2008 UPDATE

ENERGY ACTION PLAN

State of California

Arnold Schwarzenegger, Governor

February 2008

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In 2003, the California Public Utilities Commission, the California Energy Commission, and the California Power Authority adopted an *Energy Action Plan* that was, in essence, a post-energy-crisis call-to-action. It articulated a single, unified approach to meeting California's electricity and natural gas needs. That plan had an enormous impact – it represented the first time the energy agencies had described a common, unified approach to further the state's energy policy goals.

In 2005, the Energy Commission and the Public Utilities Commission adopted a second plan, *Energy Action Plan II*, to reflect the policy changes and actions of the ensuing two years.

Now, at the beginning of 2008, we don't find it necessary or productive to create a new *Energy Action Plan*. The state's energy policies have been significantly influenced by the passage of Assembly Bill 32, the California Global Warming Solutions Act of 2006. The Energy Commission's *2007 Integrated Energy Policy Report (IEPR)* advanced policies that would enable the state to meet its energy needs in a carbon-constrained world. The report also provides a comprehensive set of recommended actions to achieve these policies.

The Public Utilities Commission has a number of proceedings before it that will define its post-AB 32 energy strategies. In addition, the two agencies will, within a matter of months, make a joint recommendation to the California Air Resources Board on the implementation of AB 32 in the electricity sector.

Rather than produce a new *Energy Action Plan*, we have prepared instead an "update" that examines the state's ongoing actions in the context of global climate change. We prepared the update using the information and analysis prepared for the recent *IEPR*, as well as recent Public Utilities Commission decisions.

With California's commitment to reducing greenhouse gas emissions as the backdrop, we examined needed changes in the following policy areas:

- Energy efficiency
- Demand response
- Renewable energy
- Electricity reliability and infrastructure
- Electricity market structure
- Natural gas supply and infrastructure
- Research and development
- Climate change

We look forward to our agencies continued work together to accomplish our goals in all of these areas. This joint *EAP Update* serves as a guidepost to help us chart a course to a lower-carbon energy future.

Michael R. Peevey
President
California Public Utilities Commission

Jackalyne Pfannenstiel
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Energy Action Plan 2008 Status Update

Introduction and Summary

The first Energy Action Plan (EAP) emerged in 2003 from a crisis atmosphere in California's energy markets. The state's three major energy policy agencies (the California Public Utilities Commission, the California Energy Commission, and the Consumer Power and Conservation Financing Authority [established under deregulation and now defunct]) came together to develop one high-level, coherent approach to meeting California's electricity and natural gas needs.

There were several reasons for the impact of the original *EAP*: it was the first time that energy policy agencies formally collaborated to define a common vision and set of strategies. It was also the first time a "loading order" to address California's future energy needs was articulated. The "loading order" established that the state, in meeting its energy needs, would invest first in energy efficiency and demand-side resources, followed by renewable resources, and only then in clean conventional electricity supply. This concept is now widely understood and respected both nationally and internationally. Further, the *EAP* was the first joint energy document that emphasized the importance of the impacts of energy policy on the California environment, although energy policy and the environment have long been closely intertwined.

The *EAP* was and is a "living" process, subject to change and updating over time. More than just a document, the *EAP* initiated a collaborative governmental process among the relevant institutions, to cooperate and coordinate activities in support of common goals.

In the October 2005 *Energy Action Plan II*, the Energy Commission and the Public Utilities Commission updated their energy policy vision by adding some important dimensions to the policy areas included in the original *EAP*. The emerging importance of climate change was first highlighted in *EAP II*; transportation-related energy issues and research and development activities were also added. In addition, with *EAP II*, the California Independent System Operator (California ISO) began a collaborative role with the Energy Commission and the Public Utilities Commission.

The *EAP II* brought together a coordinated implementation plan for state energy policies that had been articulated in various Governor's Executive Orders, the Energy Commission's *Integrated Energy Policy Report (IEPR)*, Public Utilities Commission and Energy Commission proceedings, and legislative direction.

This update keeps the *EAP* process alive and current. As in the past, it is not assumed that the work undertaken in *EAP I* or *EAP II* is complete. Further, this document does not supersede or replace the extensive efforts in the *2007 IEPR* or Public Utilities Commission proceedings. The *IEPR* remains the overall guiding document on energy policy. The *EAP* is intended to capture recent changes in the policy landscape and describe intended activities to accomplish those policies.

At the end of each section below, we provide a snapshot of our recent accomplishments and our remaining challenges and next steps is provided.

Climate Change

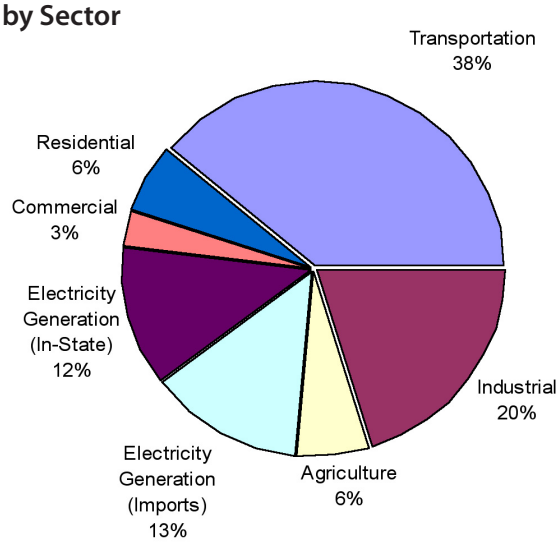
The most important development in California energy policy in the past two years, if not the past several decades, is the arrival at consensus that California must act to decrease its greenhouse gas emissions to reduce the impact of climate change. In 2006, the Legislature passed and the Governor signed two landmark pieces of legislation with far-reaching implications for energy policy.

The most comprehensive is the Global Warming Solutions Act of 2006, Assembly Bill 32, (Núñez, Chapter 488, Statutes of 2006) which sets an economywide cap on California greenhouse gas emissions at 1990 levels by no later than 2020. This is an aggressive goal that represents approximately an 11 percent reduction from current emissions levels and nearly a 30 percent reduction from projected business-as-usual levels in 2020. Figure 1 illustrates that 25 percent of the state's greenhouse gas emissions is attributable to electricity generation while 38 percent is attributed to the transportation sector.

Meeting this goal requires the cooperation and teamwork of multiple sectors of the California economy, including the electricity, natural gas, and transportation sectors.

The second important piece of climate change legislation from 2006 is Senate Bill 1368 (Perata, Chapter 598, Statutes of 2006), which requires the Public Utilities Commission and the Energy Commission to implement an emissions performance standard for all retail providers of electricity in the state. For any long-term commitment (five years or longer) to buy or build generation to serve California retail customers, emissions must be limited to 1,100 pounds of carbon dioxide (CO_2) per megawatt-hour of electricity delivered. This is roughly equivalent to the emissions from a new combined-cycle natural gas turbine. The law also provides for the possibility that the CO_2 emissions from a generator could be permanently captured and stored, thus not counting toward the performance standard limit for that generator.

figure 1
California 2005 Greenhouse Gas Emissions by Sector



Source: California Air Resources Board

Both of these laws acknowledge what California energy regulators have known for years: that energy policy and environmental policy are inextricably linked. For more than 30 years, California has had aggressive energy efficiency and renewable energy policies to minimize the impact of energy consumption on the environment. California's aggressive motor vehicle air quality standards have long exceeded the minimum federal requirements, and the state continues to push the federal government to allow us to keep exceeding those standards.

