LIGHTS ON

An Energy Policy Survey for California

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"Energy is the master resource, because energy enables us to convert one material into another. As natural scientists continue to learn more about the transformation of materials from one form to another with the aid of energy, energy will be even more important.... For example, low energy costs would enable people to create enormous quantities of useful land... reduction in energy cost would make water desalination feasible, and irrigated farming would follow in many areas that are now deserts.... Another example: If energy costs were low enough, all kinds of raw materials could be mined from the sea."

—Julian Simon, 1996

Introduction: California's Ongoing Energy Crisis

Over Labor Day weekend 2007, temperatures climbed in California. Hundreds of thousands endured power outages that led to 16 deaths by September 4.[1] The tragedy recalled past energy woes. On June 14, 2000, a blackout left nearly 100,000 San Francisco residents without power. On January 17, 2001, after a similar outage, Governor Gray Davis declared a state of emergency, but this action failed to prevent further blackouts in March, which affected some 1.5 million Californians.[2] "Rolling blackouts" continued to plague the Golden State, and as a result Californians began to think more about energy. Such power outages, in their view, might be expected in the Third World, but not in a high-tech state like California, with its strong economy. Six years after Governor Davis's declaration of a state of emergency, power outages are still claiming victims, forcing Californians to face key energy questions.

Despite the blackouts, California remains a bellwether state for American energy policy. As gasoline and oil prices continue to rise—another attention getter—there are increasing calls for higher taxes, more government spending on alternative energy sources, and more government intervention to regulate energy use. However, these calls are not necessarily well informed. What Californians need is a realistic survey of their state's current energy policies.

This report provides important facts about California's energy system, summarizes past policies, and investigates current policies that are receiving high levels of attention. For example, what effect do taxes have on consumption? Does mandated conservation work? Has state investment in alternative energy sources been beneficial?

Before the energy debacle of 2000, many states considered following California's restructuring of electricity markets. When California's infant competitive electricity market experienced a meltdown, characterized by extremely high prices, bankruptcies, and blackouts, most states abandoned their plans to follow in California's footsteps. Today, the pursuit continues through demand-side management (DSM) programs and pressure on Congress to enact similar interventions at the national level. Have California's DSM programs actually produced energy savings, or are there more fundamental reasons for flat electricity demand? Could an examination of these programs shed light on more recent efforts by California to reduce the carbon content of transportation fuels?

The *California Energy Policy Survey* will seek answers to these questions and provide California voters and policy makers with sound courses of action for meeting the state's pressing energy needs. Equally important, the *Survey* will inform national debates about whether to emulate California's energy policies.

The high price of energy, environmental concerns, and geopolitical instability in many regions of the world have heightened interest in reducing growth in energy demand and in finding suitable alternative energy supplies. Concern about human-generated global warming is increasing the pressure to reduce the "carbon footprint" of energy use. Many politicians and academics cite California's energy policy as a model for the nation. California has indeed limited growth in electricity consumption and is moving toward lower carbon content in transportation fuels. However, the modest success California has achieved in these areas has come at steep costs to the consumer and the economy, and only through heavy government intervention.

California Statistics and Trends

California is home to more than 37 million people[3] and, as of 2006, boasted the world's eighth largest economy (down from number five in 2000).[4] The population has grown to its current size from fewer than 24 million in 1980, an increase of more than 50 percent. Much of the growth in absolute numbers has occurred in large cities like Los Angeles, but less densely populated areas have grown much more rapidly in percentage terms. During this 26-year period, Los Angeles County grew by 50 percent, while the population of Placer County, east of Sacramento, more than doubled, with a rise of 173 percent. Other less populated counties have experienced similar rapid growth.[5]

In Census 2000, 15.7 million California residents age five years and over reported changing their place of residence between 1995 and 2000. The movers can be divided into four major groups: those who moved within the same county (62 percent), those who moved to a different county within California (20 percent), those who moved from different state (nine percent), and those who moved from a different country (nine percent). Approximately 2.2 million Californians migrated to other states, compared with 1.4 million who moved to California from other states and 1.4 million who moved to California from other countries.[6]

California's gross state product (GSP) was $1.6 trillion in 2006 (2000 dollars), reflecting an approximate annual growth of four percent from 2003. California's economy represents 14.6 percent of the U.S. economy as a whole.[7]

Electricity

While overall electricity consumption has grown along with population and economic growth, the sales per customer increased only one percent from 1990 to 2005,[8] while most, though not all, other states experienced higher growth. California remains in first place in electricity costs, with the highest prices per kilowatt hour (KWh) of any western state; these prices are 25 percent higher than the national average, as shown in Table 1.

California's use of electricity is affected by factors that are irrelevant to many other states. The climate in much of the state, for example, reduces consumption of energy for heating and cooling of homes and businesses. In addition, California's economy has undergone a structural change, away from energy-intensive manufacturing toward services for which electricity quality matters more than quantity.

Total Annual Sales/Customer (kWh)

State	1990	1995	2000	2004	2005	% Change '90–'05
CA	17,647	16,941	19,466	17,936	17,804	1%
CT	18,922	19,037	19,890	20,418	20,875	10%
TX	31,601	32,152	34,222	31,622	32,144	2%
VT	15,889	16,351	17,273	16,505	16,912	6%
GA	27,034	28,935	31,049	30,359	30,317	12%

Average Retail Prices in 2005 (cents/kWh Hour)

State	Residential	Commercial	Industrial	All Sectors
AR	8.86	7.4	5.85	7.79
CA	12.51	11.92	9.55	11.63
CO	9.06	7.62	5.74	7.64
ID	6.29	5.42	3.91	5.12
MT	8.10	7.43	4.83	6.72
NV	10.20	9.48	7.71	9.02
NM	9.13	7.81	5.61	7.51
OR	7.25	6.51	4.83	6.34
UT	7.52	6.07	4.24	5.92
WA	6.54	6.33	4.27	5.87
WY	7.48	6.17	3.99	5.16
U.S. Total	***9.45***	***8.67***	***5.73***	***8.14***

Table 1
Source: U.S. Energy Information Administration

While the California economy has grown during the past 25 years, it has also become more volatile and taken on a new face. In addition, demographic changes are continuing, with more people on average living in the same household and with higher prices for residential properties. California's prices for electricity are higher than the rest of the nation, with a few notable exceptions. Many state policies exacerbate the high prices.

Resource Type Statewide	
Coal	15.7%
Large Hydro	19.0%
Natural Gas	41.5%
Nuclear	12.9%
Renewables	10.9%

Table 2

Electricity Sources

California's supply of electricity comes from a variety of resource types and includes imports from other states in the Western Electricity Coordination Council. Table 2 provides the resource mix for 2006 electricity generation. The capacity necessary to "keep the lights on" during periods of heavy use is shown in Table 2. Many of the resource types specifically favored by California policy, such as wind, add little to no capacity, yet ironically are the most expensive.

Transportation Energy Demand

Californians consume nearly 44 million gallons of gasoline and 10 million gallons of diesel fuel every day.[9] California refineries produce these fuels and other products from crude oil and blending components. The production of transportation fuel in California depends on the availability and quality of the crude oils used by refineries in the state.

Petroleum and Natural Gas Supply

Natural gas is an important fuel for California. It is the primary source for space heating, generating electricity, and maintaining many industrial processes. It also provides the key feedstock for some chemical processes. Figure 1 shows sources of natural gas, which arrives in California through four large pipelines.

California ranks fourth in the nation among oil-producing states, behind Louisiana, Texas, and Alaska. Crude-oil production in California averaged 731,150 barrels per day in 2004, a decline of 4.7 percent from 2003. In 2005, the total receipts to refineries of roughly 674 million barrels came from in-state oil production (39.4 percent), imports from Alaska (20.1 percent), and imports from foreign sources (40.4 percent). Figure 3 shows the average annual refinery receipts of crude oil from 1986 to 2005. The sources of crude oil supplies to California refineries have changed substantially in the last 10 years. Most notably, receipts of foreign crude oil have increased as production sources in California and Alaska have declined.

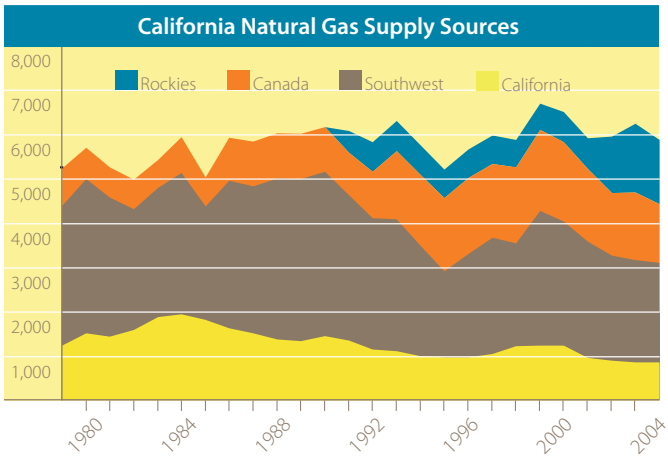

Figure 1

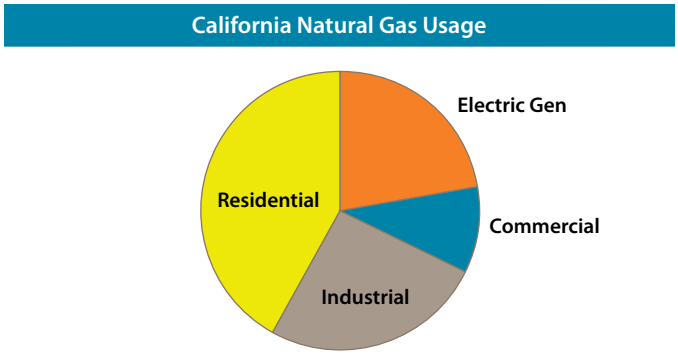

Figure 2

California domestic production is down over this period because old producing fields have not been reworked and significant new fields have been placed off limits since 1982. The U.S. Mineral Management Service estimates that approximately 86 billion barrels could be economically recovered from offshore fields, in the area known as the Outer Continental Shelf, which includes California's coast.[10] Meanwhile, crude imports from Alaska may rebound with additional development of fields in that state.[11]

California is a major refining center for West Coast petroleum markets, with combined crude-oil distillation capacity totaling more than 1.9 million barrels per day. This ranks California the third highest in the nation in refining capacity. At the same time, California ranks first in the United States in gasoline and diesel-fuel consumption and second in consumption of jet fuel.

A large network of crude-oil pipelines connects producing areas with refineries in the San Francisco Bay area, Los Angeles County, and the Central Valley. Major ports in northern and southern California receive crude oil from Alaska's North

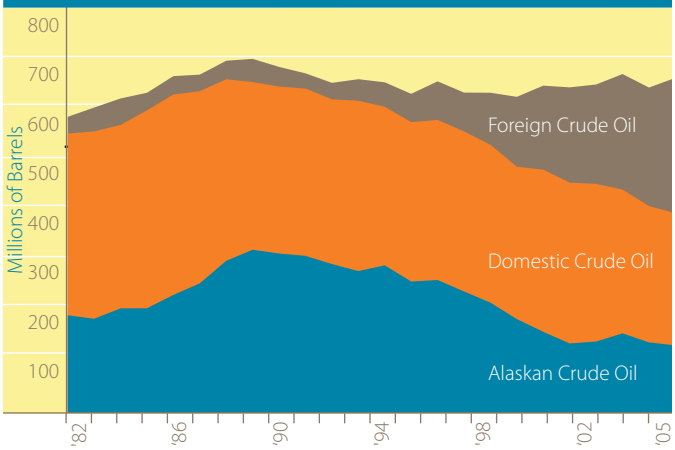

Figure 3

California's Major Sources of Energy

PETROLEUM (2005)		ELECTRICTY (2006)		NATURAL GAS (2005)	
Source		Source		Source	
In State	37.22%	In State	78.03%	In State	15.0%
Alaska	20.99%	Natural Gas	41.5%	Canada	23.0%
Foreign	41.79%	Nuclear	12.9%	Rockies	24.0%
		Large Hydro	19.0%	Southwest	38.0%
		Coal*	15.7%		
		Renewable	10.9%		
		Imports	21.97%		
		Pacific Northwest (PNW)	0.72%		
		Desert Southwest (DSW)	5.25%		

*"Out of State" Intermountain and Mohave coal plants, though outside California, are considered "in-state", since they are in California utilities' control areas.

