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CALIFORNIA'S GOLDEN ENERGY EFFICIENCY OPPORTUNITY:

Ramping Up Success to Save Billions and Meet Climate Goals

NRDC

E2 Environmental Entrepreneurs

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We would like to thank everyone for their time reviewing this report.

It should be noted, though, that the external reviews do not indicate authorship or a full endorsement of the report and its findings.

Please Note: The Clean Energy and Pollution Reduction Act of 2015 (Senate Bill 350), which was signed into law on October 8, 2015, included direction on the data to be used to determine the estimate of energy savings necessary to meet the 2030 energy efficiency goals. This report was updated accordingly.

About NRDC
The Natural Resources Defense Council is an international nonprofit environmental organization with more than 2 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, Montana, and Beijing. Visit us at nrdc.org.

About E2
Environmental Entrepreneurs (E2) is a national, nonpartisan group of business leaders, investors and others who promote smart environmental policies that drive economic growth. E2 members, active in nearly every state in the country, have built or financed more than 1,700 companies that have created more than 570,000 jobs, and manage more than $100 billion in venture and private equity capital. E2 is an affiliate of the Natural Resources Defense Council (NRDC).

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Executive Summary

California's dedication to implementing energy-saving programs, building codes, and appliance standards over the past 40 years has saved Californians nearly $90 billion on their energy bills through 2013—with average residential electricity bills that are $240 less than in other states—and reduced electricity demand by more than 15,500 megawatts (MW), equivalent to the output from more than 30 large power plants.[1]

This report, a five-year update of California's energy efficiency progress, shows California is ahead of schedule to reach its 32,000 gigawatt-hours (GWh) goal of using efficiency to cut emissions by 2020 and help the state meet its total pollution reduction target under the landmark Global Warming Solutions Act (AB 32), but a significant ramp-up is needed to meet California's long-term climate and energy goals.[2]

Since the plan for implementing AB 32 was launched in 2008, California has saved enough electricity to cut its annual climate-warming greenhouse gas (GHG) emissions by more than 8 million metric tons, equivalent to the annual pollution from nearly 2 million cars.[3] Eliminating this electricity generation also avoids hundreds of tons of sulfur oxide gases and nitrogen oxides, pollutants that contribute to health issues such as coughing, wheezing, and decreased lung function.[4]

Based on the state's energy-saving achievements as of 2013 (the most recent complete data set available), NRDC estimates that efficiency could save Californians an additional $2 billion on their utility bills through 2015—$85 for the average household in this year alone—while avoiding another 10,000 gigawatt-hours (GWh) of electricity, 270 million therms (MMth) of natural gas, and the associated pollution. These savings are enough to serve over 1.5 million households for electricity and more than 500,000 households for natural gas for one year; together avoiding the carbon dioxide pollution equivalent to annual emissions from more than 1.5 million cars.

Figure ES-1: Benefits from California's Investment in Energy Efficiency

DECREASES POLLUTION

- Avoided at least 30 LARGE POWER PLANTS since 1970s, 11 more expected to be avoided over the next decade
- Cuts MILLIONS OF TONS OF POLLUTANTS contributing to asthma, other ills

CREATES JOBS, SPURS ECONOMY

- Efficiency jobs grew 15% compared to 2% economy-wide (2002–2012)
- California produces 2x benefit for every unit of electricity compared to the rest of U.S.

CUTS ENERGY WASTE

- Saved enough electricity since 2003 to power MORE THAN HALF OF CALIFORNIA'S HOMES FOR ONE YEAR
- Met about 1/5 of the state's electricity need in 2013
- Helped keep per capita electricity use flat vs. 50% increase in rest of U.S. (since 1970s)

HELPS LOW-INCOME CUSTOMERS

- Low-income efficiency programs served almost 3 MILLION HOUSEHOLDS (since 2003)
- Saved enough electricity to power 90,000 HOMES and enough natural gas for nearly 80,000 HOMES for 1 year

SAVES CALIFORNIANS MONEY

- Efficiency programs saved $12 billion after costs (2003-2013)
- Research projects yielded $446 for every $1 invested
- Newest building codes to save $6,000 per house
- Codes and standards saved a total of $75 billion (since 1970s)

HELPS MEET CLIMATE GOALS

- Slashed 30 MILLION metric tons of CO_2 pollution, equal to annual emissions of 6 MILLION cars (since 2003)

6 MILLION

- Cuts one of the largest sources of California's greenhouse gas emissions

STRONG EFFICIENCY POLICIES SAVE CALIFORNIANS MONEY AND ENERGY

California's 2003 Energy Action Plan requires that utilities make energy efficiency the top priority to meet customer needs before turning to other sources like renewable energy and natural gas.[5] Since then, the state's efficiency efforts have cut total electricity demand by nearly one-fifth, saved nearly 50,000 GWh of electricity (equivalent to the electricity needed to power over half of California's households in 2013), and saved more than 1,000 MMth of natural gas. These efficiency savings have avoided carbon dioxide emissions equivalent to the annual emissions from more than 6 million cars.[6,7]

Thanks in part to California's strong energy and climate policies, annual household electric bills are on average 18 percent below the rest of the nation.[8] In addition to avoiding the amount of power needed from more than 10 large plants since 2003 thanks to efficiency programs alone,[9] California is expected to avoid another 11 large (500 MW) power plants' worth of electricity demand by 2025 as a result of future programs, codes, and standards.[10]

The more than $8 billion funded by customer bills that utilities and other efficiency program administrators have invested in cutting energy waste since 2003 yielded the following benefits as of 2013 (the most recent complete data set available):

- Electricity savings of 30,000 GWh in the investor-owned utilities' (IOU) territory (serving 75 percent of the state),[11] equivalent to the power needed to serve more than 4 million California homes for one year;[12]
- Natural gas savings in the same area of 500 MMth, equal to the annual consumption of 1 million California households;[13]
- Electricity savings of 3,400 GWh in the publicly owned utilities' (POU) territory (serving the remaining 25 percent of the state), enough to avoid carbon dioxide emissions equal to the annual pollution from more than 370,000 cars;[14] and
- Electricity savings of 600 GWh from low-income programs statewide, lowering electricity usage enough to power 90,000 homes for one year, and avoiding 35 MMth, enough natural gas to serve nearly 80,000 California homes for one year.[15]

In 2013, alone:

- Investment in efficiency programs surpassed $30 per capita.[16] This is more than twice the average spending of $12 per capita across the country;[17]
- All three electric IOUs' electricity savings exceeded 1 percent of electricity sales (a metric that evaluates a utility's overall effort in developing and implementing efficiency programs), along with one large POU and a number of mid-sized and small POUs;[18] and
- The IOUs (electric and natural gas) and POUs (electric) had average investments in energy efficiency programs that were approximately 2 percent of their total revenue (a metric that indicates a utility's effort to invest in energy efficiency).[19]

In addition to efficiency programs, the state continues to support research, development, and demonstration (RD&D), as well as advancing buildings codes and equipment standards. These efforts have led to:

- More than 10,000 GWh in electricity savings since 2003 from the state's appliance efficiency standards, enough to serve nearly 2 million households for one year.[20]
- Homeowner savings of $6,000 over 30 years for a house constructed in accordance with the 2013 building energy efficiency code compared with similar houses built to the previous energy code.[21]
- Nearly $450 of benefit for every $1 of public funding invested in projects.[22]

Efficiency also supports a healthy economy. In fact, California spends less of its gross domestic product on electricity to power its homes and businesses than states with comparable populations and economies, and is nearly twice as productive per unit of electricity consumed.[23] If California were as inefficient as Texas, Californians would be spending $9.5 billion more on electricity each year and $24 billion more if the state were as inefficient as Florida.[24]

Meanwhile, efficiency employment grew by 15 percent from 2002 to 2012[25] and more than 300,000 positions, or nearly 70 percent of California's green economy jobs, are now related to improving energy efficiency in buildings alone.[26]

LAUNCHING CALIFORNIA TO THE NEXT LEVEL

The urgent threat of climate change makes it incumbent upon the Golden State to substantially ramp up efficiency efforts to cut emissions and meet the state's long-term energy and climate goals. Governor Edmund G. Brown Jr. has called for a doubling of current energy efficiency savings and a 40 percent reduction of greenhouse gas emissions below 1990 levels by 2030. This will help put the state on a path to meet the goal Governor Arnold Schwarzenegger established in his 2005 Executive Order to cut emissions to 80 percent below 1990 levels by 2050.

California is ahead of schedule to meet the amount of efficiency savings projected in the state's blueprint to cut greenhouse gas emissions to 1990 levels by 2020. But without a significant acceleration, the current trajectory would fall short of Governor Brown's goal to double efficiency savings by 2030. Based on the most current projections for efficiency savings, doubling them would require that over the next 15 years, customer-funded efficiency programs for both investor-owned and publicly owned utility territories, as well as new minimum energy standards for buildings and appliances, save nearly 89,000 GWh (enough to reduce our total statewide electricity needs in 2030 by 26 percent), and 1,377 MMth (enough to meet more than 10 percent of the state's 2030 natural gas demand).[27]

Thanks in part to the state's great success, including a strong policy foundation and network of energy efficiency professionals, California is planning to significantly exceed its power plant emissions reduction requirements under the federal Clean Power Plan. But to succeed at reaching the ambitious goal to double its efficiency savings, the state must improve upon and expand policies to address a variety of issues that are limiting opportunities to capture substantial energy savings. For example, efficiency efforts are not always coordinated statewide, a number of policy rules that prevent administrators and implementers from capturing cost-effective savings need to be changed, commission staff capacity is frequently limited, and/or tasks may not be prioritized or are too numerous to complete in a timely manner.

Fortunately, many of the issues that could hamper California's future efficiency success are already being addressed in formal proceedings or by informal working groups at the state energy and climate agencies.

This report offers recommendations for how state agencies, decision makers, and stakeholders can collaboratively move forward to achieve California's efficiency and climate goals. To aid in this effort, the Legislature should codify the state's post-2020 energy efficiency and greenhouse gas reduction goals to provide a long-term framework for updating efficiency policies. However, most of the responsibility for implementing the following recommendations falls on the energy and climate agencies, which should:

- Provide strategic direction on how to double savings from efficiency;
- Establish a statewide collaborative group to inform ongoing efficiency planning and implementation;
- Prioritize the challenges to resolve;
- Align policies and processes with climate and efficiency goals;
- Set efficiency rules to enable market transformation;
- Expand the use of efficiency to avoid upgrading or adding new power generation;
- Adopt a process for ongoing program planning and oversight;
- Ensure low- and moderate- income customers have access to high-quality energy-saving opportunities;
- Include workforce strategies to help scale up efficiency;
- Accelerate implementation of building codes and appliance standards;
- Foster opportunities to capture greater efficiency; and
- Improve access to and use of energy data.

Chapter 1 of this report sets the context for energy efficiency and its critical role in meeting California's climate goals. Chapter 2 highlights California's progress and the direct benefits efficiency has yielded for customers and the economy, including contributing to a strong and growing workforce. Chapter 3 describes California's smart foundational efficiency policies and associated benefits, and Chapter 4 provides detailed, action-oriented recommendations to align the state's policy rules with its climate goals to enable more efficiency to be captured. In sum, this report examines the history, benefits, current opportunities, and potential for more energy efficiency with policy improvements and leadership.

Chapter 1

Increased Energy Efficiency Is Needed to Meet California's Climate Goals

California has been a leader on efficiency since the 1970s.[1] However, as global carbon pollution levels continue to rise, it is imperative that the Golden State redouble its efforts to leverage the smarter use of energy to grow the economy and help mitigate the effects of climate change by reducing emissions that harm our health and environment.

Levels of carbon dioxide in the atmosphere surpassed 400 parts per million (ppm) for the first time in 2012, contributing to dangerous climate conditions around the world.[2] Furthermore, the 10 hottest years on record have all occurred in the past 15 years, with 2014 being the warmest yet.[3] Rising ocean levels from melting glaciers put our coastlines at risk, and more drought and wildfires threaten the economy, public health, and food production, both in the state and worldwide.

The most recent available data show that California experienced a 1.7-degree Fahrenheit (F) increase in average temperatures from 1895 to 2011.[4] Without action to curb emissions, temperatures in the state are expected to rise to at least 3 degrees F above 2000 averages by 2050—a threefold increase in the rate of warming over the past century.[5] This will lead to heat waves that are more frequent, hotter, and longer; further threaten the state's water supply, which is already vulnerable given the extreme drought conditions of recent years; and drive up energy demand for cooling.[6]

As the lowest-cost mitigation strategy, energy efficiency is a critical component in California's effort to reach its climate goals, including the state's groundbreaking Global Warming Solutions Act (AB 32) that requires a reduction in greenhouse gas emissions to 1990 levels by 2020 (equivalent to 15 percent below business as usual).[7] California is on the path to meet—and exceed—the energy efficiency portion of AB 32's clean energy goals for 2020 as determined by the California Air Resources Board (CARB) 2008 AB 32 Scoping Plan.[8] However, more progress is needed to reach the state's long-term goals.

In particular, Governor Arnold Schwarzenegger issued an executive order in 2005 aiming for a reduction in greenhouse gas emissions to 80 percent below 1990 levels by 2050, and Governor Edmund G. Brown Jr. in his January 2015 Inaugural Address called for a doubling of the state's energy efficiency savings by 2030.[9] In April 2015, Governor Brown also issued an executive order that set the most aggressive greenhouse gas reduction target in all of North America, calling for a 40 percent drop below 1990 levels by 2030.[10] To respond to the growing threat of climate change and meet the state's long-term emissions reduction goals, various actions will be necessary.

The California Legislature should:

- Codify Governor Brown's 2015 executive order calling for a 2030 goal of reducing greenhouse gas emissions to 40 percent below 1990 levels and Governor Schwarzenegger's 2005 executive order calling for greenhouse gas emissions to be reduced 80 percent below 1990 levels by 2050.
- Codify Governor Brown's goal to double energy efficiency savings by 2030 and establish a pathway by which to achieve it.

The California energy agencies should:

- Update policy rules guiding efficiency program planning and investments to align with state clean energy objectives and enable California to capture all cost-effective efficiency. (See Chapter 4 for specific recommendations.)
- Direct energy efficiency program administrators to scale up efficiency offerings in response to these updated rules, further leveraging the expertise of and opportunities with local governments, third-party companies, and nonprofit organizations.

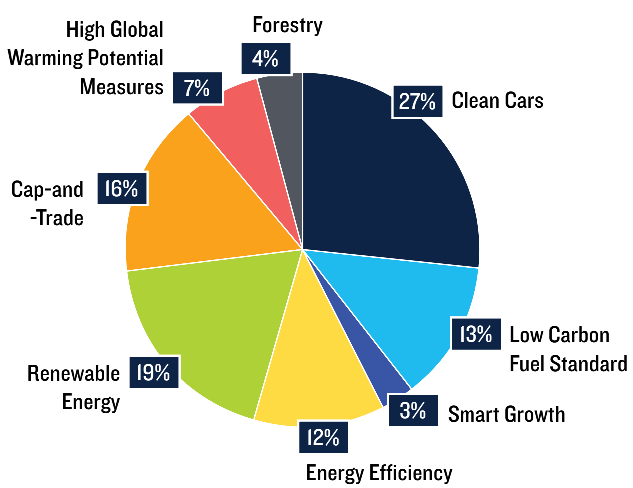
These actions will help California maintain its world leadership in combating climate change and benefit local economies when savings from lower utility bills are spent on other goods and services.

USING EFFICIENCY MEANS LESS RELIANCE ON POLLUTING ENERGY RESOURCES

Electricity generation from burning fossil fuels in power plants and the use of natural gas in buildings account for nearly 30 percent of California's greenhouse gas emissions.[11] However, those emissions can be reduced when California's investor-owned and publicly owned utilities—with partners such as efficiency companies, nonprofit organizations, local governments, and trade allies—implement efficiency programs to help customers cut energy consumption.[12] This leads to less reliance on power generated from conventional fossil fuel plants, reducing the emissions that contribute to climate change and harm Californians' health.

As seen in Figure 1, energy efficiency efforts (such as building energy codes, appliance and equipment efficiency standards, and programs that weatherize homes or lower the cost of the most efficient electronics) are a critical piece in California's efforts to cut emissions and meet its climate goals.

Figure 1: California's AB 32 Emissions Reduction Strategies[13]



Even as the state's energy generation mix gets cleaner from relying less on greenhouse gas-emitting sources, efficiency continues to be critical to lowering the overall cost of meeting the state's climate goals and to better integrate renewables as a source of energy.[14] Efficiency will likely play an even larger role moving forward and therefore policies and strategies must evolve to help the state meet post-2020 greenhouse gas and energy reduction goals.[15]

In addition to the state's foundational energy efficiency policies, California relies on a suite of complementary strategies to further decrease its dependence on polluting fossil fuels, including:

- **CLEANER VEHICLE AND FUEL STANDARDS** that help meet the governor's recent call to cut today's petroleum consumption from vehicles in half by 2030 through efforts such as requiring lowering polluting cars and trucks, putting 1.5 million electric vehicles on the road by 2025, and complying with the Low Carbon Fuel Standard, which requires that fuel providers ratchet down the carbon content of transportation fuels sold in California by 10 percent by 2020;[16,17]
- **INCREASED RELIANCE ON RENEWABLE ENERGY** such as the Renewable Portfolio Standard to increase the amount of energy from sources like wind and solar to 33 percent of all electricity generation by 2020, and Governor Brown's call for to the state to reach 50 percent renewable energy by 2030;[18]
- **SMART GROWTH STRATEGIES,** like transit-friendly communities and better public transportation options that reduce the need to drive;[19]
- **THE GREENHOUSE GAS EMISSIONS PERFORMANCE STANDARD,** which precludes new, long-term investments in power plants delivering power to California that release more greenhouse gases than a combined-cycle natural gas power plant;[20] and
- **A CAP-AND-TRADE SYSTEM** that puts a declining limit on carbon pollution from the state's largest emitters—like the utility sector, cement plants, and refineries—and allows them to buy or trade a gradually decreasing number of pollution allowances.[21]

THE STATE IS ON TRACK TO SURPASS THE 2020 GREENHOUSE GAS EMISSION GOALS

In the AB 32 Scoping Plan, which charted the course for how California would meet its emissions reduction goals for 2020, CARB anticipated the state would need to achieve 32,000 gigawatt hours (GWh) of savings from energy efficiency programs, building codes, and appliance standards.[22] This is enough electricity to power more than one-third of all California homes for a year.[23]

Thanks to the state's ongoing success with efficiency programs, codes, and standards (Figure 2), California is on track to exceed the expected 32,000 GWh savings four years ahead of schedule, as shown in Figure 3. In fact, between 2003 and 2013, these savings reached nearly 50,000 GWh, enough power to meet the needs of more than half of California's homes in 2013.[24]

In the time since the Scoping Plan was adopted in 2008, the electricity savings from energy efficiency have already reduced California's annual climate-warming emissions by more than 8 million metric tons, equivalent to the annual pollution from nearly 2 million cars.[25]

Figure 2: Cumulative Energy Efficiency Savings Due to Codes, Standards, and Programs[26]

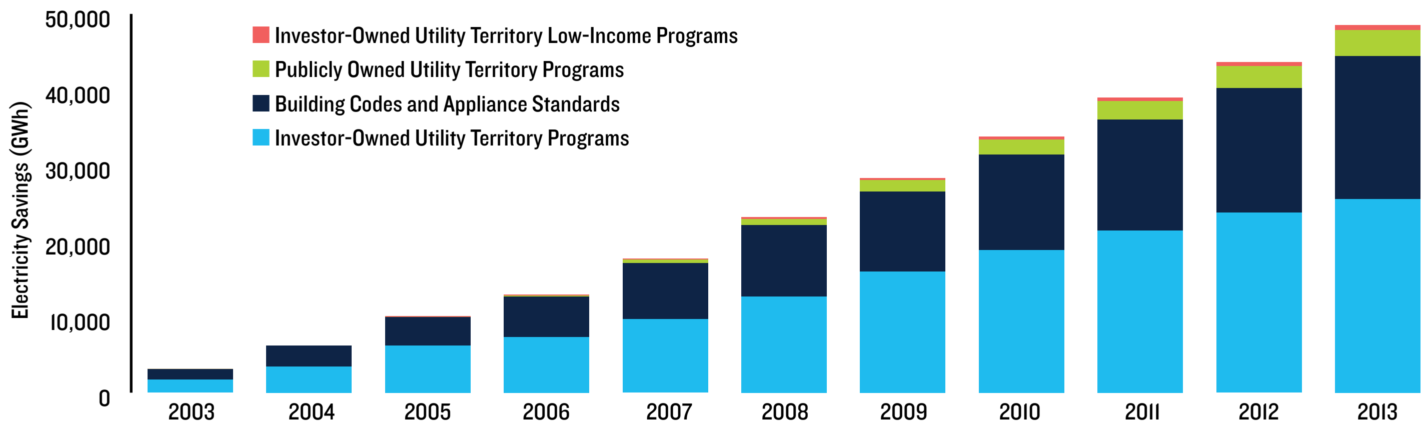
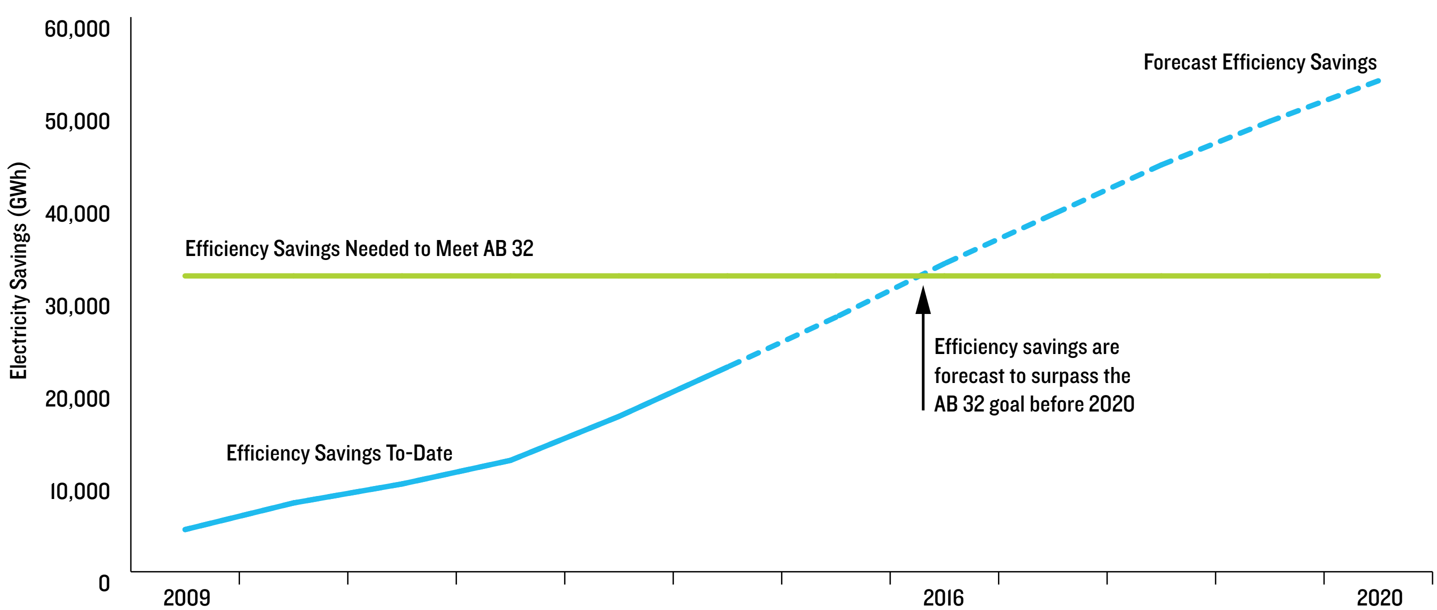


Figure 3: California Savings Compared to AB 32 Efficiency Target[27]

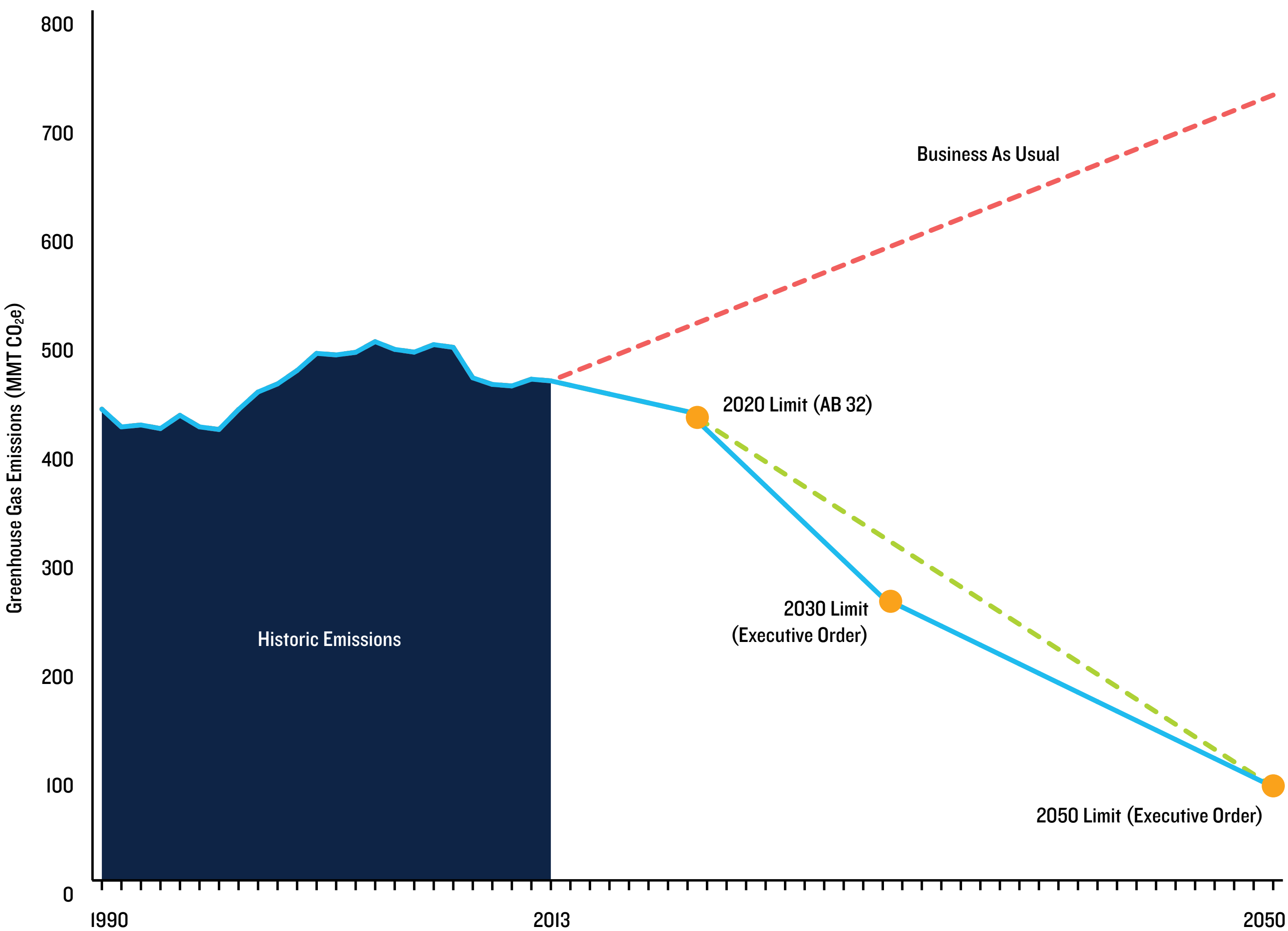


MORE EFFICIENCY IS NEEDED TO MEET LONG-TERM ENERGY AND CLIMATE GOALS

As previously noted, California has outlined a number of post-2020 energy and climate goals, including a doubling of energy savings, a reduction in greenhouse gas emissions to 40 percent below 1990 levels by 2030, and a further reduction of emissions to 80 percent below 1990 levels by 2050.[28] A doubling of energy savings from efficiency programs, as well as new building codes and appliance standards, will require an impressive 89,000 GWh and 1,377 million therms (MMth) of cumulative savings in 2030, leading to a 26 percent reduction in statewide electricity demand and more than 10 percent reduction in natural gas demand.[29] Achieving these savings will also support the pollution decreases illustrated in Figure 4 that are needed to meet the state's long-term climate goals.