In large measure, California's programs have been motivated by concerns about the environment. Those concerns are embodied in the context of global climate change. California's Climate Change Research Center states that during the last 50 years, winter and spring temperatures have been warmer, spring snow levels in lower and mid-elevations have dropped, the snowpack has been melting one to four weeks earlier, and sea levels are projected to rise. Not only will there be a change in average temperatures, but there is a projected increase in extreme conditions such as a rising incidence of "heat storms." While these trends will impact all of us, they will have an especially large consequence for California's agricultural industry.

The impact on the energy infrastructure in the state is likely to be significant as well. Lower levels of snowpack and associated decreases and changes in the spring runoff will affect hydroelectric generation. A large number of critical power plants are located at sea level along the California coast to take advantage of nearby cooling water, and even small rises in sea level will affect those facilities. Increased use of air conditioning in homes, especially those built farther inland and away from coastal areas, creates rising demand for electricity, as well as additional load on transmission and distribution lines to transport power to these areas. This increase in inland home construction also creates a feedback effect in terms of increasing emissions from automobiles traveling greater distances to transport people to work in urban coastal areas.

In addition to all of these local impacts, Californians are increasingly cognizant of the emerging impacts of climate change on the whole planet. As a coastal state, a significant majority of the world's population lives close to the sea in urban areas that are both vulnerable to weather patterns and highly dependent on agricultural production to sustain their lives.

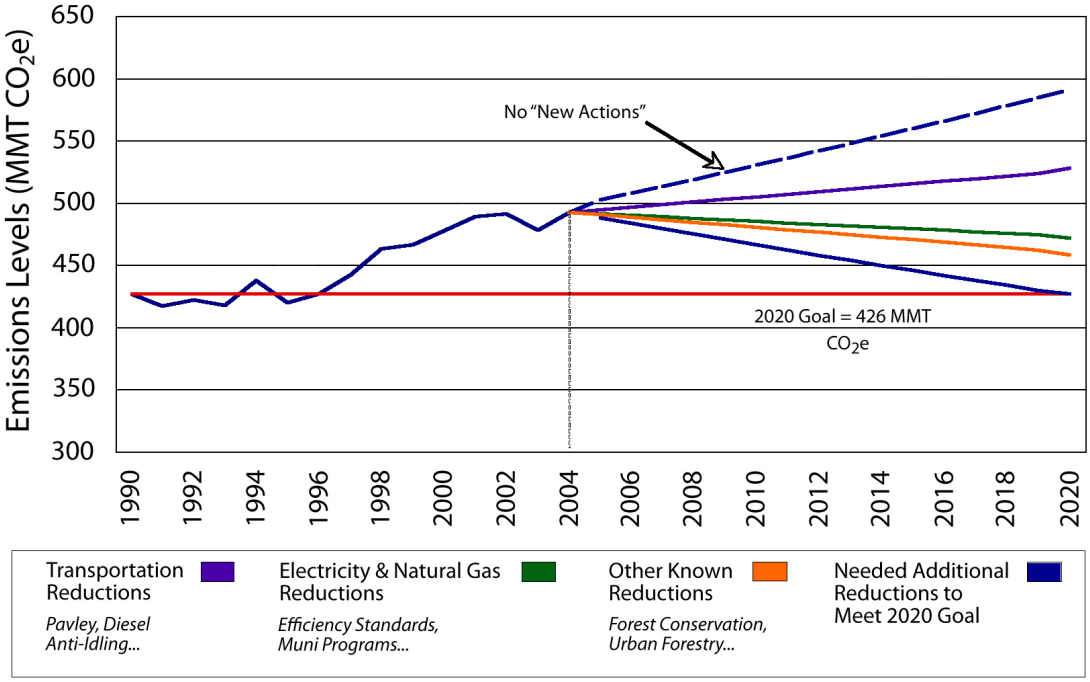
Given the emerging impact of climate change on California, and our history as environmental leaders in energy policy, we are well-positioned to take action now to mitigate our greenhouse gas emissions. Some have downplayed the impact that one state can have on such a global problem, especially a state that already has relatively low emissions. But the state's efforts should be placed in context.

The United States is the single largest emitter of greenhouse gases in the world. China is a fast-growing second. If California were itself an independent country, depending on the year, it would be somewhere between the ninth and sixteenth largest emitter in the world.

California per capita emissions are roughly five times that of China and twelve times that of India, though still only two-thirds of the U.S. average.

Although California's electricity-related emissions are significantly lower on a per capita basis than the U.S. average, our vehicle-related emissions are about the same as the nation's. Implementing the Low Carbon Fuel Standard, the state's Alternative's Fuels Plan, and the tailpipe emission reduction regulations called from in Assembly Bill 1493 (Pavely, Chapter 200, Statutes of 2002) will help to reduce the transportation sector's impact on climate change.

Figure 2.
Reaching for the AB 32 Target



Source: California Energy Commission

What all of this means is fairly simple: we are a significant part of the problem and can be a significant part of the solution. In general, our clean energy policies, begun more than 30 years ago and already reflected in the first two *Energy Action Plans*, are now even more important as strategies to reduce greenhouse gas emissions. Our involvement in and governance of all activities in the regulated energy sectors in California now operate within the context of their impact on climate change context. Decisions about issues seemingly unrelated to environmental issues, such as market structure or pricing considerations, must now be made with an eye toward their impact on climate change.

In addition, our activities are now more interrelated. Particularly in the electricity industry, regulatory structure differences are increasingly taking a back seat to our pursuit of a common goal. Investor-owned utilities, publicly owned utilities, electric service providers, independent generators, and many other industry players all have important and similar roles to play in reducing California's electricity-related greenhouse gases. We are increasingly moving to an industry in which environmental responsibility will be a condition of delivering energy services to consumers, regardless of regulatory structure.

In the remaining sections of this document, we put our activities in this climate change context and articulate our commitment to concrete actions, now and in the future. These actions will help us lower greenhouse gas emissions from the use of energy in California and adapt the energy sectors to the impacts of climate change already occurring.

Specific Action Areas

Below, we describe the nine major action areas called out in the previous *EAP*, including:

- Energy efficiency
- Demand response
- Renewable energy
- Electricity adequacy, reliability, and infrastructure
- Electricity market structure
- Natural gas supply, demand, and infrastructure
- Transportation fuels supply, demand, and infrastructure
- Research, development, and demonstration
- Climate change

Need for coordination and integration

In this update, we note that there is an increasing need for coordination and integration our agencies' overall actions across all of the targeted resource areas. A number of these areas involve strategies that individual consumers can use to manage their energy expenditures, as well as reduce their individual contributions to greenhouse gas emissions.