Table 3
Source: California Energy Commission; www.energy.ca.gov

Slope and from foreign countries for processing in many of the state's 21 refineries. Despite a population of 37 million that is heavily dependent on the automobile, California, like the rest of the nation, has not authorized construction of a new refinery for more than 30 years.

Greenhouse Gases and Air Quality Associated with Energy

Approximately one half the emissions of carbon dioxide (CO_2), the most common of the greenhouse gases, comes from the transportation sector. About 80 percent of that, or 40 percent of total greenhouse gases, is associated with end-use burning of petroleum fuel in vehicles. Other air-pollution issues relating to petroleum fuel (ozone and smog, for example) are likewise associated with the *use* of the fuel, not the production. Since the 1960s vehicles have improved dramatically in terms of efficiency and emissions levels because of advancements in fuel and vehicle technology.

According to EPA estimates, air quality in "Region 9," comprising California, Arizona, and Nevada, is better than the national average in several important measures. This region's concentrations of lead, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and one-hour maximum ozone are below the national average. Only in particulate-matter concentrations is Region 9 the highest in the nation, and just a fraction of particulate matter is related to automobile emissions; most comes from industrial sources, road dust, soot from wood combustion, and other sources. While individual locations may suffer episodes of poor air quality, the overall air quality in this region is good and improving.

EPA estimates of air-quality indicators show that between 1982 and 1991, Region 9 saw a 59-percent decrease in carbon monoxide (CO), a 28-percent decrease in NO_2, a 96-percent decrease in lead, a 39-percent decrease in one-hour ozone, and a 47-percent decrease in SO_2. Between 1992 and 2001, the EPA measured a 10-percent decrease in particulate matter.

As illustrated in PRI's 2006 *Index of Leading Environmental Indicators*, isolated air-quality incidents are also decreasing. For example, there has been a sharp drop in the number of violations of the one-hour ozone standard in Los Angeles over the last 30 years. As the *Index* explains, "This trend actually understates the magnitude of improvement since, under EPA rules, a violation at just one of the dozens of ozone monitors in the large Los Angeles air basin is enough to qualify as a violation for the whole region. In fact, there are large areas of the Los Angeles air basin where there have been no violation of the ozone standard for the last several years, meaning millions of residents have had no exposure to high levels of ozone."[12]

As a result of improved engineering and better fuel formulation, automobile tailpipe emissions of CO have fallen by 96 percent nationally since the 1960s, while hydrocarbon emissions have fallen 99.3 percent. California's emissions trends from cars and trucks follow the nationwide pattern. In 1980, cars and trucks accounted for a third or more of total emissions of volatile organic compounds. By 2020, mobile sources (such as vehicles) are projected to account for only five percent of total volatile organic compound emissions.

Government Regulatory Overview

California's energy-policy and regulatory systems are among the most complex in the nation. Multiple agencies are responsible for setting and enforcing regulations and policies that affect every person and company in California. Like every other state, California has a public-utilities commission (the California Public Utilities Commission, CPUC) and a forecasting and policy-integration function (the California Energy Commission, CEC). But in addition to these, California, like a few other states, has seen fit to create numerous other agencies with conflicting or overlapping functions.

California needs a more comprehensive approach to energy-policy development in order to reduce the level of regulatory uncertainty in the marketplace and attract the investment in new resources and energy infrastructure required to meet future demand. And since energy infrastructure does not stop at the border, California must coordinate with neighboring states to ensure adequate supplies of electricity, natural gas, and transportation fuels to meet the region's needs.

The consolidation of energy regulatory and policy functions has been discussed ever since the creation of the Energy Resources Conservation Development Commission (commonly known as the California Energy Commission, or CEC) in 1974. The CEC was created in order to "ensure that a reliable supply of electrical energy is maintained at a level consistent with the need for such energy for protection of public health and safety, for promotion of the general welfare, and for environmental quality protection."[13] Among other things, the CEC was given jurisdiction over review and approval of thermal power plants that generate electricity of 50 megawatts or more.

In 1989, in Senate Concurrent Resolution 7, the California legislature stated that the existing regulatory system has "resulted in significant fragmentation, duplication, overlap and confusion in the formulation and execution of state energy related functions." In recent years, several efforts to consolidate various state energy agencies have been advanced.

In 1995, Governor Pete Wilson sought to consolidate the CEC and elements of the Department of Conservation by creating a Department of Energy. The state's Little Hoover Commission, a watchdog agency, declared the proposal to be "an important opportunity to align similar functions so that increased efficiency, effectiveness and accountability are achieved."[14] Despite the recommendation, the plan never moved forward.

Public Policy Institute of California (PPIC) observed in 2003 that the restructuring of the electricity sector, followed by an energy crisis, has led to a confusing mix of state agencies and departments. The PPIC stated that the fractured and overlapping set of agencies led to inefficiencies and conflicts; and concluded that state energy policy has lost coherence because elements of energy policy are addressed in many separate forums. Opportunities for accountability and synergy have been missing, in a field where coordination is essential.[15]

Meanwhile, in 1996, California restructured its energy regulatory apparatus, transitioning the state from highly regulated local monopolies that provided their customers with a total package of all electric services toward a market in which companies could compete to provide the electricity while utilities continued to provide transmission or distribution services.

In 2000–2001, California experienced a significant electricity crisis. In the years leading up to the crisis, investment in new power-generation capacity did not keep pace with the increasing demand for electricity. California's electricity-generation capability actually decreased two percent from 1990 through 1999, while retail sales increased by 11 percent. Reduced hydroelectric power generation caused by a drought in the Pacific Northwest resulted in a reduction of power imports by California. Path 15, the high-voltage transmission line connecting southern California to northern California, became congested at times, reducing the flow of surplus electricity in the south to meet shortages in the north.

There has been considerable debate concerning the exact causes, but most observers agree that several factors unrelated to the restructuring of themarket contributed to the crisis.

The rules for the wholesale electricity market established under the restructuring plan contributed to the increase of wholesale prices. Under the rules, the major utilities were required to buy all of their power on the spot market and were prohibited from entering into forward long-term contracts for energy. Increases in natural-gas prices significantly contributed to the increase in wholesale electricity prices. Shortages in generating capacity increased the bargaining strength of merchant power generators and energy traders, and led to market manipulation by certain generators.[16] Unfortunately, the rules put in place by the regulators greatly exacerbated the damages caused by a few bad actors.[17]

The PPIC called the confluence of events and factors that led to the electricity crisis a "perfect storm."[18] California's electricity crisis called into question earlier assumptions about adequacy of electrical generation resources and resulted in significant and sometimes contradictory policy initiatives. There has been considerable debate concerning the exact causes, but most observers agree that several factors unrelated to the restructuring of the market contributed to the crisis.[19] It is also clear that California's energy policy structure has been in disarray for decades.

As early as February 1984, the Little Hoover Commission found that the CEC lacked the requisite mechanisms to put its policy recommendations into effect; it also noted the overlap and duplication between the Energy Commission and the CPUC. The Little Hoover Commission called for increased coordination between the two entities and wrote that the "development of state energy policy only has purpose and meaning if the policy is meaningful and there exists a mechanism for its implementation."[20]

Criticism of energy-policy inconsistency continued after the state's electricity crisis had abated. For example, the state Legislative Analyst's Office (LAO) observed that existing energy agencies sometimes advocate different policies; the LAO recommended reorganization.[21]

In 2002, the Bay Area Economic Forum studied the California power market, reporting that it is "broken and in urgent need of reform." The researchers stated:

> *Despite the wake-up call delivered by the energy crisis of 2000–2001, the state still does not have a clear and well-integrated power policy in place. Instead, the state has a complex patchwork of different agencies—each making critical decisions regarding the power industry—without a common vision or philosophy.*
>
> *The state's energy infrastructure is critical to its economy and the well-being of Californians, yet the current low level of investment in generation and transmission facilities—caused at least partly by the lack of a coherent, long-term strategy for managing the power system and lack of retail demand responsiveness—could lead to another power crisis.*[22]

Since the restructuring of California's electricity industry, the state has significantly increased its representation before the Federal Energy Regulatory Commission (FERC). Several state agencies represent or have represented various perspectives on energy-related issues before that body. The Electricity Oversight Board (EOB) oversees the California Independent System Operator (CAISO), a FERC-regulated entity that provides a variety of electricity transmission services in the state and operates wholesale electricity markets. The EOB and CPUC also represent the interests of the state's ratepayers before FERC.

The *Supplemental Report of the 2002 Budget Act* directed various state agencies to submit to the legislature reports on the perspectives they represent before FERC. In its review of the reports, the LAO concluded that several agencies represent some of the same energy-related issues before FERC, especially the EOB and the CPUC. The LAO stated, "Specifically, EOB and CPUC have each been involved in FERC proceedings related to state requests for refunds from generators, charges of market manipulation, and proposed changes in market design."[23]

In 2004, Governor Arnold Schwarzenegger proposed a reorganization and consolidation of energy-agency functions. That sparked a political fire storm, and the fragmentation and overlaps continue today. The issue is not limited to electricity. A similar story can be written about natural gas, especially regarding conflicts with the Coastal Commission in liquefied natural gas (LNG) proceedings. Transportation fuels tangle with local land-use planning, the Coastal Commission, and the Air Resources Board.

Perspective on Three Current California Policies

Demand-Side Management Programs

Many politicians and academics cite California's energy policy as a good model to replicate throughout the nation.[24] Those politicians, interest groups, and academics call for an increased use of renewables (like wind and solar power), energy efficiency, and technologies such as carbon capture and sequestration (CCS), which prevent the release of CO_2 into the atmosphere. However, it may take two decades to determine whether CCS is economical and decades more to build the necessary infrastructure. Yet renewables alone cannot provide enough energy. How then do we meet U.S. electricity needs as the economy and population grow?

Many assert that if the nation simply replicated California energy policy with respect to energy efficiency, we would become so much more efficient that we would not require new electrical capacity for decades. This would give us time to build a non-carbon energy system, in essence building a "bridge" to some as-yet-undefined future electrical-energy system. As Joseph Romm notes:

> *The state of California, in the last three decades, has kept electricity per capita flat, while it's gone up 60 percent in the rest of the United States. And they've done that with aggressive energy programs, so what you do is you use energy efficiency to keep demand growth flat and then you use these cleaner technologies, like wind power, to reduce emissions.*[25]

Marvin Horowitz, writing in *The Energy Journal*, suggests that changes in consumption can be determined by the level of "commitment" various state regulatory agencies have to demand-side management (DSM).[26] California is and has been committed to energy efficiency, and Horowitz suggests that this commitment is the cause of the state's flat energy intensity, as compared with the rest of the nation's increased energy intensity. The American Council for an Energy Efficient Economy (ACEEE) goes so far as to suggest, when ranking states according to energy efficiency, that the proper metric of performance is how many dollars are spent by government and how much intervention occurs—rather than the actual, or even hoped-for, amount of energy saved.[27]

There are many factors that influence energy consumption beyond those evaluated by Horowitz, and most of them are more significant than regulators or politicians admit. Economic conservation of energy consists of actions and investments that make sense. Political conservation, like DSM, consists of measures that require cross subsidies, encourage free ridership, and must be paid for through a coercive levy.[28]

DSM rose to regulatory prominence during the 1980s, following the expensive and disappointing power-plant construction programs of the electric utilities in the 1970s. The confidence of the utility industry in the ability to build acceptable new power plants had been shaken by public and regulatory opposition to building power plants, and everybody was open to other approaches to meet future energy demand. DSM advocates claimed that power plants could be shut down if only everybody would start conserving energy—for example, by using fluorescent light bulbs. The notion sounded plausible; perhaps high efficiency could eliminate or at least reduce the need for future power plants. But the DSM concept implied that a coercive tax-and-spend program would be required to get "everybody" to use the light bulbs, instead of depending on consumers to take rational and efficient action on their own.