To help keep the overall package of climate-fighting solutions affordable for every Californian, the state must set policies that ensure efficiency is: (1) used to cost-effectively replace the need for other energy resources and (2) relied upon to lower emissions before turning to other, more expensive greenhouse gas emission reduction strategies. While California has made great progress over the past decade, the state energy and climate agencies must evaluate how current policy rules and strategies can be updated to support this effort and lay out a long-term vision to put the state on a path to meet the ambitious long-term efficiency and climate goals.

Figure 4: California Greenhouse Gas Emissions Reduction Goals[30]



Chapter 2

Energy Efficiency Success Leads to Major Benefits for Californians

California's successful use of energy efficiency to offset the need for additional power supply is due in large part to an integrated approach that ensures the most cutting-edge efficiency technologies and strategies reach the market so customers can make smarter use of energy.

In this approach:

- Research, development, and demonstration (RD&D) projects create new technologies and methods that increasingly save energy.
- Programs help advance the most efficient products and services in the market.
- Once a technology or method becomes sufficiently established in the marketplace, minimum efficiency standards (e.g., for new buildings and appliances) eliminate the older, less efficient options.

As discussed in greater detail later in this chapter, transforming the market in this way contributes to keeping California's household electric bills lower than the national average, saving Californians tens of billions of dollars on utility bills over the past four decades. It has also helped grow an economy that uses electricity more productively than the rest of the country while cutting carbon dioxide emissions from electricity and natural gas use—the largest contributor to climate change—by 30 million metric tons since 2003, equivalent to the annual emissions from more than 6 million cars.[1]

MEETING THE STATE'S ELECTRICITY NEEDS

When utilities consider how to obtain the electricity they need to serve customers, they look to power generated from a variety of sources, such as natural gas, wind, and hydropower. At the same time, utilities know that if they help customers cut energy waste, it reduces the amount of energy the utilities must generate or buy—including energy from dirtier and more expensive resources. This means cleaner air and lower energy bills for everyone.

Thanks to decades of achievements and the state's ongoing commitment to efficiency programs, codes, and standards, smarter energy use has reduced the overall amount of electricity needed to serve customers by nearly one-fifth (Figure 5). If California had not invested in efficiency programs or codes and standards that optimize energy use, utilities would have had to build or purchase substantially more dirty and costly power to meet the additional demand for electricity.

Efficiency has also helped keep per capita electricity consumption relatively flat since 1975, compared with the 50 percent increase in the rest of the country (Figure 6). Electricity consumption per person in California was

Figure 5: Energy Efficiency as Part of California's Electricity Supply[2]

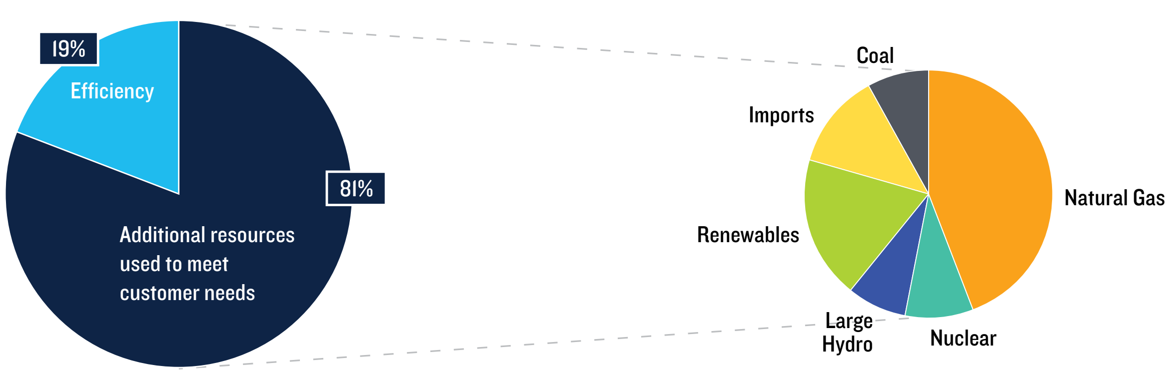
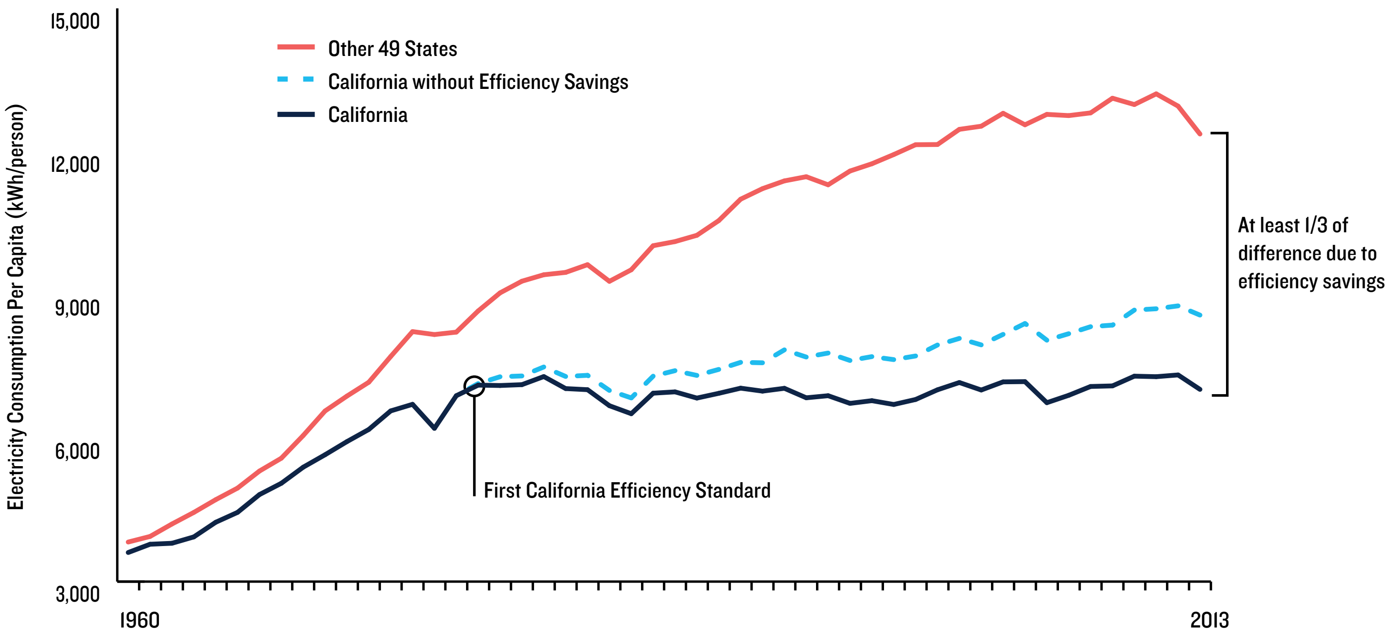


Figure 6: Efficiency Helps Keep Per Capita Electricity Use Flat[3]



also lower in 2013 than it was in 1973.[4] While some of the difference between California's per capita electricity use as compared to the rest of the nation may be explained by factors independent of energy policy (such as industrial trends and higher average household size), approximately one-third of this lower usage is due to the state's smart efficiency policies, as illustrated in Figure 6, which shows the difference between California's per-capita consumption and what it would have been absent efficiency savings.[5] While this is a significant achievement, it is not enough of a reduction to meet the state's climate goals. Efficiency must be increased to bend this curve downward, substantially lowering per capita electricity use while also reducing the state's overall demand and maintaining economic growth.

REDUCING THE NEED TO BUILD POWER GENERATION

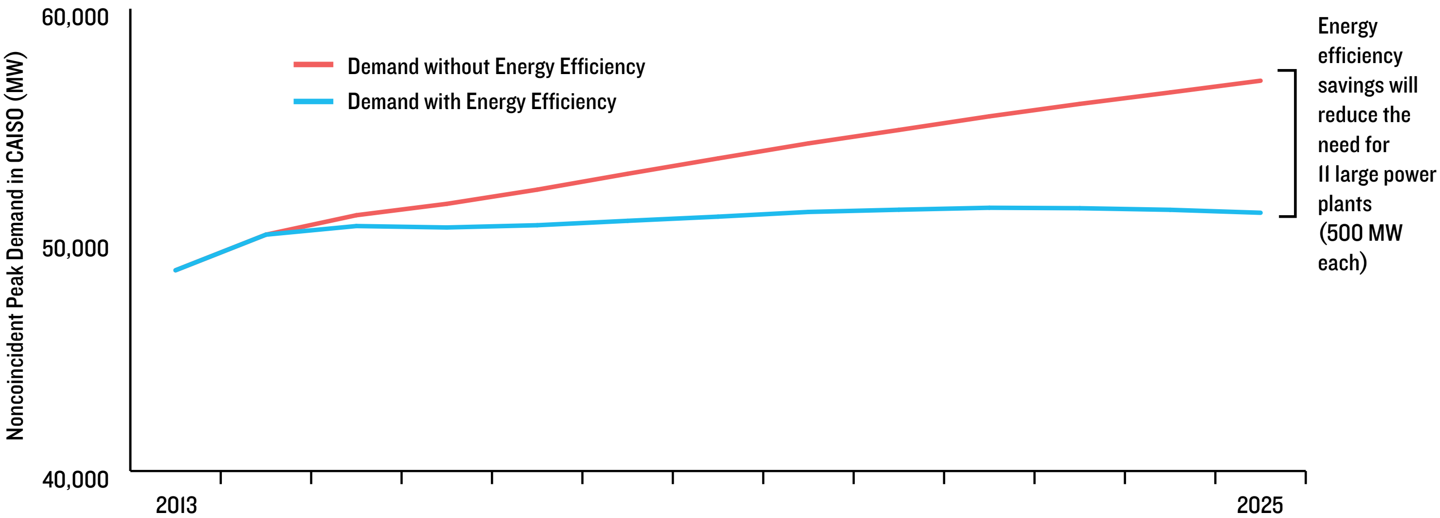
Energy efficiency—in addition to demand response—is a key strategy to reduce the amount of energy required to serve customers at times of highest (peak) demand, thus avoiding the need to build expensive (and often polluting) power-generating facilities that likely would sit idle for much of the year when typical demand is much lower. For California, this peak reduction means that since the 1970s, the state has avoided building at least 30 large power plants.[6] The avoided electricity is also quantified as "Rosenfelds," a metric created in honor of Art Rosenfeld (former commissioner of the California Energy Commission) for his contribution to advancing the role of efficiency to displace conventional power.[7]

However, moving forward, California will have to think differently about how to use efficiency to offset demand during the periods when electricity is needed the most. Thanks to strong investment in renewable energy, the time frame when the state has to power up the greatest amount of resources has shifted. It had been hot summer days when air conditioners are running full blast, but now the large amounts of solar energy flowing into the system can meet that demand. Instead, the greatest need for electricity is in the early-winter evenings when solar arrays are no longer providing electricity and Californians are powering up their lights and equipment as they come home.

California now routinely meets 15 percent or more of its midday power demand from solar generation,[8] which creates a unique challenge for the California Independent System Operator (CAISO) to ensure sufficient power is available to meet the steep ramp-up of evening peaks in electricity use.[9] Efficiency can help when programs are designed to address peak load during the evening and are targeted at particular locations where the need is the greatest.[10]

Another way the state has avoided investment in new renewable or fossil fuel generation is by fully counting on future energy efficiency in resource planning processes. The California Energy Commission (CEC) works with the CAISO and the California Public Utilities Commission (CPUC) to estimate the state's expected energy need for the following decade.[11] This 10-year forecast directly relates to how much power the utilities will be required (or allowed) to buy or build. Historically, the forecast

Figure 7: California's Flattening Electricity Demand Due to Efficiency[12]



included anticipated energy savings only from efficiency programs with approved funding (e.g., those approved by the CPUC for two to three years) rather than the entire 10-year period. This contributed to regularly overestimating the amount of energy needed to meet California's demand and led to investments in unnecessary and costly power plants.[13]

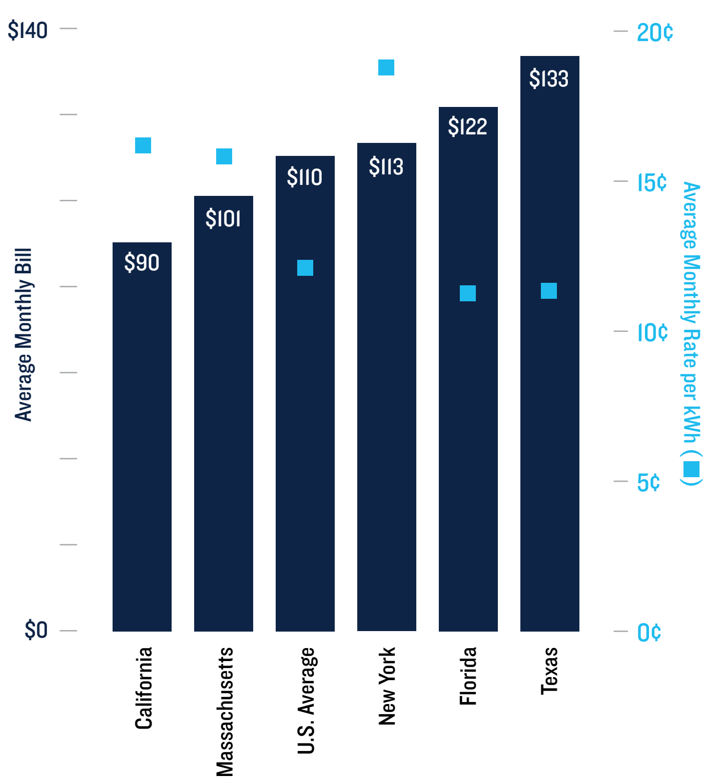
After collaborating with the CPUC, CAISO, and stakeholders, the CEC in 2013 began incorporating expected energy efficiency savings over the entire 10-year period covered by each forecast. As shown in Figure 7, anticipated savings in the next decade will allow utilities to avoid building or buying 11 plants' worth of polluting and expensive power, saving customers even more money. This is in addition to programs that helped reduce peak demand enough to avoid more than 10 large (500 MW) power plants since 2003.[14]

PROVIDING CHEAPER POWER AND LOWERING ELECTRICITY BILLS

Even after 40 years of progress, energy efficiency remains the cheapest way to meet customers' energy needs. While generating electricity from a combined cycle natural gas plant cost approximately 11 cents per kilowatt-hour (kWh) in 2013, the price of helping customers of California's investor-owned utilities save the same amount of energy averaged less than 6 cents/kWh and averaged about 2.5 cents/kWh for the publicly owned utilities.[15,16] *It costs substantially less for utilities to rely on efficiency programs than to buy and/or produce that same amount of energy to serve residential, commercial, agricultural, and industrial customers.*

Furthermore, despite having electricity rates (the price of electricity per kWh) that are higher than the national average, California's electricity *bills*—consumers' bottom-line total costs—are the seventh-lowest in the country, due in part to efficiency.[17] In fact, Californians' annual average residential electric bills are $240 or 18 percent lower than the national average (see Figure 8).[18]

Figure 8: California's Lower Residential Electric Bills (2013)[19]



HELPING CUSTOMERS OF ALL INCOME LEVELS

Improving energy efficiency significantly lowers energy bills, creates jobs to manufacture and install efficiency-related products (like insulation or lighting controls), and reduces pollution—benefits that all utility customers enjoy. However, the gains may be greatest in California's low-income communities, where poorly weatherized homes, high unemployment rates, and proximity to fossil fuel-fired power plants are often the norm.

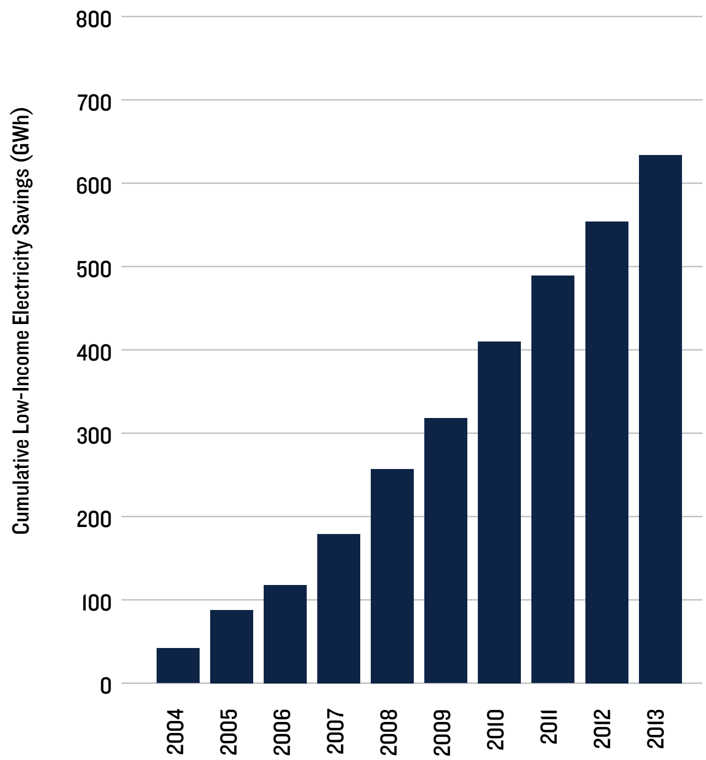
In California, at least one-third of residential customers are categorized as low-income (approximately 5 million), which is defined as having an annual income equal to or less than twice the federal poverty threshold (e.g., an income of just over $31,000 for a household of two).[20] Helping these customers use energy more efficiently can:

- Spur economic growth by lowering bills and enabling families to purchase more goods and services in the local economy;
- Create jobs in communities where energy efficiency programs are linked to hiring from the local workforce;
- Provide long-term, sustainable utility bill relief by cutting energy waste;
- Improve public health by reducing the amount of pollution from electricity generation; and
- Enhance the comfort, safety, and indoor air quality of low-income homes.

Utilities around the state have programs geared specifically to serve moderate- and low-income households, supplementing the roughly $30 million that low-income Californians receive in annual federal weatherization assistance.[21] California's investor-owned utilities also invest $300 million of customer funds annually to offer free energy efficiency services to qualified customers through the Energy Savings Assistance (ESA) Program, which is overseen by the CPUC.[22] Since 2003, these programs have served almost 3 million low-income households in California, and saved enough electricity to power more than 90,000 homes and enough natural gas to serve nearly 80,000 homes in the state for one year.[23]

The CPUC's first strategic plan for energy efficiency, adopted in 2008, included a goal to reach all eligible and willing low-income households by 2020.[24] As a result of this policy, California's efficiency spending to serve low-income households has increased dramatically, annual electricity savings from low-income programs have doubled, and cumulative savings have exceeded 600 GWh, as shown in Figure 9.[25]

Figure 9: Energy Savings Assistance Program Electricity Savings[26]



Improving the energy efficiency of low-income households is particularly important as they spend a disproportionate amount of their income on energy bills and often have added costs associated with disconnection and reconnection as a result of being unable to consistently pay them. For many, keeping up with bill payments means sacrificing other basic needs, such as food and medical care.[27]

By avoiding the need to burn dirty fossil-fuels, energy efficiency also has the potential to decrease environmental and health impacts on low-income communities. In fact, five of California's smoggiest metropolitan areas—Bakersfield, Fresno, Los Angeles, Modesto, and San Francisco-San Jose-Oakland[28]—also have the highest densities of low-income residents and/or people of color.[29]

Efficiency efforts also provide important comfort, health, and safety improvements by sealing leaks and adding insulation to eliminate drafts and by reducing health and safety hazards posed by the use of supplementary heating (e.g., using ovens to heat homes). A majority of ESA participants said they noticed improvements in their safety and comfort and experienced reduced energy costs as a result of the program, with 81 percent citing lower energy bills, 64 percent feeling safer, 65 percent feeling more comfortable, and 44 percent aware of health improvements in household members.[30]

Continuing to broaden and deepen the reach of low-income energy efficiency programs statewide will mitigate the impact of bills on overburdened households, avoid additional costly power generation, improve public health, and inject economic activity into struggling low-income communities. To better do so, the state must update policy guidance to ensure programs are both reaching households and providing greater and more durable energy savings. This is particularly true in harder-to-reach sectors like multifamily rental buildings, where owners often lack funding to make capital improvements or are not motivated to invest if they are not the ones paying the energy bills or cannot increase rent to recover their initial investment.

INVESTING IN INNOVATION

Ongoing research, development, and demonstration (RD&D) of new energy-related technologies and methods is crucial to continually advancing energy savings, spurring innovation, and supporting growing companies in California. New technologies must be researched and tested before they are introduced into the market, which requires a focus on innovation, experimentation, and a willingness to risk failure.

As the most populous U.S. state, California represents a huge market, and products developed here often are sold nationally and worldwide. When RD&D is successful, the time and money invested produce a significant payoff. For example, as part of an RD&D program called the Electric Program Investment Charge (EPIC), $22 million of investment for just 19 projects (such as improvements in HVAC, pipe insulation, television electricity use, and duct and air filter sizing) is expected to yield $10 billion in customer savings between 2005 and 2025.[31] These projects led to state and industry agreements to improve product efficiency or were included in CEC proceedings setting new appliance and equipment standards and will ultimately provide almost $450 of benefit for every $1 of public funding invested in the projects.[32]

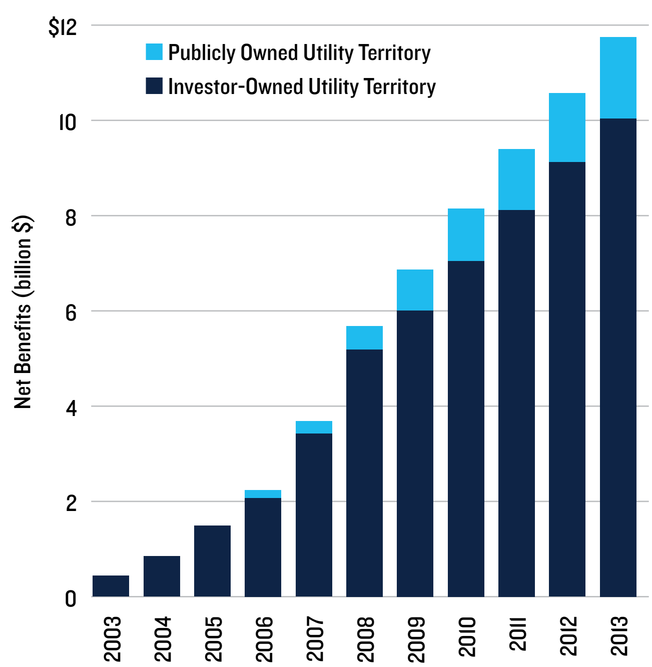
SAVING ENERGY AND MONEY THROUGH PROGRAMS

California is host to a number of program administrators that are responsible for offering a variety of efficiency strategies funded from customer bills to help the state's 38 million residents cut energy waste. These program administrators include the state's four largest investor-owned utilities (IOUs) that serve 75 percent of the state's electricity needs (Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and Southern California Gas Company) and the nearly 40 publicly owned utilities (POUs) that serve the rest. In addition, the Southern California[33] and Bay Area[34] Regional Energy Networks, and community choice aggregators (localities that provide electricity to their community) also provide efficiency services to customers in their regions.[35] The program administrators coordinate when possible to avoid program overlap or customer confusion in the marketplace and help customers use energy smarter by working closely with partners such as efficiency companies, nonprofit organizations, local governments, and trade allies.

Programs can help residential, commercial, agricultural, and industrial customers save energy and money in existing buildings through upgrading the building shell and equipment, or through highly efficient new construction. Efficiency programs also help overcome market barriers—like high costs or few product choices—by subsidizing the cost of appliances, electronics, and motors, among other things, and incentivizing manufacturers to make more efficient products.

As a result of investment (nearly $1 billion of customer funds annually since 2010) by program administrators each year, annual electricity savings from these programs have nearly doubled since 2003, reaching a cumulative total of more than 33,000 gigawatt-hours (GWh), equivalent to the annual electricity consumed by nearly 5 million California households.[36] Investments in efficiency have, in fact, led to so much energy reduction that customers saved nearly $12 billion on their energy bills after accounting for the costs of the programs from 2003 through 2013 (see Figure 10).

Figure 10: Cumulative Efficiency Program Net Benefits[37]



GAS AND WATER PARTNERSHIP SCALES EFFICIENCY

Southern California Gas (the nation's largest gas utility, serving 20 million consumers) and the Los Angeles Department of Water and Power (the country's biggest municipal electric utility, with 4 million customers) created a formal partnership in 2012 to serve their mutual customers with electric, gas, and water efficiency opportunities in a "one-stop-shop" format, where one contact reaches out to customers to offer all program options at once.

This partnership covers 11 programs, ranging from small business direct install—where a set of measures is installed for the customer at little to no cost—to making sure building equipment is being operated as efficiently as possible. These efforts have led to numerous benefits, including increased participation in the Los Angeles Better Buildings Challenge to save energy, and promoting efficient buildings in the commercial new construction sector. The partnership has also significantly increased participation in programs like the statewide Energy Upgrade California-Home Upgrade offering and the partnership's multifamily direct-install program, and has sparked other municipal utilities—such as those in Anaheim and Riverside—to seek similar cooperative agreements with Southern California Gas.