Some of the areas for coordination and integration are obvious. For example, consumers make decisions about the types of appliances to purchase for their homes, as well as when to use them. Therefore, coordination among our energy efficiency and demand response programs makes sense. Consumers also make decisions about investing in clean distributed generation, such as solar hot water or solar photovoltaic systems. Thus, integrating and coordinating energy efficiency and distributed generation programs is essential to allow customers to gain the largest benefit from their expenditures. In many cases, consumers can take advantage of financial assistance for these types of investments that are being offered through their local utility companies under the leadership of the Energy Commission and the Public Utilities Commission.

Broadening perspectives and the focus of action

Some emerging needs for integration, however, are more complex. Increasingly, we realize that overall societal and demographic trends can dwarf our efforts to encourage individual consumer investments in clean and efficient energy services. To truly reduce our energy and transportation-related greenhouse gas impacts, we need to change the way we think about our approach to community development and economic growth.

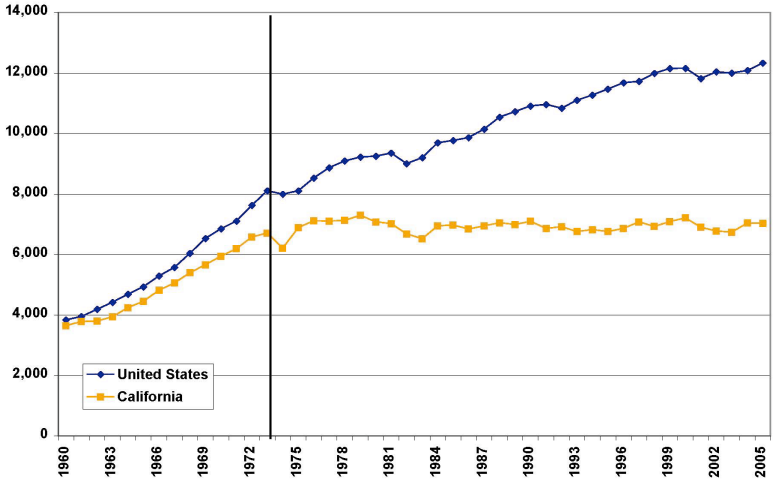
Decisions about community planning and land use, as well as transportation infrastructure and electricity infrastructure, have a dramatic impact on our ability to decrease our greenhouse gas emissions. Many of these types of long-term infrastructure decisions are made at the local level and are not governed by our energy agencies. Truly reducing our greenhouse gas footprint will require new and strengthened partnerships with local governments, as well as developers and builders in the private sector.

Leverage through partnerships

In addition, partnerships with industry in California will become increasingly important. Although most state industrial production is dominated by relatively light industry, some energy-intensive industries still remain, including cement and glass production, as well as agricultural processing and petroleum refining. By encouraging utilities to partner with these types of energy consumers, we can increase our chances of meeting our greenhouse gas goals together.

In addition, there is an unprecedented amount of collaboration occurring among not only California's energy agencies, but also with other agencies such as the California Air Resources Board and California Environmental Protection Agency, as we jointly seek methods to reduce greenhouse gas emissions in the state.

Figure 3
U.S. v. California Per Capita Electricity Sales



Source: California Energy Commission

Cross-sectional options

Finally, the climate change challenge is encouraging us to break out of our "silos" like never before. Investment in conventional transmission infrastructure is crucial to helping the state meet its renewable energy goals. One of the most promising solutions to transportation emissions involves using plug-in hybrid electric vehicles and all-electric vehicles to reduce transportation emissions, but it will simultaneously increase electricity load in the state. These and many other integrated and interactive effects will be crucial to our understanding and success at achieving our goals.

Energy Efficiency

The most important tool for addressing greenhouse gas emissions in the energy sector is energy efficiency. Of the strategies identified in the April 2006 *California Climate Action Team Report*, nearly one-quarter of the emissions reductions identified from existing or known strategies in 2020 would come from some form of energy efficiency investment, either through improved building codes or appliance standards, utility energy efficiency programs, or smart growth strategies.

By definition, energy efficiency is a zero-emissions strategy, and also a least-cost strategy. Requirements for building codes, appliance standards, and utility energy efficiency investments must be cost-effective. Theoretically, as the provision of energy becomes more expensive, and as the price of greenhouse gas emissions reductions is increasingly incorporated into the cost of energy, more energy efficiency and demand-side investments will become cost-effective.

Meeting our AB 32 goals will require, under any scenario, unprecedented levels of energy efficiency investment. This necessitates a more rigorous examination of our energy efficiency options and the setting of more aggressive energy efficiency goals.

Below we have included one of California's famous graphics of success in energy efficiency. As Figure 3 indicates, electricity use per person in California has remained relatively stable over the past 30 years, while nationwide electricity use has increased by about 50 percent.

While this stabilization of per capita electricity use is something we are proud of, it is not nearly enough to meet our AB 32 goals. To address this emissions reduction challenge for electricity, we will need to bend this curve downward, because, among other reasons, the population of California continues to grow rapidly, causing overall electricity use in the state to continue to rise by between one and two percent every year.

Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006) required the Energy Commission, in collaboration with the Public Utilities Commission and the publicly owned utilities, to set statewide energy efficiency targets for 2017. After consideration in the 2007 IEPR process, the Energy Commission concluded that the goal for the state should be to achieve all cost-effective energy efficiency.

It should also be noted that energy efficiency is also our most powerful strategy for addressing greenhouse gas emissions from the natural gas sector. In addition to the natural gas burned to produce electricity in California, a great deal of natural gas is also burned in the industrial, commercial, and residential sectors in the state. Emissions from these sources can be reduced substantially through increased energy efficiency.

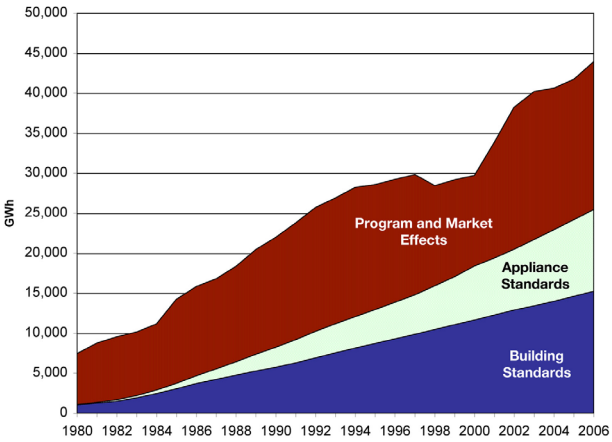
As noted below, our three most powerful strategies for increasing energy efficiency have been: building codes, appliance standards, and utility energy efficiency programs. Figure 4 below shows the contribution that each of these three strategies has made to overall energy savings from 1975 to 2006.

As Figure 4 indicates, while both appliance and building standards are wedge-shaped and have continued to grow in size since their adoption, the contribution from utility energy efficiency programs has remained about the same since the mid-1980s. This suggests several things. First, utilities have likely invested in relatively short-lived energy efficiency measures such as lighting that need to be replaced more frequently, such that the cumulative energy efficiency savings is not that great. Second, as with the per-capita trend in Figure 3, to meet the AB 32 emissions reduction goals, our success with these programs will need to increase more rapidly in the next few years.

It should also be noted that Figure 3 above includes data only from investor-owned utilities. While some publicly owned utilities have meaningful energy efficiency programs and success rates, others do not, and their service areas may represent the largest untapped potential for energy savings in the state.