Another concept that has gained currency in this field is Integrated Resource Planning (IRP). Through IRP processes, utilities and state regulatory agencies have tried to determine the "least-cost" choices between supply- and demand-side options for making investment decisions. DSM programs are an assortment of cross-subsidy programs to retrofit buildings and subsidize energy-using equipment.[29] By the late 1990s America's utilities had spent some $20 billion on DSM programs, with little

to show for it. In 1992 alone, the utilities received an estimated $1 billion in incentive payments. The supply-side alternative was managed retail competition, but when that collapsed, DSM started making a comeback. The mandatory cross-subsidies of DSM can only be accomplished in a strictly regulated sector of the economy, where the political machinery exists to shift money without consumer consent. DSM program exuberance fluctuates in a counter-cyclic manner to the viability of competition in the electric-utility industry.

Despite its claims of serving high social goals, regulation is essentially the political brokering of favors to various interest groups.

Even if cross-subsidies worked, there is a more basic problem with DSM: namely, the presumption that there is a correlation between government-mandated efficiency programs and society's overall energy use is wrong. Increased efficiency has consistently resulted in more, not less, energy use. Take the example of a typical household. If money is saved through the use of high-efficiency appliances, the family has more money to spend on other things. With the newly available disposable income, the family may take a trip to Hawaii, buy an SUV, or have a hot tub installed. Virtually any new spending will involve additional use of energy.

Standard modern televisions use less energy than older models, but consumers now have multiple sets in the home and larger screens. Similar things happen in the business world. If a retailer cuts overhead costs by installing high-efficiency air conditioning in his store, he can lower prices so as to compete for new business. A shopper in his store may now buy two sweaters at the reduced price instead of one at the original price. The retailer must buy more sweaters to keep his store stocked, which means increased energy for sweater production and delivery. A manufacturer that reduces the energy use per unit of product will make more units of that product. The federal and state subsidies and mandates for conservation have not reduced and cannot reduce energy demand in the aggregate.

Taxing all customers for conservation programs while subsidizing a few results in the punishment of the wise and rewarding of the imprudent. Those who have already installed energy-efficiency projects with their own money must pay for the same projects for the less frugal. Those who would have implemented energy-conservation measures on their own will now delay installation and wait for the subsidy.

Cross-subsidy cannot be tolerated in a competitive market, and its abolition is among the first reforms stemming from real deregulation. Despite its claims of serving high social goals, regulation is essentially the political brokering of favors to various interest groups. A competitive market may end the practice of high regulation, while socialized conservation provides a way to further entrench it.

Among its year-end actions last December, the CPUC approved more than $1 billion annually for the next two years for low-income utility-bill discounts and energy-efficiency programs run by the state's four major private-sector energy utilities. Qualifying customers can receive discounts on utility bills for 20 months and free energy-efficiency services and products. More than 3.5 million customers are expected to receive these benefits.

The CPUC action adopted budgets, policies, and program parameters for two established programs—Low Income Energy Efficiency (LIEE) and California Alternate Rate for Energy (CARE). Each is provided by Pacific Gas and Electric Co., Southern California Edison Co., Southern California Gas Co., and San Diego Gas and Electric Co., along with six other investor-owned utilities with much smaller operations in the state.

For the four largest utilities, the collective CARE budgets for the next two years are $977 million in 2007 and $1.04 billion in 2008; for LIEE, the budget calls for $157 million in 2007 and $156 million in 2008. The six smaller utilities are budgeted to spend another $11 to $12 million collectively on the LIEE and CARE programs. "These programs allow the most vulnerable Californians to save money on their bills, while including them in the statewide effort to protect our environment and assure a more reliable, low cost energy infrastructure," said Commissioner Dian Grueneich, a champion of low-income programs.[30]

The CARE program gives low-income customers a 20-percent discount on their electricity and natural-gas bills. In addition, these customers are not billed at higher rate tiers if household consumption increases. CARE is funded through a rate surcharge paid by all other utility customers.[31] Families whose household income slightly exceeds the CARE allowance can qualify to receive FERA discounts, so that some of

their electricity usage is billed at a lower rate. Some utilities also have shareholder-funded emergency payment assistance programs for their customers, which provide cash assistance to help offset the costs of heating and cooling their homes.

The LIEE program provides no-cost weatherization and other energy-saving services to low-income households. Services provided include attic insulation, energy-efficient refrigerators, energy-efficient furnaces, weather-stripping, caulking, low-flow shower heads, water-heater blankets, and door and building envelope repairs that reduce air infiltration.[32]

These programs have inherent internal conflicts. Reducing the apparent cost to low-income ratepayers (via discounts and removal of progressive rates) eliminates the incentive for this customer class to reduce energy usage. Together, the two programs multiply the "snap back" effect—the tendency to increase usage when costs to the customer have been reduced through more efficient use or lower per-unit cost.[33] Hence, efficiency gains paid for through LIEE will be lost through the increased consumption brought about by CARE.

Flex Your Power Campaigns

Flex Your Power is California's statewide energy-efficiency marketing and outreach campaign. Initiated in 2001, *Flex Your Power* is a partnership of California's utilities, residents, businesses, institutions, government agencies, and nonprofit organizations working to save energy. The campaign includes retail promotions, a comprehensive Web site, an electronic newsletter, educational materials, and advertising. According to a recent *Flex Your Power* ad campaign, "In a state with as many people—and air conditioners and light bulbs—as California, taking even small steps to save energy can quickly add up. If all California households permanently replaced five incandescent light bulbs with [compact fluorescent lamps], it would save 6.18 billion kilowatt-hours (kWh) and 2.26 million tons of CO_2 per year equivalent to *taking 414,000 cars off the road*." (Emphasis added.) But the ad neglects to mention that there are more than 25 million personal vehicles in California, so if everybody replaced five light bulbs, a reduction equivalent to only two percent of vehicles might occur.

Another recent campaign encourages people to shut off their air conditioning when the grid's power supplies are stressed. In California, that happens when it is hot and people actually need air conditioning. California's policy is simply one of denial.

Factors Affecting California Electricity Usage

Weather Affects California Energy-Use Patterns

Much of California is blessed with a mild climate that reduces heating and cooling demands for residential and commercial buildings. The most common measure of weather effects are "heating degree days" (HDD) and "cooling degree days" (CDD).[34] California is significantly lower in both than much of the rest of the nation. Further, the effects of relative humidity impact the energy needed for heating and cooling of buildings. This does not directly affect the trend in energy consumption over time. Most growth is occurring in drier, hotter central California, versus the coastal areas, and in smaller residences in high-population coastal areas.[35]

Change in Economic Structure

California's economy underwent a structural change from 1980 to 2006. In 1980, manufacturing, including both durable and non-durable goods, was the dominant sector and represented more than 10 percent of all gross state product (GSP). During the 1980s, California experienced a widespread recession, brought about in part by high energy prices and out-migration of businesses; it was exacerbated at the end of the decade by the fallout from the "peace dividend." As Governor Gray Davis noted:

> *The 1990s were both pivotal and paradoxical for California. The decade began with a severe [continued] economic slump and ended with a record-breaking expansion. The end of the Cold War led to significant reductions in federal defense spending—characterized by reduced procurement and base closures. This led to a major downsizing of the state's aerospace industry and reductions in Department of Defense payrolls. To make matters worse, the state was plagued with a series of natural and man-made disasters that further tarnished the Golden State's image. These factors resulted in a much longer and far deeper recession than the rest of the nation.*[36]

As a result, a restructuring of the economic base took place. From 1990 to 2006, manufacturing increased by an amount just over inflation (as measured in current dollars) and fell to about 8.5 percent of GSP. During the same period, information services (software, movies, and data processing) grew from less than two percent to more than five percent of total GSP. Finance and insurance grew from about two percent to almost eight percent.[37] Both information services and finance are inherently less energy intensive than manufacturing, with less than 10 percent the energy intensity of manufacturing processes. However, they typically require much higher levels of power reliability and quality than manufacturing. The demand for information and financial services is also prone to larger annual swings. Other states would be hard pressed to penetrate significantly this global market and replicate California's new structure.[38] Further, while helping maintain California's growth, the information and financial sectors also are subject to a high rate of outsourcing.

Figure 4 shows some of the more significant impacts on employment of the changes to the California economy. Senator Boxer, chair of the Senate Committee on Environment and Public Works, asserts that jobs are created when the economy shifts to low energy or carbon intensity. She and other politicians conveniently forget about jobs lost in other sectors.[39]

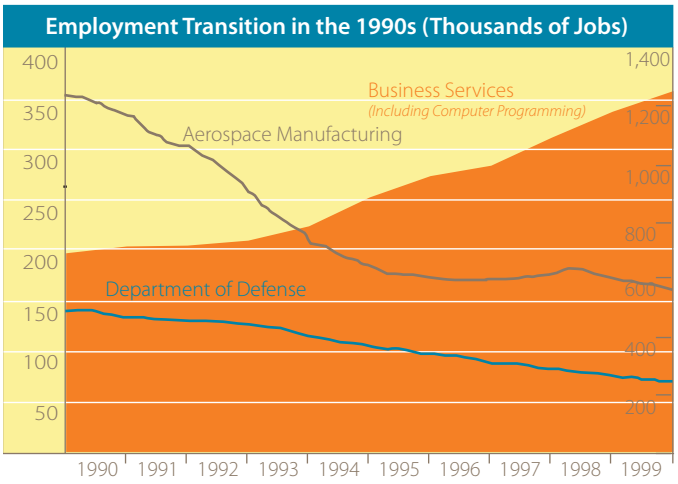

Figure 4[40]

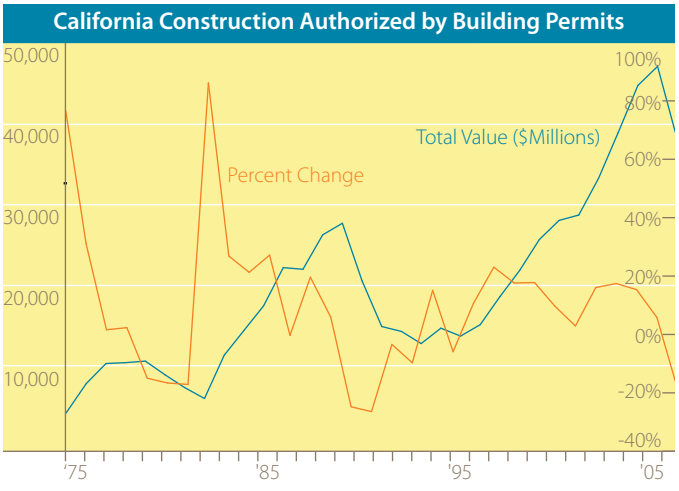

Figure 5

During the same period, residential construction experienced massive swings, as shown in Figure 5.[41] Construction activity is a significant measure of economic vitality. The real-estate market in California somewhat exaggerates any yearly increases, and still the overall performance is not good.

Building and Appliance Standards

Some of the earliest energy policies invoked in California, in the mid-1970s, were efficiency standards for buildings and appliances. Referred to as "Title 24," California's building standards have become increasingly stringent, and they more fully recognize the diversity of building technologies, building practices, and climate zones—of which 16 are recognized in California regulations. Similarly, appliance standards have changed significantly since 1977. A central component of both types of standards is a cost-effectiveness finding that would have different results in other parts of the country.[42] In addition, partly because of relative prices and building and appliance standards, Californians use more natural gas than electricity for water and space heating than people in other parts of the country, or the country as a whole (see Table 4). California also pumps more agricultural water with reciprocating engines fueled by natural gas or liquefied petroleum gas (LPG) than with electric pumps.

