV contribution should include the REC value estimated in the REC Value section of this report.



The above illustration shows that rooftop systems are probably not cost-effective for the University over the near term.

Solar installations mounted on free-standing parking structures have somewhat different fundamentals. Because larger part of the initial investment is the structure itself, it is necessary to separate expected decreases in PV costs from expected increases in construction costs. This results in an over-all cost projection with a slope that is more gradual than that for rooftop systems. Using parking fee estimates derived from the survey results, and assuming no carbon tax, results in the following projection:

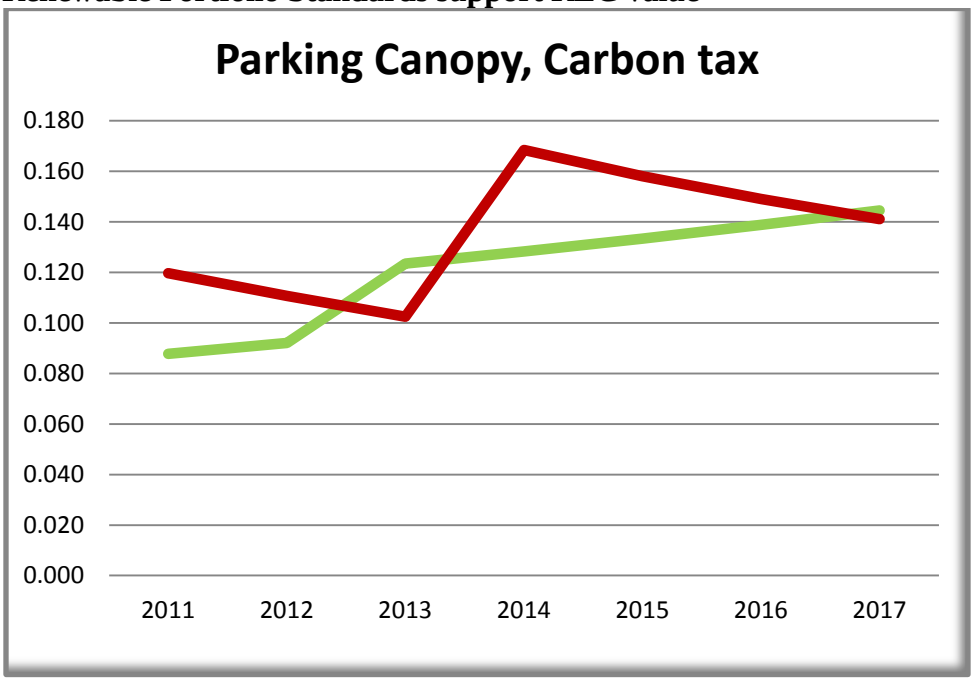
University of Utah Parking Canopy PV Grid Parity Projections

2011 $4.25 / DC watt + $.75 / DC watt Structure

	$150										
Year	Per Space Annual Parking Revenue	U of U energy + demand	REC Carbon Tax Value	Annual Parking Revenue / kWh	PV + Parking Fees	U of U PV LCOE		PV Cost	Structure Cost	Sum	% Change
2011	$150	0.058	0.000	$0.037	0.095	0.119681		3.5	0.75	4.25	
2012	$155	0.061	0.000	$0.038	0.100	0.110586		3.15	0.7725	3.9225	0.922941
2013	$159	0.065	0.000	$0.039	**0.105**	**0.102402**		2.835	0.795675	3.630675	0.925602
2014	$164	0.069	0.000	$0.040	0.110	0.164853		2.5515	0.819545	3.371045	0.92849
2015	$169	0.073	0.000	$0.041	0.115	0.153578		2.29635	0.844132	3.140482	0.931605
2016	$174	0.078	0.000	$0.043	0.121	0.143587		2.066715	0.869456	2.936171	0.934943
2017	$179	0.082	0.000	$0.044	0.127	0.134755		1.860044	0.895539	2.755583	0.938495
2018	$184	0.087	0.000	$0.045	**0.133**	**0.126973**		1.674039	0.922405	2.596445	0.942249
2019	$190	0.092	0.000	$0.047	0.139	0.12014		1.506635	0.950078	2.456713	0.946183
2020	$196	0.098	0.000	$0.048	0.146	0.114166		1.355972	0.97858	2.334552	0.950275

Assuming that RECs develop as outlined in the REC section of the report, the following scenario should evolve:

Scenario 2 assumes that Fed tax credit expires in 2013, $45 / ton carbon tax is initiated, or Renewable Portfolio Standards support REC value