In addition, it will not be enough to replicate current strategies for delivery of energy efficiency options to consumers. To meet the AB 32 goals, we will need to employ new and innovative approaches not yet

Figure 4
Cumulative Conservation Savings 1980–2006



Source: California Energy Commission

tried. Toward this end, the Public Utilities Commission launched a strategic planning process to develop comprehensive, long-term strategies for sustainable energy efficiency savings to achieve the ultimate goal of making energy efficiency a way of life for Californians. The Public Utilities Commission and the Energy Commission envision "big, bold" programmatic initiatives within the overall statewide strategic plan designed to achieve zero-net-energy homes by 2020 and zero-net-energy commercial buildings by 2030. This will be a huge challenge by itself, but it may be one of the easier ones we will take on. The community of builders and developers in California is relatively discrete, and we can envision partnerships to make these goals happen for new buildings.

Improving the efficiency of existing buildings will be an even bigger challenge. Current rebate programs have not been adequate to capture all cost-effective energy savings in the existing building stock. Increasingly, utilities will need to present their customers with comprehensive packages and strategies that address all of their energy needs. Consumers will need information, audits, appliances, insulation, ventilation system upgrades, renewable self-generation, solar hot water heating, cool roofs, or many other options. Many state and local governments have set targets to achieve efficiency in their own buildings. The advent of the U.S. Environmental Protection Agency ENERGY STAR® and the U.S. Green Building Council LEED designation for existing buildings both lend substantial support to the slow emergence of market demand to own and operate efficient buildings. In addition, the Legislature is expected to consider whether to require energy efficiency upgrades for buildings at the time of sale. We should also note the emergence of new legislative initiatives such as prohibiting inefficient lighting sales and requiring building owners to give energy efficiency benchmark data to buyers and tenants starting in 2010.

To ensure that the investor-owned utilities meet these energy efficiency goals and challenges, the Public Utilities Commission recently authorized a risk/reward mechanism to allow utilities to earn financial rewards for meeting or exceeding their goals and includes penalties for not reaching goals. This regulatory approach should give utilities a strong incentive to go beyond traditional approaches to energy efficiency to achieve even greater savings. This mechanism will give utilities equal opportunities to earn profit, whether they are investing in energy efficiency or supply resources to create a truly level playing field.

Finally, with the population and economic growth occurring in California, it simply will not be enough to be more efficient with energy use. We actually need to reduce overall energy use. Making this happen will require better planning and smart growth strategies, in partnership with local governments. We will also need the help of local governments to ensure that more stringent building codes adopted by the Energy Commission are enforced.

Table 1
Energy Efficiency Accomplishments and Next Steps

Accomplishments	Next Steps
Adoption of aggressive energy efficiency goals by both agencies	Statewide strategic plan that will service as a "roadmap" of actions needed to achieve all cost-effective energy efficiency potential in California
Institution of long-term strategic planning for energy efficiency programs	Strategies to achieve targets for "big bold" initiatives in residential and commercial new construction, and in heating, ventilation, and air conditioning systems
Energy Commission building and appliance standards being upgraded on a regular schedule	New strategies to address existing buildings, going beyond current utility programs and emphasizing a more comprehensive approach
Endorsement by both agencies of zero net energy homes by 2020 and zero net energy commercial buildings by 2030	Partnerships with local governments on energy efficiency delivery, as well as enforcement of building codes
Adoption of a risk-reward mechanism for investor-owned utilities to earn incentives for investment in energy efficiency	Utility 2009-2011 efficiency program portfolios consistent with and supportive of the statewide strategic plan
Adoption of energy efficiency requirements for customers participating in solar incentive programs	Energy savings goals through 2020, consistent with AB32, for both IOUs and POUs
	Additional, more stringent, codes and standards for appliances and buildings and the associated technology and design research and development to support them
	Local government support in building code enforcement
	Additional low-income energy efficiency initiatives

Demand Response

According to Energy Commission forecasts, while energy usage in the state is growing at 1.25 percent per year, peak demand is growing even faster, at 1.35 percent annually. This means that the need is increasingly for peaking generation that runs only a small number of hours every year, primarily during the summer months. Such generation is typically less efficient than most base load power plants. This means that peaking units contribute disproportionately not only to greenhouse gas emissions but to local air pollution because they operate during hot summer afternoons when local air quality can be poor. Thus, our emissions reduction mandates clearly require the consideration of more demand response options to help meet our AB 32 goals.

Since *EAP II*, we have made significant progress toward providing the metering infrastructure required to support stronger demand response policies. Two of our major investor-owned utilities are installing advanced metering infrastructure throughout their territories, and the third has made a proposal that is under evaluation. Some publicly owned utilities are also making or exploring investments in advanced metering infrastructure in their service areas. Around 2010, the majority of consumers in the state will have meters that can measure electricity, and in some cases natural gas, use every 15 minutes or at least every hour.

To meet our policy goals, it is imperative that we develop understandable and transparent dynamic pricing tariffs and demand response programs that operate with these tariffs. The first *EAP* set a goal of five percent of peak demand to come from price response from consumers by 2007. We are nowhere near that goal and must reinvigorate our efforts in this area.

The investor-owned utilities have also made strides in recent years to improve their demand response program offerings to consumers. Because air-conditioning use is the primary contributor to the growth in peak electricity demand, the utilities have increased their emphasis on air conditioner cycling programs. Heat storms in recent years have also emphasized the importance of load-shedding programs that relieve stress on overheated transmission and distribution infrastructure.

The availability of advanced meters is a necessary underpinning for more sophisticated approaches to demand response. The communications infrastructure to support the advanced meters is also important to provide two-way information to and from consumers about their energy use.

Many challenges lie ahead in tapping the demand response potential in the state. Some of those challenges and opportunities are discussed below.

As with energy efficiency, participation by publicly owned utilities will be very important to shaving overall peak demand. In addition, the California Independant System Operator (ISO) can be instrumental in incorporating demand response policies and appropriate operational rules at the wholesale level thereby allowing aggregated demand-side resources to be scheduled on the system along-side conventional generation. The California ISO has made some initial progress in this area, and more is anticipated in the short term.

In addition, more can be done to pair advanced meters with communications and other automatic infrastructure that allow consumers to more easily adjust their appliances in homes and buildings.

Finally, the area of greatest remaining challenge for demand response policy is in the development of dynamic pricing tariffs. Generating electricity at peak times is more expensive than base load power. Therefore, if consumers were required to pay more for electricity at peak times, it would produce an incentive

to reduce use during those periods. However, some of our other policies are potentially dampening this effect. In our efforts to ensure reliability and electric resource adequacy, we are requiring reserve margins and capacity under contract that may reduce the cost increases and volatility of prices at peak times.

In addition, and most importantly, most consumers are currently on tariffs that bear no resemblance to the actual cost of providing their electricity. Most residential consumers, in particular, see no increase in energy costs at peak times. Although they are encouraged to conserve energy overall through tiered tariffs where higher usage costs more, there is no time dimension to their prices that would help encourage reducing usage at peak times when electricity is the most expensive.

