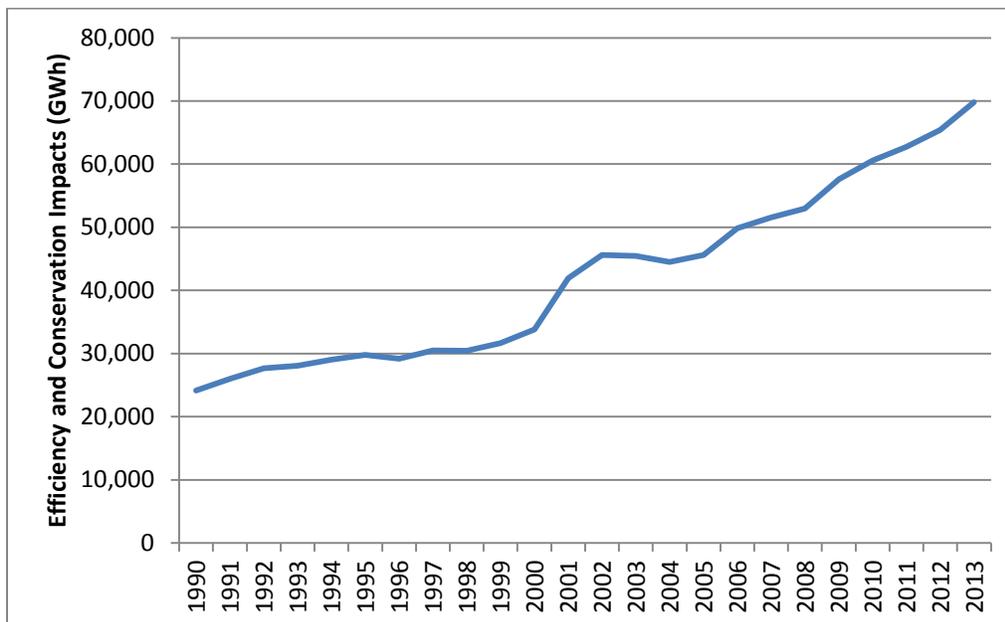




Energy Efficiency

California has long been a leader in advancing building and appliance energy efficiency. Over the last 40 years, California has implemented cost-effective building codes and appliance standards that have saved consumers billions of dollars. Combining efficiency gains from codes and standards, efficiency programs, and market and price effects, the cumulative annual efficiency and conservation savings for electricity are estimated to reach nearly 70,000 gigawatt hours (GWh) by 2013, as shown in **Figure 1**.¹

Figure 1: Statewide Efficiency and Conservation Impacts



Source: California Energy Commission, Demand Analysis Office, based on the California Energy Demand 2014-2024 Revised Forecast, September 2013.

A variety of ratepayer-funded programs, from financial assistance to workforce education and public outreach, as well as state building and appliance energy efficiency standards play key roles in advancing energy efficiency in California. With the proliferation of plug-in devices, energy demand due to plug load is a growing challenge to meeting the state’s energy efficiency goals – plug loads are expected to account for 69 percent of the growth in building electricity consumption by 2030.² While the state has made strides in advancing the efficiency of

1 These savings are measured relative to conditions in 1975, before implementation of the first efficiency standards.

2 California Energy Commission. 2015. *Existing Buildings Energy Efficiency Action Plan*. Publication Number: CEC-400-2015-013-F, http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015_20150904T153548_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf.



California Energy Commission – Tracking Progress

appliances, it is preempted from doing so for appliances that are regulated by the federal government.

Advancing energy efficiency is a key part of the state's efforts to reduce greenhouse gas emissions and achieve Governor Brown's Executive Order B-30-15, establishing a statewide goal to reduce greenhouse gas emissions 40 percent below 1990 levels by 2030.³ The Governor's greenhouse gas reduction goal was codified by the Clean Energy and Pollution Reduction Act of 2015 (De León, Chapter 547, Statutes of 2015) (Senate Bill 350).⁴

Improvements in energy efficiency also help businesses and homes reduce energy costs and increase building comfort. Further, energy efficiency improvements help reduce California's energy infrastructure costs since it eases demand that must be met by either fossil or renewable generation. Past successes in energy efficiency have contributed to limiting electricity consumption growth to roughly 1 percent annually and natural gas consumption growth to nearly zero.

Advancing Energy Efficiency of Existing Buildings

In his 2015 inaugural address, Governor Edmund G. Brown Jr. set an ambitious goal to double the efficiency savings achieved at existing buildings and make heating fuels cleaner. Senate Bill 350 codifies the Governor's goal for existing buildings and expands it to all retail end-use. It also requires the Energy Commission to establish annual targets to double statewide energy efficiency savings in electricity and natural gas end uses by January 1, 2030 and report on progress toward the goal.

In conjunction with the goal of doubling energy efficiency savings in existing buildings, Assembly Bill 802 (Williams, Chapter 590, Statutes of 2015) (AB 802) revisits the treatment of utility incentives for existing buildings. Currently, electrical and gas corporations may offer incentives only for energy efficiency measures that improve a building beyond current efficiency codes and standards. AB 802 requires the California Public Utilities Commission (CPUC) to consider incentives for energy efficiency measures that improve the efficiency of a building beyond current conditions and up to current code. This will allow for a broader array of incentive programs with higher potential efficiency savings. AB 802 also requires the Energy Commission to develop and implement a statewide building benchmarking and public disclosure program to increase demand for energy efficiency in existing buildings. Among these provisions, AB 802 requires utilities to maintain energy usage records for both commercial and large multifamily buildings and to provide combined energy usage data to the building owner, owner's agent, or operator upon request. The legislation also allows the Energy Commission to adopt regulations providing for the collection and public disclosure of energy benchmarking information.