The energy efficiency programs in the IOUs' territory alone saved nearly 30,000 GWh of electricity between 2003 and 2013 (see Figure 11), enough to power more than 4 million California homes for one year.[38] The electric efficiency programs also reduced power plant emissions by an amount equivalent to the annual emissions from more than 3 million cars.[39]

Between 2006, when they first began reporting savings, to 2013, the POUs—serving one-quarter of the state—collectively saved more than 3,400 GWh, enough to power 500,000 California homes annually.[41] The POU efficiency programs also avoided carbon dioxide emissions equal to the annual emissions from more than 370,000 cars.[42] Figure 12 breaks down the POU savings by utility size, based on the amount of electricity provided.[43]

Figure 11: Cumulative IOU Territory Electricity Savings[40]

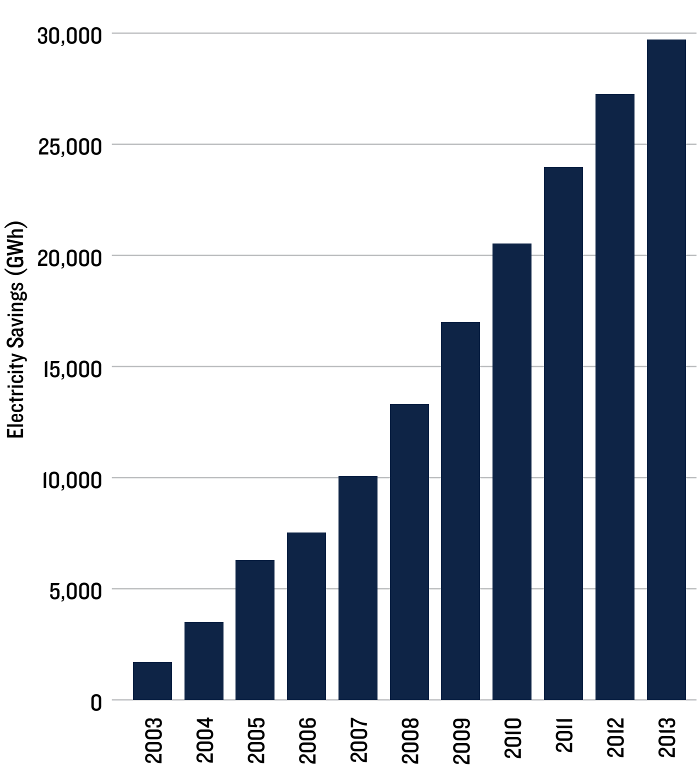
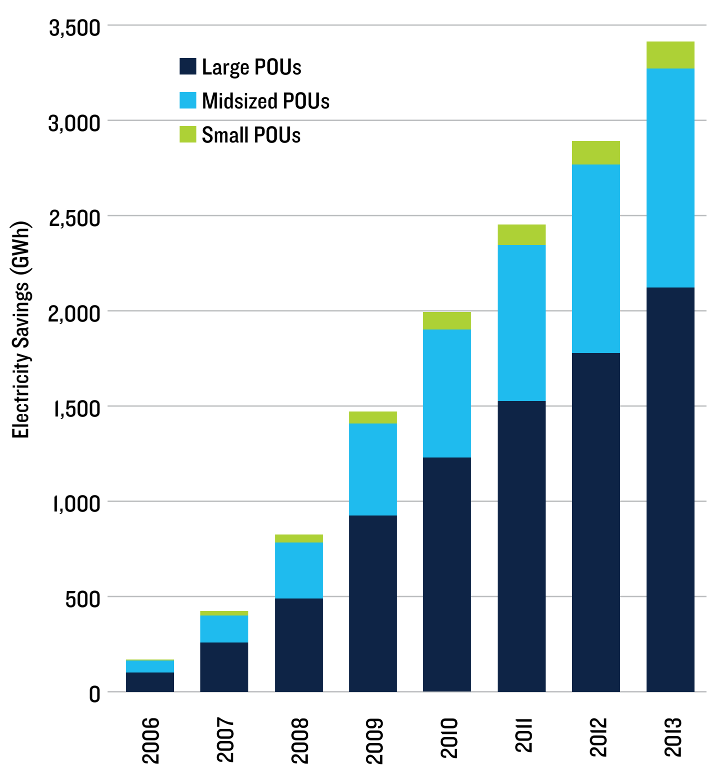


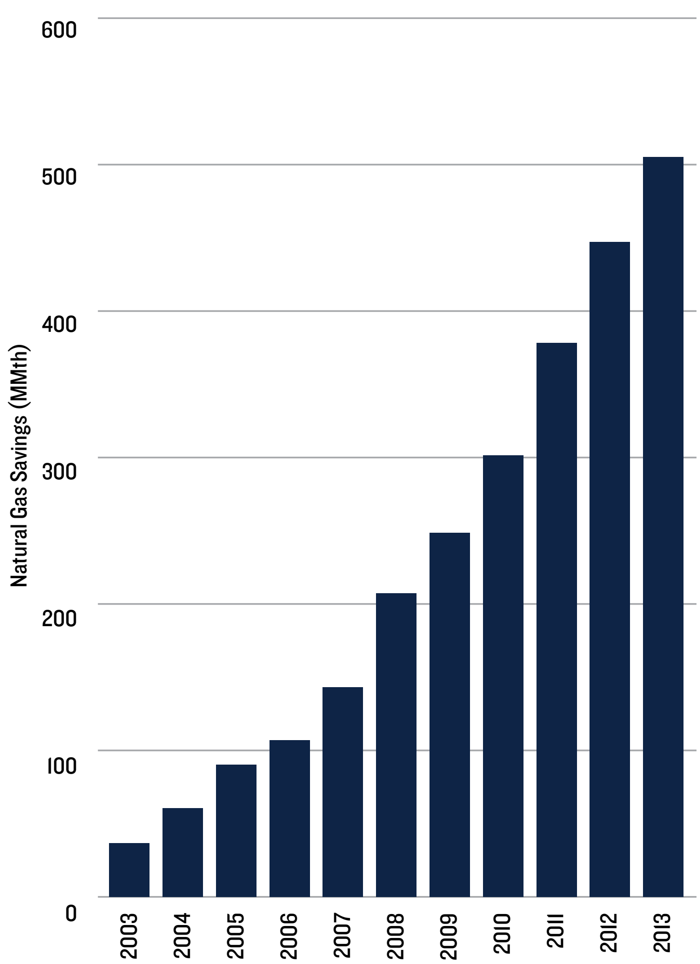
Figure 12: Cumulative POU Territory Electricity Savings[44]



Note: POUs began formally reporting savings to the CEC in 2006

Additionally, as the major providers of natural gas service in California, the IOUs (with the help of other program administrators and partners) offer natural gas efficiency programs, such as rebates on the purchase of efficient hot water heaters or programs that check to make sure heating ducts are properly sealed. From 2003 through 2013, annual natural gas savings increased by more than 50 percent, reaching cumulative savings of 500 million therms (Figure 13), equal to the annual consumption of 1 million households.[45] That's about the number of households in San Diego, San Jose, Fresno, and Bakersfield combined.[46]

Figure 13: Cumulative IOU Territory Natural Gas Savings[47]



ENSURING SMARTER ENERGY USE

To complement the energy-saving programs offered by program administrators, the CEC sets aggressive efficiency requirements (like requiring better insulation) for new buildings or extensive retrofits, as well as for appliances and equipment (such as requiring minimum levels of efficiency for products like refrigerators or battery chargers). It is far cheaper to rely on these building codes and appliance and equipment standards in new construction than to try to retrofit a facility at a later time or to depend on consumer behavior changes to compensate for inefficient appliances.

Together, the Golden State's energy efficiency building codes and appliance standards saved Californians more than 15,000 GWh since 2003 and more than $75 billion in reduced electricity bills since the mid-1970s.[48] In addition, the 2013 building energy efficiency codes, which went into effect on July 1, 2014, are expected to cut energy consumption in new homes by 25 percent, saving each household $6,000 on utility bills over the course of 30 years ($200/year) compared with similar homes built according to the previous energy code.[49] California's appliance efficiency standards alone have also avoided more than 10,000 GWh of electricity since 2003 and saved consumers tens of billions of dollars through reduced utility bills since 1975.[50]

Furthermore, NRDC estimates (based on the state's energy-saving achievements as of 2013) that efficiency could save customers another $2 billion on their utility bills in 2014 and 2015—or $85 for the average household in this year alone. These savings would also avoid 10,000 GWh of electricity (equivalent to providing power for over 1.5 million households) and 270 MMth of natural gas (enough to serve more than 500,000 households); together avoiding the carbon dioxide pollution equivalent to the annual emissions from more than 1.5 million cars.

COLLABORATION CREATES CORRECTIONS FACILITY SAVINGS

Since Southern California Edison (SCE) began partnering with the California Department of Corrections and Rehabilitation (CDCR) in 2006 as part of a statewide program run similarly by all IOUs, the CDCR has implemented energy efficiency projects that currently save more than 64 GWh of electricity and over 2 million therms of natural gas annually in state correction facilities. These projects save taxpayers on average nearly $7 million a year in reduced utility payments for the corrections buildings.

All projects are overseen by the CDCR Facility Planning, Construction and Management Division's Energy and Sustainability Section, with ongoing technical support from SCE to identify the best retrofit projects—usually funded through a loan on the utility bill—such as modifying heating and air-conditioning systems and controls, replacing ovens, and upgrading outdated light fixtures and electric motors.

SUPPORTING A PRODUCTIVE ECONOMY

One measurement of the productivity of a state's economy is the amount it pays for electricity relative to its gross domestic product (GDP). Comparing a state's total electricity bill to the size of its economy allows for a normalized comparison with other states, including those that differ in size, industrial output, and climate. By this metric, California spends less of its GDP on electricity bills than other states with comparable economies and populations (Figure 14), indicating that its factories and businesses are producing substantially more value while using less electricity. For example, if California were as inefficient as Texas, Golden State consumers would be spending $9.5 billion more on electricity each year, rather than investing that money elsewhere in the economy.[51] They would spend $24 billion more if the state were as inefficient as Florida.[52]

Another important metric of economic productivity is how much GDP is produced per unit of electricity used—that is, how much in goods and services the state produces from using one unit of electricity. By this metric, California yields nearly twice as much monetary benefit for each kilowatt-hour as the rest of the United States.[54] Smart energy policies contribute to these positive economic effects and show that cutting electricity use helps lower the cost of power for customers, thus boosting the economy.

SPURRING JOBS

California's energy policies also have led to substantial efficiency activity across the state, as shown in Figure 15. Increased demand for energy upgrades results in a need for more companies and nonprofit organizations to deliver the programs, as well as training facilities across the state to ready the workforce for efficiency upgrade installations, quality control, and other related implementation activities. Other groups, such as energy service companies, can act as "project leads," providing all of the services needed to upgrade a building (e.g., auditing, financing, contracting, and quality assurance), relying on energy bill savings to pay for the project. Even if they do not directly leverage customer-funded energy efficiency programs, California's businesses and organizations benefit from an environment that has been strongly supportive of, and reliant on, efficiency for more than 40 years.

Figure 14: Efficiency Is Part of a Productive Economy[53]

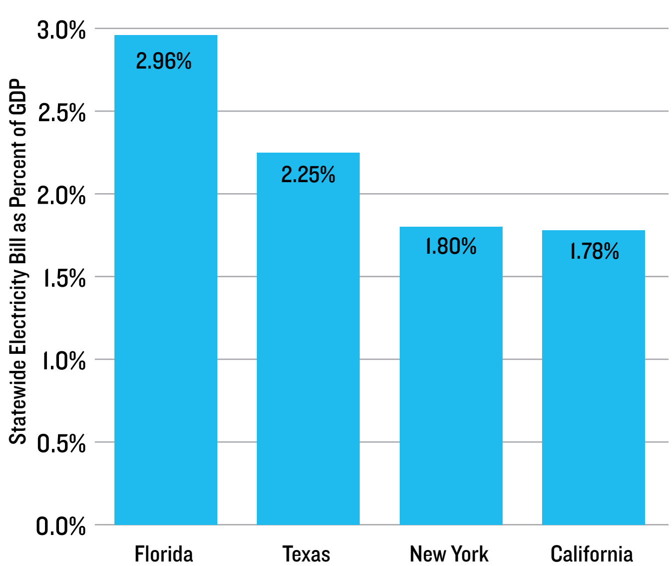
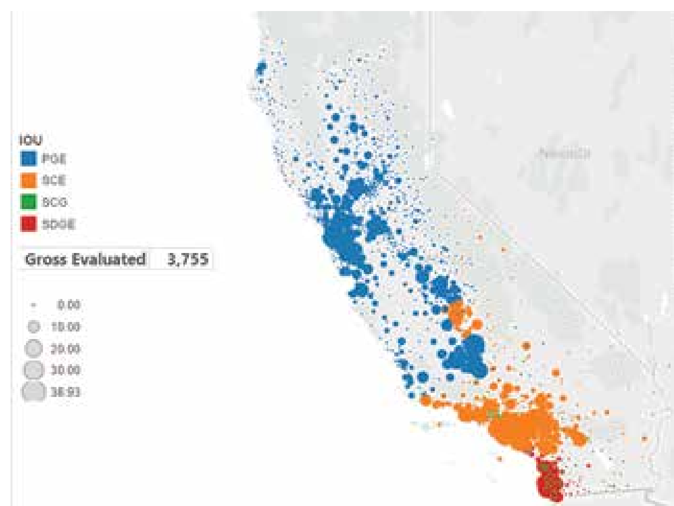


Figure 15: IOU Territory Efficiency Program Activity (2010-2012)[55]



CONNECTING CUSTOMERS TO EFFICIENCY PROVIDERS

San Diego Gas & Electric (SDG&E) has launched a new way for customers to use energy in a smarter way. Its Energy Marketplace pilot project directs participating SDG&E customers to a website where they can easily connect with third-party providers of efficiency and demand response products, and soon will include a list of energy service options for customers to choose from, such as upgrading buildings with more efficient windows and insulation. The website also offers available rebates, easy comparison shopping for the best product prices, and in short order will provide personalized recommendations and savings tips. This pilot is expected to increase customer engagement, helping them save even more money on energy bills. PG&E recently launched a similar pilot.

Many of the jobs created by increased demand for energy efficiency products and services are construction jobs—depending on the expertise of electricians, heating and air conditioning installers, insulation workers, and building inspectors. It is also important to make sure efficiency programs have strong skill requirements and that workers are sufficiently trained so energy-saving upgrades are properly installed and customers receive the savings they expect.

California's progress on energy efficiency and policies like Proposition 39, which funds efficiency improvements in schools, also create quality job training and work opportunities for underserved communities whose members wish to gain long-term career skills.[56] Ensuring a clear path from training to skilled employment, especially for low-income Californians, is critical to creating an inclusive clean energy economy where opportunities are available to all.

Most of the efficiency work, such as insulating attics or installing high-efficiency air-conditioning equipment, cannot be outsourced. More than 300,000 positions, or nearly 70 percent of California's clean-energy employment, are related to improving energy efficiency in buildings.[57] As California increases investments in efficiency services to meet higher energy-saving goals, more workers will be needed.[58] Not only are local jobs created to install efficiency improvements, but the manufacturing of products for those upgrades also creates employment.

Meanwhile, additional jobs are created as a result of greater spending in the local economy due to lower energy bills. When Californians save money on energy bills through efficiency, they tend to spend it elsewhere in the economy. This helps create jobs and economic opportunities outside the energy efficiency sector (Figure 16). For example, Californians saved more than $56 billion due to efficiency-focused building codes, appliance standards, and utility programs from 1972 to 2006. These customers were able to redirect those savings toward other goods and services (like restaurants and retail), creating 1.5 million jobs with a total payroll of $45 billion during this time frame.[59]

Figure 16: Jobs Related to Energy Efficiency

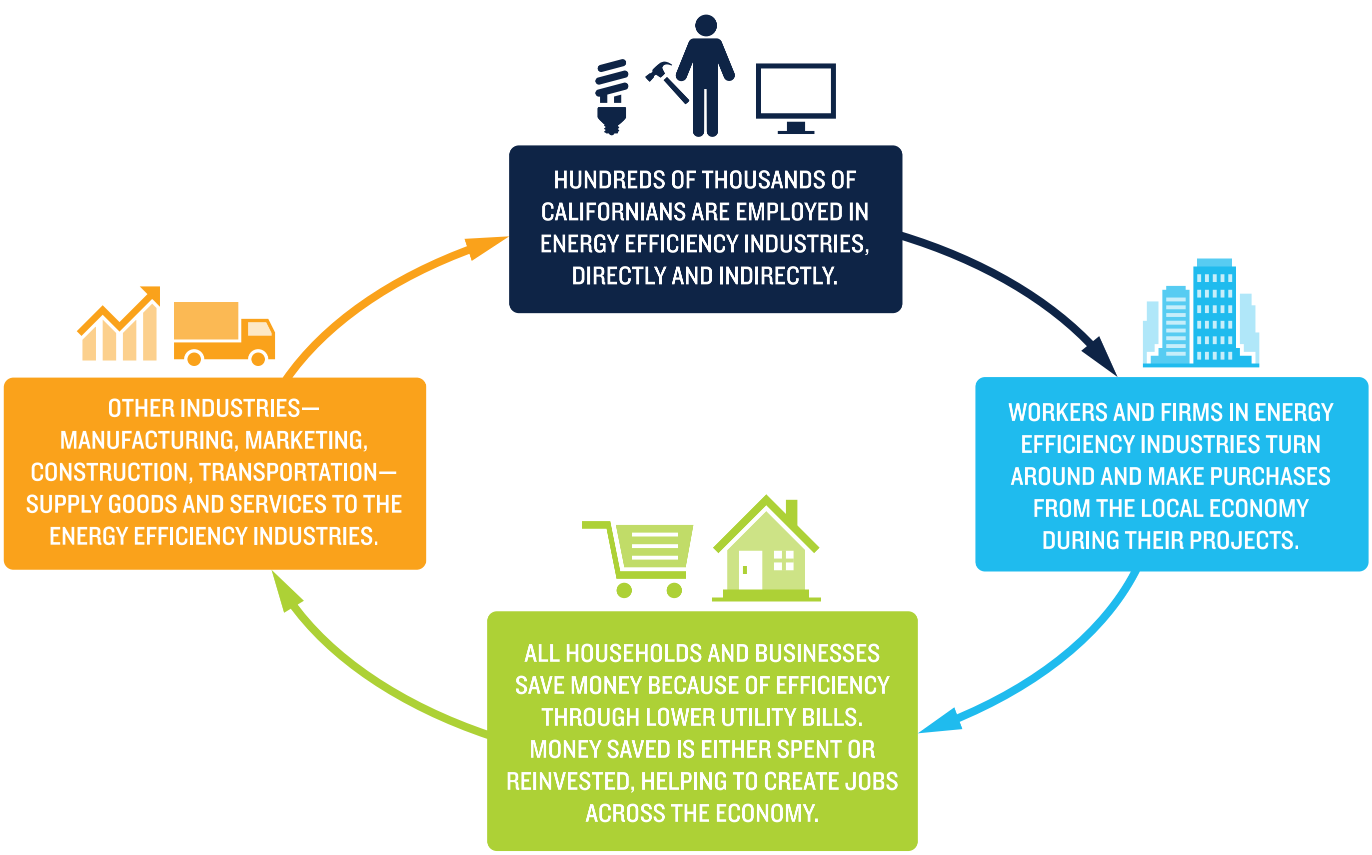
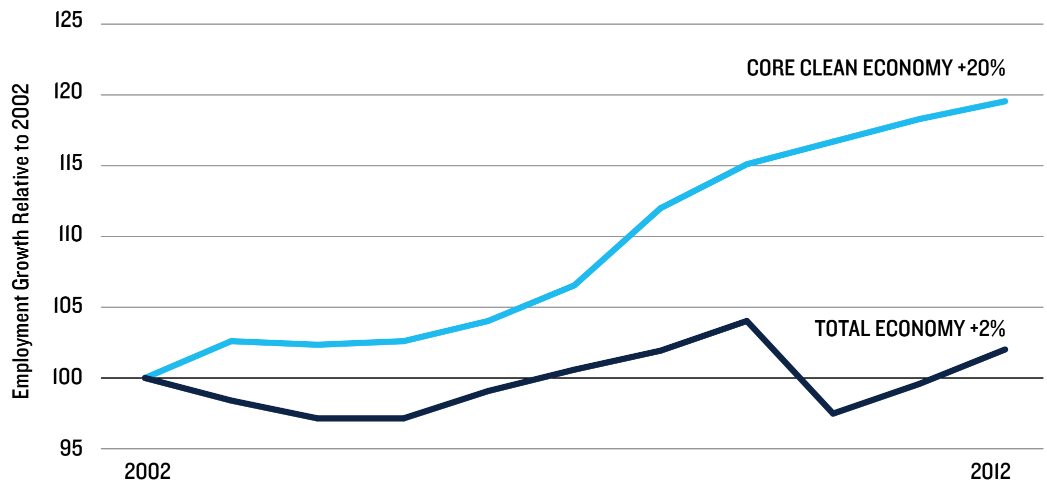


Figure 17: Employment Growth in the Core Clean Economy[62]



Source: Next 10, 2014

Furthermore, California's "core clean economy" (a classification coined for the state's numerous clean energy jobs by the nonprofit, independent think tank Next 10) grew 10 times more than the total state economy, as shown in Figure 17 (20 percent compared to 2 percent for rest of the economy).[60] Energy efficiency is a key part of the core clean economy, and its employment grew by 15 percent from 2002 to 2012.[61]

IMPROVING CALIFORNIANS' HEALTH

Conventional power plants emit pollutants that harm Californians' health.[63] Fortunately, investing in energy efficiency to reduce dependence on fossil fuel power also helps reduce illnesses from air pollution and save lives. When fossil fuels are burned to generate electricity, power plants emit pollutants such as nitrogen oxides (NOx) and sulfur oxide gases (SOx). These pollutants can lead to respiratory problems, from coughing and wheezing to decreased lung function, and can contribute to hospitalizations and even premature death.[64] While California does not currently have any large coal plants—the largest polluters in the nation's power sector—it does produce power from natural gas, which can contribute to air pollution.[65]

In addition, developing natural gas for electricity production along with heating, cooling, and cooking, has a rampant methane emissions problem (a potent climate pollutant responsible for 25 percent of the global warming experienced today).[66] Fracking, a process for producing natural gas, poses other serious health and environmental risks—from drinking water contamination to air pollution linked to serious health risks like cancer and birth defects.

According to the American Lung Association, almost 80 percent of Californians live in counties affected by unhealthy air.[67] Eight California counties are among the 10 most-polluted counties in the United States for ozone smog, which is formed by NOx and other pollutants and can cause breathing problems, cardiovascular effects, and premature death.[68] As climate change increases temperatures across California, pollution conditions may become even worse because warm weather contributes to the formation of ozone smog. Climate change also increases the frequency and severity of extreme weather events like droughts, wildfires, storms, and heat waves. These events can jeopardize access to medical care, food, and water supply, thereby putting individuals with health conditions at an even greater risk and posing a serious and costly threat to the state's economy.

Using energy efficiency to save the 32,000 GWh of electricity called for in the AB 32 Scoping Plan for California's landmark Global Warming Solutions Act could prevent the emission of more than 100 tons of SOx and 2,000 tons of NOx by 2020.[69] An NRDC analysis showed that meeting AB 32's overall emission reduction goals with efficiency, plus all other reduction strategies, could avoid more than 140,000 tons of NOx and particulate matter, which would prevent more than 700 premature deaths and 18,000 cases of asthma and other respiratory illnesses in the year 2020.[70]

In addition, the use of new tools—such as the California Communities Environmental Health Screening Tool developed by the California Environmental Protection Agency and the Office of Environmental Health Hazard Assessment—provides the state with a method by which to identify communities that are disproportionately burdened by multiple sources of pollution.[71] Such tools can help policy planners better strategize deployment of clean energy solutions like efficiency.

Chapter 3

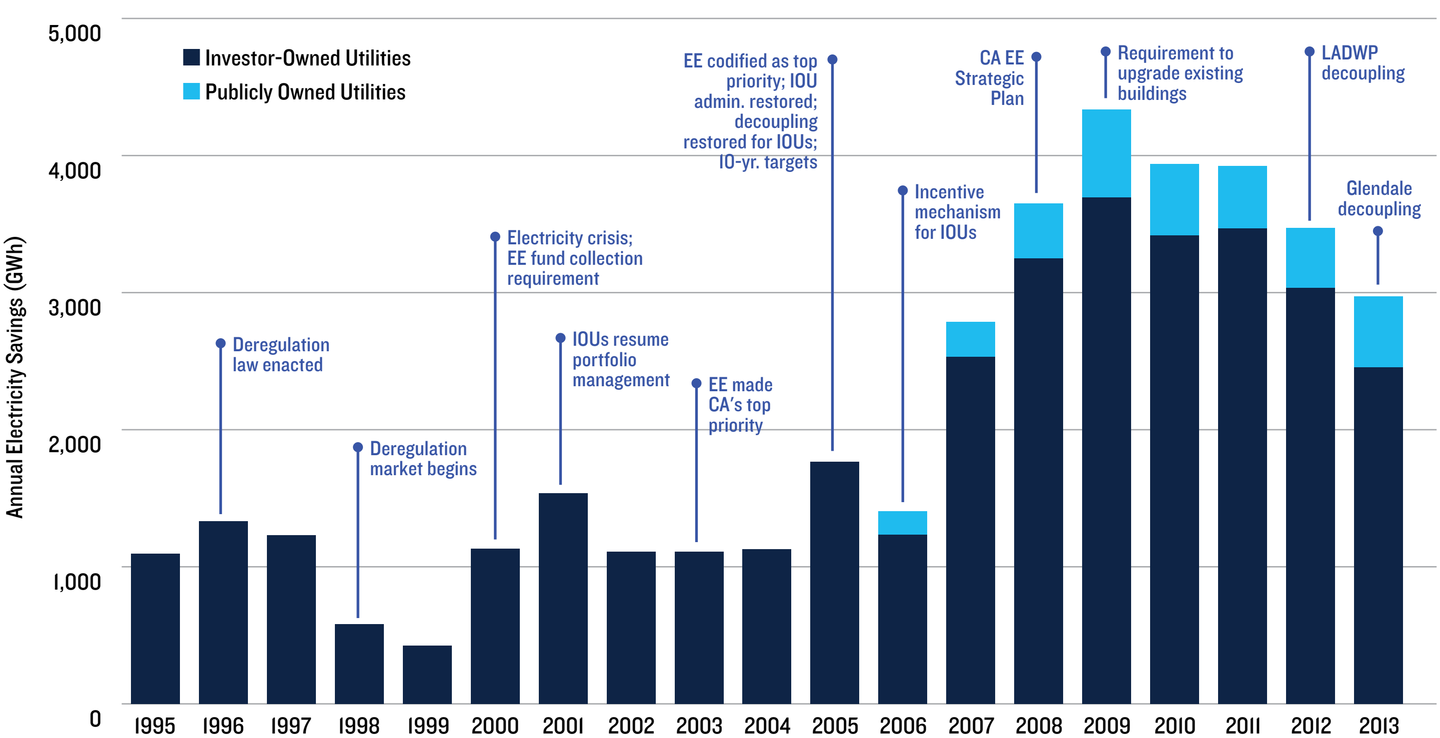
Strong Efficiency Policies Help Californians Use Energy Smarter

California's energy efficiency policies are the foundation that enables the state's program administrators, implementers, trade allies, local governments, businesses, residential customers, and other partners to capture significant energy savings and reap substantial economic and environmental benefits.