There is a serious legislative impediment to moving residential customers onto dynamic rates. Enacted during the height of the energy crisis of 2000/2001, AB 1X caps residential electricity usage under 130 percent of baseline amounts at the then-existing rates. This was motivated by a desire to protect vulnerable consumers from potential rate increases but instead has had the effect of moving residential tariffs farther away from their relationship to underlying costs. Under this provision of AB 1X (now Water Code 80110), the Public Utilities Commission is constrained in modifying rate structures to have a time variable dimension. This impedes efforts to encourage demand response from customers who should participate. We believe the Legislature can modify this provision to allow time-differentiated rates while still protecting the most vulnerable consumers.

We also should be moving toward more time-differentiated default rates for larger consumers, with the ability of those customers to opt out of these types of rates if they are willing to pay a higher flat rate (essentially a slight premium for the insurance of predictability in their tariffs).

The Energy Commission has opened a proceeding to examine how its legislative authority to adopt load management standards for the state can be used to accelerate our pace of demand response. In addition to being able to integrate technology and tariff innovations, the Energy Commission's standards would be applicable to publicly owned utilities.

Table 2
Demand Response Accomplishments and Next Steps

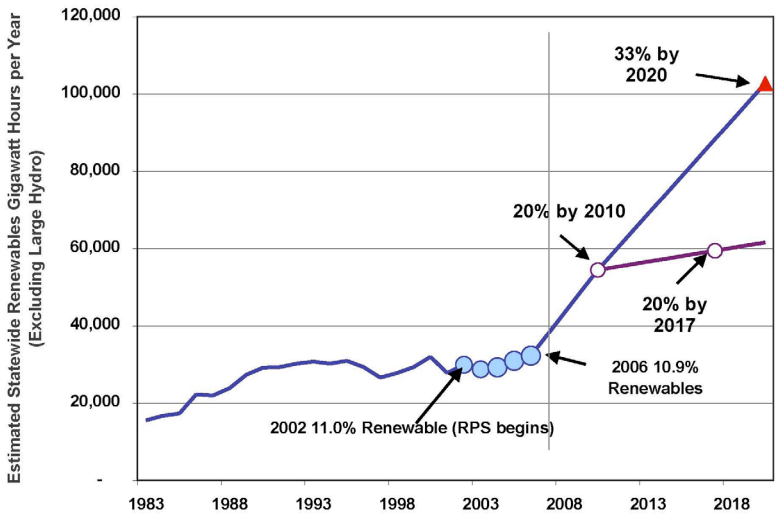
Accomplishments

- Advanced metering installation in progress
- Investor-owned utility continuous improvement in demand response program offerings

Next Steps

- Adopt load-management standards to establish a demand-response infrastructure
- Legislative authorization for time-varying pricing for residential consumers
- More progress on dynamic pricing rate design reform for all types of consumers
- Programs that utilize advanced metering, tariff, and other automated demand response infrastructure
- Modify retail programs so that they can more fully participate in the California ISO's new wholesale market structure
- Develop a load impact and cost-effectiveness protocol for demand response programs

Figure 5
Progress Toward California's Renewable Energy Goals



Source: 2007 *Integrated Energy Policy Report*

Renewable Energy

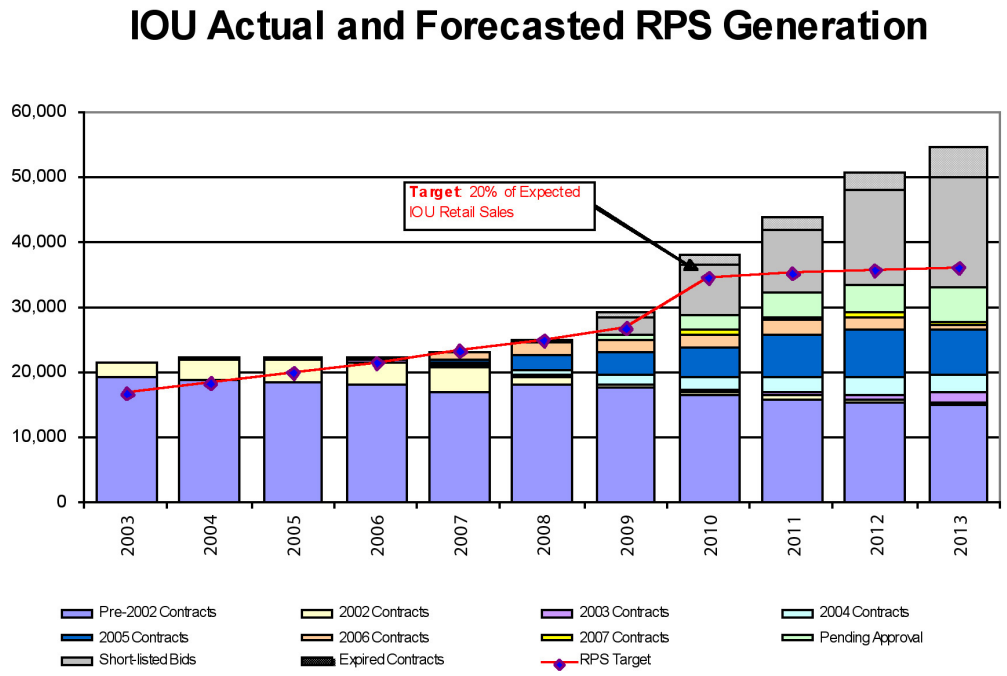
Renewable energy policy is a cornerstone of our approach to reducing greenhouse gas emissions in the electricity sector. In the first *EAP*, we committed to reaching 20 percent renewables in California by 2010, seven years ahead of the statutory deadline at that time. The Legislature agreed and moved up the deadline for investor-owned utilities. In *EAP II*, we are committed to working together to evaluate the potential for making 33 percent of the power delivered in California renewable by 2020.

Today, we strengthen our commitment to increasing the electricity generation from renewable energy in California and throughout the West. Since our Renewable Portfolio Standard (RPS) was adopted, most other states in the West have also adopted RPS requirements. To meet the AB 32 emissions reduction goal in 2020, or the even more aggressive goal suggested by the Governor's executive order S-3-05 for 2050, we will need to maximize the development of renewable resources throughout the West.

Figures 5 and 6 detail our progress toward our RPS goals so far. Figure 5 shows that while the amount of renewables has increased, so has the load, so we are at about the same percentage of renewables as we were when the program began.

Figure 6 indicates that while we will likely not make 20 percent renewables by 2010, we will be close if the generation under contract is achieved. Furthermore, many of the approved projects still must successfully overcome project development obstacles, such as permitting, siting, and the development of new transmission. To achieve a 33 percent goal, we need to implement some aggressive programmatic changes.

Figure 6
RPS Generation Forecast



Source: California Public Utilities Commission

The *2007 IEPR* describes a number of obstacles that impede our ability to reach our RPS targets and makes recommendations for their removal. The first obstacle that was highlighted was the lack of transmission access from the areas rich in renewable resources to the load centers. The *IEPR* noted a number of efforts underway to mitigate the problems with transmission siting, most encouragingly, the creation of the Renewable Energy Transmission Initiative, which is a statewide planning collaborative among the Public Utilities Commission, Energy Commission, California ISO, and a number of public power entities to identify and plan for the development of renewable energy zones within California. Further, the *IEPR* urged a joint consideration by our two agencies of a feed-in tariff for all renewable energy projects to replace the cumbersome, opaque contracting process that renewable developers face.