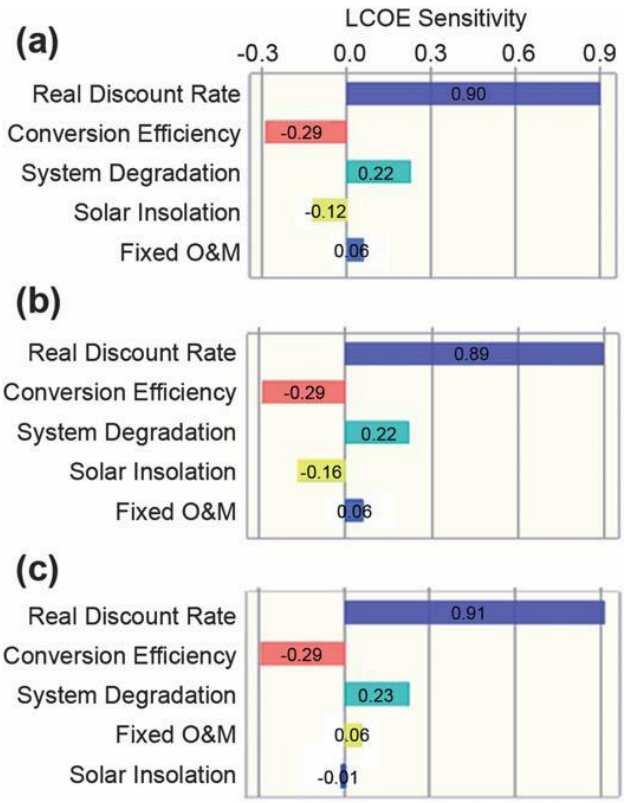


Year	Per Space Annual Parking Revenue	U of U energy + demand	REC Carbon Tax Value	Parking Revenue	PV + Parking Fees	U of U PV LCOE		PV Cost	Structure Cost	Sum	% Change
2011	$150	0.058	0.000	0.029432	0.088	0.119681		3.5	1	4.5	
2012	$155	0.061	0.000	0.030315	0.092	0.110586		3.15	1.03	4.18	0.928889
2013	$159	0.065	0.027	0.031225	**0.123**	**0.102402**		2.835	1.0609	3.8959	0.932033
2014	$164	0.069	0.027	0.032162	0.128	0.168312		2.5515	1.092727	3.644227	0.935401
2015	$169	0.073	0.027	0.033126	0.133	0.158042		2.29635	1.125509	3.421859	0.938981
2016	$174	0.078	0.027	0.03412	0.139	0.148995		2.066715	1.159274	3.225989	0.942759
2017	$179	0.082	0.027	0.035144	**0.144**	**0.141056**		1.860044	1.194052	3.054096	0.946716
2018	$184	0.087	0.027	0.036198	0.150	0.13412		1.674039	1.229874	2.903913	0.950826
2019	$190	0.092	0.027	0.037284	0.157	0.128092		1.506635	1.26677	2.773405	0.955058
2020	$196	0.098	0.027	0.038403	0.163	0.122889		1.355972	1.304773	2.660745	0.959378

Both scenarios predict that a shaded parking-PV installation should be cost effective in 2013, prior to the potential expiration of the Federal ITC.

Sensitivity Analysis

A recent Argonne Labs PV LCOE sensitivity factor analysis illustrates the importance of the discount rate used in the determination of system value.



Because of current low interest rates, the University's non-profit status and the very low risk of a performance-guaranteed, insured system, a discount rate of 6% is used for analysis. If long term interest rates rise by 1% between now and the time that the system is commissioned, the true cost of the system, measured by LCOE, will rise by 10.2%. As some movement by rates in that direction may be likely, a margin of safety should be built into the bid-consideration process.

IV. CONCLUSION

Considering the high visibility of a well-placed parking array, the intangible benefits, particularly the public relations benefits and the very visible use of the Student Sustainability fund would clearly be worth the cost of a very small demonstration project (20-40 spaces). The early-adoption benefits[24] still available in Salt Lake City add leverage to these effects.

The leading candidate for this site is the Student Union pay lot, for the following reasons: very high-profile visibility for both students and visitors, reasonable small-system connection costs[25] and the potential availability of EV charging stations in a premium University lot . Disadvantages of the site include: an offset from true-south orientation and the probable relocation of 3-4 small to medium-sized trees. The southeast orientation is expected to reduce kWh output by a modest 3.5%. The importance of appearance in this location, along with the lack of scale, would likely add to construction costs. Voluntary donations derived from the lot may potentially exceed the revenue that might be generated from increased fees charged for covered parking. Financing should be available in the form of a lease, with no down payment. Additional incentives, e.g. RMP's Blue Sky Fund, may be available.

A larger array (1 MW or larger) appears to become a good financial decision for the University in 2013. Assuming that the Federal ITC expires in 2014, it may take 3-5 years for system prices and electric rates to re-converge. The Merrill Engineering main lot is currently the leading site candidate for the following reasons: size, lack of shading, due south orientation and

[24] Knut Haanaes et.al. Sustainability: The 'Embracers' Seize Advantage, MIT Sloan Management Review, Winter, 2011

[25] The array would lie within 150 feet of a connection point estimated to be appropriate by the University Electrical Shop. The shop estimates connection costs at $200 per lineal foot plus endpoint costs.

availability within the University's long term development plans. Planning of a system of this size should begin now, with a final bid accepted *only* after the system economics are born out. Financing should be available in the form of either a lease or a PPA, with no down payment. Additional incentives may also be available for this project.

Financing for these projects appears to be readily available for the University. The University should avoid estimates or financial characterizations from outside sources that have an interest in the outcome. The University should carefully consider the variables explored in this report, and make decisions based on the best internally-generated data available.