The state's track record of energy efficiency success spans more than four decades of bipartisan leadership, thanks to a highly coordinated effort among agencies, market players, local governments, and utilities to bring new efficiency technologies (such as smart programmable thermostats) and services (like data analytics to better manage energy use) to consumers. While the state has made great progress, continuing to improve policies—as described in Chapter 4—is critical to keeping California on track.

Smart policies can support energy savings, as shown in Figure 18. Since the 1970s and through the early 1990s, California adopted strategies to encourage energy efficiency, and energy savings began to rise. Unfortunately, the state changed course dramatically when it adopted its deregulation law in 1996, which eliminated most of the policies encouraging energy efficiency.[1] As a result, energy savings dropped sharply. During the ensuing electricity crisis of 2000 and 2001, an emergency conservation and efficiency effort was implemented and yielded impressive results.[2] This success was in large part due to the infrastructure of efficiency contractors and program implementers built over the prior decade. In the aftermath of the crisis, the state began reassembling the policies necessary to support smarter use of energy, yielding strong progress once again.

Figure 18: Timeline of Energy Efficiency (EE) Savings and Policies[3]



However, while California has seen solid growth in efficiency savings overall, there has been a decline in savings attributed to customer-funded efficiency programs. This is largely due to the state's expanding efforts to advance building codes and appliance standards, and policy rules that limit the ability of program administrators to test new approaches and strategies to reach deeper savings and more customers. To meet Governor Brown's call for doubling energy efficiency savings by 2030, policies must be updated to enable innovation and program designers will need to rely on additional creative strategies to increase customer participation.

DESIGNING POLICIES TO MOTIVATE ENERGY SAVINGS

To ensure California pursues all cost-effective efficiency, the state has established a suite of policies to help remove disincentives for utilities to save energy (i.e., utilities do not risk financial harm when they offer efficiency programs that reduce their electricity sales) while also encouraging comprehensive programs to overcome numerous barriers preventing efficiency from happening on its own (e.g., lack of quality efficient technology options, access to capital, and/or contractors to carry out the work). Table 1 summarizes the policies in place for investor-owned and publicly owned utilities while Chapter 4 offers policy enhancements to help capture even more savings.

Table I: Status of Key Energy Efficiency (EE) Policies and Strategies

Key Efficiency Policies	For Investor-Owned Utilities (IOUs)	For Publicly Owned Utilities (POUs)
EE as top priority[4]	SB 1037 (Kehoe, 2005)	SB 1037 (Kehoe, 2005)
Removal of disincentive to invest in EE [i.e., separation of fixed cost recovery from sale of electricity (decoupling)][5]	Through California Public Utilities Commission (CPUC) decisions	Generally no, but the Los Angeles Department of Water and Power and Glendale Water and Power have adopted decoupling (and are the only public utilities in the country to have decoupled to date)
Cost recovery for EE program expenses	Through rate cases	Through rate cases
Aggressive EE goals	Through the CPUC proceeding that addresses the efficiency potential study and goal-setting process[6]	AB 2021 (Levine, 2006) requires POUs to set targets as well as for CEC to assess POU targets and provide recommendations; individual city councils or governing boards set targets for POUs[7]
Long-term energy efficiency funding	Authorized 10 years of funding through 2025[8]	Not usually; budgets tend to be approved for only 1-2 years
Wide range of efficiency strategies	Based on potential studies and required in CPUC policy decisions	Yes for many, but funding levels and size of utilities may inhibit fully comprehensive portfolios (not formally required)
Evaluation, measurement, and verification of reported savings	CPUC oversees process[9]	AB 2021 (Levine, 2006) requires evaluation; POUs use independent parties to conduct evaluations and report these to the CEC[10]
Reward for high performance	To shareholders and potentially to utility staff[11]	Potentially to utility staff
Low-income efficiency programs[12]	Through the Energy Savings Assistance Program	Low-income programs required and funded through public purpose charges; programs are described in the annual report submitted to the CEC
Process to integrate EE into resource procurement planning	Addressed in biennial long-term procurement proceedings at the CPUC[13]	Procurement planning is typically conducted at the local level

In addition to the foundational policies summarized in Table 1, California has taken a number of actions to spur more energy savings. For example, over the years the state has pursued the following efforts.

- **Strategic planning:** Identifying a long-term goal and crafting a plan with specific actions to achieve that goal are important to keep California thinking about the next advancement in efficiency and to inspire creativity. For example, in 2008 the CPUC approved California's first strategic plan to lay out a vision of how to achieve greater energy efficiency savings across all sectors.[14] It included "big bold strategies" such as (1) reaching zero net energy (ZNE) in new residential construction by 2020 and in new commercial buildings by 2030; (2) improving heating, ventilation, and air-conditioning equipment performance; and (3) ensuring that all eligible and willing customers have received available low-income efficiency measures by 2020.

  In addition, Assembly Bill 758 (Skinner) was passed in 2009, requiring that the California Energy Commission (CEC) collaborate with the CPUC and other stakeholders to develop a comprehensive action plan to improve the efficiency of all existing buildings in California.[15] The draft plan, released in March 2015, is expected to be adopted by the CEC by the end of the year.

- **Affordable financing options:** Many customers lack sufficient capital to cover the cost of improving the energy efficiency of their home or building. Financing programs can offer support, but there is still a lot to learn about how various offerings help customers make improvements in different building sectors. In addition, program experience suggests that offering financing products alone does not always spur substantially greater uptake of efficiency programs, but it can help customers take action or tackle larger projects than they otherwise would. In addition to numerous local offerings, there are various statewide options to access capital, as summarized in Figure 19.

- **Energy use reporting:** In order to manage energy use and take advantage of efficiency opportunities, building owners and tenants must be able to obtain information about the energy consumption in their buildings. In 2007, Assembly Bill 1103 (Saldana) required utilities to deliver information on energy use in nonresidential buildings (larger than 10,000 square feet) to building owners for the purpose of tracking (also known as benchmarking) energy consumption and greenhouse gas emissions.[17] This policy has not been fully implemented, however.

LOCAL BANKS MAKE EFFICIENCY PROJECTS POSSIBLE

Marin Clean Energy (MCE) is one of a number of program administrators across the state that offers financing programs for their residential and commercial customers. MCE's Green Home Loan for single-family homeowners and the Green Property Loan for commercial customers offer loans through locally owned community banks on a range of efficiency options, from a full home upgrade to replacing a single piece of equipment. All projects must meet certain minimum levels of efficiency, and customers are able to pay back the loan directly on their utility energy bill. These programs, in conjunction with other rebates and offerings, are expected to help increase efficiency program participation.

Figure 19: Examples of California Efficiency Financing Options[16]

CALIFORNIA ENERGY COMMISSION	INFRASTRUCTURE BANK	TREASURER'S OFFICE	CPUC/UTILITIES
ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT	CALIFORNIA LENDING FOR ENERGY & ENVIRONMENTAL NEEDS	PACE LOSS RESERVE PROGRAM	ON-BILL FINANCING
ENERGY CONSERVATION ASSISTANCE ACT		QUALIFIED ENERGY CONSERVATION BONDS	MULTIFAMILY EE LOANS (ADMINISTERED BY CHEEF)
ENERGY EFFICIENT STATE PROPERTY REVOLVING LOAN FUND		CALIFORNIA HUB FOR EE FINANCE (CHEEF)	SINGLE-FAMILY EE LOANS (ADMINISTERED BY CHEEF)
CLEAN ENERGY BUSINESS FINANCING PROGRAM			

Source: Adapted from Advanced Energy Economy, 2014

The law also requires certain information, including the resulting ENERGY STAR® score,[18] to be disclosed to prospective buyers, lessees, and lenders, as well as to the CEC. Understanding a building's energy use is an essential prerequisite to taking action, but data must be coupled with strategies to encourage building owners to implement efficiency upgrades at the time they move into their space.

- Serving California's public schools: California educates more than 6.2 million students (one out of every eight in the nation) in over 10,000 public schools, 70 percent of which are more than 25 years old.[19] Further, one-third of all classrooms in the state are located in modular buildings, and many of these need substantial efficiency upgrades.[20]

  The California Clean Energy Jobs Act (Proposition 39), a $2.5 billion, five-year initiative funded by closing a tax loophole for out-of-state corporations and overseen by the CEC,[21] enables energy efficiency retrofits of the state's public schools and higher-education institutions. The proposition was passed with the help of a strong coalition of labor, businesses, environmentalists, and educators who wanted to improve the schools, transform California's energy system, and meet climate goals.

  Since the program began in 2013, school upgrade plans submitted to and/or approved by the CEC are expected to save participating schools nearly $20 million in annual energy costs and enough power each year for more than 17,000 homes.[22] Although this funding will lead to much-needed retrofits while saving money and improving learning environments, the budget for each participating school is likely not sufficient to cover possible upgrades throughout the entire campus. Therefore, certain districts may still need the support of customer-funded efficiency programs to supplement the Prop 39 funding in order to upgrade the entire facility.

- Inclusive clean energy economy: To ensure that all customers benefit from the clean energy economy and that California focuses on increasing the number of clean energy jobs, the state legislature passed bills to set aside a portion of climate funds for disadvantaged communities[23] and established a Green Collar Jobs Council to develop a clean energy workforce plan for the state.[24]

BRINGING ADVANCED EFFICIENCY OPTIONS TO CUSTOMERS

As previously noted, RD&D projects create new technologies and approaches to save more energy; utility efficiency programs pull these products and services into the market; and codes and standards "lock in" the savings as a minimum efficiency level. This interrelated approach ensures that Californians continue to have access to the most efficient products and services.

Research, development, and demonstration (RD&D)

New technologies and services are introduced into California's markets through a variety of programs such as emerging technology collaboratives and state-administered research initiatives. For example, from 1996 to 2013, the Public Interest Energy Research (PIER) program funded energy RD&D with the goal of providing increased environmental benefits, greater grid reliability, and lower costs. The research priorities and distribution of funds were decided according to California's energy loading order, in which energy efficiency and demand response are relied upon before turning to renewable energy or conventional fuel sources.[25]

PIER funded $884 million in electric and natural gas research projects between 1997 and 2013, with approximately $300 million allocated to efficiency and demand response projects.[26] These investments helped bring innovative products to customers. For example, one PIER project researched a technology for sealing building envelope leaks with aerosol particles; this is expected to save Californians more than $750 million in energy costs over eight years after accounting for the cost of the project.[27]

Following the 2013 sunset of funding for the PIER program, the state legislature gave approval for the CPUC to establish a $162 million annual clean energy research, development, and demonstration program called the Electric Program Investment Charge (EPIC), to be administered by the CEC and the utilities.[28] By supporting clean energy innovation, EPIC furthers greater electricity reliability, lower costs, increased safety, and a cleaner grid.

In addition to the statewide EPIC program, the investor-owned utilities provide funding and technical support to help inventors and companies bring early-stage products, practices, and tools (like smart data analytics software) to building owners and other potential clients by underwriting small test projects.[29] In conjunction with this effort, they host roundtables and symposiums for entrepreneurs to network and learn how to leverage these customer-funded programs to advance market adoption of their products. The investor-owned utilities also help fund the Emerging Technologies Coordinating Council (ETCC)—in conjunction with the Los Angeles Department of Water and Power, the Sacramento Municipal Utilities District, the CEC, and the CPUC—to collaboratively discuss technology opportunities for companies and utilities to pursue across California.[30]

Customer-funded programs

California has a strong track record of helping residential, commercial, industrial, and agricultural customers optimize energy use. Much of this support comes from efficiency programs, like working with building energy managers to assess energy-saving opportunities in their building, or offering rebates for highly efficient appliances. These programs also provide critical transition opportunities for new technologies and approaches, bringing new ideas into the mainstream so they become standard practice or are formally integrated into energy codes or standards. To ensure maximum benefit to Californians, programs should be integrated, comprehensive, and long-term. They also should reach all types of customers as well as target the times and locations in the greatest need of reduced energy use. In addition, they should be designed to incentivize manufacturers, retailers, and contractors to support energy efficiency.

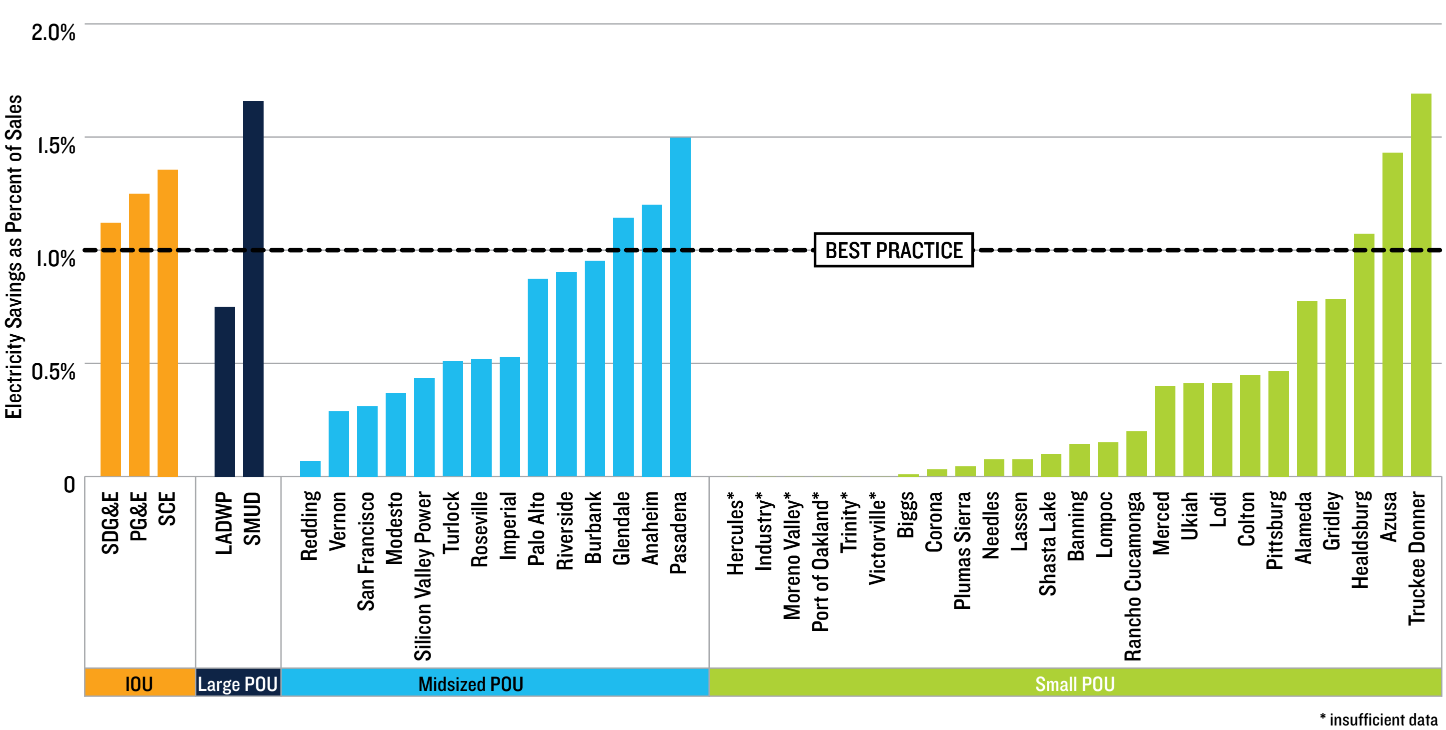
Efficiency programs come in many varieties, including offering direct rebates to customers, technical assistance to architects, and aiding in development of an energy strategy for large commercial facilities. Other programs help customers become aware of their energy usage and how to lower it (e.g., by replacing inefficient equipment or using programmable thermostats), influence manufacturers by offering them an incentive (e.g., $50 per efficient television, based on criteria determined by the program), or motivate retailers by incentivizing them to put the most efficient products up front (e.g., $25 for each efficient TV displayed at a store entrance). Programs also help contractors become more energy efficient by rewarding advanced training, quality installation work, and stocking only efficient equipment. By helping change behavior at each juncture of the market (e.g., manufacturers, retailers, contractors, and customers), these programs help Californians obtain—and stores make available—efficient equipment and services.

Assessing California's efficiency program progress

California's utilities, with the help of their partners (such as local governments, third-party implementers, and trade allies), have helped customers achieve energy and money savings, as discussed in Chapter 2. Another way to measure progress is to calculate a utility's efficiency savings as a percentage of its electricity sales. This metric evaluates a utility's overall effort in developing and implementing efficiency programs (a higher percentage means more efficiency activity) and allows a comparison among utilities of different sizes.

From 2003 through 2013, California's investor-owned utilities' electricity savings averaged just above 1 percent of their sales. Collectively, the publicly owned utilities are approaching savings equal to 1 percent of sales but have been, on average, historically below 1 percent.[31] In 2013, all three electric investor-owned utilities' electricity savings exceeded 1 percent of sales, along with the Sacramento Municipal Utility District and various midsized and small POUs, as shown in Figure 20.

Figure 20: Utility Electricity Savings as a Percentage of Electricity Sales (2013)[32]



PUBLICLY OWNED UTILITIES ARE SCALING UP EFFICIENCY

The publicly owned utilities (POUs) collectively showed improvement in helping their customers save energy in 2013, driven in large part by the Los Angeles Department of Water and Power (LADWP) and the Sacramento Municipal Utility District (SMUD). These two large public utilities, which serve 1.3 million customers and 538,000 customers, respectively, together invested approximately 2 percent of their revenue in efficiency programs and saved energy that represented more than 1 percent of their electricity sales, which is in line with the top national performers. In saving 345 GWh of electricity in 2013 alone, LADWP and SMUD avoided an amount of carbon pollution equivalent to the emissions of nearly 40,000 cars.[38] A number of midsized and small utilities also continue to make great strides. For example, in 2013 the midsized utilities City of Pasadena, City of Anaheim, and Glendale Water and Power, and small utilities Truckee Donner Public Utility District, City of Azusa, and City of Healdsburg, all achieved savings exceeding 1 percent of their electricity sales. Additionally, the midsized utilities serving the City and County of San Francisco, and Imperial Irrigation District, along with small utilities Truckee Donner, City of Needles, Azusa, Healdsburg, and Gridley Municipal Utilities, invested at least 2.4 percent of their revenues into energy efficiency.

Meanwhile, investment as a percentage of total revenue also gives a sense of a utility's effort to invest in energy efficiency and similarly allows for an assessment among utilities of varying sizes. The IOUs (electric and natural gas) collectively invested approximately 1.8 percent of their revenues in 2013 efficiency programs while the POUs (electric) invested 1.7 percent of revenues.[33]

Measuring how much California spends on efficiency per person is another way to evaluate a state's commitment to saving energy. In 2013, investment in efficiency programs was greater than $30 per capita.[34] This is more than twice as much as the average spending of $12 per capita across the country.[35]

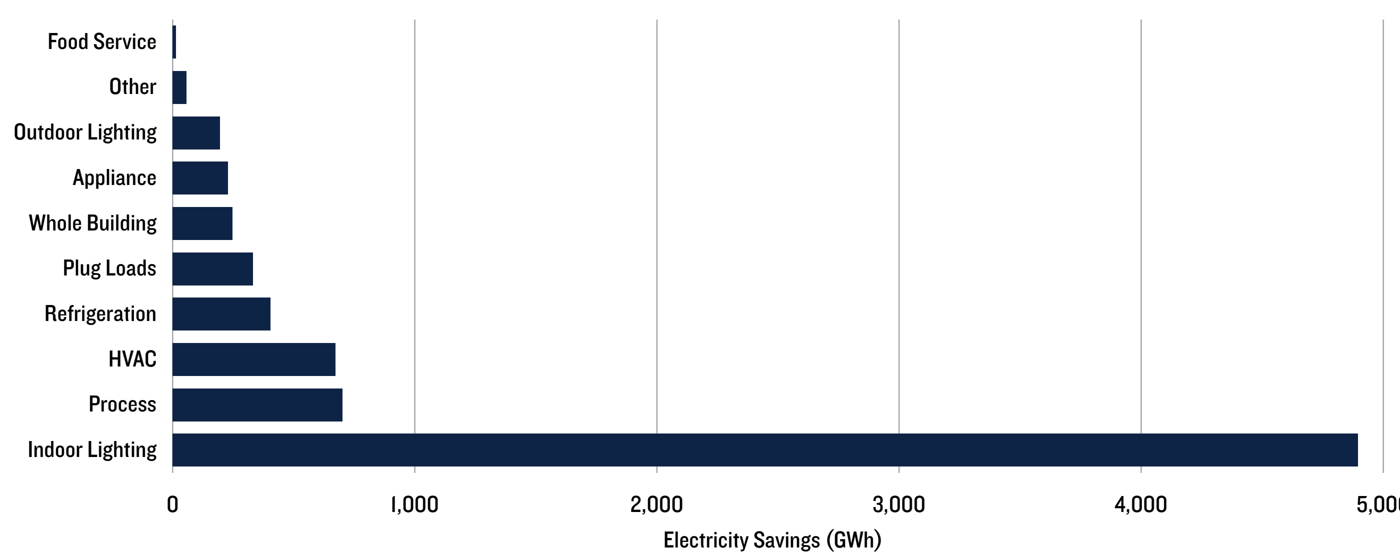
While the state continues to have a strong energy efficiency record, 2 percent of sales has recently emerged as the benchmark for aggressive energy savings, according to the American Council for an Energy-Efficient Economy (ACEEE), with 4 percent of revenue investment the mark for the highest performers.[36]

Comparing California's achievements against these higher metrics of success can be a useful exercise to learn where more can be done. However, it is also important to take into account the state's long history of successfully pursuing efficiency programs, codes, and standards, making it more difficult to achieve additional program savings. California continues to be ranked among the top 10 performing states for energy efficiency but can also learn from other high-performing states like Massachusetts and Vermont.[37]

Opportunities exist to save more energy

Although customer-funded utility programs cover a wide variety of sectors, energy savings across IOU and POU efficiency portfolios continue to come predominantly from the highest-potential, lowest-cost opportunities, such as indoor lighting (Figure 21). These savings are critical to balance out and enable inclusion of less cost-effective programs—like reaching middle-income customers or providing technical assistance.

Figure 21: IOU Territory Electricity Savings by End Use (2010–2012)[39]



While implementers should continue to pursue all available savings, including lighting opportunities, more can and should be done to increase savings in other areas of potential (such as plug loads and HVAC). This will require California to evaluate its policies to ensure rules do not inhibit investment in other areas that could yield high levels of energy savings (see Chapter 4 for more details). It will also require that administrators and implementers be increasingly creative and use stakeholder forums to vet their program proposals (e.g., by providing data analytics, design ideas, and rationale for their specific strategy) to help ensure programs are as innovative and effective as possible.

Codes and standards

Since California is home to one in eight U.S. consumers, benefits from standards requiring more efficient electronics and appliances can go far beyond the state borders when manufacturers choose not to manage separate inventories and instead apply California's standards to the products they sell everywhere. To continually advance codes and standards, the CEC relies on "Codes and Standards Enhancement Initiative" (CASE) reports, which are often funded by the California utilities through their codes and standards advocacy efficiency programs. These CASE reports are critical technical analyses that determine whether efficiency products are ready to be considered as a code or standard by the CEC.[40]

In addition, all program administrators offer strategies to support codes and standards, including training for building department code enforcement staff, opportunities to share best practices, and exploration of additional approaches, such as using electronic permitting systems or establishing local codes that exceed the minimum requirements of the state.[41] While California has been a pioneer in setting strong codes and standards and numerous programs exist to support the state's effort, it continues to grapple with how well codes and standards are enforced, such as in new building construction and during retrofits.

Building Codes

California's building codes, which set requirements for the maximum energy consumption of all new residential and nonresidential buildings, have saved more than 5,000 GWh of electricity since 2003.[42] By avoiding the need to burn fossil fuels to generate that electricity, building codes also prevented as much carbon pollution as comes from burning more than 4 billion pounds of coal.[43] The building codes specify requirements or minimum efficiency levels for all types of building elements, including walls, windows, lighting, and water heaters. By cutting energy waste from each component, the codes make buildings more comfortable and lower utility energy bills.

California's building codes are updated periodically to incorporate improvements in efficiency technology and allow for new methods and materials. The 2015 update for codes is especially important because the CPUC Strategic Plan has set a zero net energy (ZNE) goal for homes by 2020 and for commercial buildings by 2030. This target means that all new buildings must produce as much energy as they consume each year, using a combination of options to cover the energy needs of the building, including energy efficiency and onsite renewable energy generation, such as rooftop solar power.[44]

This ambitious goal will ensure that California's building codes reduce the building sector's energy consumption and the corresponding greenhouse gas emissions, improve the value of buildings, and play an important role in meeting California's climate goals while growing the economy. The CEC recently passed the next level of energy-saving codes that will get the state closer to its ZNE goal.[45]

Appliance Standards

Appliance standards remove the worst energy performers from the market by mandating that new products achieve specific minimum levels of efficiency. Because buyers cannot always know which products are energy hogs, California's appliance efficiency standards prevent the sale of models that waste the most energy.

The successes of California's stringent appliance efficiency standards have spread far beyond its borders. For example, California established the world's first minimum efficiency performance standards for external power supplies, which are used to power electronics such as laptops and cell phones.[46] The external power supply standards are expected to save more than 1,000 GWh of electricity annually in California, alone—avoiding over 500,000 metric tons of carbon pollution each year—by 2020.[47]

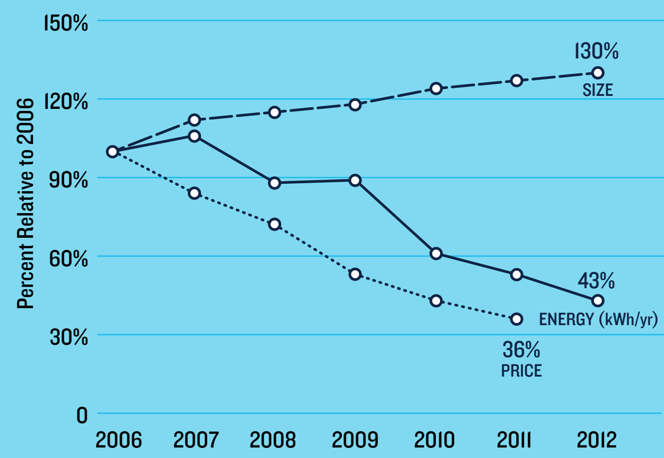
California was also first in the world to adopt efficiency standards for battery chargers, and similar standards are being considered in the rest of the United States. California's battery charger standards are projected to save 2,200 GWh annually by 2020.[48]

Efficiency policies have built a strong foundation for California to reach savings in all areas of the market. Continuing to improve upon and expand these efforts is critical for the state to capture the benefits of efficiency and be successful toward achieving its long-term energy and climate goals.