To help us, the Legislature must remove the prohibition against any requirement for the utilities and other electric service providers to go beyond 20 percent renewables, and publicly owned utilities also must be part of the RPS program. The Sacramento Municipal Utility District has always been a leader in the use of renewable resources. The Los Angeles Department of Water and Power and the Imperial Irrigation District have also made recent commitments to increasing renewable generation. Other publicly owned utilities should be required to follow suit.

To meet our ambitious goals, we will need to include new renewable technologies. We will discuss this more below in the section on research, development, and demonstration. Meanwhile, several existing technologies promise to become even more important. Very important among those is solar, since California has an abundance of powerful sunlight.

First, we have made a large investment in solar photovoltaic potential through the California Solar Initiative. With our move to a stand-alone solar program for consumers in 2007, we have already received applications this year alone for more capacity than had been installed in California to date. We stand to nearly double California's photovoltaic stock by mid-2008. In addition, we have adopted guidelines that reflect the state's loading order and newly adopted goals aspiring to zero-net energy buildings by requiring significant investments in energy efficiency as part of our solar investment. This is an encouraging start to our newly revamped distributed solar approach.

We also believe there is a great deal of potential for solar water heating. In 2007, the Solar Water and Heating Efficiency Act of 2007, was passed to create a broad market for solar water heating technologies by offering $250 million in rebates for the state's consumers over the next ten years that will be implemented by the Public Utilities Commission. This year we will evaluate the creation of a program to encourage installation of solar water heating systems throughout the state.

There is also a tremendous potential for utility-scale solar facilities in California. The Energy Commission and the Federal Bureau of Land Management have signed a memorandum of understanding to facilitate permitting of these facilities. Projects representing more than 30,000 megawatts of solar have initiated discussions about development. A number of these projects have agreements with utilities to provide power under RPS contracts and have begun the licensing process at the Energy Commission. As many of the best wind energy and geothermal energy sites in California become built out, we expect increasingly to be relying on large-scale solar energy to meet our renewable goals.

Table 3
Renewable Energy Accomplishments and Next Steps

Accomplishments

- Strong progress in contracting resources to achieve 20% renewables in 2010
- Launch of interagency Renewable Energy Transmission Initiative
- Surge in applications to install solar photovoltaics in 2007
- Growing participation of utility-scale solar thermal in RPS solicitations
- Enrollment of 1,777 MW statewide in emergency demand response programs and 1,106 MW in price-triggered demand response programs

Next Steps

- Examine adoption of load-management standards to establish a demand-response infrastructure
- Seek Legislative authorization for time-varying pricing for residential consumers
- Implement dynamic pricing rate design reform for all types of consumers
- Consider programs that utilize advanced metering, tariff, and other automated demand response infrastructure
- Modify retail programs so that they can more fully participate in the California ISO's new wholesale market structure
- Develop a load impact and cost-effectiveness protocol for demand response programs
- Issue decisions on remaining advanced metering proposals.

In addition, due to our abundant agricultural activity in California, we also benefit from the availability of biomass and biogas resources that can be used for energy production. Governor Schwarzenegger recognized the important benefits of bioresources by signing Executive Order S-06-06, setting a target for biomass to comprise 20 percent of the state's Renewables Portfolio Standard for 2010 and 2020, and requiring minimum percentages of biofuels be produced within the state. The Energy Commission reported on progress on these targets in the *2007 IEPR*.

We face operational challenges in achieving our renewable energy goals. Wind energy comprises a significant amount of the new renewable resources being developed but is intermittent in nature, which presents integration issues that the California ISO can help solve.

Finally, we face some key policy design questions as we contemplate increasing our reliance on renewable energy. For a number of years, the Public Utilities Commission and the Energy Commission have been considering the use of renewable energy credits or certificates (RECs) to help facilitate compliance with the RPS. Questions also remain about the potential overlap between a carbon market and a REC market in California that will need to be thoughtfully addressed.

Electricity Adequacy, Reliability, and Infrastructure

As we seek a cleaner energy future in pursuit of our AB 32 goals, we remain cognizant of our responsibility to ensure the reliability of our system. Even with energy efficiency, demand response, and renewable resources, investments in conventional power plants and transmission and distribution infrastructure will still be needed.

So far, we have succeeded in putting into place a resource adequacy framework for the state. We have also streamlined transmission-permitting processes and established an approach to corridor designation. In addition, the Public Utilities Commission recently resolved its pricing policy for qualifying facilities (QFs).

Considerable work remains in a number of areas. In *EAP II*, we identified the desirability of repowering aging power plants in the state, using access to existing transmission while upgrading the efficiencies of the plants. There are significant potential benefits to California from both a reliability and a greenhouse gas emissions perspective.

In addition, new combined heat and power applications could play a large part in avoiding future greenhouse gas emissions due to the combined efficiency of the heat and power portions of the project. The *2007 IEPR* contains policy support for such installations. Other forms of distributed generation, even if not renewable, can also have benefits over centrally

Table 4
Electricity Adequacy, Reliability, and Infrastructure Accomplishments and Next Steps

Accomplishments
Resource adequacy framework for IOUs and POUs
QF pricing policy for IOUs
Transmission corridor designation process
Next Steps
Evaluating the need for a combined heat and power policy
Encouraging technological development for carbon capture and sequestration

located generation that suffers from transmission and distribution line losses. Distributed generation can also help support grid reliability.

Finally, we recognize that some new fossil-fueled generation is probably in our future as well. Over the last decade and at present, the majority of such generation under development is natural gas. But we recognize that our goals become more stringent after 2020 and we will need to continue reducing our emissions until 2050 and probably beyond. Investments we make now will have long lifetimes, and we need to ensure that their emissions are as low as possible. Therefore, we hope that advances can be made over the next few years in the utilization of carbon capture and sequestration techniques, to ensure that even when a power plant emits greenhouse gases, they can be captured permanently without being allowed to escape into the atmosphere. We support the development of carbon capture and sequestration technologies through additional policies and demonstration efforts, as well as continued research and development. This breakthrough is crucial given the abundance of coal generation worldwide.

Electricity Market Structure

A number of initiatives on electric market structure are underway in California; we remain committed to completing them although, being cognizant that Californians pay some of the highest utility rates in the nation, we are equally committed to holding down customers' costs. Below, we discuss three activities that are helping to moderate the cost pressures.

First, the California ISO is about to implement its Market Redesign and Technology Upgrade to reform California's wholesale electricity market and to ensure adequate market power mitigation to protect California consumers.

Next, the Public Utilities Commission is investigating the potential to reopen the retail market for direct access to allow consumers to choose electricity providers. That option already exists for cities to undertake community choice aggregation for electricity services.

Finally, the Public Utilities Commission and California ISO are investigating the potential for the development of a centralized capacity market for California, which could create tradable capacity rights and obligations, and incentives and flexibility for power plant development and utility procurement in the state.