V. APPENDIX

Survey Responses-- 04/04/2011

1. Please indicate your relationship with the University of Utah:

#	Answer		Response	%
1	Undergraduate Student		691	15%
2	Graduate Student		488	11%
3	Faculty		621	14%
4	Staff		2,716	59%
5	Other		67	1%
	Total		4,583	100%

2. How do you typically get to the University?

#	Answer		Response	%
1	Drive a car		3,245	71%
2	Drive a motorcycle/scooter		35	1%
3	Ride Trax		368	8%
4	Ride the Bus		527	12%
5	Walk		170	4%
6	Ride a Bike		118	3%
7	I get dropped off		98	2%
	Total		4,561	100%

3. How many days in a month do you drive and park a car on Campus?

#	Answer		Response	%
1	Zero		653	14%
2	1-3 times		582	13%
3	4-9 times		628	14%
4	10-15 times		457	10%
5	16 or more times		2,228	49%
	Total		4,548	100%

4. What current University of Utah parking permit do you own?

#	Answer		Response	%
1	E Permit		382	8%
2	U Permit		642	14%
3	A Permit		1,309	29%
4	Reserved Permit		200	4%
5	I do not own a parking permit		1,386	31%
6	T Permit		294	6%
7	The parking permit I own is not listed		322	7%
	Total		4,535	100%

5. Commuter Services is considering placing covered parking closer to central campus. Would you like to see more covered parking spaces on campus?

#	Answer		Response	%
1	Yes		1,938	43%
2	No		335	7%
3	It doesn't matter to me.		2,250	50%
	Total		4,523	100%

6. What are some of the reasons that you would like to see more covered parking spaces on central campus?

Text Response
• protect my vehicle from sun/ snow/ ice and utilize the opportunity for solar energy collection and use by the campus
• Shade and moisture protection. Options to mitigate the heat-island nature of asphalt. Less light pollution skyward.
• Reduce heat effect of blacktop
• no snow; roofs can produce solar energy
• Because it would be awesome.
• It would be nice to have covered parking in the summer because my car has a dark interior and no air conditioning.
• convenience
• more parking on campus means fewer cars parking on surface streets

- Cuts down on heat trapped in vehicle, cuts down on the Urban Heat Island Effect, and can generate electricity!
- I've seen solar parking garages in Germany and thought they were amazing, plus covered parking is always nice, especially when it is really sunny or snowing.
- covered parking spaces help with snow removal
- for solar paneling opportunities
- Easier to get into/out of cars in the winter... less slippery
- I can be on time to class more often. Less hassle with the unknowns of parking on campus.
- Cooler car in the summer, don't have to scrape snow off car.
- Did not know we had any covered parking. Covered parking helps protect vehicles (and provides some shelter in bad weather).
- solar generation, shade
- To increase available parking on campus, keep car cool in summer
- To create space for photovoltaic panels!
- Weather
- To protect from the snow.
- Too much congestion with parking currently
- snow, protect car
- Increased feeling of safety; better protection against UT's random weather
- Due to the need during severe weather conditions
- because it snows a lot. and just any additional parking, in whatever form, is helpful
- I would like to see much more parking for U permits. I've noticed parking for U permits has been significantly reduced. Also, I would like to see parking garages. Takes up less space can accommodate many cars. The U is the only campus I know of that does not have parking garages, except for the institute building one. Covered parking would make it a lot more convenient when it snows.
- Better protection from the elements
- Parking is awful! I'm all for having more of ANY kind of parking! I don't care if it's covered or not, but a parking structure that allows for as many spots possible would be great, especially centrally located!!!!
- Keep car out of the elements
- Hard to find parking.
- it would be nice in the winter
- There is not enough parking
- I figured it there is covered parking it may mean a parking garage which would make for more spaces and also not having to scrape off snow

- Parking is getting ridiculous. Some students are not able to commute on the less than adequate public transit system. We pay enough in tuition and parking expenses to be provided enough space to park a car when we get here.
- Improved experience for those of us who park.
- So I don't have to scrap the snow off my car after class
- if there was a parking structure close to campus it would make it a whole lot easier to get to classes on time as well as it would make it easier to find a parking spot
- Because of the weather. Night classes are particular awful because of snow at night.
- Snow sucks
- Weather
- makes parking more efficient; it will cut on costs of snow removal I would assume
- Due to the weather. Also, if they were parking towers, it could increase parking availability.
- The only covered parking structure I know if is by the Institute Buildings, which is nowhere close to where most students need to go. Also if there were parking structures then there could be more parking covering a smaller total area resulting in more parking for students. Parking during the day is ridiculous and should get fixed if the school wants to keep expanding.
- convenience
- too much snow in the winter. More convenient
- Cars tend to get hot in the sun.
- To save people from snow and rain, but it's not a huge deal.
- So we actually have parking, there is no parking ever!
- it's in the middle of campus and it's more convenient
- I would like more parking period. That said, this campus is plagued with weather extremes it would be nice to have parking that would provide protection from the elements.
- If this includes multi-level covered parking, the University is definitely in need of this. The University has outgrown its single ground parking places available for faculty/students/staff/visitors. My biggest concern with covered parking is security, both during the day and especially at night.
- There aren't enough spaces as it is. I commute to school every day. The number one reason I'm ever late is because I have to hunt for parking.
- It can be hard to find convenient parking on campus
- Really I would just like to see more parking in general. There is a big lack of space...not to mention the high price for visitors to come and visit campus.
- You guys need to just build a parking garage. I went to UNR for a year and they have parking garages that solve their problems.