CALIFORNIA'S SUCCESS WITH TELEVISION EFFICIENCY

There are approximately 35 million televisions in California, with 4 million new TVs purchased annually.[49] In 2006, TVs in the United States consumed an estimated 46,000 GWh annually, or 1 percent of America's electricity use (and nearly 6,000 GWh or 2.3 percent of California's 2013 electricity use).[50] In 2009, the California Energy Commission unanimously approved the nation's first efficiency standard for televisions, mandating that models sold in California use almost 50 percent less energy by 2013.[51] This was projected to save Californians more than $8 billion over 10 years.[52] While some industry representatives protested that the standard would lead to higher consumer costs, fewer products, and decreased innovation, history has shown the opposite. Manufacturers continue to create innovative TVs that consumers enjoy while still reducing power consumption. In fact, both the cost and energy consumption of TVs have decreased since 2006, even while their average size has increased.

Efficient Televisions Save Money and Energy for Californians[53]



SAMPLING OF CALIFORNIA-BASED ENERGY EFFICIENCY COMPANIES

LivingPlug, www.livingplug.com

LivingPlug, an E2 member and start-up based in San Francisco, has seized upon the smart energy awareness of the California consumer in the launch of a product by the same name, a simple device that provides both safety for children drawn to electrical outlets and a way to tame those vampire charging stations that are forever on.

A LivingPlug fits over electrical outlets, concealing them behind a decorative faceplate, turning a two-plug outlet into a tamper-resistant triple outlet at the bottom. An on/off button stops the flow of electricity—no unplugging necessary—thereby helping owners save on their utility bills. It also includes a 2.1 USB port on top for turbocharging devices.

Cofounder Sam Leichman says Californians are astutely aware of how vampire electronics can suck down power that is never actively used. "The customer base here is more attuned to the environment," he notes. "A key component of our product saves energy by mitigating vampire charges."

Six months after start-up in mid-2014, the company had six full-time employees and is looking to develop additional energy-saving household electric devices.

Finelite, www.finelite.com

Finelite, Inc., a lighting fixture company based in Union City, doubled its size in just two years, supplying commercial LED lighting fixtures to customers across the United States and Canada. One-fifth of its business is in California.

The company's growth is tied to "the revolution" in LED solid-state lighting, which is extremely energy efficient, says Finelite's CEO Jerry Mix. "We're growing. We're profitable. We are winning markets."

California's energy efficiency standards are another big reason for Finelite's growth. The state has been a national leader in promoting efficiency and conservation.

In 2012, the company shipped 1 mile of lighting fixtures a day, most of them fluorescent. Today it is 2 miles of fixtures per day, 70 percent of them energy-efficient LEDs. There's up to 30 percent energy savings for companies when LED lighting is used as opposed to fluorescent lighting, Mix says.

kW Engineering, www.kw-engineering.com

kW Engineering, an Oakland-based consulting firm that helps private and public companies increase their energy efficiency, has grown and flourished because of California's energy efficiency policies. President Jim Kelsey cofounded kW Engineering in 1998 and saw it grow as more companies reached out to find efficiency savings. "Our business really only makes sense in states where energy efficiency is important," Kelsey says. "We would not have founded kW if it weren't for California's energy policies."

Today the company has 70 to 80 clients that include Apple, Stanford University, and Southern California Edison. It has added offices in Long Beach; in Chicago, where its clients include ComEd; and in New York, where its clients include the New York State Energy Research and Development Authority (NYSERDA). kW specializes in cost-effective, innovative strategies for reducing energy in commercial, institutional, and industrial facilities. That includes heating, ventilating, and air-conditioning (HVAC); lighting; refrigeration; and compressed air systems in both existing and new buildings.

Efficiency is a great way for companies to save money, Kelsey says. "There are terrific opportunities to save energy in your business. The cost savings go right to the bottom line."

Carbon Lighthouse, www.CarbonLighthouse.com

Carbon Lighthouse, an E2 member based in San Francisco, reaps multiple benefits from California's culture of energy efficiency, driven in good part by the strong policies that support a robust efficiency industry.

As a growing (and hiring) project development firm, Carbon Lighthouse works to help property owners profit from reducing their energy consumption. It uses proprietary software to help mine energy savings in buildings, increasing the bottom line for their owners while helping cut greenhouse gas emissions by reducing the amount of electricity that needs to be generated to run the building and equipment inside them.

"We are always swimming in data," says CEO Brendan Millstein. "The sea of otherwise unknown information helps us make more-informed decisions about building operations and control that result in 20 to 30 percent whole-building energy savings."

Founded in 2009 by Millstein and Raphael Rosen, Carbon Lighthouse has completed more than 360 efficiency projects in California and along the West Coast, cutting more than 40 million pounds of carbon pollution and saving customers thousands of dollars on their annual energy bills.

WattzOn, www.wattzon.com

WattzOn, in Mountain View, offers a personal energy management software platform for businesses and local governments to connect with families, individuals, and communities to help them save money and energy by altering their "energy behavior."

Launched in 2008, WattzOn is now used in all 50 states, and the company says typical users save $15 to $20 per month on their gas and electric bills. The software and associated mobile tools use utility data to provide personalized recommendations as well as links to energy-smart purchases, information on home upgrades, and tips on easy habit changes. For example, consumers might receive such email and text reminders as "Keep your fridge at least three-quarters full for maximum efficiency."

"We're based in Silicon Valley, which is always helpful for gaining the best access to venture capital, talent, and business partnerships," says WattzOn founder and CEO Martha Amram. Clients include the cities of San Jose, Livermore, Patterson, and Benicia; JC Penney; and the Joint Base McGuire–Dix–Lakehurst in New Jersey.

Chapter 4

Launching California to the Next Phase of Efficiency

California's energy efficiency efforts have captured substantial energy savings and provided countless benefits to the state, but numerous statewide analyses show that much more must be done to meet the state's long-term greenhouse gas reduction goals and the governor's objective of doubling energy efficiency savings by 2030.[1]

California's energy agencies have launched a variety of formal and informal efforts to address many of the challenges highlighted throughout this chapter, such as through the Integrated Energy Policy Report proceedings at the California Energy Commission (CEC) as well as through a variety of proceedings and working groups at the California Public Utilities Commission (CPUC). These include, among other issues, general energy efficiency, low-income efficiency, procurement planning, the water-energy nexus, and integrated demand side management.[2]

This chapter includes a proposal to establish a new coordinating structure to help California reach its energy and climate goals and also provides a compilation of the numerous open policy matters along with recommendations for how energy agencies, decision makers, and stakeholders can collaboratively resolve outstanding issues to garner greater savings. While we urge the legislature to codify the 2030 and 2050 state climate and energy efficiency goals as noted in Chapter 1, the following recommendations focus predominantly on energy agency activity—rather than efforts in the legislature—as the majority of critical matters fall within current agency authority. Furthermore, while we offer a few recommendations for program enhancements, we focus primarily on improving the efficiency policy rules to remove barriers that are inhibiting the acceleration of energy-saving efforts. See Figure 30 for a summary of these recommendations.

ESTABLISH A STATEWIDE APPROACH TO POLICY AND PROGRAM PLANNING

Although efficiency planning and implementation have yielded substantial success, the state needs a more unified vision and implementation plan to capture the remaining potential and to achieve the state's greenhouse gas reduction goals. The energy and climate agencies (California Public Utilities Commission, California Energy Commission, and California Air Resources Board) as well as the grid operator (California Independent System Operator)—referred to throughout Chapter 4 as the agencies—are in a key position to implement changes that will catalyze greater efficiency.

These agencies have been collaborating on a number of issues over the past few years, such as how to account for efficiency in determining future electricity demand and evaluating how best to meet the state's greenhouse gas emissions reduction targets. They should build upon this interagency coordination to develop a path for dramatically increasing energy savings. More specifically, the agencies should:

Set a clear vision to achieve goals and clarify roles and responsibilities

While the agencies have made great progress resolving various statewide issues, a number of outstanding matters, multiple interested parties with varying viewpoints, and the lack of forums in which to discuss differences have led to a contentious environment and inefficiencies in many aspects of program planning and implementation. In addition, the tasks of the different efficiency actors (regulators, administrators, implementers, etc.) have become intermingled in recent years, creating confusion and inhibiting program effectiveness. The agencies are in a strong position to fix these problems by establishing a clear vision with defined roles for each of the players.

The agencies should clearly delineate:

- Which tasks should be statewide (e.g., cost-effectiveness, evaluation, etc.);
- How much formal oversight is required to ensure prudent use of customer funds (i.e., what information is critical for regulators to determine whether efficiency plans and budgets are appropriate);

- How best to hold administrators accountable for overseeing portfolios (i.e., what information or processes are needed to ensure program administrators follow the commissions' guidance, meet state climate goals, and serve customer needs without slowing down progress, hampering innovation, or overburdening agency staff);
- How the mixture of efficiency efforts (codes and standards, customer-funded programs, and private efforts) will work together and achieve the state's efficiency goals; and
- How the agencies will track progress in meeting California's energy-saving targets.

This vision should rely on the following proposed collaborative forum to relieve some of the demands on agency staff so they can focus primarily on their higher-level regulatory oversight role. The agencies would retain all current authority but would be able to leverage the statewide collaborative to more efficiently and cooperatively approach program and policy oversight, review implementation activities, and solve problems.

Create a collaborative forum to inform ongoing planning and implementation

As described in the "Existing Buildings Energy Efficiency Draft Action Plan," the CEC proposes to establish a statewide collaborative effort to enable successful implementation of the action plan.[3] NRDC suggests that this effort be expanded to: ensure statewide consistency on a variety of critical efficiency policy matters (e.g., cost-effectiveness, evaluation, setting energy-savings goals, and data access issues); engage stakeholders to cooperatively resolve challenges; and leverage the expertise of those on the ground—including stakeholders who do not participate in regulatory proceedings—to ensure programs capture substantial savings and serve customer needs.

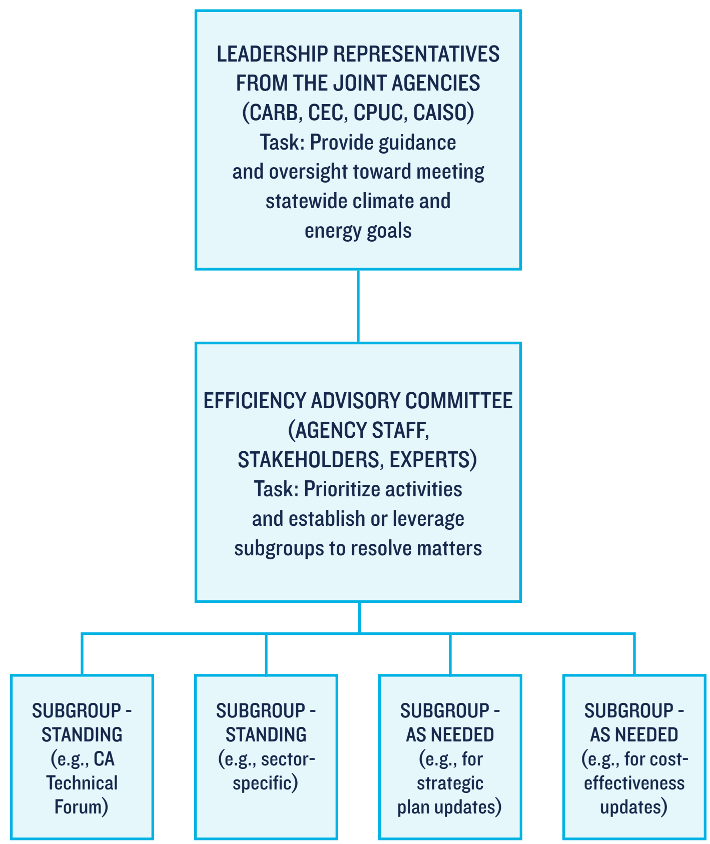
This recommended collaborative forum—comprised of a leadership group, an Efficiency Advisory Committee, and subgroups as needed—would advise on key energy efficiency policy and program decisions, but existing entities would retain all current oversight and decision-making authorities. For example, program administrators would continue to be responsible for what to submit to their regulators, and the regulators would remain the ultimate decision-making authorities on program and budget approval, as well as policy setting. Furthermore, this approach should not add a layer of bureaucracy but rather rely on existing successful working groups where possible, streamline duplicative efforts, and identify gaps. It would also serve the function of coordinating and carrying out a shared vision, something that does not exist currently.

The agencies should take the following steps to establish a collaborative as soon as possible:

Define the key structure, roles, and responsibilities

Figure 22 sets forth NRDC's concept whereby the leadership at the agencies would provide overall guidance to the process and the determination of roles and responsibilities, as well as oversee a newly established Efficiency Advisory Committee to be comprised of staff from the commissions along with other key parties and experts. This committee would be responsible for implementing the leadership's guidance, including prioritization of programmatic and technical matters. The committee would also assess which existing groups could be leveraged, whether new subcommittees are needed, and if these forums should be used on an ongoing basis (e.g., sector-specific subgroups to help ensure program effectiveness and vet program changes) or for a limited time to resolve a particular issue (e.g., to propose cost-effectiveness methodology updates for consideration by the energy agencies).

Figure 22: Concept for a Statewide Efficiency Collaborative Forum



Make sure the right people are at the table

A number of interested parties should be involved in the collaborative. The agencies would need to determine a process for choosing members of the Efficiency Advisory Committee (e.g., request for qualifications, assignment, or other). In addition to representatives from the agencies, the advisory groups should at minimum include a cross-section of active parties involved in various energy agency proceedings as well as other experts in the field. This could include, but not necessarily be limited to, efficiency program administrators; efficiency industry members; local government representatives; consumer advocates; and environmental, social justice, and workforce or labor organizations. Subgroups need not be as formal but should particularly consider key experts in the field who may not actively participate in regulatory proceedings (e.g., contractors and academics). To ensure smaller organizations are able to participate in the collaborative, the agencies would need to determine a process to compensate eligible entities for substantive participation.

Prioritize challenges to resolve

Once the collaborative is launched, the first order of business should be to evaluate the current policy framework and determine whether existing rules enable a consistent statewide effort, are in line with national best practices, and are aligned with the state's goals. Given that there is no statewide approach to prioritizing the resolution of outstanding matters, this collaborative should also set annual priorities (through a predetermined set of criteria such as need, scope, urgency, etc.) to focus efforts and move more quickly to resolve challenges. This should be done on a set schedule (e.g., in the last quarter of each year) and include checkpoints (e.g., quarterly) to review progress and/or modify tasks if needed.

NRDC proposes that the Efficiency Advisory Committee make the following items its first set of priorities because they are critical foundational policies that affect numerous other issues described in more detail throughout this chapter:

- Update the cost-effectiveness methodology to be consistent across the state, more accurately value efficiency relative to other energy resources, and better assess the value of energy efficiency as a greenhouse gas mitigation strategy.
- Make energy-saving guidelines and estimates (including evaluation processes) consistent across the state and transparent to increase confidence in the resulting savings values for program and procurement planning.
- Identify all possible efficiency opportunities in efficiency potential studies and adjust rules to make certain that the state's utilities, local governments, and third-party implementers are able to take advantage of all available savings.

While many of these items are being considered by the agencies, there is still a need to coordinate across the state, ensure a cooperative environment to help resolve differences in a timely manner, and support agency staff in their efforts to oversee efficiency and climate objectives. To help do so, the collaborative should leverage existing forums to resolve these matters rather than create alternative venues that would be duplicative. The Efficiency Advisory Committee could then present the recommendations developed in these forums to the agencies for consideration.

Any collaborative effort should guarantee transparency (e.g., meetings would be open to the public and offer the opportunity for public comment), use peer review and/or experts in the field (e.g., to propose new or updated policies to the agencies, design programs, and establish saving estimates), and create synergies where appropriate for more effective implementation of the many state efficiency efforts.

NRDC recommends that in establishing such a collaborative group, the agencies rely on best practices from other successful entities, such as the Regional Technical Forum in the Northwest; efficiency advisory bodies in Massachusetts, Connecticut, and Rhode Island; and the Illinois Stakeholder Advisory Group.[4] All of these efforts have a number of common practices enabling them to be successful, including:

- A clear charter or mission;
- Defined and measurable outcomes;
- A process to keep track of discussions and action items;
- An independent facilitator and administrative support;
- Committed and representative membership;
- A consensus-driven process;
- Presentation of ideas at an appropriate time to allow for input early in development;
- Resources to follow through with action items and decisions; and
- A feedback loop to update stakeholders on actions taken after a discussion.

The state should move quickly to implement a collaborative structure to set a clear direction, prioritize efforts, and put California on the right track toward a wide-scale increase in activity to upgrade all existing buildings, double efficiency savings by 2030, and reach Governor Brown's recent directive to reduce greenhouse gas emissions 40 percent below 1990 levels by 2030.

IMPROVE POLICIES TO ENABLE A DOUBLING OF ENERGY EFFICIENCY SAVINGS BY 2030

The following recommendations are intended to help guide the agency efforts addressing these issues.

Update cost-effectiveness methodologies

As previously noted, California law requires that utilities capture all cost-effective energy efficiency to avoid more expensive generation options. In order to do so, regulators determine a framework to make sure efficiency funds are prudently spent. This framework should align with the state's objectives and serve the dual purposes of meeting the state's energy and climate goals while offering customers effective programs at reasonable costs.

However, the various efficiency programs, codes and standards, and state initiatives currently use different methodologies to evaluate cost-effectiveness. In addition, the CPUC methodology undervalues efficiency, is out of line with national best practices, and leaves a substantial amount of savings on the table, making it difficult to meet state objectives.

While this issue is slated to be addressed at the CPUC over the next few years, updating the cost-effectiveness methodology affects much more than the CPUC-related programs, such as CEC-overseen projects through Proposition 39 funding and publicly owned utilities (POU) programs. Therefore, the agencies should use the proposed Efficiency Advisory Committee to develop a statewide approach based on best practices that allows for consistency across the offerings and ensures that efficiency can be used both to replace more expensive power and as a way to avoid more costly greenhouse gas mitigation strategies.[5] In particular, the agencies should:

Use a societal discount rate

A discount rate is used to indicate the time value of costs and benefits and to facilitate a comparison with alternative investments that would deliver value over time. How it is selected and applied can greatly influence the opportunities a program administrator is allowed to pursue. At minimum, the state should use the societal discount rate for the Total Resource Cost (TRC) test, which includes the perspective of the utilities plus the customers and would also more accurately value long-term savings from efficiency as compared to other greenhouse gas mitigation strategies. Table 2 illustrates the discount rates used by the White House Office of Management and Budget and in various states across the country. The discount rate should:

- **Align with state goals and the perspective of the test.** For example, if the test or objective of the program values longer-term gains to society (as is the case with customer-perspective cost tests and the state's climate and energy goals), the discount rate should match the value of an investment in the long term. Along the same lines, government projects—or projects carried out by the private sector that serve the public good—should use a lower discount rate because their focus is future welfare. A lower discount rate also more accurately values projects that require costly investment in the short term to derive greater savings in the long term (e.g., whole building approaches or market transformation efforts).

- **Reflect the lower risk associated with investing in energy efficiency.**[6] Years of program experience have demonstrated that investments in efficiency are typically less risky and less costly than investments in traditional generation and infrastructure. This is due to the fact that funding comes from monthly utility bills and carries much less risk than supply-side investments that often put customers on the hook for highly variable (and therefore risky) future costs, including fuel and environmental regulatory costs.

  In addition, efficiency investments have proved to be less risky for utilities both in terms of recovering the costs of investment (the funds for efficiency are collected from customers without accessing shareholder capital) and in terms of reducing the risk of planning, construction, and operation of power plants. The discount rate used for cost-effectiveness tests should be at the lower end of the range to reflect these facts.

Table 2 – Comparison of State Discount Rates

State	Discount Rate
California PUC[7]	After-tax Weighted Average Cost of Capital (WACC) SCE: 7.65%; PG&E: 7.66%; SDG&E: 7.36%; SCG: 7.38%
California Energy Commission[8]	3.0% real (5.0% nominal)
White House Office of Management and Budget[9]	3 year – 1.7% nominal 5 year – 2.2% nominal 20 year – 3.1% nominal 30 year – 3.4% nominal
Maine[10]	Current yield of long-term (10 years or longer) U.S. Treasury securities, adjusted for inflation
Massachusetts[11]	12-month average of yield from a 10-year U.S. Treasury note
New York (NYSERDA)[12]	Utility WACC (5.5% real)
Northwest Power & Conservation Council[13]	5.0% real
Vermont[14]	Societal (3% real)

Account for all the benefits of efficiency

Efficiency delivers benefits for customers, businesses, utilities, and society that are often not accounted for in the calculation of cost-effectiveness (Figure 23). The cost-effectiveness methodology should include all quantifiable non-energy benefits (such as water savings) and include "adders" or approximations for non-energy benefits (such as comfort) that are hard to quantify.[15] Alternatively, the non-energy costs could be removed from the formula, such as the added cost of expensive trim on an efficient window.

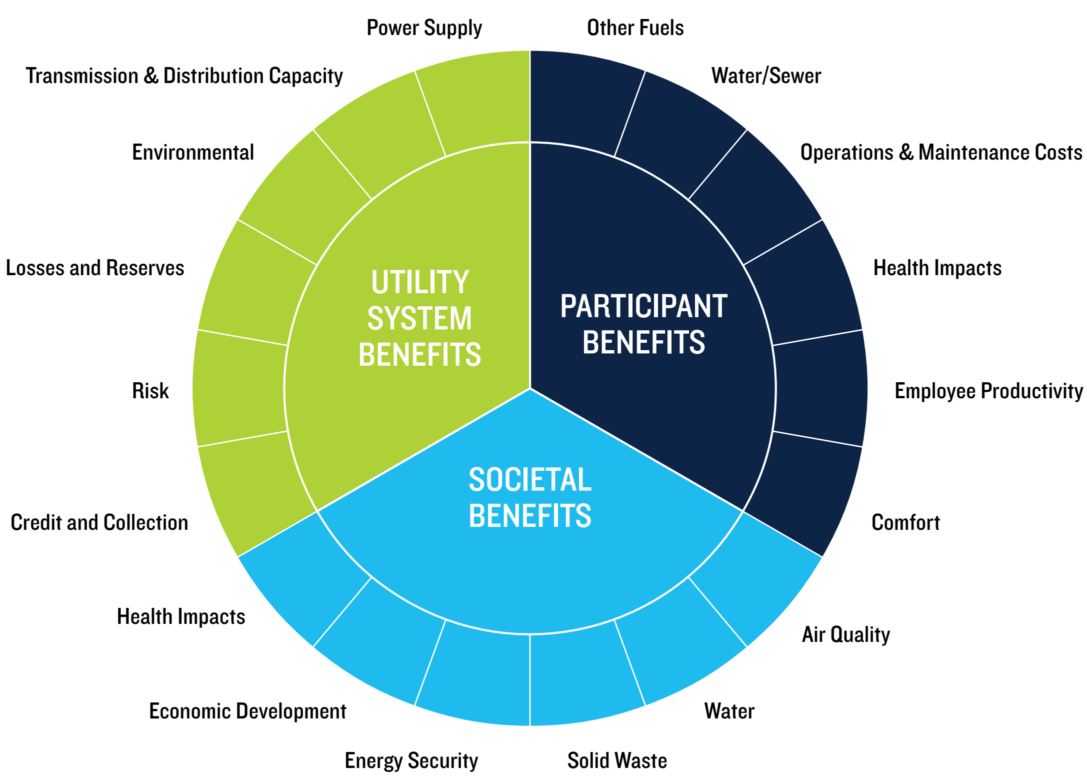
Update avoided cost values

The current CPUC cost-effectiveness methodology—which is often used by POUs as well—includes assumptions of the benefits of reducing peak usage. Currently the mid-afternoon is assumed to be a high-value time to reduce demand. However, as noted in Chapter 2, since California has sufficient solar resources to meet this peak, the time of greatest need is now in the evening hours. The valuation of energy efficiency needs to be updated to account for the appropriate level of peak savings or reduced impacts of a quick-ramp rate for the utility. Any update should also include improved assumptions that value targeting efficiency at a particular time or location to fill a supply gap or defer investment in transmission and distribution upgrades.

Rely on the Program Administrator Cost (PAC) test

If the recommendations above are not implemented, the agencies should use their current authority and move swiftly to rely on the PAC test as the primary determiner of efficiency funding. They could rely on the PAC test (utility-only perspective) instead of the TRC (utility and customer perspective) at minimum for determining how much efficiency to approve in lieu of conventional resources. If an efficiency portfolio—for either the IOUs or POUs—has a PAC greater than 1.0 (i.e., efficiency costs less than or the same as the other resources utilities would have to procure to meet customer demand), this portfolio should be encouraged as customers will continue to receive energy services that cost less than conventional power. Agencies could still require the application of the TRC test to provide additional information for program planning, design, and implementation purposes.

Figure 23: Benefits from Electric Energy Efficiency Programs[16]



Source: Regulatory Assistance Project, 2013

Improve how savings are estimated and measured

Evaluation is critical to provide confidence that efficiency can be used to offset the need for conventional power, make sure efficiency activities are as effective as possible, and establish new or updated savings estimates used for program planning. While opportunities exist to informally comment on the evaluation studies at the CPUC (but there are fewer public processes to respond to POU evaluations), improvements could be made to enable more meaningful participation in the design of the studies and in determining whether the final study result is robust enough to replace an existing estimate.

The proposed Efficiency Advisory Committee should facilitate a process to make the savings guidelines and estimates the same for all administrators and implementers, leveraging existing evaluation protocols and priorities.[17] Having a robust and transparent process for all evaluations (including those conducted by POUs) would increase confidence in the estimates used for program planning, allow program savings to be compared across the entire state, and enhance integration of efficiency into the procurement planning process.

To accomplish this, the agencies and the proposed Efficiency Advisory Committee should pursue the following strategies:

Establish a statewide Evaluation Team to further improve confidence in evaluation, measurement, and verification (EM&V) results

The CPUC has made substantial progress in increasing transparency and providing opportunities for stakeholders to discuss evaluations. However, further improvements would enhance meaningful input and ensure statewide consistency since the CPUC processes apply only to the IOUs. The agencies should establish a statewide Evaluation Team to enable a consistent strategy across all program offerings, enhance opportunities for stakeholders to participate throughout the evaluation design and implementation phase, and help determine when the final study result is sufficient to use in program planning.