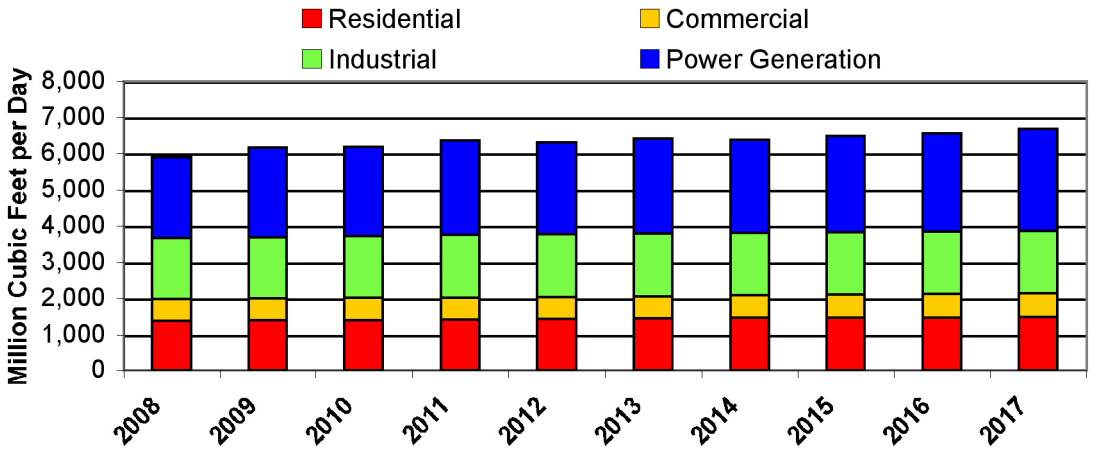
Table 5
Electricity Market Structure Accomplishments and Next Steps

Next Steps
Launching market redesign and technology update
Evaluating reopening of direct access market (retail competition)
Evaluating development of centralized capacity market

Natural Gas Supply, Demand, and Infrastructure

Natural gas provides a significant portion of California's energy requirements and its use in California is expected to remain relatively flat in the near term. Natural gas prices remain much higher and more volatile compared to the last decade, and there is little expectation in the market that prices will significantly decrease within the next few years. Higher prices and volatility are primarily related to production difficulties in the United States and Canada, higher production costs, and falling imports of natural gas from Canada. Diversifying our natural gas sources

Figure 7
Projected California Demand by Sector 2008-2017



Source: California Energy Commission

to include liquefied natural gas (LNG), as well as promising sources of domestic supplies, and ensuring adequate natural gas transmission and storage infrastructure are important to ensuring the reliability of California's natural gas supplies. A diverse portfolio of natural gas supplies and reliable deliveries of those supplies will be particularly important as we increasingly rely on natural gas as the lowest-emission fossil fuel for thermal power plants and other industrial, commercial, and residential applications.

California's initial receipts of LNG supplies are expected to occur in 2008, but regular, reliable cargoes are not expected until later years. As California's natural gas supplies will increasingly be part of a global market, we will need to:

- Continue to monitor and assess that market and its impact on California consumers.
- Examine whether and how California utilities should enter into contracts for LNG supplies.
- Ensure that California has adequate access to those supplies.

In addition, proposals for significant expansion of pipeline capacity from the Rocky Mountains to California have been announced in recent months. California will need to assess the impact these expansions could have on the western natural gas market and determine whether California utilities should enter into contracts for pipeline capacity rights with any of these projects. A new intrastate gas transmission framework will be implemented in Southern California in 2008, and California will need to follow closely the progress of that framework and market impacts. Finally, current and new independent storage providers are proposing expansions of their storage capacity, and in some cases have already requested approval from the Public Utilities Commission for these projects.

While natural gas is a cleaner fuel than coal or petroleum, we also recognize that natural gas contributes a portion of California's total greenhouse gas emissions, due to emissions from electric generation, industrial, residential, and commercial use. California needs to consider means by which natural gas usage can be minimized to reduce total greenhouse gas emissions,

while still meeting California's overall energy needs. Energy efficiency and renewable energy production are the most important tools for reducing California's dependence on natural gas and also decreasing the contribution of the electric generation and natural gas sectors to greenhouse gas emissions. Significant reduction of natural gas use could also contribute to a moderation of natural gas prices.

We also note that methane is a greenhouse gas, which has 23 times the global warming potential of carbon dioxide in the atmosphere. Thus, minimizing leaks from gas pipelines, compressor stations, and storage facilities is extremely important in reducing emissions from the natural gas sector. Increasing the use of certain biofuels, such as methane from cattle farms, not only can help reduce California's dependence on imports of natural gas, but can also significant reduce methane releases to the atmosphere.

Table 6

Natural Gas Supply, Demand, and Infrastructure Accomplishments and Next Steps

Accomplishments

Aggressive energy efficiency goals set for both IOUs and POUs

Developed biogas projects under RPS

Reviewed overall adequacy of infrastructure, established reliability standards for gas transmission

Established procedures under which local gas transmission system would be expanded in Southern California, and approved investment for Northern California local transmission projects

Adopted rules to facilitate the receipts of LNG deliveries

Adopted agreement under which storage capacity development could occur in Southern California

Improved transmission access terms for California gas producers

Next Steps

Monitoring and assessing the global natural gas market and its impacts on LNG deliveries and prices

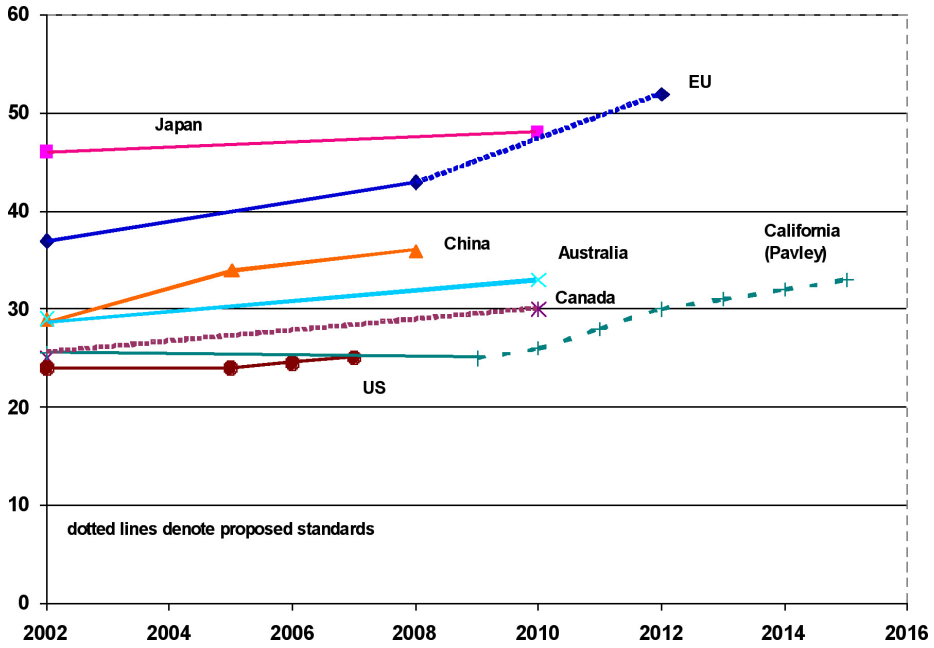
Examining whether and how California utilities should enter into contracts for LNG supplies

Examining the need for development of additional storage and pipeline infrastructure

Examining whether increased deliveries of Rocky Mountain supplies are appropriate

Implementing incentives for solar water heating

Figure 8
Comparison of Fuel Economy of Passenger



Source: Pew Center on Global Climate Change, *Comparison of Passenger Vehicle Fuel Economy and Greenhouse Gas Emission Standards Around the World*, December 2004.