- protection from weather
- Having a central parking garage would be nice not everyone has the luxury to spend 30min before class to get a parking spot. I come from work and or have work after class parking is ridiculous. Buy if bit for my situation I would take the bus
- It would be convenient for when it rains and snows. Also I would think it would reduce the amount of door dings I get!!!
- So cars don't get stuck in the snow.
- Car protection
- Ease of access and well as accessibility during the winter months.
- We live in Utah. It snows. Also covered parking usually means parking garages. We definitely need more parking garages.
- Shade for cars so that the sun cars are not over heated when people get in.
- The location and accessibility of most parking is inconvenient for those of us who commute t work every day and have to compete with students for parking. The ability to have more options for parking would make my daily commute less stressful!
- I only drove to the school when it's snowing/raining. It'd be more convenient to have covered parking spaces in bad weather.
- To make it faster to walk from my car to class.
- So I can actually find a parking spot and not have to get to campus an hour early for class just to fight for a parking spot!
- Weather
- because for some reason there are no parking spots ever available on campus. this is ridiculous.
- covered parking is better than uncovered
- for adverse weather conditions
- High rise parking decks will increase the number of parking spots
- protect ny car from weather
- I think a large central parking structure would be nice or even a small pay one for those snowy days.
- very limited current parking; hard to get to class on time if you have to fight for parking spots.
- I think you could get more for your money when you have high structure parking you can get more stall in the space but they need to be wider
- There are not many parking spaces at the U and that is suck for most of the students who are driving.
- Snow removal will be easier, parking will be more defined and stall will not be occupied by extra snow. Car's will not be as hot in summer time

- I want more U parking spaces, there are tons of free spaces for A parking that nobody uses and we struggle finding a parking spot. Covered or uncovered I don't really car much, i want more spaces available
- I hate scraping snow off my car
- It would make getting to class faster and not having to walk far.
- There are many people who do NOT clean their windshields sufficiently before leaving the parking lot on a snowy day! It would make everyone safer!
- Because on snow days, you can't see the parking stall lines and people park wherever they want.
- Safer, cleaner, more convenient in the colder months, Structure multi-level parking is preferred. I think most of the lots should be converted to structured - multi-level parking
- Protection from the weather
- It would be more convenient, add a more developed look to campus, and helpful for when severe weather strikes the city (Especially useful in the winter with snowstorms, blizzards).
- I teach until 10 pm at night for 2/3 of my teaching, getting out at 10 pm. There is nothing worse than exiting a class after teaching for 4 hours than having to unbury it from snow.
- I want to see more parking spaces period...
- protect the car better
- It would be nice to have so you don't to scrap the windshield in the cold and warm car up makes it easier so you are not slipping and falling
- Keep snow off in the winter - sun off the rest of the year
- I would like to see more covered parking spaces so I do not end up being late to class or having to pay for "pay parking" especially since I paid to have a "U" parking pass (which is not cheap).
- That is the only reason why I don't drive to campus because parking is too far away from my classes.
- It would be convenient
- Weather inclement.
- to cover my car
- We have no parking, it needs to be expanded, garages may be a good solution to provide more in limited space.
- When it snows! Then I don't have to worry about scraping my car off after class
- More accommodating during winter weather events.
- because there are none

7. What are some of the reasons you would NOT like to see more covered parking spaces on central campus?

Text Response
• Although I understand many students must drive to campus, I think there are too many single-commuting students trying to park on or around campus. I'm all in favor of having covered parking with solar PV charging stations, if that's the idea, but I think students who carpool, or ride share with their cars should be rewarded with those spaces more than students who want to continue driving to school by all alone, and feel entitled to a parking space.
• They typically are reserved and it restricts the places I can park on the few days I do drive. I also think they might be an eyesore. I would rather see more trees in parking lots than structures.
• obstruction of view scape, worry about snowfall and dripping off of the roofs as I walk under them through the parking lot, not needed.
• Waste of money, space, and resources.
• Increasing parking at the U will encourage people to drive more, which is the very last thing our city's air quality, horrid public transit options, and traffic problems need. If covered structures are required, I would rather see them house constructive learning environments than other people's cars.
• It's unnecessary to the University. It's simply for aesthetics and I believe the money could be more appropriately used elsewhere.
• to discourage SOVs and encourage transit/bikes
• not needed, cost, encourages driving
• Unnecessary cost and luxury. The U should not encourage more students to drive to campus. Renewable energy should be employed for more important, less ironic, uses.
• I would like to see less traffic in general.
• It would encourage people to drive to campus rather than using alternative means.
• Encourages less use of public transportation, causes congestion on roads, etc.
• because we need to discourage driving. spend the money on better shuttles or to promote better public transit/more use of it.
• because the rest of the valley is designed for cars
• Pointless expense. Why do people need covered parking? Don't waste my tuition - cut costs.
• I think we just need more parking, who cares about covered parking. If it is in a parking structure that will provide more parking. We just need more regardless if it is covered or not.
• I probably wouldn't be able to use them anyway. Why should maybe 20 people get a convenience when others can't even get a spot?
• You should spend more money on better parking before they get covered