Fuel Choice for Major Home Energy Use

	CA	GA	NY	TX	FL	U.S.
Electric Space Heat	18%	50%	14%	58%	83%	31%
Electric Water Heat	14%	52%	28%	43%	83%	40%

Table 4: Various states and the United States as a whole. The majority of non-electric use is natural gas.[43]

Decrease in Average Household Size

The number of people in each home also affects the energy use per capita for residential heating and cooling and other purposes. Overall, major metropolitan areas like Los Angeles have a high number of people per household (PPH), compared with the national average, or with other areas in the state. Los Angeles has a PPH of 3.12, compared with Placer County's 2.5 and a national average of 2.6.[44] Further, more of the housing stock in California than in many other states consists of multi-family homes, such as apartment complexes and condominiums. Given structural differences between apartments and single-family homes, requirements for heating and cooling are further reduced. The trend in housing within California is moving toward a greater share of multifamily housing, and to smaller residences overall.[45] Coupled with this shift is an increase in energy used for transportation, a significant use not addressed in many of the calls to follow California's lead on energy policy. [46]

High Energy Prices—Fallacy of Rates Versus Bills

One of the common arguments for DSM is that total bills are more important than the rate per unit ($/kWh). That is only true for residential and some commercial customers. Worse, in areas with high DSM activity like California, total bills have not decreased or even had only moderate increases. While high bills and rates cannot be entirely attributed to DSM intervention, DSM has contributed significantly to increases in both rates and bills.[47] Average California bills for all customer types have increased 34 percent since 1990. Californians' bills have increased more during this period than bills for residents in 60 percent of all other states.[48] This increase affects residential consumers in a direct fashion, but also indirectly. When bills for commercial and industrial customers are driven higher, economic competitiveness suffers, and this results in a natural increase in business migration and outsourcing.

The high rate paid for electricity in California also imposes downward pressure on usage through natural price effects, although elasticity is hard to determine.

Increases in Electric Bills from 1990–2005

Total Annual Sales/Customer ($)

State	1990	1995	2000	2004	2005	% Change '90–'05
CA	$1,560	$1,679	$1,880	$2,036	$2,085	34%
CT	$1,733	$1,981	$1,894	$2.095	$2,518	45%
TX	$1,827	$1,961	$2,221	$2,514	$2,938	61%
VT	$1,316	$1,547	$1,774	$1,819	$1,852	41%
GA	$1,773	$1,916	$1,928	$1,998	$2,253	27%

Table 5

Unintended Consequences of California Energy Policy

High energy prices have driven some types of business out of California, especially those energy intensive by nature, such as manufacturing. The change in economic structure, with the shift to services, software, and entertainment activity, has left the California economy more subject to boom/bust because these services are dependent on customers' discretionary dollars.[49] As noted, these changes, along with California's building and appliance standards, have also caused a shift from electricity to natural gas where fuel switching is feasible. The structural change in the economy, coupled with demographic shifts, also affects state tax revenues.

If one burrows into the state's storehouse of statistical data, a disturbing pattern emerges on financing government services. A generation ago, the state's two major revenue sources, personal income taxes and sales taxes, were producing almost exactly the same amount of money, around $10 billion each per year. While state sales taxes have climbed to about $30 billion a year since then, income taxes have exploded to $56 billion, nearly twice as much.

Two factors are widening the gap between the two tax types. A very "progressive" income-tax system with narrow brackets puts the biggest burden on high-income residents, boosting revenues faster than overall income rises. Also involved is a flattening of consumer spending on taxable retail goods such as cars, clothing, and appliances. As a portion of personal income, taxable sales have been declining steadily, from more than 50 percent a generation ago to about 40 percent today.

Put another way, since 1981 retail spending subject to taxation has declined from 48 percent of sales to 38 percent. Why? There have been few detailed studies, but the aging of the economically dominant population is a major factor. As people age, they spend less of their income on hard goods and more on non-taxed services and investments. Internet commerce is another, lesser factor.

The relative handful of high-income Californians who pay the vast majority of personal income taxes are, in turn, increasingly dependent on capital gains and other non-salary income. Even the slightest uptick or downturn in the stock market, real estate, or other speculative arenas can generate a rapid increase or decrease in tax revenues, as the past decade has shown on several occasions.

Thin and Absent Supply Reserves

California relies heavily on DSM and other efficiency measures, coupled with other government intervention such as a renewable portfolio standard, a prohibition on new nuclear or coal plants, resistance against new gas-fired facilities, and extremely long lead times for new transmission lines. As a result, the supply of electricity for California is not keeping pace with demand growth. For many years, a central feature of power-plant siting proceedings was the determination of need; now that consideration is often overridden by claims of DSM and energy efficiency. A healthy reserve margin is necessary to protect against grid imbalances caused by a temporary spike in demand, caused in turn by such events as a heat wave or a power-plant breakdown. Today the reserve margin has decreased to only about 10 percent from an average level of about 18 percent in the early 1980s. On many days, especially in summer, operational reserves drop to less than five percent or worse, leading to curtailments and potential rolling blackouts. Price volatility is also closely associated to thin supply.

More Price Volatility

While most retail consumers are isolated from the time-dependent cost of capacity, this price volatility does harm utilities directly and consumers indirectly. Because of demand patterns, which peak during hot afternoons, and greater reliance on inefficient generation, costs during those hours can be five to 10 times those of normal hours. The marginal unit to be dispatched determines the cost for those hours. With a larger reserve margin, the marginal need can be made up by increasing loads on more efficient units, thus reducing the costs and volatility.

Renewable Portfolio Standard

California has a renewable portfolio standard (RPS), which requires utilities to include a certain (and growing) percentage of renewable energy sources in their electricity mix. California is having problems in meeting the standard, including the inability to sign contracts and secure permits. It also remains troublesome to finance, permit, and build transmission to areas with renewable resources. More recently, nationwide demand for some equipment, especially wind turbines, in response to 20 states having enacted similar RPS requirements, has driven prices through the roof and availability through the floor.[50] Partially in response to its difficulty in complying with its self-imposed mandate, California is working with other western states to "trade" renewable energy through WREGIS (Western Renewable Electricity Generation Information System), using tradable credits.

Achieving the RPS goals is an essential component of California's greenhouse-gas (GHG) emission reduction plan. The *2005 Integrated Energy Policy Report* concluded that statewide renewable procurement is not occurring at a pace that will reach RPS goals by 2010. According to CEC analysis, and conventional wisdom, even with increased amounts of energy efficiency and renewables—which will increase total system costs—the state will still fail to meet GHG reduction goals. Increasing renewables to about 30 percent of energy sales would mean system costs of approximately $19 billion, versus more than $16 billion without the change (mandatory 20 percent renewables).

Analysis also shows that the state will fail to meet GHG reductions expected under California Global Warming Solutions Act of 2006 (AB 32). Under the best case modeled, California would emit 80 million tons of CO_2 by 2020. "Even the combination of high energy efficiency and high renewables fails to achieve the general goal established in AB 32 for GHG reduction for all sectors," an addendum to the report stated. "The largely untapped GHG emission reductions associated with existing or named additions of coal generation are not an element of California's carbon emission inventory [i.e., using CCS or IGCC with capture], so that a much more difficult set of choices will be needed in order to achieve the AB 32 overall goal within the electricity sector."[51] Apparently, none of those difficult choices includes revisiting the necessity, cost effectiveness, or even fundamentals of either the RPS or the requirements of AB 32.

Nearly four years after the RPS program went into effect, California has made very little progress in bringing new renewable projects on line. Statewide, renewable energy as a percentage of retail sales increased less than 0.6 percent from 2002 to 2005. Although Investor-Owned Utilities (IOUs) have signed contracts for as much as 3,936 megawatts (MW) of renewable capacity, only 242 new MW are actually on line and delivering energy. Because the RPS statute includes provisions for flexible compliance—with retail sellers given up to three years to make up deficits in current-year RPS targets—the IOUs have argued that they have until 2013 to meet the "20 percent by 2010" goal.[52]

Figure 6 shows the three major IOUs' renewable energy procurement in 2002 (the year before the RPS began) and 2005 (latest available annual data) and compares RPS procurement during the period between the two years as a percentage of sales.

Most renewable advocates claim that RPS and similar mandates will create jobs. It should be noted that approximately 55 percent of the wind turbines installed last year (2006), in response to RPS and heavy federal tax subsidies, were imported. The remaining jobs were temporary.

Much of the push for renewable energy technology development focuses on a new and artificial commodity called "renewable energy credits (RECs)," often traded separately from the actual electricity. RECs encompass "all" beneficial environmental attributes of renewable energy, along with, purportedly, energy security and jobs creation. They are typically normalized to one megawatt hour (MWh) of electrical production. Often claimed to be a market mechanism, RECs are one means of compliance with renewable portfolio standards in 18 of the 26 states

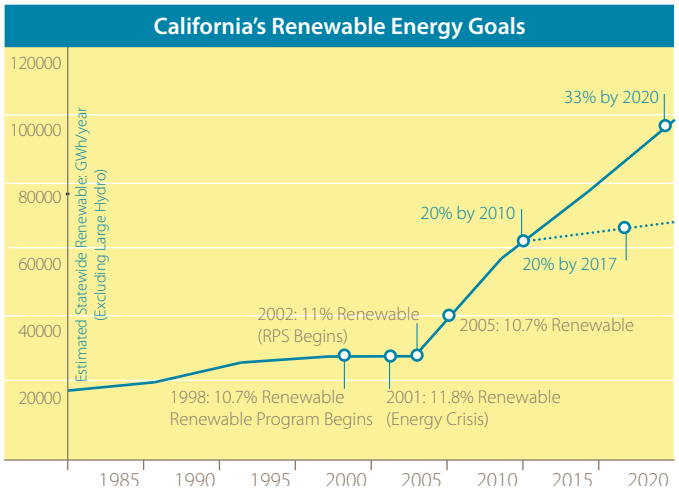

Figure 6

with such requirements, and are specifically encouraged by a number of state and local governments as the answer to the higher costs of renewables.

The problem is that RECs homogenize all renewables and imply that, technologically and individually, they each provide *exactly* the same attributes in terms of type and magnitude. For example, RECs assume biomass projects have the same environmental attributes as wind energy, even though biomass has additional benefits not provided by wind. Biomass may help reduce forest-fire risk, when fueled by timber wastes, or reduce odor when fired with feedlot waste—two specific benefits not provided by wind generation. Thus, a biomass generator is selling a commodity for the same price as a wind-energy generator, even though the value of his REC is different—truly a perverse market signal.

The result is a definite subsidy from those renewables that provide more beneficial attributes to those that provide less, although the subsidy is less obvious than direct government uplifts. This harms those renewable developers actually providing real and quantifiable environmental enhancements. Another less obvious issue is that RECs only transfer the benefits, but not the harms, of the renewable generation to the purchaser. They ignore such environmental jeopardy as bird kills from wind turbines or toxic releases from geothermal facilities.

There is significant controversy associated with the specific attributes within a REC. To illustrate the level of controversy, the CPUC, as part of the implementation of Senate Bill 1078 (which mandated an RPS on California utilities and energy service providers), spent more than a year trying to find an appropriate definition of RECs—what attributes are included and what attributes are not. RECs are increasingly used to comply with RPS statutes and policies and other government-imposed requirements. They are also used to market retail "green" power and, to a growing extent, to assist with renewable energy project financing.

Substituting for electricity generation, renewables "offset" emissions of regulated and unregulated air pollutants from fossil-fuel-fired generation. The amount and type of emissions that are offset vary, depending most on the electric grid into which the power is sold. As should be obvious, emissions offsets in an electric grid dominated by older coal power plants would be significantly different from emissions offsets in a system dominated by natural gas (no SO_2) or hydroelectric (no air emissions) or any number of other system configurations. In addition, the time of electrical production has a significant effect on emissions offsets, since very few grids rely on the same fuel for balancing supply and demand at all hours.