This approach would maintain all of the current CPUC and POU authority to oversee evaluation activity and conduct studies, and should use existing successful EM&V processes where feasible (e.g., already established subject matter subgroups). While there will be instances where program administrator- or program-specific matters arise, enabling a standard process for planning evaluations and reviewing their quality will increase consistency and confidence in the resulting estimates. In addition, including interested parties early on tends to lead to buy-in and reduce objections to final results.[18]

Such a team should rely on a consensus-driven approach (among other best practices, as previously described) and be closely coordinated with a neutral technical forum, such as the California Technical Forum (described in more detail later in this chapter), to vet savings estimates. This team could function similarly to the existing subgroup of the Regional Technical Forum, whose task is to "aid in the planning, development, and prioritization of these required research plans," or could model itself after the Illinois Stakeholder Advisory Group, which has a similarly focused Technical Advisory Committee (TAC) subgroup to review study priorities and comment on initial methodologies prior to the launch of the studies.[19]

The meetings should be open to the public, with agenda and documents posted to a common website so stakeholders who are not on the Evaluation Team could follow the discussions or know when meetings of interest are scheduled. Specifically, Evaluation Team tasks should include:

- Prioritizing studies and establishing the EM&V work plan;
- Reviewing specific study plans and proposed methodologies;
- Setting tailored criteria for when a study value would be robust enough to be used as the new estimate;
- Updating the study approach, prioritization, and quality criteria if needed;
- Reviewing results to ensure the final study complies with the predetermined criteria and is therefore ready to be used to inform updates; and
- Identifying areas where new measurement and verification methodologies are needed and providing expertise in developing such methodologies.

Having such a forum would minimize delays, increase consensus, and enable POUs and other program administrators to more easily leverage the work of others. Ensuring that evaluations are developed in a transparent manner, held to a certain level of quality, and vetted prior to finalization would also increase confidence in the studies and the values produced. In addition, it would reduce contention by using an open, consensus-driven approach and by providing all stakeholders with an opportunity to participate at meaningful points. Relying on such a structure could also make the evaluation process more efficient and less costly by ensuring that chosen studies are the most needed, designed to get the most critical information, and vetted by experts to ensure that the values are reliable and therefore can be confidently used in planning.

Rely on the California Technical Forum (CalTF) to establish savings estimates for consideration

The current process for establishing savings estimates from final evaluation studies or through proposals by program administrators is opaque and can be contentious. To address these challenges, a group of stakeholders established the California Technical Forum in 2014, modeling it on the successful Regional Technical Forum in the Pacific Northwest.[20] The California Technical Forum includes a Policy Advisory Committee and a Technical Forum.

- The Policy Advisory Committee oversees the Technical Forum and sets the annual business plan for what the technical group will achieve over the coming year.
- The Technical Forum is a panel of 30 independent experts selected following an extensive solicitation process and who are broadly representative of the energy efficiency community across the country.[21] Their role is to use collaborative deliberation and peer review to evaluate data and develop robust estimates of energy savings based on the best available information.

The agencies should rely on this independent collaborative technical group to vet saving estimates prior to using them for program planning.

Use forward-looking market assessments to focus programs on motivating customers to cut energy waste

Assessing how much energy would be used without a given efficiency program is critical to ensure that programs are designed to promote efficiency action among people who would not otherwise act and that customer funds are wisely spent. The state's current approach to determining "what would have happened" relies mainly on a customer survey done years after an efficiency upgrade, making it difficult, if not impossible, to obtain accurate and useful information in a timely manner for program improvements.

In addition, many question the validity of asking customers if they would have taken an efficiency action "anyway," since it is inherently challenging to gauge this accurately and this approach is not applied to other customer offerings, such as solar or demand response programs. The after-the-fact studies also add an element of uncertainty for program administrators; they run approved programs based on information available today, but estimates of expected long-term savings can be reduced based on the responses of a subset of participants. California is one of the few states that retroactively applies evaluation results to reduce program achievements that rely on pre-determined energy-saving estimates (also known as deemed savings).[22] This uncertainty—among other things—could limit the risks that program administrators are willing to take with new programs and technologies, thereby potentially missing out on innovations that could yield substantial future savings.

Instead of using qualitative surveys, it would be more effective to rely on the process used in the Pacific Northwest and conduct an assessment of the market before the program begins and then again soon after it ends. This would yield a more accurate and timely accounting of what additional savings were achieved due to a program beyond what was originally anticipated in the pre-program market assessment.[23] Such a baseline process should be developed in a transparent manner (through a clear public process that provides access to the data being used) and be dynamic, so that baseline information is updated through a similar process as needed when new market information becomes available. The agencies could rely on the statewide collaborative previously noted to further develop this approach.

Pursue all available energy efficiency opportunities

To determine where program administrators, implementers, local governments, and third-party efficiency actors should focus efforts, an energy efficiency potential study is conducted (either through a CPUC process or by the publicly owned utilities) to identify the amount of available efficiency opportunities and to set energy-saving goals. However, the current process is an example of how existing rules have the unintended consequence of limiting investments in efficiency programs. If the potential study does not identify all available savings—such as those from emerging plug load technologies or improved policies—it limits the extent to which program administrators and implementers can pursue offerings.

Potential studies identify three levels of opportunity: technical (an engineering assessment of what is available, not taking cost into account), economic (application of cost-effectiveness assumptions to the technical potential), and market achievable (determination of what is realistic in the market, given existing barriers). These studies rely on a wide array of input assumptions that dramatically impact how much potential is identified and therefore how policy is set or how program portfolios are designed.

Current practice at the CPUC is to make numerous adjustments to the estimated economic potential before determining the energy-saving goals for the program administrators under their jurisdiction. In aggregate, these adjustments result in just half of the economic savings being available for consideration when the commission sets goals, as seen in the most recent Navigant potential study prepared for the CPUC. While the targets will undoubtedly be less than all cost-effective savings (i.e., lower than the economic potential) due to various challenges like getting enough customers to participate, the fact that there is such a wide gap makes it difficult to ramp up efficiency and therefore challenging to meet the state's climate and energy goals. To narrow the difference between economic and achievable opportunities, the CPUC should identify and resolve the key issues that substantially reduce the cost-effective opportunities and ensure efficiency policies enable program administrators to pursue greater savings. To help do so, the agencies should make the following specific improvements to the potential study process:

Use methodologies that do not rely on past performance to unduly limit future opportunities

CPUC practice is to take the amount of energy efficiency potential identified as "market achievable" and further reduce the estimated savings based on past program experience (Figure 24).[24] This means the CPUC program administrators are only pursuing the same level of savings as in the past, making it difficult, if not impossible, to use innovative approaches to scale up savings.

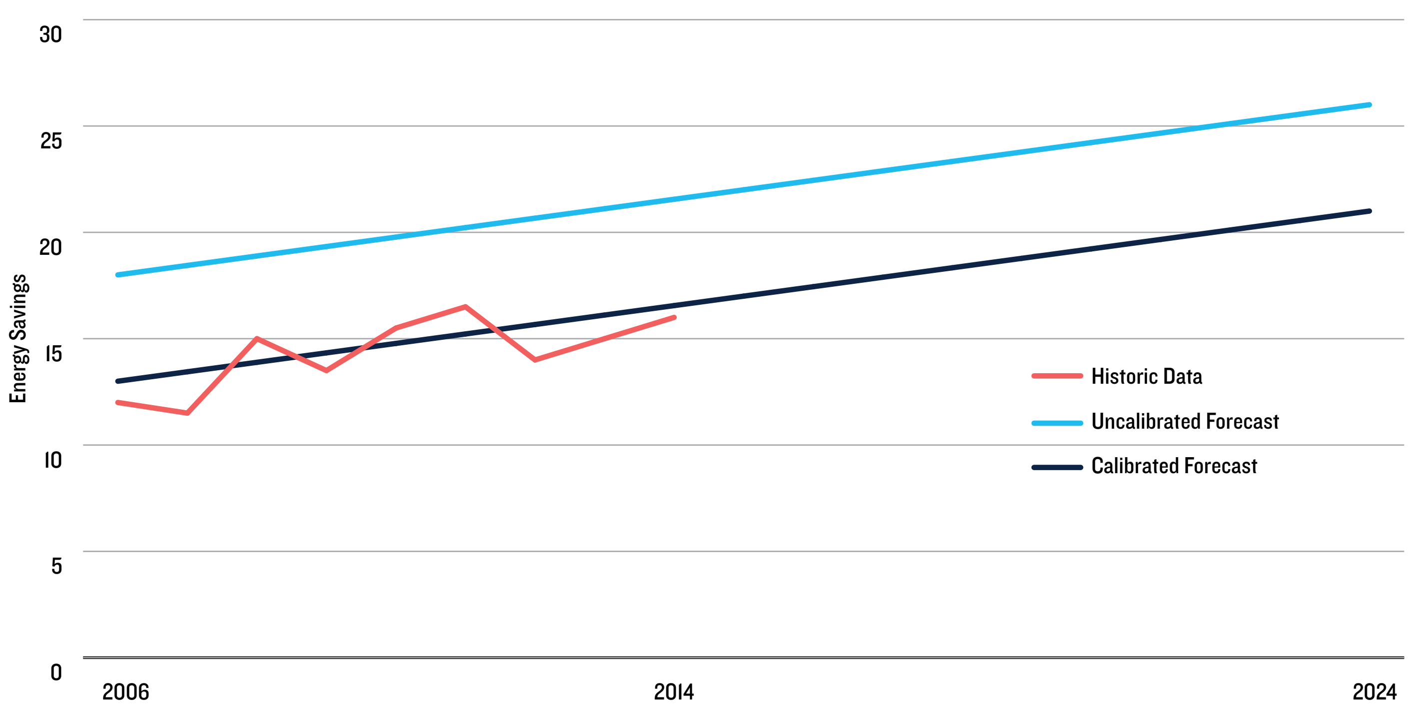
While regulators may want to take previous program achievements into account when establishing energy-saving goals for program administrators, past efforts should not be used to limit the identification of future efficiency potential. By removing this constraining factor, studies would produce results that far better reflect actual potential and allow policymakers to make more informed decisions about setting goals and identifying policies that may need to be updated.

Include all types of energy-savings opportunities in potential studies

Estimated efficiency potential is also used to guide program design. If some opportunities are omitted from the potential study, programs will be unable to reach those savings, even if they exist, as they are not identified as savings that program administrators could claim. While regulators may decide to require or omit certain programs from efficiency portfolios, those policy or programmatic decisions should not limit the identification of actual potential. Therefore, efficiency potential studies should include:

- **All emerging technologies.** The current CPUC potential study methodology includes only five emerging technologies for electric plug-in equipment in the residential sector and none in the commercial sector, for example.[26] Plug-in equipment is the fastest-growing segment of energy consumption by end use, accounting for three-quarters of residential electricity consumption, yet it accounts for less than one-quarter of current savings potential from 2015 through 2017. In addition, the potential study shows virtually no future savings from plug-in equipment in the commercial sector.[27] The state has robust emerging

Figure 24: Illustrative Example of Adjusted or "Calibrated" Results[25]



Source: Recreated from Navigant presentation for the CPUC, 2014 technology and research programs, and additional technologies are anticipated to be included in future iterations of the potential study. Therefore, the agencies should make sure that all identified technologies are included in future studies to most accurately assess efficiency potential from this important end use.

- Operations, maintenance, and behavior programs. In addition, potential studies should include all available operational and maintenance improvements, such as those associated with resetting controls or changing the time when equipment is used to more accurately match a building's needs. Training the facilities managers and identifying problems with operations can produce electricity savings of 10 to 20 percent, without substantial equipment upgrades.[28] The next iteration of the CPUC potential study is expected to include a number of these opportunities and NRDC supports including a robust set of such strategies to ensure building equipment is optimized. NRDC also recommends that policy rules be updated to allow and encourage program administrators to pursue these savings through pilots or programs as appropriate.

- Below-code savings opportunities. Current CPUC policy does not allow administrators, local governments, and third parties to incentivize activity that is below code because the CPUC assumes individuals will bring buildings and equipment up to code on their own without additional support. However, implementers in the field see that these savings are not "happening anyway," thereby stranding savings.[29]

  To address this, the CPUC is collaborating with the CEC to identify the extent to which savings are not being captured because of this policy, how accounting of the savings would change if implementers claim savings below code (e.g., whether changes are needed to savings that are currently being attributed to utility codes and standards advocacy work or the CEC's accounting of code savings), and if incentivizing activity to capture below-code savings does, in fact, increase participation to capture more savings. This policy issue needs to be resolved quickly to allow administrators and implementers to pursue the most inefficient buildings that are not currently being upgraded. The final policy should also avoid complex implementation processes that make it difficult to capture savings in the buildings with the greatest opportunities, and not necessarily limit opportunities to a few select measures.

Identify where and when efficiency is most needed

In order to rely fully on energy efficiency in resource planning efforts, planners increasingly need more detailed data on its impacts based on location as well as time of day and/or year. Increased granularity with respect to locational impacts allows efficiency to displace the need for resources at the local level—which frequently is the most important issue for electric system planners to address. More detail with respect to impacts throughout the day and year allows efficiency to better support the integration of time-dependent renewable generation. Improving both of these outputs in potential studies would also provide critical information needed to better design efficiency portfolios in the future. For example, the fact that residential lighting measures save disproportionate amounts of energy in the evening—when solar generation is decreasing—means that these efficiency improvements have great value to resource planners looking to optimize grid operations (and minimize curtailment of renewables), which should be considered in designing portfolios.[30]

Set efficiency rules to enable and encourage market transformation for key goods and services

California has long supported the need to develop energy efficiency programs that improve markets—such as for appliances—over time. These market signals are important to build demand, stimulate innovation, lower costs of products and services, and enable the market to thrive after the program phases out. To expand the state's effort to do so, the agencies should:

- Correct the use of a high discount rate that values shorter-term investments as market transformation is designed to promote longer-term activities.

- Enact policies based on best practices (such as measuring benefits over a longer time horizon) to support market transformation efforts.[31]

- Establish an advisory group comprised of California and national experts as part of the collaborative structure described earlier in this chapter. This group would advise the state on where to focus efforts to stimulate market transformation and should also be involved in vetting proposed program designs, metrics, and evaluation plans to ensure program success.

By designing programs that move markets and setting up the right policies, the state can send a strong signal to the private sector to unleash investment, stimulate innovation, and create jobs.

Expand the use of efficiency to avoid upgrading or adding infrastructure

California has made great strides in integrating efficiency into resource planning to avoid investment in new infrastructure, and electricity consumption is now expected to remain flat over the next decade (as seen in Chapter 2). However, relying on efficiency will still be critical to avoid investing in new infrastructure or buying energy to replace older systems as they are retired. In addition, efficiency can help offset increases in electricity consumption as more Californians turn to electric vehicles. To assure that California's great progress on integrating efficiency in resource planning is maintained and expanded, the agencies should:

Refine how efficiency is forecast

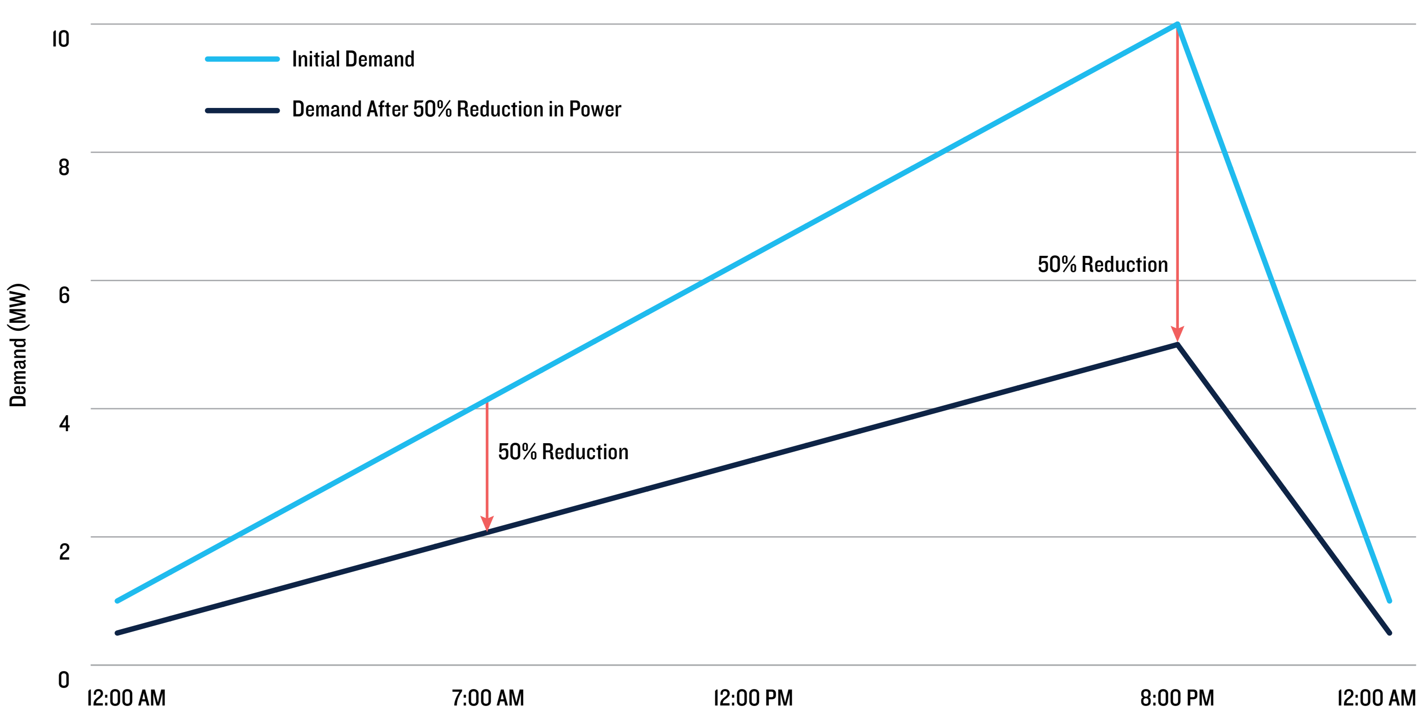
Current hourly data exist for many of the measures that provide energy savings. While the CPUC updates its potential study to include improved energy efficiency data throughout the day and over the year, the CEC, working with the CAISO, should incorporate the available hourly data into the estimates it uses for the annual statewide forecast. By producing a forecast that contains varied energy savings based on the time of day and year, the CEC will enable resource planners at CAISO (as well as at the CPUC) to better rely on energy efficiency to meet the state's electricity needs.

Design programs to capture savings where and when they are most needed

While efficiency programs provide enormous savings to customers, improving how efficiency is valued at critical times and locations would yield even greater benefits. The agencies should gather better details about when and where efficiency offers the greatest savings to further offset investment in costly utility infrastructure (like poles and wires) and help integrate renewable power into the generation mix. The agencies should also ensure that any programmatic guidance is in line with updated information to enable programs to capture savings at times and in areas with the highest value.

Using hourly forecasts of energy efficiency savings (e.g., from lighting) that predict specific electricity needs (e.g., a spike in usage as customers turn on their home lights in the evening), rather than an average amount over the course of the day, can help program planners better target programs to reduce the ramp-up that is needed to serve customers in the evening. It also lowers overall electricity demand (Figure 25).[32]

Figure 25: Illustrative Sample Load Profile for an Evening Peaking End-Use[33]

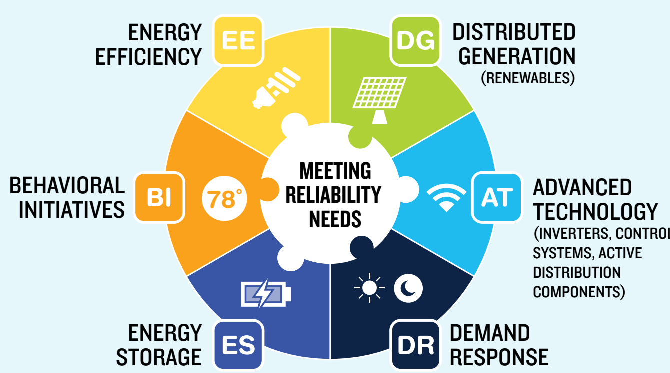


INNOVATIVE WAYS TO MEET LOCAL ENERGY NEEDS AND AVOID COSTLY UPGRADES

SOUTHERN CALIFORNIA EDISON (SCE)

SCE launched a multiyear pilot in one of its transmission-constrained areas in central Orange County in late 2014. The "preferred resources pilot" includes clean energy options, such as energy efficiency, energy conservation, solar, wind, and energy storage (Figure 26). More than other parts of SCE's territory, this area is facing potential future power challenges given the closure of the San Onofre Nuclear Generating Station in 2013. By relying on the right mix of preferred resources now, SCE is working to ensure that electricity continues to be available and to reduce or eliminate the need to build new gas-fired plants to meet the energy demands of that region. Results of the pilot will be used to inform how SCE can use similar approaches throughout its service territory and could be a model for other utilities.

Figure 26: SCE Preferred Resources Options[34]



PACIFIC GAS & ELECTRIC (PG&E)

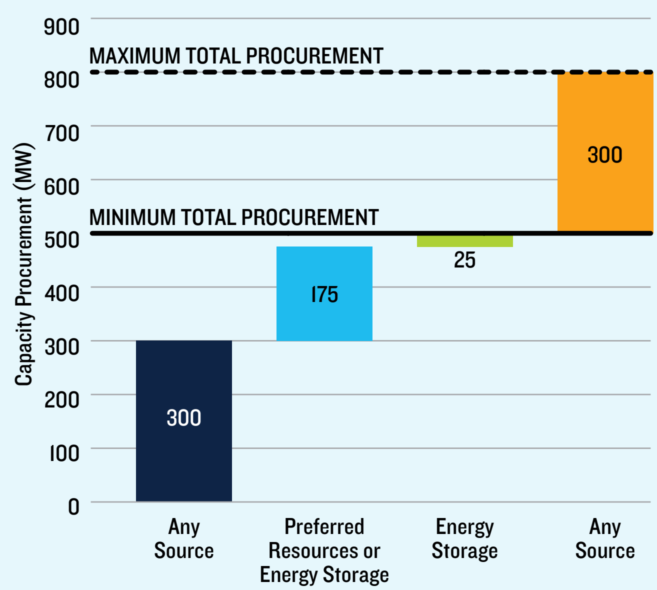
PG&E is targeting areas in its service territory that are likely to require future transmission and distribution upgrades (Figure 27). By using smart meter data coupled with other data analytics, PG&E can identify which customers are using the most energy and see whether they previously participated in efficiency programs. Efforts to lower energy usage can then be targeted to specific customers to enhance program participation in areas where PG&E wants to avoid potentially costly infrastructure upgrades.

Figure 27: PG&E Locations for Targeted Efficiency[35]

SAN DIEGO GAS & ELECTRIC (SDG&E)

San Diego Gas & Electric similarly has a preferred resource program and is authorized to procure up to 800 MW of energy storage, up to 775 MW of preferred resources (not including energy storage) or up to 600 MW from 'any source', such as conventional resources or some combination thereof totaling up to 800 MW (Figure 28).[36]

Figure 28: SDG&E Preferred Resources Program



Explore additional approaches to supplement traditional efficiency programs

Traditional efficiency programs have provided enormous benefit and avoid costly infrastructure. However, there are additional market-based methods that could allow efficiency opportunities to be bid into a competitive market, paid based on savings performance, or procured by utilities to replace existing or planned generation resources. While procurement programs such as these may effectively yield additional savings at a time or location where they are needed, or for particular markets or customers (e.g., large nonresidential), they are not necessarily appropriate for meeting all of the state's energy goals.

For example, procurement programs do not always achieve savings at the lowest cost,[37] nor do they necessarily achieve other important goals that the energy commissions hope to meet through customer-funded efficiency programs. There will continue to be a need for a comprehensive portfolio of programs that sufficiently address all customer types, advance codes and standards, and provide critical assistance in training, education, and outreach. Nevertheless, the agencies should experiment with targeted efficiency procurement models to see how they could be leveraged to meet demand, particularly in instances where conventional resources are being considered.

Adopt a process for ongoing program planning and oversight

The CPUC is working to initiate an unprecedented approach to program planning and implementation. In the past, efficiency programs operated in funding cycles lasting one to three years. The new "rolling portfolio" approach allows for ongoing funding from 2015 until 2025, unless modified by a subsequent CPUC decision.[40] This time frame will allow program administrators under CPUC oversight to design longer-term programs, be more responsive to market changes, and enable an ongoing review of programs.

The CPUC is now determining how to set up proper oversight, ongoing program review and improvement opportunities, and a stakeholder process. A decision is expected within the next year, and NRDC recommends that it include:

- An alternate approach to designing an energy efficiency portfolio that focuses on customer segments (e.g., residential, commercial, agricultural, and industrial), provides a holistic vision to achieve cost-effective long-term and comprehensive savings through strategies that reach all customers, and is presented in a more efficient and accessible manner;
- A collaborative process (including stakeholders and CPUC staff) that relies on greater transparency and consensus-building to help improve program planning and implementation;
- A technical collaborative stakeholder group process to prioritize evaluation, measurement, and verification studies and to make sure that only the most robust ones are used in program planning;
- An approach to updating technical assumptions that relies on a predetermined schedule, which will increase predictability and allow more timely and transparent evaluation feedback; and
- Ongoing check-ins to ensure regular review and modification of programs as needed, and to provide opportunities for integration of new programs into the program administrators' efficiency portfolios.

CPUC RULES TO INCLUDE PREFERRED RESOURCES TO HELP FILL GAP IN ELECTRICITY SUPPLY

The process to replace the San Onofre Nuclear Generating Station (SONGS) with preferred clean energy resources is a great example of how efficiency can help avoid investment in conventional fuel sources. The 2,200-megawatt nuclear power plant in Southern California malfunctioned in 2012 and was retired the following year, leaving an annual hole in the state's electricity supply equal to the output of five large conventional power plants. The California Public Utilities Commission decided to rely mainly on helping customers optimize their energy use and other "preferred resources" to address this challenge. These include demand response programs that reward customers for reducing energy use at key times of the day; renewables, which are all cleaner than conventional generation from natural gas; and improvements to the system of electricity wires and boxes.[38] The plan calls for this clean energy to replace at minimum two-thirds of the gap left by SONGS.[39] Using efficiency as part of the solution shows how the state can integrate it to transition to a clean energy economy.

Ensure low- and moderate-income customers have access to energy-saving opportunities

All customers should have access to programs that help lower their individual bills. Therefore, in addition to general efficiency programs that may require a substantial co-pay from participating customers, there should be programs that provide energy-saving products (like LED lighting in homes or upgraded equipment in businesses) to moderate- and low-income customers who qualify and to the owners of their affordable rental housing.

As noted previously, California offers the majority of its low-income efficiency initiatives through the Energy Savings Assistance (ESA) Program, overseen by the CPUC and administered by the IOUs. The California Department of Community Services and Development (CSD) also implements programs, including the federal Weatherization Assistance Program and the state Low-Income Weatherization Program, funded through California's greenhouse gas reduction fund.[41] NRDC recommends the following to further improve these offerings:

Design programs that yield greater energy savings

On average, California's ESA Program is cutting household energy usage by 3 to 9 percent, but it could increase that by modifying the mix of measures to ensure more savings are achieved for customers.[42] The ESA Program has specific numeric outreach goals that are driving its design and implementation strategy, but no comparable energy goal to motivate program design to capture more savings for residents.