- Waste of money, Parking prices would probably increase and I already can't afford a parking pass and therefore have to take Traxx or park illegally on campus
- I would just like to see MORE parking spaces on campus. I cannot afford to purchase a parking pass. I park at my work in Research Park and walk or take a bus to class. More spaces, at more affordable prices, would be much more worthwhile to me.
- The expenses to the student body would increase and for students not driving it is not worth incurring greater expenses and tuition fees.
- Waste of money
- I've never seen covered parking spaces on campus, period. I honestly think we'll all be fine brushing snow off of our cars anyways. I'd like to see money that would go towards the covers, go towards more light bulbs since the parking lots are TOTALLY dark @night. It's pretty terrifying.
- there is better use of the valued land surrounding campus -- more green space, for example
- Covered parking will be a waste of money. Additional parking spots need to be put in. For the amount of money paid for parking passes, the number of spaces is ridiculous. Add parking garages and additional lots.
- You should clarify if you mean parking garage or covered parking. I have little concern for protecting my car from the elements, but some sort of parking structure central to campus would be nice.
- Impede view of landscape
- I think there should be more spaces instead of covered spots... covered spots seem kind of useless
- construction! there are already limited spaces and the time it would take to build the covered spaces would make it nearly impossible to find a parking spot.
- cost
- More student fees will likely be charged to pay for it
- Instead of spending money on covered parking, they should just make better and more spaces so if you have an E pass you don't walk a mile to your car. I only have an A pass cause it's my wife's who is a grad student.
- It is a waste of money. I would rather see improvements made to our learning facilities.
- There is plenty of parking already. We don't need another cement lot.
- We are already getting hijacked with parking prices. (parking services suck). don’t want to make parking passes, tickets, or other fees go up!
- aesthetics
- Cost. How would this be paid for? Higher tuition expense. I don't think that's justifiable just to keep snow off my car.
- I think large parking garages are more ugly than blue skies.
- I don't want to pay for covered parking spaces. One way or another, it does affect my

pocket. This is a frivolous use of money in hard economic times.

- Cost too much. Would rather see other upgrades on campus.
- not necessary, it would probably just increase the cost of parking
- cost, unsightliness
- ugly and costly. Prefer landscape between parking rows as you have some places
- My needs are met.
- we need parking spaces, not covered.
- Open Parking is just fine. Less costly to maintain and build.
- Keep central campus open with unobstructed views. Covered parking is an eye sore. People need to ride the bus and train more anyway.
- Don't tear down President's circle or anything else. Parking isn't so bad that campus needs to be ripped to pieces.
- Visual clutter
- Don't have enough regular spaces as is.
- Unless the covered parking lots have solar panels, I think covered lots are ugly and I hate parking my car in them.
- I would rather see the money spent to expand parking or keep the costs down. It seems like a waste to cater to a select few.
- There ain't no such thing as a "free lunch" and covered parking is very expensive. I'd rather have the $$$ put in raises instead of covered parking.
- Spend the funds on finding/creating MORE stalls, NOT increasing the cost of the few we still have.
- not necessary
- invest taxpayers money into other things like staff raises.
- Cost
- It just isn't a priority for me and I could think of better uses of the monetary resources.
- If the parking structure was placed under ground it would be OK. But in general these structures are ugly and to expensive to build
- Spend money elsewhere.
- I am not sure that more covered parking is needed. I guess it will depend on location and design. Current parking seems to be adequate. I would like to see more effort and resource put into promoting walking and public transportation.
- If by covered parking you mean multi-level parking, I am for it. There is definitely not enough parking here that we pay for.
- More parking is ugly and encourages more driving. There is no need for people to drive to the U; it just causes traffic problems and angry people.
- More convenient, nicer parking contributes to more commuting by car. I would like to

commute using TRAX more and it would help if you didn't make it exceeding convenient to park.

- The only thing the U needs to do is to encourage students and staff to ride buses or TRAX. Building more covered parking would not help to encourage public transportation usage.
- Our permit prices will only keep going up- I know because I shell out for my T pass because I work at the CNC and its my only parking option.
- Covered parking does not allow as many spaces unless it is stacked covered parking.
- I want to less parking on campus, be it covered or otherwise. If you are converting non-covered parking to covered parking, I'm neutral.
- I don't like parking terraces
- Costs
- If it means a parking garage, this to me is less attractive than cars in a lot.
- Needs to be closer to hospital for employees
- More parking spaces should be eliminated and more people need to rely on public transportation to campus.
- Use the space for something besides cars
- Not attractive looking to have parking garages and other covered lots - we should encourage other means of transportation
- The view of open space, can see across campus to all the great buildings and landscaping w/out parking structures in the way.
- Driving cars is NO sustainable solution. It is the anti-solution.
- Enough of the campus has already been torn up for development.
- If you want to place a solar grid on top of a parking structure, that would be an appropriate use of SPACE. While the U is pushing Mass transportation, it doesn't work for everyone. It's ironic that Mass transportation in Utah costs tax payers money. Spend that money on parking structures that maximize space and capacity with a solar grid on top.
- Aesthetics and potential increased parking fees
- We should encourage more sustainable modes of transportation like riding bikes, and Uta. Creating more parking spaces only encourages people to drive their cars more.
- I would like to see more parking spaces, why would they need to be covered? Unless by covered you meant a parking garage.
- Cost - let’s spend the money on something else...maybe give raises?
- destruction of green space, encouragement of more driving, cost
- COST!!1 We just want PARKING SPACES!!
- We need more spaces, not covered