Thus, a renewable source that delivers at night may be offsetting emissions from coal, used typically for base load generation. Meanwhile, a source delivering power during the day, into the same system, may be offsetting natural gas or hydroelectric, used for peaking power. The amount offset also varies over time as new generation systems are added to a grid and existing facilities are upgraded. Estimating the actual amounts and types of emissions offsets requires sophisticated modeling of future system loads, weather, economic and population growth, system conditions, etc.

While difficult, such modeling can be done on an individual system basis. However, it should suffice to note that the type and tonnage of emissions offset from a unit (MWh) of renewable power may vary by two orders of magnitude from one locale to another. A MWh offsetting grid power in, say, the Pacific Northwest offsets primarily hydroelectric power, which has a different emissions profile from natural-gas generation in California, or coal-fired generation in the South. Date and time of day also affect actual emissions offset, since grid operators rely on different generation sources during different periods, and each has a unique emissions profile. Homogenizing trading permits for renewable energy credits presumes perfect knowledge on the part of regulators as to what is offset and when.

Reliance on an artificial commodity assumes that a small cadre of bureaucrats possesses perfect knowledge about the hourly operation of generation sources in real time, the location and timing of offsets, and the actual damages those offsets avoid. It further assumes that regulators have incorrectly set emission level standards.[53]

The values of those tons also vary even more dramatically since the receptors are different from one location to another. Receptors are people breathing the air, plants (including crops), and buildings that require cleaning and experience accelerated deterioration. Prices paid for RECs on a national basis do not reflect the value in those areas that experience or avoid the environmental impacts supposedly valued by the RECs. Figure xx shows recent REC trading prices.

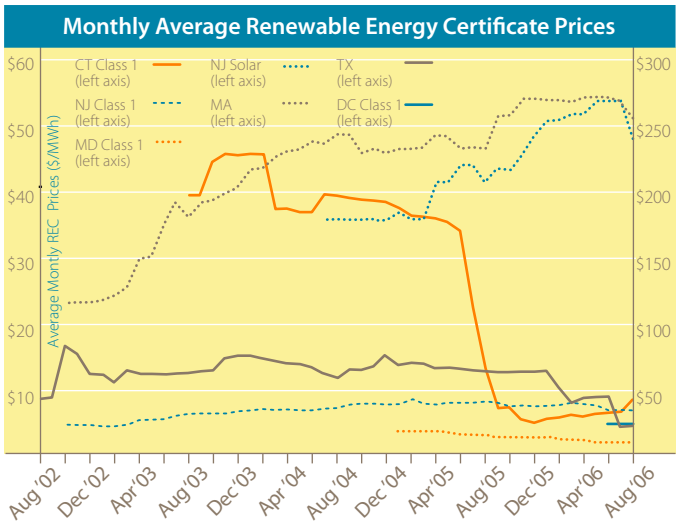

Figure 7
Souce: Evolution Markets, Inc. Data Bank (http://www,evomarkets.com/index.html). Compiled by Lawrence Berkeley National Laboratory. October 2006.

The mandatory importation of equipment from foreign countries also has negative effects. The single largest new source of renewable energy is wind. Currently approximately 55 percent of wind turbines installed in the United States are foreign sourced.

For biomass technologies, the situation is even more contorted. Some types of biomass are considered renewable while others are not, a situation complicated by varying definitions across states. The distinction between qualifying and non-qualifying biomass is often a function of local resources and definitely a function of local pressure groups. Ironically, in many locales biomass residues that would otherwise be considered waste material or burned openly (e.g., tree trimmings, cereal husks, rice straw) do not qualify as a renewable source simply because they are considered "open loop" and are not grown specifically for energy.

National markets for RECs will lead to uneven geographic development of renewable resources, as some regions are better endowed with cost-effective resources than others. Based on modeling of proposed federal RPS legislation, analysts at the U.S. Energy Information Administration (EIA) predict that a national RPS would lead to significant wind development in the Northwest and Midwest, where strong resources make wind power most cost competitive, and significant biomass development in the Southeast and Central states. This prediction did not, however, take account of windy areas to areas of electrical demand. Less well-endowed regions would end up paying for renewable energy development elsewhere in order to achieve compliance, with loss of many of the claimed benefits of renewable development, such as emission offsets. The emissions offset in far regions would not benefit those paying for them.

The single largest new source of renewable energy is wind. Currently approximately 55 percent of wind turbines installed in the United States are foreign sourced.

The creation and trading of RECs will likely lead to worse conditions, with forced transfer of wealth and diminution of energy security, and would further distort emissions trading markets, all for the questionable goal of subsidizing an already too-expensive class of technology. Trading of RECs to comply with renewable portfolio standards will certainly complicate the trading of carbon emissions in California and elsewhere, as carbon emissions are a significant portion of the (ill-defined) renewable energy attributes. Such a program also opens the market to abuse and cheating.

As noted, the creation and trading of RECs distort electricity markets, as those markets have two important components: capacity and energy. Capacity is as important to providing service to customers as is the amount of energy produced. Unfortunately, REC markets unfairly benefit wind to the exclusion of other renewables, several of which are also capable of providing capacity necessary to meet customer loads. Wind plant capacity is often measured in "nameplate" capacity, the maximum rated output of a generator under specific conditions designated by the manufacturer, usually in kilovolt-amperes (kVA) and kilowatts (kW). A nameplate on the generator denotes the output. For grid operations, nameplate capacity must be discounted for weather effects, forced outages, and similar factors. In other words, during periods of high demand only some portion of that nameplate is actually available, which reduces the value of that electricity to the grid.

During the July 2006 heat wave in California, the average capacity available from all wind farms in the California Independent System Operator's control area was approximately four to five percent of nameplate rating. Of over 2000 MW of installed wind capacity in California, only about 100 MW was available when California really needed it.

Low Carbon Fuel Standard

Governor Schwarzenegger has implemented a "Low Carbon Fuel Standard" (LCFS), which seeks to reduce the carbon content of transportation fuels by 10 percent. Under the plan, transportation fuel sold in California will be subject to a ceiling on the amount of carbon it can emit per unit of energy it contains. The limit will take into account the carbon produced throughout the fuel's entire "life cycle," from production to consumption in a car or truck.

The legislature passed AB 32 last year with the aim of reducing CO_2 emissions, and the LCFS is a significant regulatory mechanism to implement AB 32. Though purportedly a market-based mechanism, the LCFS fails the test because buyers of the products are not willing participants. Innovators are harmed when the governor parses the energy market to impose such selective standards. Worse, parsing negatively affects other important sectors of our economy.

One beneficiary of the new standard is ethanol, but there are downsides to that fuel as well:

* *Fuel will be less efficient.* Ethanol contains about 34 percent less energy per gallon than gasoline, so the miles traveled per gallon on ethanol are greatly reduced. This increases the effective price per gallon and the inconvenience of refueling.

* *Fuel will be more expensive.* Ethanol must be transported by truck or rail because it is too corrosive for pipelines. Increased costs of transportation contribute to higher prices at the pump. Equally important, given ethanol's lower energy content and the associated higher consumption, the amount of CO_2 that is reduced is minimal at best.

* *Cost of food will increase.* The California Farm Bureau Federation reported on the squeeze placed on milk producers because of skyrocketing corn prices, driven by the clamor for ethanol. Not only will the governor's proposal increase transportation costs—hurting the poor most—but it will add insult to injury by driving up the costs of producing food, harming our agricultural economy.

* *Energy savings are negligible.* When transportation, refining, and farming costs are factored into the production of ethanol for fuel, the energy savings are negligible. Some researchers, such as David Pimentel of Cornell University, even claim that ethanol requires more energy to produce than it actually contains. Savings likely depend on year-to-year and farm-to-farm crop yields and other case-specific factors. Promoting alternative and renewable fuels will be a critical component of California energy policy; however, creating artificial markets for inefficient sources will only stifle innovation and raise prices.

The governor's proposal tries to overcome some of these issues by having each gallon of fuel separately tracked on a "life cycle" basis. In other words, a gallon of ethanol that was produced locally, in an efficient process, and used in a vehicle with good gas mileage, would be treated differently from a gallon of ethanol that was produced in Iowa with heavy fertilizer and pesticide use and shipped by truck to California. The variety of life-cycle impacts is recognized by the governor's proposal, but the administrative nightmare of calculating and tracking the carbon content of each gallon is not.

Few, if any, of the alternative fuels provide meaningful reduction in GHG emissions compared with traditional sources of transportation fuels.

Researchers are investigating numerous creative ways to increase ethanol yield from per-acre corn production, as well as conversion processes for other cellulose sources, but it will be years until those approaches have been adequately tested and validated. In the meantime we can expect disruptions in our food and fuel supplies.

There are numerous alternative fuels available or being developed that can replace petroleum derivatives for the light- and heavy-duty vehicle market. A disproportionate amount of attention in government incentives and programs and private-sector investment focuses on two fuels in particular: ethanol and biodiesel. This disproportionate attention reduces the development opportunities for other potentially promising fuels.

The taxonomy of alternative fuels can be confusing and contradictory. There are several substitutes for diesel fuel that are derived from biologic sources (cellulose, lignocelluloses, triglycerides, etc.) but that are not called "biodiesel," which is limited to trans-esters.

Vehicle technology that allows multiple fuels, depending on local availability and price (i.e., "flexible fuel"), has seen better, more persistent acceptance by the public than dedicated- or single-fuel applications. This acceptance might be reduced or eliminated if fuel availability and convenience are reduced.

Problems in production and distribution infrastructure development are key impediments to all petroleum derivative substitutes. The petroleum derivative infrastructure has developed over 100 years, and it will likely take a considerable amount of time for alternative systems to develop. Each alternative fuel has infrastructure compatibility issues, stemming from technical questions and chemical/physical properties. A related infrastructure issue is that of maintenance personnel. Flexible-fuel vehicles require special knowledge to maintain and repair. That knowledge is not yet widespread among technicians.

Few, if any, of the alternative fuels provide meaningful reduction in GHG emissions compared with traditional sources of transportation fuels. There are multiple approaches and development paths available for a variety of feedstocks and fuels. For example, cellulose may be converted into ethanol or into direct substitute alkanes, and individual fuels may be made from multiple feedstocks. Hydrogen may be produced electrolytically, or from steam reforming biomass-derived syngas or natural gas.

The LCFS is in fact an ethanol mandate, which constitutes its biggest problem. There are many reasons to believe that ethanol is a promising fuel option, but only if the pitfalls can be overcome. There are also sound reasons to believe that other non-gasoline technologies may be at least as promising as ethanol in the long run. If attention is focused exclusively on one transportation-sector option, continued research and development of other alternatives will suffer.

Policies that address fuel needs are important, but lawmakers and regulators should not be in the business of selecting some technologies and excluding others. When one considers the wide array of interconnected systems, it is unwise to mandate certain technologies, which may or may not prove to be the best. The LCSF assumes that a small cadre of bureaucrats possesses perfect knowledge about the source and usage requirements of each gallon of fuel and its inherent value to the user.

Greenhouse Gases and AB 32

California has set climate policy goals to reduce GHG emissions by 80 percent by 2050. The California Global Warming Solutions Act of 2006 (AB 32) mandates reductions in future California GHG emissions; specifically, GHG levels in 2020 must match those from 1990. EPRI estimated the impacts of these policies using advanced, widely accepted economic models. According to the Electric Power Research Institute (EPRI), there will be significant costs to the state, and costs will increase as future GHG emissions decrease. Additionally, cumulative real costs to the California economy could range from $100 billion to $511 billion through 2050, according to EPRI.[54] The role of out-of-state electricity generation is important, since there is the potential for increased GHG emissions from nearby states.

Policies that combine market-oriented abatement incentives with increased technological innovation are the most cost-effective. For a market-oriented emission-control policy, marginal abatement costs increase with the stringency of the emission reduction targets. Costs increase more rapidly over time than do annual emission reductions.

Therefore, the long-term cost would be the equivalent of nearly two-thirds of one year's median income to every household in California.

These policies, whose key aspects remain unclear, will entail large costs to the California economy, in terms of reductions in economic welfare, consumption, and GSP. The cost of meeting the 2020 emission reduction goal could range from $104 billion to $367 billion of reduced consumption (discounted present value through 2050).