NRDC recommends adopting an energy goal specific to the state's low-income program. Concurrently with this goal, the CPUC should provide clear authority for utilities to tailor offerings according to customer segments and based on energy-savings potential. In addition, the California utilities should use audits to identify the most cost-effective opportunities for their low-income customers. The CSD should also explore adopting energy-savings goals for its low-income offerings.

Coordinate, or combine where appropriate, all California programs that reach low-income and moderate-income customers

Low-income tenants and residents are eligible for numerous programs across the state, all with varying incentives, applications, eligibility, and enrollment rules. For example, in the affordable multifamily sector, building owners or tenants are potentially eligible for the following utility programs: Multifamily Energy Efficiency Rebate, Energy Upgrade California-Multifamily Program, Residential Direct Install, and the ESA Program. They are also potentially eligible for similar state and federal programs administered by CSD.

These programs should fully share data for optimal tracking of progress and, where possible, align eligibility and incentive structures so that customers can easily leverage multiple offerings to achieve deeper energy savings. For example, instead of offering a separate low-income direct install program, the agencies could combine efforts from the ESA Program with other initiatives, such as the statewide Energy Upgrade California-Multifamily Program or a similar offering through CSD's Low-Income Weatherization Program.

Serve all customer types, including residents of multifamily rental buildings

Affordable multifamily buildings are home to approximately 32 percent of the low-income population in California.[43] However, because programs have not been designed to meet these buildings' unique characteristics and needs (e.g., owners do not always pay the tenant energy bills and buildings might have either central or individual heating and cooling systems, which requires different strategies), programs have historically provided significantly fewer offerings and lower savings to residents compared with their single-family counterparts.

NRDC recommends that all agencies responsible for low-income programs continue to work together to establish multifamily-specific offerings that reflect the needs of this sector. For example, any program should:

- Work directly with the building owner;
- Offer or leverage common area and central system measures;
- Undertake or leverage robust energy assessments to provide critical information that can be used to design a project that yields the greatest energy savings at reasonable cost; and
- Assure owners have adequate information on their building's energy consumption to better manage it, benchmark the building, and assess efficiency opportunities.

Given the various needs of different multifamily buildings and the constraints of affordable housing, NRDC also recommends that the relevant state agencies ensure there are sufficient contractors trained for the needs of this sector. It might also make sense to allow building owners to use their existing contractors, provided they meet appropriate qualification standards.

ADDRESSING THE HARD-TO-REACH MULTIFAMILY SECTOR

Energy efficiency programs in California historically have not fully capitalized on the enormous savings potential of multifamily buildings. There are numerous contributing factors, such as lack of capital, the fact that owners are in charge of approving upgrades but often do not pay the energy bills, constraints on rent increases to cover the cost of upgrades, and the logistical challenges of upgrading multiple individual units. Fortunately, through the Energy Upgrade California-Home Upgrade multifamily program, program administrators are beginning to design programs to address these issues, and best practices have been identified.[44]

For example, the Bay Area Regional Energy Network Multifamily Building Enhancements program is designed to address this gap in the Bay Area's nine counties with more than 3 million inhabitants. This program offers free energy consulting to help property owners identify energy upgrades, qualify for rebates, and access financing. Since its 2013 launch, the program has provided property owners with more than $6 million in rebates, and participants have reduced their total energy use on average by 16 percent. In addition, the program has served more than 8,000 units, saving residents more than 400 kWh of electricity.

Provide support for owners of affordable multifamily buildings

Direct and ongoing engagement among owners, utilities, and key market participants is needed to accomplish meaningful energy savings. Building relationships with lenders that serve the sector, housing agencies, and nonprofit housing developers can facilitate program participation. These entities all have an interest in improving the quality of properties and reducing utility expenses for residents, but may be unfamiliar with how to participate in utility programs.

In addition, the differences among program requirements, timing, and financing, as well as the inability to select a single contractor for projects, requires ongoing and coordinated technical support from the program administrators. Examples include advising on which combination of the various offerings provides the maximum benefit, the contractors available to do the work, available financing options, among other things, in order to facilitate participation in multiple programs to achieve deep energy savings.

The Better Buildings Challenge in Los Angeles is beginning to provide such comprehensive technical support services for affordable multifamily building owners served by the Los Angeles Department of Water and Power (LADWP) or Southern California Gas (SCG).[45] Its offerings present a potential model for what utilities or third parties could provide to enable affordable multifamily building owners to participate in program offerings.

Include strong workforce strategies to help scale up efficiency

California faces the challenge of substantially scaling up building efficiency upgrades by 2030 while ensuring that increasingly stringent codes and standards are delivering projected energy savings. This will require a much larger, well-trained workforce to install and/or tune up equipment to operate at expected levels of efficiency. The potential for more construction jobs to carry out upgrades also provides an opportunity for the state to reach underserved communities and displaced workers who need quality jobs. To support a strong efficiency workforce, the state should at minimum focus on the following:

Require high performance

To achieve California's energy efficiency goals, the state needs a market that allows workers to compete not just on the basis of their bids but on the quality of their work. There are a variety of ways to shift the competitive environment toward a higher performance standard. For example, quality assurance requirements, data transparency, and workforce skill standards are all critical strategies to encourage participation by high-performing contractors and workers.[46]

In addition, there is a need for development of skill standards and certifications specific to energy efficiency. Given the ever-changing technological environment, it is very difficult to establish and maintain, not to mention enforce, appropriate worker skill standards for every efficiency technology, measure, and sector. However, there are at least two options to ensure reliance on the most effective skill standards. First, when there is widespread industry agreement for a particular skill standard (such as with the California Advanced Lighting Controls Program), it could be required for specific customer-funded or public projects. Second, in the absence of agreed-upon skill standards, the energy agencies could set up a prequalification process to assure a minimum skill level for implementers and contractors who participate in state energy efficiency programs.[47]

Provide a path from training to jobs

There are a host of training opportunities in California but current policies do not necessitate or encourage that customer-funded efficiency programs or state energy initiatives be linked with quality career training. In addition, most training programs are not set up to feed into companies that are hiring workers. As the state updates and expands efforts to save energy, there should be complementary policies to make sure that workers from recognized training programs are connected to companies that are hiring.

MODELING EARN-WHILE-YOU-LEARN PROGRAMS TO GIVE WORKERS A PATH TO QUALITY JOBS

LOS ANGELES

The Los Angeles Department of Water and Power (LADWP) Utility Pre-Craft Trainee program is a model for workforce training, providing entry-level workers with a career path into a middle-class job while helping the nation's largest municipal electric utility decrease the city's dependence on fossil fuels. The program was developed by LADWP and the International Brotherhood of Electrical Workers (IBEW) Local 18. Under the "earn while you learn" pre-apprenticeship program, trainees work full time weatherizing the homes of low-income utility customers, learn other related skills, and prepare for the civil service exams and career opportunities in the utility sector.

The program's wage standard of $16 per hour, plus benefits, is considerably more than most workers would earn doing residential weatherization through other low-income efficiency programs. It has received strong support from RePower LA, a broad coalition of environmentalists, low-income advocates, and labor that views the program as a central element of its ongoing campaign to reduce the city's carbon footprint and create good jobs for local residents. Since its inception, the program has trained more than 100 workers, with 40 graduating to full-time civil service employment to date and others receiving interim work.

SAN FRANCISCO BAY AREA

Through the Proposition 39 California Clean Energy Jobs Creation Fund, the California Workforce Investment Board's Regional Green Jobs Training Initiative awarded the San Francisco Conservation Corps $500,000 over an 18-month period to provide local workforce training. The goal is to implement and support energy efficiency-focused "earn and learn" job training and placement by targeting disadvantaged job seekers to ensure they earn industry-valued credentials, enter into apprenticeships, gain direct employment in the energy efficiency or construction sector, and fill critical workforce skill gaps. Since July 2014, the corps has implemented three pre-apprentice training program cycles—including six-week intensive certification trainings—and helped prepare nearly 40 people for jobs.

Accelerate building codes and appliance standards

Codes and standards are the most cost-effective way to lock in savings for customers. To maintain California's leadership in establishing precedent-setting benchmarks, the agencies should take the following actions.

Building Codes

- Regularly update building energy efficiency standards (Title 24) at the highest levels found to be cost-effective and continue to make progress toward meeting California's zero net energy goals. When considering building standard updates, the agencies should:
  - Modify the trade-offs between fuel types to ensure that California's building energy efficiency standards align with its carbon reduction goals;
  - Move toward standards that address cost-effectiveness from a whole-building perspective rather than measure by measure; and
  - Better align the California Home Energy Rating System with the national system and include a ratings-based compliance pathway in the California code.
- Expand efforts to improve building energy standards compliance through agency activities, increased capacity of local governments to monitor implementation, and use of technologies to simplify compliance review, such as through electronic permitting systems.

Appliance Standards

- Accelerate progress on the current appliance efficiency standards (Title 20) rulemaking for phases 1 to 3 (covering 30 electronic, lighting, and other products, including computers, monitors, LED lamps, electric spas, and pool pumps). Set standards at the highest efficiency level found to be cost-effective.
- Implement a cross-cutting standby efficiency standard to reduce the power consumption of all products when not in active use.
- Accelerate market adoption of mobile technology standards to make every plug-in electronic device as efficient as battery-powered devices like phones and tablets.
- Regularly update existing California efficiency standards to keep pace with technology development, such as for audio equipment and TVs.
- Collaborate with the U.S. Department of Energy to increase the stringency of federal efficiency standards where California is preempted, such as those applying to refrigerators.

Finally, the state would not have such strong codes and standards without efficiency programs that provide technical and advocacy support. Ensuring utilities are motivated to actively advance new minimum efficiency requirements is critical to successfully transition technologies and practices into a code or standard. Therefore, the state should continue to enable and encourage development of efficiency programs that support research and advocacy efforts at the state and federal levels.

Foster opportunities to capture greater efficiency

New strategies and ideas—as well as tried-and-true approaches—must be utilized to meet the governor's goal of doubling current efficiency savings. The energy agencies should ensure policies enable program administrators to pursue the following activities:

Offer additional programs that save water as well as energy

In light of California's record drought, the agencies need to establish rules as quickly as possible to enable all utilities to fund additional programs that also save water for the customer. Reducing customers' use of water reduces the cost and need for "embedded energy"—that is, energy to treat and transport water to homes and businesses. The CPUC has an open proceeding to address this issue and should move swiftly to resolve outstanding policy issues (e.g., establish a value for programs that reduce embedded energy) so joint water-energy programs can be ramped up. The CPUC should also expand current offerings that reduce water use in homes and businesses (e.g., programs that fix leaks during water delivery or replace inefficient dishwashers and clothes washers).

EFFICIENCY PROGRAMS SAVE MORE THAN ENERGY

California program administrators run critical energy efficiency programs that also save a substantial amount of water amid California's extensive drought. For example, Pacific Gas & Electric's clothes washer rebate program includes a cooperative rebate program with 28 Bay Area partner water agencies to simplify customer participation and expand the program's reach. By partnering in this way, customers only need to fill out one application and receive a larger rebate for clothes washers that meet a minimum level of water and energy efficiency than they would if the rebate were solely based on energy savings. In 2013 alone, PG&E issued rebates for nearly 70,000 clothes washers, saving 10 GWh, 665,000 therms, and 273 million gallons of water (enough to serve 40,000 California homes for a month).[48]

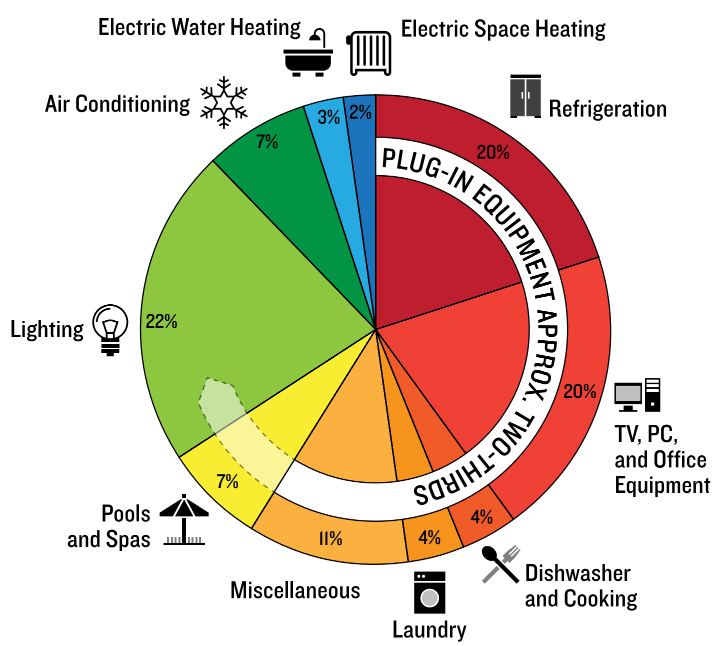
Establish one-stop shops to improve the customer experience

Ensuring that customers can access efficiency offerings and obtain assistance from professional staff in one location has proved to be effective, especially in complex sectors such as the multifamily residential sector. One-stop shops allow a customer (or building owner) to get help in understanding how to monetize rebates, obtain financing, and access technical assistance (such as energy management training). Making it easier to take advantage of efficiency programs often leads to higher participation. Program administrators should build on past efforts to ensure all customers can easily gain access to the suite of available energy-saving opportunities.

Develop a strategy to capture savings from plug-in equipment

With around 50 appliances, electronics, and miscellaneous electric devices connected to the typical household's electrical sockets, plug-in equipment is responsible for approximately two-thirds of all electricity use in California homes (Figure 29).[49] Unfortunately, much of this energy is wasted through high standby power levels when the devices are not in active use, and through equipment that is not as energy efficient as best practices allow. Given the explosion in the number of devices in the modern home, plug-in equipment is projected to account for most of the growth in electricity demand in the coming decade.[50] Efficiency programs and standards should be accelerated and scaled up to cut energy waste for plug-in equipment in order to help meet the state's energy and climate goals.

Figure 29: Residential Plug-in Equipment Usage Breakdown[51]



---- equipment that is mostly hard-wired to the building, with some exceptions (e.g., bedside lamps) that are plug in.

Along with advancing equipment standards, efficiency programs have an important role to play in transforming the plug-in equipment market. The energy agencies should update policy rules if necessary and ensure that program administrators pursue the following strategies:

- Programs to incentivize manufacturers to develop and deploy higher efficiency technologies, and retailers to sell the most efficient products. Policy intervention is necessary to provide business incentives to bring these technologies to market;[52]
- Expanded customer rebate programs to accelerate market adoption of high-efficiency appliances where cost remains a barrier;
- Leverage emerging energy data analytics solutions to influence building occupant behavior and encourage the deployment of plug-load management and control solutions that allow outlet monitoring and control, and switching off devices when not in use; and
- Scale up efforts to increase energy efficiency in data centers of all sizes, from server closets and rooms embedded in office buildings, to large standalone colocation (servers located in a different building from the business) and corporate data centers.[53]

Improve access to—and utilize—energy usage information

In order for building owners to manage the energy use in their buildings, comply with benchmarking requirements, and make investments to improve the efficiency of their buildings, they must be able to obtain reliable information about their buildings' energy usage in a timely manner and in a form that works with modern systems and tools. In addition, smart meter data and new analytics are available to help customers better understand their energy use and for program administrators and implementers to more strategically design and track programs. NRDC recommends the agencies focus efforts on the following areas.

Large commercial and multifamily buildings

Currently, property owners of non-master metered commercial and multifamily buildings have no consistent way of determining historic or current energy usage for a property because of difficulties obtaining anonymized, aggregated whole-building data and individual consent-based tenant data. This often means the owner and the residents/tenants are unaware of the amount of energy waste and are hindered in their ability to reliably plan for efficiency and renewable investments.

Utilities have discretion and legal authority to provide aggregated data to building owners so long as individual usage cannot be reasonably deduced.[54] However, neither the CPUC nor the CEC has promulgated specific tenant-aggregation parameters for commercial or multifamily buildings. NRDC recommends that the utilities adopt policies to deliver monthly whole-building usage information to building owners whenever permitted, or if necessary have such policies established by the CPUC, the CEC, or the legislature, as appropriate.

State benchmarking requirements

As described in Chapter 3, the AB 1103 benchmarking law requires electric and gas utilities to deliver energy usage information to building owners upon request, thereby enabling owners to track the energy use of their property and compare energy performance to other properties. However, owners have been unable to receive this data or to comply with point-of-sale energy disclosure requirements (also mandated under AB 1103) because utilities have not provided owners with building-level data through the U.S. Environmental Protection Agency's ENERGY STAR® Portfolio Manager, citing privacy concerns.

It is essential that owners be able to obtain this information, not only for energy management purposes, but also to implement local benchmarking ordinances. The agencies should issue clear regulations under their authority, clarifying reasonable data delivery methods while preserving an individual customer's confidentiality. The energy agencies should also ensure regulations clearly define terms and conditions for utilities to deliver aggregated whole-building data to multifamily owners, a sector that is not covered under AB 1103.

Finally, the state should consider expanding AB 1103 to capture water benchmarking opportunities as there are energy-saving opportunities from reduced water consumption (e.g., less hot water use leads to lower electricity or natural gas use to heat that water). There is also a strong link between the amount of water use and the energy needed to transport and treat that water.

Tracking progress and improving program design

While understanding energy usage is critical for building owners to manage their electricity and natural gas consumption, as well as comply with state and local benchmarking requirements, accessing detailed usage and savings data is also important for agencies to track progress and program administrators or implementers to best know how to improve their programs. The California utilities have a wealth of data being collected by the smart meters deployed across the state. In addition, state law requires the investor-owned utilities to report the anonymized data on a public website, including such details as project zip code.[55] However, data for publicly owned utilities, codes and standards, and other statewide efficiency initiatives do not have similar requirements and are therefore extremely difficult to access and aggregate to analyze statewide progress. The agencies should leverage the numerous existing databases and set up one statewide public repository.

In addition, policies should allow for program administrators to actively explore how building owners could use the information to better manage energy use (e.g., through daily or weekly reports or through efforts to improve operations and maintenance). This information should also be used to a greater extent to plan and update programs in a timely manner, target efficiency offerings to areas or customers who need it most, and evaluate the impacts of the programs.[56]

OPENING THE FRONTIER TO ENERGY DATA USE

The Southern California Regional Energy Network (SoCalREN), in partnership with UCLA and the City of Los Angeles, is piloting a region-wide effort to analyze energy usage data compared to publicly available building and parcel information. The aim is to inform local governments on the need for—and potential benefits of—energy codes and ordinances.

As an educational institution, UCLA was able to acquire usage information from the CPUC and the Los Angeles Department of Water & Power and is working with SoCalREN to develop analyses showing how people use energy and the trends across different building types (while maintaining individual customer confidentiality). SoCalREN is developing a region-wide database to archive building energy reporting and performance data, and this information is helping Los Angeles design a commercial building energy benchmarking and reporting ordinance.

Figure 30: Summary of Recommendations

Recommendations	Primary Agency Responsible
I. Establish a Statewide Approach to Policy and Program Planning	
Set vision & clarify roles	California Environmental Protection Agency Air Resources Board; [seal]; [seal]; California ISO
Create a statewide collaborative	
Prioritize challenges to resolve	
II. Update Policies to Enable a Doubling of Energy Efficiency Savings By 2030	
Update cost-effectiveness methodology	[seal]; [seal]; California ISO
Improve how savings are estimated and measured	[seal]; [seal]
Pursue all available efficiency opportunities	[seal]; [seal]
Set efficiency rules to enable and encourage market transformation	[seal]; [seal]
Expand the use of efficiency to avoid upgrading or adding infrastructure	[seal]; [seal]; California ISO

Adopt a process for ongoing program planning and oversight	
Ensure low- and moderate-income customers have access to energy-savings opportunities	
Include strong workforce strategies to help scale up efficiency	California Environmental Protection Agency Air Resources Board
Accelerate building codes and appliance standards	
Foster opportunities to capture greater efficiency	
Improve access to, and utilize, energy usage information	

CONCLUSION

California has a proud history of energy efficiency success but faces a significant amount of work to achieve a substantial reduction in the pollution driving climate change. The good news is that the state is in a great position to build on its strong foundation of efficiency policies: ongoing research and development of new technologies, utility programs to help consumers lower bills, and minimum standards that ensure new buildings and appliances are not energy guzzlers.

This success can be expanded in the state and replicated nationwide to help meet national climate goals, save homeowners and businesses additional energy and money, foster collaborative efforts to resolve policy issues quicker, invite innovation, and ensure that efficiency can be relied upon so utilities do not buy more expensive and often polluting resources to generate electricity.

The numerous and critical issues facing California's efficiency efforts are clear, and thankfully many are being addressed in existing forums. However, now is the time to rethink how the state approaches policy and program planning, prioritize issues to ensure important decisions are made in a timely manner, and put in place important statewide mechanisms to scale up efficiency across California. By leveraging existing policies, inspiring creative approaches, and establishing a collaborative regulatory environment, the state can fully tap into its golden energy efficiency opportunity to support a productive economy, reduce pollution, and save customers even more money.

Appendix 1: Net Benefits Sources

Annual net benefits increased from nearly $440 million in 2003 to almost $1.2 billion in 2013. Cumulative net benefits for 2003–2013 were nearly $12 billion. Program Administrator Cost (PAC) test net benefits were used whenever possible, since the PAC test most accurately represents savings from avoiding conventional power that utilities would have had to purchase were it not for the efficiency achievements. When PAC net benefits were unavailable, Total Resource Cost (TRC) test net benefits were used. The TRC test was used for investor-owned utilities (IOUs) in 2003 and publicly owned utilities (POUs) in 2006–2013. All net benefit data are net of free riders.

IOU NET BENEFITS DATA SOURCES:

2003: TRC Net Benefits. CPUC, Annual Earnings Assessment Proceedings (AEAP) data, November 17, 2006.

2004–2005: CPUC, *Energy Efficiency 2006–2008 Interim Verification Report*, Resolution E-4272, October 15, 2009, p. 85, Table 31: RRIM Calculator Output with Positive and Negative Interactive Effects, docs.cpuc.ca.gov/word_pdf/FINAL_RESOLUTION/108628.pdf (accessed May 16, 2015). PAC net benefits were provided only for 2006–2008, so these benefits were assumed to be proportional to 2004–2005 benefits. 2004 and 2005 annual PAC net benefits were calculated by scaling the 2006–2008 cumulative benefits by energy savings in 2004 and 2005 compared with 2006–2008 cumulative savings.

2006–2008: CPUC, Decision 10-12-049 in Rulemaking 09-01-019, *Decision Regarding the Risk/Reward Incentive Mechanism Earnings True-up for 2006–2008*, December 16, 2010, Appendix A, "Calculation of RRIM Earning Using Assumptions Listed on the Preceding Page" (p. 82 in the PDF), www.cpuc.ca.gov/NR/rdonlyres/D8629516-AF24-4E6E-9366-CBCBA70709C5/0/D1012049_RRIM_3.pdf (accessed May 16, 2015). PAC net benefits were reported for 2006–2008 cumulatively, so these were scaled by annual savings to calculate annual net benefits.

2009: CPUC, *Energy Efficiency Evaluation Report for the 2009 Bridge Funding Period*, January 2011. PAC Total Benefits and PAC Total Costs, Table 13, p. 54, www.cpuc.ca.gov/NR/rdonlyres/D66CCF63-5786-49C7-B250-00675D91953C/0/EEEvaluationReportforthe2009BFPeriod.pdf (accessed May 16, 2015). PAC net benefits were calculated by subtracting PAC total costs from PAC total benefits.

2010–2012: CPUC, *2010–2012 Energy Efficiency Annual Progress Evaluation Report*, March 2015, Appendix D Data, Excel Table 12, www.cpuc.ca.gov/NR/rdonlyres/052ED0ED-D314-4050-9FAA-198E45480C85/0/EEReport_Main_Book_v008.pdf and www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/Energy_Efficiency_2010-2012_Evaluation_Report.htm (accessed May 16, 2015). PAC Costs and PAC Benefits were reported for 2010–2012 cumulatively, so these were scaled by annual savings to calculate annual costs and annual benefits. Annual PAC net benefits were calculated by subtracting the scaled annual PAC Costs from PAC Benefits.

2013: Utilities' Energy Efficiency Annual Reports, Section 4: Cost-Effectiveness, Table 4, www.eestats.cpuc.ca.gov (accessed May 16, 2015). See: Regulatory > Filed Reports. PAC net benefits were calculated by subtracting Total Cost to Billpayers (PAC) from Total Savings to Billpayers (TRC) using the assumption that the total benefits to billpayers would be the same under either TRC or PAC.

POU NET BENEFITS DATA SOURCES: Total cost and TRC ratio data are from CMUA's annual editions of *Energy Efficiency in California's Public Power Sector: A Status Report*, http://www.ncpa.com/policy/reports/energy-efficiency/ (accessed May 16, 2015).

2006: December 2006. Total Cost: p. 23, Table 8; For 2006, no TRC ratio was reported, so a TRC of 3.15 was assumed (the aggregate TRC for 2007).

2007: March 2008. Total Cost: p. 14, Table 7; TRC: p. 17, Table 10.

2008: March 2009. Total Cost: p. 17, Table 4; TRC: p. 19, Table 6.

2009: March 2010. Total Cost and TRC: p. 31, Table 7.

2010: March 2011. Total Cost and TRC: p. 20, Table 7.

2011: March 2012. Total Cost and TRC: p. 25, Table 4.

2012: March 2013. Total Cost and TRC: p. 16, Table 2.

2013: March 2014. Total cost: p. 22, Figure 6; TRC available in each utility's summary.

POUs began reporting data in 2006, although many POUs offered efficiency programs prior to 2006. Only total costs and a TRC ratio were reported for each utility in each year. Therefore, we calculated net benefits: [TRC net benefits = (Total Costs * TRC ratio) – Total Costs].

Appendix 2: Electricity Savings Sources

Annual gross electricity savings from utility efficiency programs in California increased from approximately 1,700 GWh in 2003 to nearly 3,000 GWh in 2013. Annual electricity savings from building codes and appliance standards increased from approximately 1,400 GWh in 2003 to 2,400 GWh in 2013. Cumulative electricity savings from customer-funded efficiency programs from 2003 through 2013 reached more than 33,000 GWh, and cumulative electricity savings from codes and standards reached almost 19,000 GWh (or more than 15,000 GWh after accounting for the IOU codes and standards overlap), for a total electricity savings of approximately 48,500 GWh from 2003 through 2013 (after adjusting for overlap of codes and standards savings). Cumulative electricity savings from utilities were calculated by adding gross annual electricity savings from utilities' efficiency programs (when possible, electricity savings from low-income programs and codes and standards efficiency programs were included in the annual total). For the investor-owned utilities in 2003–2005, only net savings were available. Therefore, a net-to-gross ratio of 0.65—the average IOU net-to-gross ratio for programs in 2006–2008—was applied to electricity savings for those years. Publicly owned utilities do not apply a net-to-gross ratio to their reported or evaluated savings. All savings analyses rely on gross values whenever possible as this Report focuses on the statewide impact of efficiency toward meeting the state's climate objectives.