Transportation Fuels Supply, Demand, and Infrastructure

In the transportation sector, our gasoline and diesel markets in California continue to be characterized by increasing demands, tight supplies, and volatile and high prices. In addition, the transportation sector is the single largest contributor to California's greenhouse gas emissions. For these reasons, this area is one of increasing focus in the state. A number of initiatives are underway to help address this crucial policy area.

Assembly Bill 1493 requires a 30 percent reduction in greenhouse gas emissions from vehicles sold in California by 2016, Although California has consistently received waivers to enforce more stringent emissions standards in the state, the federal government recently denied a waiver required for California to enforce the regulations developed under that law. In response, California has sued to overturn that denial.

The most recent activity is around the development of a Low-Carbon Fuel Standard for California. This initiative encompasses both the development of alternative fuels and alternatively fueled vehicles, including the potential for electric, natural gas, and hybrid vehicles. Governor Schwarzenegger initiated the effort for a Low Carbon Fuel Standard (LCFS) in California through Executive Order S-01-07. The California Air Resources Board is scheduled to develop regulations to implement the LCFS in 2008. In support of the LCFS and under Assembly Bill 1007 (2005), in 2007 the Energy Commission developed a full fuel cycle assessment of the greenhouse gas implications of transportation fuel alternatives and adopted a State

Alternative Fuels Plan. Recently, Assembly Bill 118 was signed into law, providing an ongoing funding source for programs to enhance the development and use of alternative fuels in the state.

After initial analysis, one the most promising options for reduction of greenhouse gases from transportation involves the increasing penetration of plug-in hybrid electric vehicles and all-electric vehicles. If such technologies become commercially viable, they would reduce emissions from the burning of gasoline but offset those emissions with those from the production of electricity. Key to minimizing the impact of this cross-sector approach is ensuring that the electricity for the powering of plug-in hybrid electric vehicles is from clean or renewable energy. Most appealing is the option to charge vehicles at night using the output of off-peak wind energy.

These and many other technology and fuel options for the transportation deserve increasing attention to help reduce our emissions overall. Coupled with these initiatives, we also stress the importance of smart growth and land-use policies by local governments. This is analogous to energy efficiency, where it is not enough to make our fuel use more efficient. We actually need to reduce our use of fuel overall. To accomplish this, we need to begin reducing the number of vehicle miles traveled in the state, locating our homes closer to workplaces, and increasing our public transportation options and use.

Table 7

Transportation Fuels Supply, Demand, and Infrastructure Accomplishments and Next Steps

Accomplishments

Developed and Adopted State Alternative Fuels Plan

Next Steps

Continue to monitor and recommend enhancements to transportation fuel infrastructure needs

Adopt regulations to implement the Low Carbon Fuel Standard

Begin Implementation of Transportation Incentive Programs funded by AB 118

Develop a strategic investment plan for alternative fuel and vehicle incentives

Research, Development, and Demonstration

As we have mentioned several times, to meet our long-term greenhouse gas goals, we will likely need the development of new technologies in at least the following areas:

- Energy efficiency technologies
- Renewable generation
- Clean fossil generation (including carbon capture and sequestration)
- Transportation fuels and vehicles
- Bioenergy

There may be additional key energy areas for research and development that emerge over the next decade. In addition, we see a need to emphasize the demonstration of and the feasibility of new technologies to build confidence in our ability to meet our aggressive goals.

Natural gas research and development (R&D), administered under the Energy Commission's natural gas R&D program, is expected to be conducted in coming years in the above areas, as well as others including:

- LNG quality and interchangeability
- Solar thermal technologies
- Natural gas storage impacts and conditions needed for investment
- Efficient interface of electricity and natural gas infrastructure
- Improved technologies and tariffs for demand response
- Reduction of greenhouse gas emissions associated with natural gas

Table 8
Research, Development, and Demonstration Accomplishments and Next Steps

Accomplishments

Development of cool roof technologies allowing incorporation in building standards

Development of super-efficient lighting systems for offices and residential kitchens

Development of technology for automating demand response

Development of ultra-clean fossil fuel generation systems

Research on climate change impacts and solutions

Next Steps

Particular focus on bioenergy, energy efficiency, renewable energy, transportation fuels and vehicles, and carbon capture and storage technology development

LNG quality and interchangeability

Natural gas storage options

Climate Change

To conclude, as mentioned at the beginning of this document, how we address the climate change challenge will define this generation and those to come. AB 32 requires that we chart a course to reduce the state's greenhouse gas emissions and reduce dependence on fossil fuels.

Many policy questions remain to be answered. We are pledged to work closely with the California Air Resources Board as it fulfills its responsibility under

AB 32. Indeed, we are already partnering to design a framework for regulating the electricity and natural gas sectors under the law. In a joint proceeding, the Public Utilities Commission and Energy Commission are working together to provide recommendations for addressing these sectors, including developing a system popularly called "cap and trade."

We are also supporting the development of the Western Climate Initiative (WCI), which is designing a "cap and trade" system for the West. Governor Schwarzenegger helped initiate the WCI with representatives from five other Western states and two Canadian provinces. Since the initial formation, two other Western states have joined the WCI, and it is hoped that more partner states will join the effort. Ultimately, we need a national program for reducing greenhouse gases. All single-state or even regional approaches suffer from some shortcomings and would benefit from a national strategy. However, we cannot wait for the national government to act. We will continue to lead in this crucial policy area and make sure that California, given its past history and the knowledge and talent in our universities and private sector, leads in reducing emissions.

As alluded to several times, although AB 32 and the 2020 emissions reduction goal is a crucial first step. Ultimately we must keep our eye on the longer-term goal that Governor Schwarzenegger outlined for 2050 of reducing our greenhouse gas emissions to 80 percent below 1990 levels. This level of reductions is necessary worldwide to stabilize concentrations of carbon dioxide in the atmosphere and minimize the global change rise in sea level and ambient temperatures.

We, too, believe these levels of greenhouse gases will be necessary. Therefore, although we are focused on the 2020 goals, we are mindful that our actions for reductions in 2020 may not be enough for 2050, and indeed may actually undermine our ability to reach the 2050 goals. This could happen if we invest in mediocre solutions now and leave the hardest reductions until later. Avoiding such a suboptimal outcome is why we are motivated to act aggressively now to ensure that our long-term future environment in California, and in the world, is the best it can possibly be. We look forward to working with all stakeholders in California to make a low-emission future a reality.

Table 9
Climate Change Accomplishments and Next Steps

Accomplishments

Implemented SB 1368, the Emissions Performance Standard, for both IOUs and POUs

Next Steps

Making recommendations to the Air Resources Board for how electricity and natural gas sectors should be included in AB 32 framework

Planning for emissions reduction goals in 2050

Expanded scenario analysis efforts to evaluate the impact of high energy efficiency and 33 percent renewables on greenhouse gas emissions

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