Regulating emissions associated with electricity imports entails a trade-off between leakage of emissions and higher abatement costs. "Leakage" refers to California climate policies that reduce in-state GHG emissions while increasing out-of-state emissions. The policy being developed assumes that California utilities could shift long-term contracts for electricity supply from outside California, although such shifts could potentially result in significant leakage. Under such contract "shuffling," coal plants in other states could continue to operate at full capacity by selling in other markets, while hydro and other renewable resources are contracted to sell power to California. Because of contract shuffling, for every ton of emission reduction from the electricity sector in California, there could be an increase of 0.85 tons of electricity-sector emissions from the rest of the western states.

Regulatory efforts to prevent such contract shuffling could significantly increase costs to California ratepayers. Uncertainties about the future course of California's climate policy will affect consumer behavior, business R&D spending, and investments in capital assets. Failure to resolve these issues leaves firms and households uncertain even about relatively near-term investment decisions. Investors faced with this situation may defer decisions until future regulatory policy becomes clear, and this may result in inadequate investment—in particular, in future California electricity supply. Thus, these policies could lead to future electricity shortages in California.

The average long-term cost, through 2020, of this policy would be about $31,900 to every California household. Median California household income is about $50,000. Therefore, the long-term cost would be the equivalent of nearly two-thirds of one year's median income to every household in California.

The costs to blacks and Hispanics in California would be even more severe. Median household income for blacks in California is about $35,000. Therefore, the long-term cost would be the equivalent of more than 90 percent of one year's median income to every black household in California. Median Hispanic household income is about $36,500.

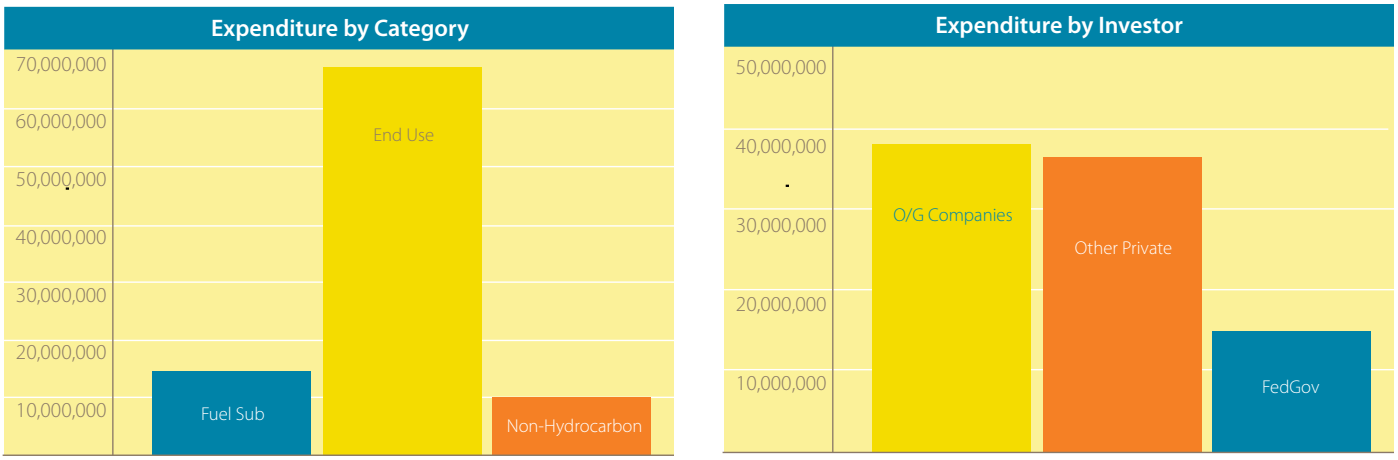

Figure 8 Investments in GHG-Emission-Reducing Technologies In North America 2000–2006

Therefore, the long-term cost would be the equivalent of 87 percent of one year's median income to every Hispanic household. Blacks account for seven percent of the population and Hispanics 35 percent.

In fact, the impact on these households will be even more severe than these data indicate. The energy and energy-induced price increases resulting from these policies would be regressive, in that poorer households would bear a larger burden relative to their income than wealthier households. Indeed, as confirmed in a recent U.S. Congressional Budget Office study, the economic effects of the type of policy that California is implementing are almost perfectly regressive. At every level of income the percentage increase in household costs is higher for less wealthy households, and the relative impact on the lowest income quintile is twice as great as on the highest. And even this understates the economic impact, since wealthier individuals have more discretionary income. A $50 increase in monthly energy bills is more harmful to a family with an annual income of $30,000 than a $100 increase to a family with an annual income of $150,000.

According to a Management Information Service report based on analysis of data from the Congressional Budget Office, most of the costs of California's GHG reduction policies would be borne by consumers, who would face persistently higher energy and energy-induced prices. "The price increases would be regressive in that poorer households—disproportionately Black and Hispanic—would bear a larger burden relative to their income than would wealthier households."[55]

Government intervention is especially troublesome when the free market is making significant progress on an issue like GHG emissions. The main GHG is CO_2, and its major source is the combustion of fossil fuels to supply energy. Emissions can be reduced by a variety of measures, such as improving energy efficiency and developing alternative energy sources, like wind and solar power. However, a rapid move away from fossil fuels is unlikely since energy supply infrastructure has a long lifetime and such a move could significantly harm economies. Another way to reduce emissions is to capture the CO released from fossil-fuel–fired power plants and store it underground. Carbon capture and sequestration (CCS) is the focus of significant attention, as power generation accounts for about one-third of CO_2 emissions from fossil-fuel use. On other fronts, companies are reducing natural-gas flaring to cut emissions, while also adding to energy supplies.

A $50 increase in monthly energy bills is more harmful to a family with an annual income of $30,000 than a $100 increase to a family with an annual income of $150,000.

Most of the investments have benefits beyond reducing GHG emissions. They typically increase energy supplies, improve efficiency, or diversify energy supplies. From 2000 through 2006, U.S. oil and gas companies invested $38 billion in energy technologies in the North American market[56] (Figure 8) that have lower GHG emissions.[57] This expenditure is 42 percent of the estimated total of $91 billion spent by U.S. companies and the federal government. Of

the industry investments, $34 billion (94 percent of the $38 billion total) were directed toward efficiency, fuel diversification, and reduced methane flaring.

In addition to U.S. oil and gas interests, the motor-vehicle, agricultural, electric utility, and renewable-fuel industries made significant technology investments. They are estimated to have invested $37 billion (or 41 percent of the $91 billion total technology investments) from 2000 to 2006. Of the $37 billion, $20 billion (54 percent) is associated with end-use technologies and $12 billion (32 percent) with non-hydrocarbons. Likewise, the federal government is estimated to have invested $15 billion (16 percent of the $91 billion total) from 2000 to 2006 through the Climate Change Technology Program. While the level of investment is low relative to the private sector, government seed-money investments, particularly at the basic research stage, can leverage billions of dollars of later private investment. We did not include federal tax transfers in the form of credits and similar techniques, or international assistance.

The Energy Information Administration (EIA) reported on May 23, 2007, that CO_2 emissions in the United States had dropped by nearly 100 million tons in 2006 compared with 2005.

The preponderance of investments in improved efficiency (accounting for 41 percent of the $91 billion total) reflects a continuing primary role for oil, gas, and coal in the energy mix over the next decades. All major forecasts of U.S. and global energy supply, including outlooks developed for the United States by the Energy Information Administration (U.S. Department of Energy) and for the world by the International Energy Agency (Organisation for Economic Co-Operation and Development), continue to place carbon-based fuels in the forefront for supplying the world's energy needs. However, even given this preponderance, there is substantial activity in fuel substitution and non-hydrocarbon technologies. These applications will play a growing and important role in the future, an energy cornucopia that promises a new chapter in the history of the energy industry. Similarly, today's investments in enabling technologies promise expanded flexibilities in meeting the future's need to supply humanity with cost-effective and clean power and energy.

California legislators and policy makers seem bent on following Europe, but that parade seems headed for a questionable destination. Weekly announcements of agreements between California and Europe, and others, on international trade, increased mandates and subsidies for alternatives, and faux-markets go hand in hand with lawsuits against the federal government. These artificial mechanisms are supposedly justified by the federal government's "failure to act." However, Washington has indeed taken actions and implemented policies that work better than Europe's mix of statist programs.

The Energy Information Administration (EIA) reported on May 23, 2007, that CO_2 emissions in the United States had dropped by nearly 100 million tons in 2006 compared with 2005. This was during a time of significant economic growth, coupled with a mild winter. This reduction was the largest decline in carbon intensity—the amount of emissions related to economic growth—since 1990.

Further, 2006 continued a two-decade trend toward emissions stabilization for the United States, now at a rate of less than one half percent growth per year. While the United States is often criticized for being the world's largest emitter of CO_2, it is also the largest contributor to the world's wealth, producing about 28 percent of the world's goods and services. Our carbon intensity continues to improve.

The European Union (EU) has attempted to reduce GHG emissions through a complex web of mandates, subsidies, regulations, and cap-and-trade programs imposed on member countries and residents. Growth in emissions in EU countries has increased faster and farther than the United States, as reported by the EIA. The growth in EU emissions would likely have been much greater had trading of emissions from coal-dominated Poland and East Germany not occurred, which ironically did not reduce emissions.

In both the United States and the EU, emissions have increased compared with 1990 levels, but the EU is increasing emissions three times more rapidly than the United States. California would do best for its citizens by putting aside the heavy hand of government and following the more results-oriented lead of the U.S. government.

Toward a High-Energy Future for the Golden State

Californians seldom think of their state as a major energy source but it is, ranking fourth among states in oil production. Yet, as we have noted, politicians and policy makers have placed vast oil reserves off limits. California is also a major consumer of energy, but state leaders are not taking effective steps to meet energy needs. Though blessed with entrepreneurs and inventors, in addition to natural resources, California tilts to government intervention in energy markets, a trend harmful to consumers and the economy, and often with little benefit to the environment.

As this survey has noted, taxes wield considerable effect on consumption, not always for the greater good. Mandated conservation, likewise, has proved a disappointment. California's investment in alternative energy, though of noble intentions, has failed to deliver, leaving the state in need of an alternative policy. DSM programs have not performed as intended, and negative consequences are looming from the GHG emission restrictions, the low carbon fuel standard, and the renewable portfolio standard. These unintended consequences involve billions of dollars and threaten reliable and affordable energy in the Golden State.

After thirty years of increasingly heavy-handed government regulation, with little to show for it, the time has come for California to consider seriously the approach of free-market environmentalism and protection of property rights.[58] California should strive to increase energy supply options, rather than limiting them to fads favored by regulators and interest groups.

California should strive to increase energy supply options, rather than limiting them to fads favored by regulators and interest groups.

The automobile remains a mainstay of life in California, a reality that demands an assessment of our considerable oil reserves. Leaders should find a way to make these reserves work for a population now pushing 40 million. The time has come to revisit exploration and development of crude oil and natural gas, both on-shore and off-shore. State leaders should also authorize construction of at least one new oil refinery. Current technology would make such a refinery more efficient and reliable than the old facilities on which we currently depend. Increased refinery capacity would also create jobs and set an example for the rest of the nation.

Legislators should eliminate overlapping energy agencies and normalize tax preferences and subsidies across technologies. The state would benefit by making actual performance criteria the focus, not the specific technology itself. These key reforms, long overdue, will restore stability to the energy market, keep business and consumers in the state, and lessen the prospect of blackouts. State leaders should seize the opportunity to make California a leader in a field vital to its future and that of the nation.

Appendix A

Federal Tax Incentives for Alternative Fuel

Biodiesel and Ethanol (VEETC) Tax Credit

The American Jobs Creation Act of 2004 (Public Law 108-357) created tax incentives for biodiesel fuels and extended the tax credit for fuel ethanol through 2009. The biodiesel credit became available to blenders/retailers beginning in January 2005.