IOU ELECTRICITY SAVINGS DATA SOURCES:

2003: CPUC, Annual Earnings Assessment Proceedings (AEAP) data (November 17, 2006). A net-to-gross ratio of 0.65 was applied to calculate gross savings.

2004–2005: CPUC, *Energy Efficiency 2006–2008 Interim Verification Report*, Resolution E-4272, October 15, 2009, p. 85, Table 31, docs.cpuc.ca.gov/word_pdf/FINAL_RESOLUTION/108628.pdf (accessed May 16, 2015). Savings were provided as cumulative. Therefore, we calculated annual savings by scaling total cumulative 2004–2005 evaluated savings based on reported annual savings for 2004 and 2005. Low-income efficiency savings are often reported separately, so we added low-income efficiency savings to the portfolio savings to calculate total annual savings. A net-to-gross ratio of 0.65 was applied to calculate gross savings.

2006–2008: CPUC, *2006–2008 Energy Efficiency Evaluation Report*, July 2010, ftp://ftp.cpuc.ca.gov/gopher-data/energy%20efficiency/2006-2008%20Energy%20Efficiency%20Evaluation%20Report%20-%20Full.pdf (accessed May 16, 2015). Gross Evaluated Savings. PG&E: Table 27, p. 108; SCE: Table 28, p. 110; SDG&E: Table 29, p. 113; SCG: Table 30, p. 115. Savings were reported as cumulative, so NRDC calculated annual savings by scaling 2006–2008 total cumulative evaluated savings by each utility's reported annual savings for 2006, 2007, and 2008. Savings from codes and standards (C&S) and low-income programs from Table 24 were added to program savings to calculate total annual savings.

2009: CPUC, *Energy Efficiency Evaluation Report for the 2009 Bridge Funding Period*, January 2011, www.cpuc.ca.gov/NR/rdonlyres/D66CCF63-5786-49C7-B250-00675D91953C/0/EEEvaluationReportforthe2009BFPeriod.pdf (accessed May 16, 2015). Gross Evaluated Savings. PG&E: Table 8, p. 36; SCE: Table 9, p. 38; SDG&E: Table 10, p. 41; SCG: Table 11, p. 43. C&S and low-income savings from Table 6, p. 28 were added to program savings to calculate total annual savings. 2006–2008 values were subtracted from C&S and low-income savings to calculate 2009 savings only.

2010–2012: CPUC, *2010–2012 Energy Efficiency Annual Progress Evaluation Report*, March 2015, www.cpuc.ca.gov/NR/rdonlyres/052ED0ED-D314-4050-9FAA-198E45480C85/0/EEReport_Main_Book_v008.pdf and www.cpuc.ca.gov/NR/rdonlyres/31854D3C-2096-4FEE-B562-DB3C5D6A3EF7/0/AppendixA_v002.pdf (accessed May 16, 2015). Gross Evaluated Savings. Appendix A. PG&E: Table A-2; SCE: Table A-3; SDG&E: Table A-5; SCG: Table A-4. Evaluated gross savings were given for the whole portfolio period in Appendix A. Evaluated gross annual savings (which add up to the period totals provided in Appendix A) were downloaded from the Energy Efficiency Data Portal, www.eestats.cpuc.ca.gov/Views/EEDataPortal.aspx, on March 20, 2015. Evaluated C&S savings (located in same tables of Appendix A; evaluated C&S savings were given only for the whole portfolio period, so values were scaled by annual savings to provide annual C&S numbers) and reported low-income savings were added to the program savings to calculate total savings for each program year.

2013: Utilities' 2013 Energy Efficiency Annual Reports, May 2014, Section 1: Energy Savings, Table 1, www.eestats.cpuc.ca.gov (accessed May 16, 2015). See > Regulatory > Filed Reports. Savings from C&S and low-income programs were usually already included in the reported total annual savings. PG&E's annual savings did not include C&S savings, so these savings were added in from Table 1 to calculate total annual savings.

POU ELECTRICITY SAVINGS DATA SOURCES:
CMUA's annual editions of *Energy Efficiency in California's Public Power Sector: A Status Report*, http://www.ncpa.com/policy/reports/energy-efficiency/ (accessed May 15, 2015). POUs did not start reporting data until 2006.

2006: December 2006, p. 23, Table 8.

2007: March 2008, p. 14, Table 7.

2008: March 2009, p. 17, Table 4.

2009: March 2010, p. 31, Table 7.

2010: March 2011, p. 20, Table 7.

2011: March 2012, p. 25, Table 4.

2012: March 2013, p. 16, Table 2.

2013: March 2014, p. 22, Figure 6.

CODES AND STANDARDS:
Overall C&S savings for 2003–2013 are from CEC, *California Energy Demand Forecast 2014–2024*, 2013, "Table A-8: Electricity Efficiency/Conservation Consumption Savings," www.energy.ca.gov/2013_energypolicy/documents/demand-forecast/mid_case/ (accessed May 16, 2015). In order to avoid double counting of C&S savings, the C&S savings attributed to the utilities were subtracted.

TOTAL ELECTRICITY SAVINGS:
Total savings were calculated by adding utility program savings to CEC C&S savings. Total electricity savings from 2003–2013 were approximately 48,500 GWh.

Appendix 3: Natural Gas Savings Sources

Annual natural gas savings from utility programs increased from approximately 36 million therms in 2003 to nearly 58 million therms in 2013. Cumulative natural gas savings from utility programs from 2003 through 2013 reached more than 500 million therms. Most publicly owned utilities do not offer natural gas efficiency programs, so all utility program data are from investor-owned utilities. Cumulative savings from codes and standards reached more than 660 million therms, for a total savings of more than 1,000 million therms from 2003 through 2013 (after adjusting for overlap of codes and standards savings). Cumulative natural gas savings from utilities were calculated by adding gross annual savings from utilities' efficiency programs (when possible, savings from low-income programs and codes and standards efficiency programs were included in the annual total). For the investor-owned utilities in 2003–2005, only net savings were available. Therefore, a net-to-gross ratio of 0.65—the average IOU net-to-gross ratio for programs in 2006–2008—was applied to natural gas savings for those years. All savings analyses rely on gross values whenever possible as this Report focuses on the statewide impact of efficiency toward meeting the state's climate objectives.

IOU NATURAL GAS SAVINGS DATA SOURCES:
2003: CPUC, Annual Earnings Assessment Proceedings (AEAP) data (November 17, 2006). A net-to-gross ratio of 0.65 was applied to calculate gross savings.

2004–2005: CPUC, *Energy Efficiency 2006–2008 Interim Verification Report*, Resolution E-4272, October 15, 2009, p. 85, Table 31, docs.cpuc.ca.gov/word_pdf/FINAL_RESOLUTION/108628.pdf (accessed May 16, 2015). Since savings were reported as cumulative, we calculated annual savings by scaling total cumulative 2004–2005 evaluated savings by reported annual savings for 2004 and 2005. Low-income savings were added to portfolio savings to calculate total annual savings. A net-to-gross ratio of 0.65 was applied to calculate gross savings.

2006–2008: CPUC, *2006–2008 Energy Efficiency Evaluation Report*, July 2010, ftp://ftp.cpuc.ca.gov/gopher-data/energy%20efficiency/2006-2008%20Energy%20Efficiency%20Evaluation%20Report%20-%20Full.pdf (accessed May 16, 2015). Gross Evaluated Savings. PG&E: Table 27, p. 108; SCE: Table 28, p. 110; SDG&E: Table 29, p. 113; SCG: Table 30, p. 115. Since savings were reported as cumulative, NRDC calculated annual savings by scaling 2006–2008 total cumulative evaluated savings by each utility's reported annual savings for 2006, 2007, and 2008. Savings from codes and standards (C&S) and low-income programs from Table 24 were added to program savings to calculate total annual savings.

2009: CPUC, *Energy Efficiency Evaluation Report for the 2009 Bridge Funding Period*, January 2011, www.cpuc.ca.gov/NR/rdonlyres/D66CCF63-5786-49C7-B250-00675D91953C/0/EEEvaluationReportforthe2009BFPeriod.pdf (accessed

May 16, 2015). Gross Evaluated Savings. PG&E: Table 8, p. 36; SCE: Table 9, p. 38; SDG&E: Table 10, p. 41; SCG: Table 11, p. 43. C&S and low-income savings from Table 6, p. 28 were added to program savings to calculate total annual savings. 2006–2008 values were subtracted from C&S and low-income savings to calculate 2009 savings only.

2010–2012: CPUC, *2010–2012 Energy Efficiency Annual Progress Evaluation Report*, March 2015. Gross Evaluated Savings. Appendix A, www.cpuc.ca.gov/NR/rdonlyres/052ED0ED-D314-4050-9FAA-198E45480C85/0/EEReport_Main_Book_v008.pdf and www.cpuc.ca.gov/NR/rdonlyres/31854D3C-2096-4FEE-B562-DB3C5D6A3EF7/0/AppendixA_v002.pdf (accessed May 16, 2015). PG&E: Table A-2; SCE: Table A-3; SDG&E: Table A-5; SCG: Table A-4. Evaluated gross savings were given for the whole portfolio period in Appendix A. Evaluated gross annual savings (which add up to the period totals provided in Appendix A) were downloaded from the Energy Efficiency Data Portal, www.eestats.cpuc.ca.gov/Views/EEDataPortal.aspx, on March 20, 2015. Evaluated C&S savings (located in same tables of Appendix A; evaluated C&S savings were given only for the whole portfolio period, so values were scaled by annual savings to provide annual C&S numbers) and reported low-income savings were added to the program savings to calculate total savings for each program year.

2013: Utilities' 2013 Energy Efficiency Annual Reports, May 2014, Section 1: Energy Savings, Table 1, www.eestats.cpuc.ca.gov (accessed May 16, 2015). See > Regulatory > Filed Reports. Savings from C&S and low-income programs were usually already included in the reported total annual savings. PG&E's annual savings did not include C&S savings, so these savings were added in from Table 1 to calculate total annual savings.

CODES AND STANDARDS:
Overall C&S savings for 2003–2013 are from CEC, *California Energy Demand Forecast 2013–2024 Staff Revised Forecast*, 2013, Table A-8: "Natural Gas Committed Efficiency/Conservation Savings (MM Therms)," energy.ca.gov/2013_energypolicy/documents/2013-10-01_workshop/spreadsheets/Mid/ (accessed May 16, 2015). In order to avoid double counting of C&S savings, the C&S savings attributed to the utilities were subtracted.

TOTAL NATURAL GAS SAVINGS:
Total savings were calculated by adding utility program savings to CEC C&S savings. The total savings were more than 1,000 million therms from 2003 through 2013.

Appendix 4: Demand Savings Sources

Annual demand savings from utility programs increased from more than 300 MW in 2003 to more than 500 MW in 2013. Cumulative demand savings from utility programs exceeded 5,500 MW from 2003 through 2013. Incremental annual demand savings from codes and standards increased from more than 300 MW in 2003 to approximately 750 MW in 2013. Cumulative demand savings from codes and standards from 2003 through 2013 exceeded 5,300 MW. Total demand savings from utilities and codes and standards exceeded 10,500 MW (after subtracting the overlap from C&S). A large power plant is assumed to be 500 MW; therefore, savings equaled the output of about 20 large power plants (10,500 MW/500 MW = 21). When possible, annual demand savings are gross values and include low-income programs and codes and standards. For the investor-owned utilities in 2003–2005, only net savings were available. Therefore, a net-to-gross ratio of 0.65—the average IOU net-to-gross ratio for programs in 2006–2008—was applied to demand savings for those years. All savings analyses rely on gross values whenever possible as this Report focuses on the statewide impact of efficiency toward meeting the state's climate objectives.

IOU DEMAND DATA SOURCES:
2003: CPUC, Annual Earnings Assessment (AEAP) Proceedings data (November 17, 2006). A net-to-gross ratio of 0.65 was applied to calculate gross savings.

2004–2005: CPUC, Energy Efficiency 2006–2008 Interim Verification Report, Resolution E-4272, October 15, 2009, p. 85, Table 31, docs.cpuc.ca.gov/word_pdf/FINAL_RESOLUTION/108628.pdf (accessed May 16, 2015). Since savings were reported as cumulative, NRDC calculated annual savings by scaling total cumulative 2004–2005 evaluated savings by reported annual savings for 2004 and 2005. Low-income savings were added to portfolio savings to calculate total annual savings. A net-to-gross ratio of 0.65 was applied to calculate gross savings.

2006–2008: CPUC, *2006–2008 Energy Efficiency Evaluation Report*, July 2010, ftp://ftp.cpuc.ca.gov/gopher-data/energy%20efficiency/2006-2008%20Energy%20Efficiency%20Evaluation%20Report%20-%20Full.pdf (accessed May 16, 2015). Gross Evaluated Savings. PG&E: Table 27, p. 108; SCE: Table 28, p. 110; SDG&E: Table 29, p. 113; SCG: Table 30, p. 115. Since savings were reported as cumulative, NRDC calculated annual savings by scaling 2006–2008 total cumulative evaluated savings by each utility's reported annual savings for 2006, 2007, and 2008. Savings from codes and standards (C&S) and low-income programs from Table 24 were added to program savings to calculate total annual savings.

2009: CPUC, *Energy Efficiency Evaluation Report for the 2009 Bridge Funding Period*, January 2011, www.cpuc.ca.gov/NR/rdonlyres/D66CCF63-5786-49C7-B250-00675D91953C/0/EEEvaluationReportforthe2009BFPeriod.pdf (accessed May 16, 2015). Gross Evaluated Savings. PG&E: Table 8, p. 36; SCE: Table 9, p. 38; SDG&E: Table 10, p. 41; SCG: Table 11, p. 43. C&S and low-income savings from Table 6, p. 28 were added to program savings to calculate total annual savings. 2006–2008 values were subtracted from C&S and low-income savings to calculate 2009 savings only.

2010–2012: CPUC, *2010–2012 Energy Efficiency Annual Progress Evaluation Report*, March 2015. Gross Evaluated Savings. Appendix A, www.cpuc.ca.gov/NR/rdonlyres/052ED0ED-D314-4050-9FAA-198E45480C85/0/EEReport_Main_Book_v008.pdf and www.cpuc.ca.gov/NR/rdonlyres/31854D3C-2096-4FEE-B562-DB3C5D6A3EF7/0/AppendixA_v002.pdf (accessed May 16, 2015). PG&E: Table A-2; SCE: Table A-3; SDG&E: Table A-5; SCG: Table A-4. Evaluated gross savings were given for the whole portfolio period in Appendix A. Evaluated gross annual savings (which add up to the period totals provided in Appendix A) were downloaded from the Energy Efficiency Data Portal, www.eestats.cpuc.ca.gov/Views/EEDataPortal.aspx, on March 20, 2015. Evaluated C&S savings (located in same tables of Appendix A; evaluated C&S savings were given only for the whole portfolio period, so values were scaled by annual savings to provide annual C&S numbers) and reported low-income savings were added to the program savings to calculate total savings for each program year.

2013: Utilities' 2013 Energy Efficiency Annual Reports, May 2014, Section 1: Energy Savings, Table 1, www.eestats.cpuc.ca.gov (accessed May 16, 2015). See > Regulatory > Filed Reports. Savings from C&S and low-income programs were usually already included in the reported total annual savings. PG&E's annual savings did not include C&S savings, so these savings were added in from Table 1 to calculate total annual savings.

POU DEMAND DATA SOURCES:

CMUA's annual editions of *Energy Efficiency in California's Public Power Sector: A Status Report*, http://www.ncpa.com/policy/reports/energy-efficiency/ (accessed May 16, 2015). POUs did not start reporting data until 2006.

2006: December 2006, p. 23, Table 8.

2007: March 2008, p. 14, Table 7.

2008: March 2009, p. 17, Table 4.

2009: March 2010, p. 31, Table 7.

2010: March 2011, p. 20, Table 7.

2011: March 2012, p. 25, Table 4.

2012: March 2013, p. 16, Table 2.

2013: March 2014, p. 22, Figure 6.

CODES AND STANDARDS DEMAND SAVINGS:

C&S savings for 2003–2013 are from CEC, *California Energy Demand Forecast 2014–2024*, 2013, Table A-8: "Electricity Efficiency/Conservation Peak Savings," www.energy.ca.gov/2013_energypolicy/documents/demand-forecast/mid_case/ (accessed May 16, 2015). In order to avoid double counting of C&S savings, the C&S savings attributed to the utilities were subtracted.

TOTAL DEMAND SAVINGS:

Total savings were calculated by adding utility program savings to C&S savings. Total demand savings from utilities and codes and standards exceeded 10,500 MW.

Appendix 5: Energy Efficiency Timeline Sources

1996 DEREGULATION LAW: Assembly Bill 1890 (Brulte, 1996).

2000 EE FUND COLLECTION REQUIREMENT: California State Legislature, Electric Restructuring: Public Benefit Programs, Assembly Bill 995 (Wright, 2000), leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=199920000AB995&search_keywords (accessed June 5, 2015) and Senate Bill 1194 (Sher, 2000), leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=199920000SB1194&search_keywords (accessed June 5, 2015).

2001 IOUS RESUME PORTFOLIO MANAGEMENT: California State Legislature, Electrical Corporations: Procurement Plans, Assembly Bill 57 (Wright, 2002), leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200120020AB57&search_keywords, (accessed June 6, 2015).

2003 EE MADE TOP PRIORITY: CEC, *Energy Action Plan*.

2005 EE CODIFIED AS TOP PRIORITY: Senate Bill 1037 (Kehoe, 2005).

2005 IOU ADMINISTRATION RESTORED: CPUC, *Interim Opinion on the Administrative Structure for Energy Efficiency*, (D.05-01-055), January 27, 2005, docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/43628.PDF (accessed June 5, 2015).

2005 DECOUPLING RESTORED FOR IOUS: Implemented at the CPUC pursuant to California State Legislature, Energy, Assembly Bill 1X-29 (Kehoe, 2001), leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200120021AB29&search_keywords (accessed May 21, 2015).

2005 10-YEAR TARGETS: Implemented in 2006 pursuant to CPUC, *Interim Opinion: Energy Savings Goals for Program Year 2006 and Beyond*, (D.04-09-060), September 23, 2004.

2006 INCENTIVE MECHANISM: Applied to 2006–2008 program cycle pursuant to CPUC, *Interim Opinion on Phase 1 Issues: Shareholder Risk/Reward Incentive Mechanism for Energy Efficiency Programs* (D.07-09-043), September 20, 2007, docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/73172.PDF (accessed June 5, 2015).

2008 CA EE STRATEGIC PLAN: CPUC, *Energy Efficiency Strategic Plan*, www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/ (accessed May 20, 2015). 2009 Passage of AB 758: CEC, "Comprehensive Energy Efficiency Program for Existing Buildings," www.energy.ca.gov/ab758/ (accessed May 20, 2015).

2012/2013 LADWP AND GWP DECOUPLING: Dylan Sullivan, "Southern California Municipal Utilities Innovate with Decoupling," NRDC Switchboard, April 11, 2014, switchboard.nrdc.org/blogs/dsullivan/southern_california_municipal.html (accessed May 16, 2015).

SOURCE FOR SAVINGS DATA: 1995–1997, CEC, provided by Sylvia Bender; 1998–2002, IOUs' Annual Earnings Assessment Proceeding (AEAP) reports, including savings from "Summer Initiatives" during California's electricity crisis; 2003–2013; Appendix 2.

ENDNOTES

Executive Summary

1 **Source for $75 billion total savings:** California Energy Commission (hereinafter CEC), *2013 Integrated Energy Policy Report,* CEC-100-2013-001-CMF, 2013, p.28, www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-CMF.pdf (accessed June 6, 2015). The CEC reports codes and standards benefits as a total, not accounting for the cost of the programs. **Source for $12 billion net savings:** See Appendix 1: "Net Benefits Sources" (benefits are net of the cost to run the programs). **Source for 15,500 MW:** CEC, *California Energy Demand 2014–2024 Final Forecast Vol. 1*, 2013, p.77; Figure 38, p.78, www.energy.ca.gov/2013publications/CEC-200-2013-004/CEC-200-2013-004-V1-CMF.pdf (accessed June 6, 2015). **Power plant equivalent:** Jonathan Koomey, et al., "Defining a Standard Metric for Electricity Savings," *Environmental Research Letters* 5, no. 1 (January–March 2010): 014017, iopscience.iop.org/1748-9326/5/1/014017/pdf/1748-9326_5_1_014017.pdf (accessed June 15, 2015 by pasting URL into browser). Peak demand savings were approximately 15,500 MW in 2012. One large power plant is 500 MW (15,500MW/500MW = 31).

2 **Source for AB 32:** California State Legislature, A*ir Pollution: Greenhouse Gases: California Global Warming Solutions Act of 2006*, Assembly Bill 32 (Nunez, 2006), September 27, 2006, leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32&search_keywords (accessed June 6, 2015). **Source for AB 32 energy saving targets:** California Air Resources Board (hereinafter CARB), *Climate Change Scoping Plan*, December 2008, p. 41, www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf (accessed June 6, 2015). **Source for electricity savings:** CEC, *California Energy Demand 2014–2024,* Mid-Case Final Baseline Demand Forecast Forms, Table A-8: Electricity Efficiency/Conservation Consumption Savings (GWh), Statewide Residential + Non-residential, http://www.energy.ca.gov/2013_energypolicy/documents/demand-forecast_CMF/mid_case/ (accessed June 6, 2015), and Additional Achievable Energy Efficiency (hereinafter AAEE) forecasted savings, added individual utility's mid-case AAEE together, http://www.energy.ca.gov/2013_energypolicy/documents/demand-forecast_CMF/Additional_Achievable_Energy_Efficiency/ (accessed June 6, 2015). Governor Edmund G. Brown, Jr., Inaugural Address, remarks as prepared, January 5, 2015, gov.ca.gov/news.php?id=18828 (accessed May 16, 2015). CEC, *California's 2030 Climate Commitment: Double Energy Savings in Existing Buildings & Develop Cleaner Heating Fuels by 2030*, 2015, www.energy.ca.gov/commission/fact_sheets/documents/Fact_Sheet_-_Energy_Efficiency.pdf (accessed May 16, 2015). Governor Edmund G. Brown, Jr., Executive Order B-30-15 (California, 2015), https://www.gov.ca.gov/news.php?id=18938 (accessed May 16, 2015).

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6 **Source for natural gas savings:** See Appendix 3: "Natural Gas Savings Sources. **Source for electricity savings:** See Appendix 2: "Electricity Savings Sources." **Source for CO_2:** E3, *Developing a Greenhouse Gas Tool for Buildings in California*. **Source for cars equivalent:** CARB *EMFAC Database*. **Source for calculating households (GWh):** EIA, *Electric Sales, Revenue, and Average Price,* Table 5a, 2013, http://www.eia.gov/electricity/sales_revenue_price/ and www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf (accessed May 16, 2015). 2013 average annual California household consumption was 6,684 kWh (557 kwh/month*12). U.S. Census Bureau, "American FactFinder," Community Facts, California, http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml (accessed June 5, 2015).

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8 **Source for historic electricity consumption:** EIA, *State Energy Database System* (SEDS), June 27, 2014, www.eia.gov/state/seds/seds-data-complete.cfm (accessed May 16, 2015). **Source for 2013 electricity consumption:** EIA, *Form 826 Monthly Utility Data* (October 2014), www.eia.gov/electricity/data/eia826/ (accessed May 16, 2015). **Source for population:** 1960-2012 population data is from EIA SEDS. 2013 population data from U.S. Census Bureau, www.census.gov/popest/data/state/totals/2013/index.html. **Source for electricity bills:** EIA, *2013 Average Monthly Bill—Residential*, www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf (accessed May 16, 2015). Calculation: California average monthly residential bill is $90.19 ($1,082.28 annually); U.S. average monthly residential bill is $110.20 ($1,322.40 annually). [110.20 – 90.19 = $20.01/month, or approximately $240/year] and [(90.19 –110.20)/110.20 = -18%]. Energy consumption per capita in California in 1973 = 6,711 GWh and 2013 = 6,704 GWh.

9 See Appendix 4: "Demand Savings Sources." Cumulative demand savings from utility programs exceeded 5,500 MW from 2003-2013. (5,891 MW/500 MW per power plant = 11.8 large power plants avoided).

10 CEC, *California Energy Demand Updated Forecast, 2015–2025*, 2014, Form 1.5b, compared the Mid Demand Baseline with Mid Additional Achievable Energy Efficiency Savings and without AAEE Savings, www.energy.ca.gov/2014publications/CEC-200-2014-009/CEC-200-2014-009-SF.pdf (accessed June 6, 2015). Expected savings reach 5,713 MW in 2025/500 MW = 11.4 large power plants avoided.

11 Appendix 2. EIA, *Electric Power Sales, Revenue, and Energy Efficiency Form EIA-861*, www.eia.gov/electricity/data/eia861/ (accessed May 16, 2015).

12 EIA, *Electric Sales, Revenue, and Average Price*.

13 Appendix 3 and CEC, "California Residential Natural Gas Consumption," 1967–2012, *CEC Energy Almanac*, www.energyalmanac.ca.gov/naturalgas/residential_natural_gas_consumption.html (accessed May 16, 2015). The average California household uses 453 therms per year.

14 **Source for savings:** Appendix 2. **Source for emissions reductions and cars equivalent:** E3, *Developing a Greenhouse Gas Tool for Buildings in California*. CARB *EMFAC Database*. Based on publicly owned utilities' (POUs) cumulative energy savings of 3,413 GWh from 2006 through 2013 (POUs began officially reporting savings in 2006).

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calculating electricity household equivalent (GWh): EIA, *Electric Sales, Revenue, and Average Price.* **Source for calculating natural gas household equivalent (therms):** CEC, "California Residential Natural Gas Consumption."

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17 Galen L. Barbose et al., *The Future of Utility Customer-Funded Energy Efficiency Programs in the United States: Projected Spending and Savings to 2025*, Ernest Orlando Lawrence Berkeley National Laboratory, January 2013, p. 10, footnote 11, emp.lbl.gov/sites/all/files/lbnl-5803e.pdf (accessed May 16, 2015).

18 **Source for electricity savings:** Appendix 2. Savings as a percentage of sales are calculated by dividing annual electric energy efficiency savings by annual electricity sales. **Source for energy sales:** CEC, "Electricity Consumption by Entity," Energy Consumption Data Management System (hereinafter ECDMS) Database, ecdms.energy.ca.gov/elecbyutil.aspx (accessed May 16, 2015).

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25 Next 10, *2014 California Green Innovation Index,* p.40.

26 Advanced Energy Economy Institute (hereinafter AEE) and BW Research Partnership, *California Advanced Energy Employment Survey*, December 2014, Figure 3, p. 5, info.aee.net/hs-fs/hub/211732/file-2173902479-pdf/PDF/aeei-california-advanced-energy-employment-survey-fnl.pdf (accessed May 16, 2015).

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Chapter I

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