- Because it costs money, and I would like to see money going towards more important things like lowering tuition and fees.
- too much money
- Cost!
- It would be better to have multi-level parking garages than to have some select covered parking stalls. This would serve the university, and the public at large much better than either is served today.
- There are more critical places to spend the money.
- I would like to see more parking spaces. I don't care if they are covered. The bus or trax are not an option for me.
- No need to increase non green space sprawl.
- too costly
- We should be doing all that we can to encourage people to walk, bicycle, and take public transportation. Covered parking will not do this.
- Not worth the cost
- Huge waste of money, just make the drivers brush off snow from their cars.
- Unnecessary, not green
- they're ugly. make parking buildings to better conserve resources and stop the big-flat open heat-reflectors that parking lots are...
- My permit cost would increase to cover the cost of covered parking. Besides that, you guys don't have a clue about service or maintenance of such facilities.
- I don't see a need for them. Save the money and spend it on something we need. There is nothing wrong with parking in the open.

8. How much would you be willing to pay extra per month for a reserved covered parking space closer to central campus?

#	Answer		Response	%
1	Zero		707	37%
2	$5-20		827	44%
3	$21-40		229	12%
4	$41-60		81	4%
5	$61-80		19	1%
6	$81 or more		33	2%
	Total		1,896	100%

9. The Office of Sustainability and Commuter Services are considering creating covered parking spaces that have solar panels on the roof that may generate power for the

University. How much extra would you be willing to pay for a reserved parking space per month that will generate renewable electricity for the University?

#	Answer		Response	%
1	Zero		1,893	43%
2	$5-20		1,792	40%
3	$21-40		488	11%
4	$41-60		142	3%
5	$61-80		53	1%
6	$81 or more		74	2%
	Total		4,442	100%

10. In your opinion, how important are campus sustainability efforts like recycling, installing LED lights, using alternative transportation to get to school, supporting the local farmers market, solar power, etc?

#	Answer		Response	%
1	Not at all Important		95	2%
2	Very Unimportant		201	5%
3	Neither Important nor Unimportant		544	12%
4	Very Important		2,027	46%
5	Extremely Important		1,555	35%
	Total		4,422	100%

11. How do you feel the community would react to the University of Utah installing covered parking stalls that have solar panel arrays on the roof that will generate renewable solar power?

#	Answer		Response	%
1	Very Displeased		41	1%
2	Displeased		135	3%
3	Neutral		857	19%
4	Pleased		2,172	49%
5	Very Pleased		1,210	27%
	Total		4,415	100%

12. Would you be more likely to purchase a reserved parking spot on campus knowing that a covered parking space that generated electricity for the university was available?

#	Answer		Response	%
1	Very Likely		516	12%
2	Somewhat Likely		1,333	30%
3	Neutral		1,526	35%
4	Somewhat Less Likely		130	3%
5	Very Unlikely		907	21%
	Total		4,412	100%

13. Buying a "Renewable Energy" parking permit may create the opportunity for electric power generated to be considered a “gift/donation” to the University. Would this entice you to purchase a "Renewable Energy" parking permit?

#	Answer		Response	%
1	Yes		2,540	58%
2	No		1,869	42%
	Total		4,409	100%

14. Are you considering buying an electric vehicle within the next 5 years?

#	Answer		Response	%
1	Yes		985	22%
2	No		2,061	47%
3	Undecided		1,363	31%
	Total		4,409	100%

15. Would you be more likely to drive your electric car to campus if you were able to charge your car while at the University using the renewable energy provided by the covered solar parking?

#	Answer		Response	%
1	Yes		909	92%
2	No		75	8%
	Total		984	100%

16. Would you consider upgrading to an R Pass if you were guaranteed covered parking that provides solar power?

#	Answer		Response	%
1	Yes		680	53%

2	No		602	47%
	Total		1,282	100%

17. How would you feel if 2 dollars of the money you are paying for tuition was used to support the sustainability efforts on campus?

#	Answer		Response	%
1	Very Displeased		57	5%
2	Displeased		48	4%
3	Neutral		224	20%
4	Pleased		332	29%
5	Very Pleased		477	42%
	Total		1,138	100%

18. If you have any other comments that you would like to share with us regarding campus sustainability efforts, parking on campus, or otherwise, please feel free to use the space below.

Text Response
• More parking closer to the center of campus would be a great thing for those of us with disabilities.
• Since I don't pay my own tuition, I would be more than happy to see an increase in tuition to cover sustainability costs.
• Covered parking would be really beneficial. I suggest to build a 3 level parking garage with solar panels to generate electricity for the University on the A/U parking lot next to the Humanities building. Also a road connecting Central Campus Drive to this parking lot would create much easier access and alleviate the traffic trying to access this central parking lot.
• What about making it so that you could plug and electric vehicle into a covered parking stall with a solar panel on it.
• Sustainability is a step in the right direction.
• there should be separate, more convenient parking for graduate TAs who teach classes
• Why not install these solar panels on existing structures? Covered parking is not necessary, and paying more for an already overpriced parking permit does not make sense.
• Because I take public transportation, parking is not an issue for me and I definitely don't need a reserve space. However, I think there are several faculty who drive daily and would pay the additional costs.
• what a waste of money. I hope this doesn’t raise tuition prices
• I answered that the public would view solar panels as unfavorable. That is because there are many people out there who are not sold on alternative power sources. They believe in the "drill baby drill" approach.