It also established the Volumetric Ethanol Excise Tax Credit (VEETC), which provides ethanol blenders/retailers with $0.51 per pure gallon of ethanol blended or $0.0051 per percentage point of ethanol blended (i.e., E10 is eligible for $0.051/gal; E85 is eligible for $0.4335/gal). The incentive is available until 2010.

Section 1344 of the Energy Policy Act of 2005 extended the tax credit for biodiesel producers through 2008. The credits are $0.51 per gallon of ethanol at 190 proof or greater, $1.00 per gallon of agri-biodiesel, and $0.50 per gallon of waste-grease biodiesel. If the fuel is used in a mixture, the credit amounts to $0.0051 per percentage point ethanol, $0.01 per percentage point of agri-biodiesel used, or $0.0050 per percentage point of waste-grease biodiesel (i.e., E100 is eligible for $0.51 per gallon)

Electric Vehicle Tax Credit

A tax credit for the purchase of qualified electric vehicles is provided under Section 179A of the Energy Policy Act of 1992; it was extended through 2007 by the Working Families Tax Relief Act of 2004. IRS Form 8834 can be used to calculate the credit for qualified electric vehicles placed in service. The credit amount equals 10 percent of the cost of the vehicle, up to $4,000. This credit is scheduled to expire in 2007. To qualify for the credit, the vehicle must be powered primarily by an electric motor drawing current from batteries or other portable sources of electricity. All dedicated, plug-in-only electric vehicles qualify for the tax credit, available for business or personal vehicles. A tax deduction of up to $100,000 per location is available for qualified electric vehicle recharging property used in a trade or business.

Small Agri-Biodiesel Producer Credit

Section 1345 of the Energy Policy Act of 2005 allows a tax credit of $0.10 per gallon to small agri-biodiesel producers for up to 15 million gallons. To be eligible, a producer must make less than 60 million gallons of biodiesel per year.

Energy Policy Act of 1992

Congress passed the Energy Policy Act of 1992 (EPAct) on October 24, 1992, with the goals of enhancing our nation's energy security and improving environmental quality. The Act addresses all aspects of energy supply and demand, from common forms of energy such as coal, oil, and nuclear power to alternative fuels; it also addresses energy efficiency. Through EPAct, the U.S. Department of Energy (DOE) aims to decrease the nation's dependence on foreign oil and increase energy security by encouraging the use of domestically produced alternative fuels. DOE's overall mission is to replace 30 percent of petroleum-based motor fuels by the year 2010. EPAct helps DOE achieve this goal by mandating that federal, state, and alternative-fuel-provider fleets purchase alternative-fuel vehicles.

On August 8, 2005, EPAct was amended to include several new provisions, which are noted in the table.

Alternative Compliance for State and Alternative Fuel Provider Fleets: Section 703 of EPAct of 2005 expanded compliance options under EPAct of 1992 by allowing fleets to choose a petroleum reduction path in lieu of acquiring Alternative Fuel Vehicles (AFVs). Interested fleets must obtain a waiver from the U.S. DOE. To receive a waiver, fleets must prove to DOE that they will achieve petroleum reductions equivalent to their AFVs running on alternative fuels 100 percent of the time.

- 125%–149%: $400
- 150% –174%: $800
- 175%–199%: $1,200
- 200%–224%: $1,600
- 225%–249%: $2,000
- 250%+: $2,400

The conservation credit increases the fuel economy credit based on the following lifetime fuel savings:

- 1,200–1,799 gal: $250
- 1,800–2,399 gal: $500
- 2,400–2,999 gal: $750
- 3,000 gal+: $1,000

Tier 11 emission standards break down into numbered "bins" from Bin 1, the cleanest, to Bin 11, the dirtiest. To qualify for the credits, the vehicles must meet at least Bin 5 standards if they are up to 6,000 lb Gross Vehicle Weight Rating (GVWR), or Bin 8 standards if the vehicles are 6,001 lb–8,500 lb GVWR.

Heavy-duty hybrid vehicles are subject to the following incremental cost limitations:

- 14,001 GVWR: $7,500
- 14,001–26,000 GVWR: $15,000
- 26,001+ GVWR: $30,00

This tax credit replaces the tax deduction previously available to purchasers under the Clean Fuel Vehicle Property guidance. This tax credit expires December 31, 2010.

Fuel Cell Motor Vehicle Credit: Section 1341 of the Energy Policy Act of 2005 provides a base tax credit of $8,000 for the purchaser of light-duty fuel-cell vehicles (8,501 lb GVWR). The $8,000 credit is valid until December 31, 2009. After that, the credit is $4,000. To qualify, the vehicles must meet at least Bin 5 Tier II emission levels.

Base tax credits are also available for medium- and heavy-duty fuel-cell vehicles. The Internal Revenue Service (IRS) will determine the credit amount based on a sliding scale by vehicle weight. The credit is available until December 31, 2014. For tax-exempt entities, the credit can be passed back to the vehicle seller.

Alternative Fuel Infrastructure Tax Credit: Section 1342 of the Energy Policy Act of 2005 provides a tax credit equal to 30 percent of the cost of alternative refueling property, up to $30,000 for business property. Qualifying alternative fuels are natural gas, propane, hydrogen, E85, or biodiesel mixtures of B20 or more. Buyers of residential refueling equipment can receive a tax credit for $1,000. For non-tax-paying entities, the credit can be passed back to the equipment seller. The credit is effective on equipment put into service after December 31, 2005. It expires December 31, 2009 (hydrogen property credit expires in 2014). This legislation also extends the Tax Deduction Timeline that was established by EPAct 1992, Section 179, and extended by the Working Families Tax Relief Act of 2004.

In May 2006, the IRS published Form 8911, which provides a mechanism to claim the infrastructure tax credit. Owners who install qualified refueling property on multiple sites can utilize the credit for each property.

Small Ethanol Producer Credit: Section 1347 of the Energy Policy Act of 2005 changes the definition of a "small ethanol producer" to include a production capacity of up to 60 million gallons, instead of the up to 30 million gallons originally established by Congress in 1990.

Energy Policy Act of 2005

The Energy Policy Act of 2005 (EPAct), signed into law on August 8, 2005, offers consumers and businesses federal tax credits beginning in January 2006 for purchasing fuel-efficient hybrid-electric vehicles and energy-efficient appliances and products. Most of these tax credits remain in effect through 2007. Some consumers will also be eligible for utility or state rebates, as well as state tax incentives for energy-efficient homes, vehicles, and equipment.

Alternative Motor Vehicle Credit: Section 1341 of the Energy Policy Act of 2005 provides a tax credit to buyers of new vehicles placed in service as alternative-fuel vehicles after January 1, 2006. The legislation provides for a tax credit equal to 50 percent of the incremental cost of the vehicle, plus an additional 30 percent of the incremental cost for vehicles with near-zero emissions (Super ultra low emissions vehicle (SULEV) or Bin 2 for vehicles 14,001 lb GVWR). The IRS has issued two notices to establish rules for manufacturers and qualified vehicle buyers to claim the credit.

The credit is available on the purchase of light-, medium-, and heavy-duty vehicles and fuel-cell, hybrid, and dedicated natural-gas, propane, and hydrogen vehicles. Light-duty lean-burn diesel vehicles are also eligible. The tax credit is capped based on vehicle weight as follows:

- $5,000: 8,500 GVWR or lighter
- $10,000: 8,501–14,000 GVWR
- $25,000: 14,001–26,000 GVWR
- $40,000: 26,001 GVWR and heavier

For non-tax-paying entities, the credit can be passed back to the vehicle seller. The tax credit can be applied to vehicle purchases made after December 31, 2005. The credit expires December 31, 2010.

IRS *Notice 2006-9*, issued in January 2006, establishes procedures for manufacturers to certify to the IRS that a vehicle meets requirements to claim the credit and the amount of the credit for which the vehicle is eligible.

IRS *Notice 2006-54*, issued in June 2006, extends the Qualified Alternative Fuel Motor Vehicle (QAFMV) tax credit to vehicle conversions. This IRS notice states that new or used vehicles placed in service as alternative-fuel vehicles after January 1, 2006, qualify for the tax credit when the conversion system manufacturer has received a certificate of conformity from the EPA or California Air Resources Board. This notice also establishes that manufacturers (conversion system installers) must provide certification to the IRS that a vehicle is eligible for a tax credit. The IRS must then provide the manufacturer with acknowledgement that a vehicle qualifies for the credit. The credit is taken by the buyer of a vehicle, and IRS Form 8910 should be used to claim the credit. The credit cannot be sold or transferred but can be carried forward by the seller for use in later years. This legislation replaces the Clean Fuel Vehicle Property Tax Deduction previously available to purchasers.

Further, the DOT/FTA (Federal Transit Authority) provides incentives to transit districts (as defined) for the purchase of alternative-fuel vehicles.

Appendix B

California Executive Order

Low Carbon Fuel Standard

EXECUTIVE ORDER S-01-07

WHEREAS *greenhouse gas ("GHG") emissions pose a serious threat to the health of California's citizens and the quality of the environment; and*

WHEREAS *California's transportation sector is the leading source of GHG emissions in the state, contributing over 40 percent of the state's annual GHG emissions; and*

WHEREAS *Assembly Bill 32 (Chapter 488, Statutes of 2006) requires a cap on GHG emissions by 2020, mandatory emissions reporting, identification of discrete early action measures, achievement of the maximum technologically feasible and cost-effective emission reductions from sources, and authorizes the development of a market-based compliance program; and*

WHEREAS *California is almost entirely dependent on one energy source for its transportation economy, relying on petroleum-based fuels to meet 96 percent of its transportation needs; and*

WHEREAS *there were more than 24 million motor vehicles registered in California in 2005 which is more than one per licensed driver; statewide gasoline consumption was almost 16 billion gallons in 2005 which is second only to the United States and slightly more than that of Japan (a country with four times the population); and there are only 80,000 hybrids and 240,000 flex-fuel vehicles on our roads today, together composing only 1.3% of all cars in California; and*

WHEREAS *California's dependence on a single type of transportation fuel whose price is highly volatile imperils our economic security, endangers our jobs, and jeopardizes our industries; and*

WHEREAS *diversification of the sources of transportation fuel will help protect our jobs and economy from the consequences of oil price shocks; and*

WHEREAS *alternative fuels can provide economic development opportunities and reduce emissions of greenhouse gases, criteria pollutants, and toxic air contaminants.*

NOW, THEREFORE, I, ARNOLD SCHWARZENEGGER, *Governor of the State of California, by virtue of the power invested in me by the Constitution and statutes of the State of California, do hereby order effective immediately:*

1. *That a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020 ("2020 Target").*

2. *That a Low Carbon Fuel Standard ("LCFS") for transportation fuels be established for California.*

3. *The Air Resources Board ("ARB") shall determine if an LCFS can be adopted as a discrete early action measure pursuant to AB 32, and, if so, shall consider the adoption of a LCFS on the list of early action measures required to be identified by June 30, 2007, pursuant to Heath and Safety Code section 38560.5.*

4. *The LCFS shall apply to all refiners, blenders, producers or importers ("Providers") of transportation fuels in California, shall be measured on a full fuels cycle basis, and may be met through market-based methods by which Providers exceeding the performance required by a LCFS shall receive credits that may be applied to future obligations or traded to Providers not meeting the LCFS.*

5. The process for meeting the 2020 Target shall be as follows:

A. The Secretary of the California Environmental Protection Agency ("Secretary") shall coordinate activities between the University of California, the California Energy Commission ("CEC"), and other agencies as required to develop and propose by June 30, 2007, a draft compliance schedule to meet the 2020 Target.

B. The CEC shall incorporate as appropriate the LCFS draft compliance schedule into the State Alternative Fuels Plan ("SAFP") per AB 1007 (Chapter 371, Statutes of 2005), and upon adoption shall submit the SAFP to the ARB for consideration.

C. Upon submission of the SAFP, the ARB shall consider initiating a regulatory proceeding to establish and implement the LCFS.

6. The Public Utilities Commission, in the implementation of the GHG emissions cap adopted by Decision 06-02-032, is requested to examine and address how the investor-owned utilities can contribute to reductions in GHGs in the transportation sector.

7. The Secretary for Environmental Protection shall report to the Governor and the State Legislature by January 2008 and biannually thereafter on progress made toward meeting the 2020 Target.

This Order is not intended to, and does not, create any rights or benefits, substantive or procedural, enforceable at law or in equity, against the State of California, its departments, agencies, or other entities, its officers or employees, or any other person.

***I FURTHER DIRECT** that as soon as hereafter possible, this Order shall be filed with the Office of the Secretary of State and that widespread publicity and notice be given to this Order.*

Endnotes

[1] Francisco Vara-Orta, Ari B. Bloomekatz, and David Pierson (*Los Angeles Times* reporters), "16 Die in South State Heat," *Sacramento Bee*, September 5, 2007.

[2] Lance Izumi, *Lights Out: California's Electricity Debacle—Causes and Cures*, Pacific Research Institute, May 1, 2001. http://liberty.pacificresearch.org/publications/id.370/pub_detail.asp

[3] California Department of Finance, Demographic Research Unit; http://www.dof.ca.gov

[4] http://www.dof.ca.gov/HTML/FS_DATA/LatestEconData/documents/BBRANK.XLS

[5] Derived from California Department of Finance, Demographic Research Unit; http://www.dof.ca.gov

[6] California Department of Finance, *They Moved and Went Where: California's Migration Flow, 1995-2000* (Sacramento, June 2007). It would be interesting to correlate the level of economic and political freedom in the locations where immigrants to California from other countries originated, with the relative freedom in California and other states.

[7] U.S. Bureau of Economic Analysis.

[8] U.S. Department of Energy, Residential Energy Consumption Survey, 2005.

[9] California State Board of Equalization data for 2004. Taxable gasoline figures amounted to an average of 43.5 million gallons per day, while taxable diesel-fuel sales figures have been adjusted upward to reflect an estimated 22 percent distribution of exempt and refund diesel sales that are excluded from taxable gallons.

[10] http://www.mms.gov/offshore/Resources.htm

[11] Environmental concerns have been at the center of debates limiting offshore exploration and development, even though according to the Mineral Management Service less than one percent of oil found floating in the ocean is due to exploration and development.

[12] Steve Hayward, *Index of Leading Environmental Indicators 2006* (San Francisco: Pacific Research Institute, 2006), p.47.

[13] Warren-Alquist Act; Public Resources Code, Division 15, Section 25000 et.seq.

[14] http://www.lhc.ca.gov/lhcdir/139/energy.html

[15] Christopher Weare, *The California Electricity Crisis: Causes and Policy Options*, Public Policy Institute of California, 2003.

[16] See Benjamin Zycher, *Power to the People: An Economic Analysis of California's Energy Crisis and Its Lessons for Legislators*, Pacific Research Institute, 2002. http://liberty.pacificresearch.org/publications/id.3268/pub_detail.asp

[17] In particular, the rules prohibiting long-term contracts created increased sensitivity to minor changes in spot prices, and the second-price auction, also required by regulations, meant that even well-behaved generators got paid the prices set by manipulators.

[18] *What Can Be Learned from California's Electricity Crisis?* Research Brief, Public Policy Institute of California, Issue 66, January 2003.

[19] See, e.g., *California Electricity Situation*, Energy Information Administration, U.S. Department of Energy, available at http://www.eia.doe.gov/cneaf/electricity/; and Weare, *The California Electricity Crisis: Causes and Policy Options*, Public Policy Institute of California, 2003.

[20] Little Hoover Commission, *A Study of the Organization and Coordination of Electric Energy Planning and Electric Utility Regulation in California*, February 1984.

[21] *Reorganizing California's Energy-Related Activities*, Legislative Analyst's Office, 2002–2003 Budget Bill: Perspectives and Issues.

[22] *California's Energy Future: A Framework for an Integrated Power Policy*, Bay Area Economic Forum, November 2002.

[23] *Coordinating State Agency Representation Before the Federal Energy Regulatory Commission*, Analysis of the 2003–04 Budget Bill, Legislative Analyst's Office.

[24] David R. Baker, "Sen. Boxer In Silicon Valley to Emphasize Conservation," *San Francisco Chronicle*, August 15, 2007; M. Horowitz, "Changes in Electricity Demand in the United States from the 1970s to 2003," *The Energy Journal*, V. 28, Number 3, pp. 93–107.

[25] Joseph Romm, "OnPoint" broadcast http://www.eenewss.net/tv/video_guide/531 01/16/2007 discussing his book *Hell or High Water*. Unfortunately, Mr. Romm completely mischaracterizes the reasons for California's energy-intensity trends.

[26] Horowitz, "Changes in Electricity Demand in the United States from the 1970s to 2003," *The Energy Journal*, V./ 28, Number 3, 2007 pp. 93-107.

[27] Maggie Eldridge, Bill Prindle, Dan York, and Steve Nadel, *The State Energy Efficiency Scorecard for 2006*, Report Number E075, American Council for an Energy-Efficient Economy, June 2007.

[28] What is DSM? DSM programs provide cross subsidies to consumers to install or use more efficient appliances—ones that some consumers would use naturally, without the subsidies. Free ridership and inflated costs are endemic to most DSM programs. For example, one DSM program proposes to give away 200,000 compact fluorescent light bulbs for an estimated cost to ratepayers of $700,000. That is $3.50 apiece. A six-pack of these light bulbs at Lowe's or Home Depot costs $9.96, or $1.67 apiece. If a consumer has $20 to spend on energy efficiency, he can get 12 light bulbs on his own. If that $20 is taken from the consumer in inflated power bills, it will only put about six light bulbs in place. The program's high overhead eats up half the conservation money. Taking that money away from consumers and spending it in such a wasteful manner reduces the ability of individuals to conserve or make more attractive investments.

[29] See, e.g., Docket No. 17687-U: Georgia Power Company's Application for Approval of its 2004 IRP, before the Georgia Public Service Commission, and Direct Filed Testimony of Resource Supply Management.

[30] http://www.latimes.com/business/la-fi-energy10aug10,1,3143392.story?coll=la-headlines-business

[31] http://www.cpuc.ca.gov/static/energy/care.htm

[32] http://www.cpuc.ca.gov/static/energy/liee.htm

[33] "Snap back" usually does not completely offset efficiency gains, but does significantly reduce them compared to a straight engineering analysis.

[34] U.S. Department of Commerce National Oceanic and Atmospheric Administration National Environmental Satellite, Data, and Information Service Historical Climatology Series 5-1, November 2006.

[35] California Department of Finance, *They Moved and Went Where*. The migration to hotter, drier inland climates also increases the importance of electrical capacity (MW) compared to electrical energy (MWh) yet most policy focus, such as California's renewable portfolio standard (RPS,) reduces capacity expansion at the altar of high energy prices.

[36] Gray Davis, *Economic Report of the Governor 2000*, p. 42.

[37] U.S. Department of Commerce, Bureau of Economic Analysis, http://www.bea.doc.gov

[38] Of course if they did, California's economy would likely shift back to manufacturing of durable goods, with an associated jump in energy use.

[39] Baker, "Sen. Boxer in Silicon Valley to Emphasize Conservation."

[42] Gray Davis, *Economic Report of the Governor 2000*.

[41] Construction Industry Research Board (Security Pacific through 1986), seasonally adjusted by the California Department of Finance.

[42] It is interesting to note that in some specific climate zones within California, early versions of the building standards led to issues with moisture control, due to high levels of envelope insulation and air infiltration control, which caused premature rotting of wood in walls and ceilings. Other areas of the country have different climates and different energy prices, and many requirements contained in California's standards would not pass a cost-effectiveness test in those areas.

[43] U.S. Department of Energy, Residential Energy Consumption Survey, 2001

[44] State data from California Department of Finance, Demographic Research Unit http://www.dof.ca.gov; national data from U.S. Census Bureau, Current Population Survey, 2006, Annual Social and Economic Supplement, Internet Release Date: March 27, 2007.

[45] U.S. Department of Energy, Residential Energy Consumption Survey, 2005.

[46] Sidebar reference: William Fulton, "Trading places: As the affluent go downtown, the working poor are tripling up to buy homes in the 'burbs," Los Angeles Times, July 29, 2007.

[47] Derived from EIA Electric Power Annual 2005 State Data Tables.

[48] Derived from http://www.eia.doe.gov/cneaf/electricity/esr/esr_tabs.html

[49] Construction Industry Research Board, (Security Pacific through 1986), seasonally adjusted by the California Department of Finance; updated May 31, 2007.

[50] The price of wind turbines has increased approximately 125 percent in the past year, if one can find them for sale.

[51] *Economic Analysis of California Climate Initiatives: An Integrated Approach*, Electric Power Research Institute, June 2007.

[52] California Public Utilities Commission, Opinion on Reporting and Compliance Methodology for Renewable Portfolio Standard Program, D.06-10-050, October 19, 2006.

[53] Offset emissions claimed by renewable generation affect only what may be termed "residual" emissions. Residual emissions are those emissions remaining after a power plant complies with regulatory standards. Those standards are ostensibly set to protect public health and safety; hence any "residual" should have little to zero negative effect on public health and safety and consequently little additional value. When RECs are required, the effective value of those residual emissions is greatly inflated.

[54] *Economic Analysis of California Climate Initiatives: An Integrated Approach*. Electric Power Research Institute, June 2007.

[55] Management Information Services, Inc., *Summary and Implications of the EPRI Report Economic Analysis of California Climate Initiatives: An Integrated Approach, June 2007*; U.S. Congressional Budget Office, "Trade-Offs In Allocating Allowances for CO_2 Emissions" April 25, 2007.

[56] "North American market" is used herein to include Canada and the U.S.

[57] Institute for Energy Research and University of Texas, *Greenhouse Gas Emission Reduction Investments by Energy Firms*, Other Industry and Federal Government; forthcoming.

[58] In 1991, Terry Anderson and Donald Leal released Free Market Environmentalism (San Francisco: Pacific Research Institute, 1992). Their thesis, that free markets could protect the environment as well as or better than government if property-rights institutions were in place, challenged conventional thinking. In the past, environmental policy had always been viewed as an example of market failure. Anderson and Leal claimed that this was not the case and offered alternatives to prove it. *Free Market Environmentalism* has been used in curricula at Stanford, Harvard, and other universities.

About the Author

Thomas Tanton
Fellow in Environmental Studies

Tom Tanton is a Vice President and Senior Fellow with the Institute for Energy Research, joining the group in 1997. Mr. Tanton has 35 years direct and responsible experience in energy technology and economic evaluations. Mr. Tanton is a strong proponent of free market environmentalism and consumer choice, and frequently publishes and speaks against alarmist and reactionary policies and government failures. As the General Manager at EPRI, from 2000 to 2003, Mr. Tanton was responsible for the overall management and direction of collaborative research and development programs in electric generation technologies, integrating technology, market infrastructure, and public policy.

Mr. Tanton has over three decades of experience in the energy, economy, and environmental fields. Until 2000, Mr. Tanton was Principal Policy Advisor with the California Energy Commission (CEC.) He developed and implemented policies and legislation on energy issues of importance to California, the U.S. and International markets, including electric restructuring, gasoline and natural gas supply and pricing, energy facility siting and permitting, environmental issues, power plant siting, technology development, and transportation. He served as lead advisor on energy and infrastructure to California's task force on 21st Century development. He has testified before several state legislatures and Congress, and provided expert witness testimony in power plant siting cases.

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PRI proposes market-based reforms that would improve affordability, access, quality, and consumer choice. PRI also demonstrates why a single-payer, Canadian model would be detrimental to the health care of all Americans.

Technology Studies

PRI advances policies to defend individual liberty, foster high-tech growth and innovation, and limit regulation.

Environmental Studies

PRI reveals the dramatic and long-term trend towards a cleaner, healthier environment. It also examines and promotes the essential ingredients for abundant resources and environmental quality property rights, markets, local actions, and private initiative.

Lights On: An Energy Policy Survey for California

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