- I think this would be a much more valuable survey if you would have included information regarding the ROI information of the proposed project. Without any additional information, I am forced to jump to the conclusion that this will simply be a net loss of cash. What's wrong with using the readily available and cheap coal generated power?
- I think you are doing a great job-but what about lights that come on automatically, in the huge rooms when a person is in there?
- Good job/cool idea. My brother is looking into something like this in Oregon.
- When you are raising tuition by roughly 10% year in and year out, the last thing we need is covered parking with solar panels. Get the other rampant construction on campus under control and then we can talk.
- as an adjunct, I find it more economical to pay to park in the public parking lot, although it really dings my small paycheck
- the parking lots between the Shoreline Trail and EEJ/upper campus are in poor repair. Also, it is quite dangerous to ride a bike through this area. Any chance of a painted bike lane?
- put in parking terraces to allow more parking overall, add what you're talking about on top of them, win win for all of us
- where's my $50?
- the free bus pass for students and employees is a huge benefit that makes my being able to work on campus possible (financially) and allows me to commute to my job in a more environmentally friendly way - thanks
- It would be important to me to see what these solar-powered parking areas would look like, and how many of them there would be, before I developed a strong opinion.
- We need more bike lock-ups at the Chemistry building!
- Build a giant parking infrastructure in an existing lot and use solar panels on top of that and anything else renewable you want.
- I do not park on campus regularly, so I would not buy a reserved parking pass. However, I support the use of renewable resources.
- How about a parking discount for clean fuel cars and electric cars?
- I really like the idea of covered parking that generates solar energy. Unfortunately, I can't afford to buy a higher priced parking permit.
- The field behind my office is mowed by a tractor mower that spews smoke into the air. I think new, cleaner equipment would be a wise expenditure.
- If I drove every day to campus I would be much more interested in purchasing a reserved, covered parking spot similar to what was described in this questionnaire. However it would not be financially viable for me since I don't have to park every day on campus. Also, when I do travel to campus it is to upper campus.
- Each recycling station on campus should have a spot for plastic, aluminum and paper. It is frustrating when you go to recycle a bottle and the bin is cans only (and vice versus).

Also, $2 of tuition seems minimal. Why not $20?
• I don't feel that there is enough affordable parking near the medical center for employees. I have to park far away and walk a long way just to get to my building.
• encourage more pedestrian friendly routes to and around campus; turn off the lights at night in research/office space
• it's good idea to install solar panel on campus parking.
• U of U Sustainability Office is doing an awesome job! Thanks!
• I think more money should be spent on additional parking; I don't think people would be willing to spend extra money on a covered parking space if they have to park and walk five blocks to get to where they are going.
• There is lots of idling in U lots when people are waiting for other cars to leave. It is a major pollution source. Converting some more A spots to U spots would decrease this. Or maybe there are other solutions....
• great idea!
• Placing solar panels on top of parking structure will generate review for Parking Services, so it's unclear why any cost should be passed on to employees paying parking fees. If anything, parking fees should be decreased by the value of the energy generated by parking structures supported by parking fees.
• I work a swing shift which requires me to drive due to limited transportation options at midnight. However, should a day position be available for me in the future I would be very interested in this parking option, as long as the fee is reasonable.
• I work at the Center for American Indian Languages (east of Eccles Bridge) as a research assistant; all the parking anywhere near where I work is assigned to student housing (Heritage, Sage Point, Ft. Douglas) or to other specific institutions (Officer's Club, Guesthouse, etc.); I don't drive and I don't purchase a parking permit because even if I had one, there very limited parking that I could use in the vicinity of my work. If there was parking available (for example, in the often-vacant parking lot behind our building assigned to the Officer's Club), I would buy a permit.
• I think more parking is more important than "sustainable energy" parking. Ask people how much more they would pay if we could get a large parking garage by the business building. I think that would be an effective use of parking money.
• I think it's an excellent idea to install solar panels on all rooftops throughout the entire campus.
• I think that decreasing the parking available would help encourage more people to use public transit or to commute, especially since it is free (at least for students)
• I work off of the main campus at BSB (very few uncovered parking spots.) Allowing telecommuting for office employees- even a couple of days per week -would make the biggest contribution.
• Wouldn't you generate more electricity if all the exercise equipment was setup to generate power?

-
- I think the ideas are great. I currently park at the LDS Institute. I do not however feel that tuition should be increased to help.
- Rather than having covered parking, how about having more parking in general? I hate having to worry about trying to find a parking spot. It adds unnecessary stress to my day.
- UTA bus service to the U should not be cut, but should be increased for convenience of more employees and students.
- Great idea...thank you for your efforts!
- We need reliable transportation
- strongly support more efficient (and less polluting) campus shuttles. expansion of mass transit opportunities for U commuters. do not favor lots of effort to improve the driving experience.
- Please make this happen!! And more recycling and green efforts please!
- Stop subsidizing the UTA and build some sensible parking structures, and most other major universities have don.
- UTA should schedule the busses that come to the hospital, to arrive PRIOR to the starting of each shift at the hospital. There are a lot of hospital employees taking the busses, to cut down on the need for parking, and to save on gas, also. It would be great if they would take this into consideration. Thank You
- additional south campus parking or turn some of the A spots into U spots
- How about making more parking spaces be a priority over thinking about ways to make more money off of already limited parking spaces?
- I dig it.
- What a great idea!!!
- I think that campus sustainability is a very important issue and I full heartedly support it.
- Why not place solar panels on some of the building too?
- keep up the good work. I appreciate the efforts that have taken place. I see a lot more recycling on campus and lights that shut off automatically and such. these are all good things
- This is a great concept for use.
- Thank you. This is absolutely a great idea.
- building roofs, glass windows and parking lots are good place to have solar panels to generate electricity.
- Keep working on it as we need to conserve resources when possible. Thanks for your efforts.
- I think doing a covered parking with a field on top would be good ideas since it would provide parking while keeping the beauty of the campus.
- I like the idea, just not sure this would help me as I park in covered parking already

(specific to the building I work in).
• I would recommend using sustainable runoff management practices if parking areas are covered with solar panels, such as diverting roof runoff to small rain gardens around the parking area.
• I like the idea, and the efforts to improve sustainability, but I already pay for a terrace parking permit pretty close to where I work.
• I would be riding the bus still if the route of the 220 had not been changed such that it does not go to PCMC anymore
• I attend meeting in different areas of campus, specially Research Park where the campus buses do not service and I find it difficult to find a spot back (near the school of Medicine) after my meetings are over. I applied for reserved parking or parking in the paid lot behind the Biopolymer's building over two years ago and I still have not been contacted. I is especially frustrating with all of the construction and concerts that happen near the Red Butte Gardens.
• We need bike lanes around the campus to promote more cycling to work and school. There are several internal lanes but none around the perimeter of campus
• No, thanks.
• Not enough parking near campus. Garages near stadium would help.
• At building210 football we have more cardboard than we can recycle a cardboard recycling cart or bin is needed
• The lab I work in is located at Research Park. We don't need a permit there, but I often go to upper campus and it is a real hassle in some cases to wait for shuttles etc. There is not enough parking in the middle of the day so not even sure I would buy a permit if I could afford it. Please consider building a tall parking deck on upper campus that could accommodate more parking so there is somewhere to park in the middle of the day if I need to go over for a seminar or use a core facility. Then I would pay for a parking pass - solar or otherwise.
• The U. should transition away from permit-based parking toward the use of pay lots. Incremental pricing of parking (per day/hour) discourages driving; fixed cost parking (through permits) encourages driving.
• I don't own a car, but love the idea of a sustainable movement on campus
• Sustainability is an important issue to many of us. Since the University is one of the largest entities in the state of Utah and more precisely Salt Lake City it needs to take a lead role in using renewable energy. It would be nice to receive emails about changes and progress that are being made at the University in terms of sustainability and renewable energy.
• I am an undergrad student and part-time staff.
• Though I indicated I would not pay "more" for a reserved parking space, this is only because I currently am satisfied with riding a bike and taking the bus. However, having solar panel covered parking is a terrific idea, in particular if it would mean being able to plug in an electric car. I currently have a hybrid car, but my next car is likely to be

electric and I would take advantage of an outlet when I drive to campus on the weekends.

- I hope solar panels are installed on as many U of U rooftops as possible. Thank you.
- Some of my responses were influenced by the phased retirement I start in June 2011
- I'd love to see more motion sensor lights or light timers to save energy. The lights in our building are on at all hours and even on holidays.
- I do take issue with the whole parking situation at the U. it seems strange that I have to pay to come to work.
- It is frustrating to think of having to pay more for parking when I haven't had a raise in three years.
- So many sustainability programs around the country are silly. The U's is very practical. Thanks for the work you do.

- The cost of parking in a reserved space on campus is simply absurd. When I tell people that I pay almost $1,300 to park on campus (only until 6pm!), they are stunned. A reasonable fee? Absolutely. The current fee(s)? Absolutely unreasonable.
- A bus to park city would be allow me to commute to school on public transportation.
- "green" education has to start as early as possible (elementary school?), to make people aware how important it is - then it will be easier to make people act environmental conscious in college and later on
- It would be nice to have more parking in general on upper campus. I take the bus to work because even if I had a permit there would be no where to park. Every space is filled before 9am.
- I think it's petty for the administration to nickel and dime the students to make themselves look better.
- your group should also look at having UTA run buses later to and from the u hospital. the only reason i don’t take the bus more is because i often work late.
- My answers seemed negative but I already pay a lot for a covered T permit so a sort of covered space does not appeal to me and I really don't want my permit to get more expensive so that someone else can have a covered spot.
- I love the idea of covered parking that will create sustainability efforts. However, I think that we need to consider creating more parking space, which is very needed. Also, what I don't like is that it is being considered to create more expenses. Students shouldn't pay for that.
- I like doing sustainability projects but I wouldn't want to see tuition money go to them if we're planning on raising tuition
- there are better places for the panels
- the parking spaces at the stadium and engineering lots are compact and sometimes difficult to get into if someone doesn't park correctly. There are not enough spaces most days and I have waited at least 20 min for someone to leave to finally get a space. And

when it snows everyone parks in more than one space limiting availability.
• Great Effort! Thank U!
• This is such a great idea!! We all need to help make these green changes!
• I'm assuming this was meant for lower campus--not the U Hospital or HCI, etc.
• I disagree with the fact that employees have to "pay" to park their car at their own place of employment.