3 Executive Order B-30-15, <http://gov.ca.gov/news.php?id=18938>.

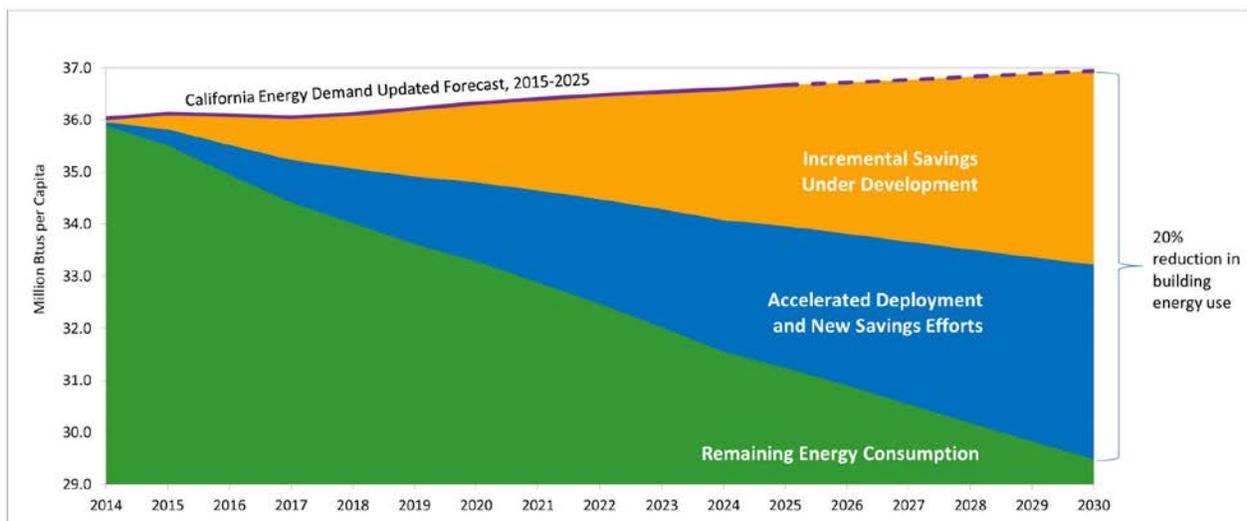
4 Public Utilities Code Section 454.52(a)(1)(A) and similar language in 9621(b)(1)



California Energy Commission – Tracking Progress

Figure 2 shows the approximate reduction in building energy consumption per capita that will be necessary to double energy efficiency savings by 2030. The purple line at the top of the chart shows energy consumption assuming the state achieves energy efficiency from adopted and funded policies, standards, and programs (also known as “committed savings”). The orange wedge represents savings, or reduced energy consumption, projected as result of planned California and national appliance efficiency standards, increasing building energy efficiency standards through 2022, and continuous implementation of ratepayer-funded energy efficiency programs. The blue wedge represents a doubling thereof, achieved by restructuring of current programs to align with SB 350 and AB 802 mandates, efficiency savings achieved through scaling investments in energy efficiency, and behavioral changes made by consumers and businesses outside incentive programs. Achieving a doubling of energy efficiency in existing buildings is likely to require both new efforts and revised approaches to encouraging energy efficiency gains.

Figure 2: Reduced Energy Consumption by Doubling Energy Efficiency in Buildings



Source: California Energy Commission

Commercial and residential buildings account for nearly 70 percent of California's electricity end-use consumption and 55 percent of its natural gas end-use consumption. The residential and commercial sectors account for over 26 percent of California's total greenhouse gas emissions.

Assembly Bill 758 (Skinner, Chapter 470, Statutes of 2009) recognized the need to improve the energy efficiency of existing buildings and directed the Energy Commission to develop a comprehensive plan to achieve cost-effective energy savings in California's existing residential and nonresidential buildings. In September 2015, the Energy Commission adopted the *Existing*



California Energy Commission – Tracking Progress

Buildings Energy Efficiency Action Plan,⁵ a roadmap to reach the goal of doubling energy efficiency in existing buildings by 2030. The action plan describes a group of goals and strategies that, if put fully into action, would accelerate the growth of energy efficiency markets, more effectively target and deliver building upgrade services, and better inform the decisions of occupants and investors, leading to scaled deployment of energy efficiency in California's existing buildings. The action plan provides a comprehensive framework centered on five goals, each with a series of strategies that includes collaboration between industry and government. Improved access to energy-use data for building owners and account holders is a key component of the action plan. The aim is to help consumers recognize the benefits and value of efficiency, supported by policies to make public and private financial resources available and easy to access. Government leadership plays a key role in this by creating a new statewide commercial benchmarking and disclosure program (now mandated by AB 802), encouraging local government innovation, and shaping energy codes to reflect the needs of existing buildings.

Zero-Net-Energy Goal for New Buildings

With respect to new buildings, building standards implemented by the Energy Commission are following a path toward zero-net-energy (ZNE) for newly constructed buildings. As part of the background for the *2013 Building Standards*, the Energy Commission states:⁶

The 2007 *Integrated Energy Policy Report (IEPR)* established the goal that new building standards achieve "zero net energy" levels by 2020 for residences and by 2030 for commercial buildings. A zero net energy building consumes only as much energy on an annual basis as can be generated with an on-site renewable energy system. The Energy Commission has begun a path toward a tiered approach to achieve zero net energy in future building standards. The base tier will be the traditional mandatory standard that increases in stringency with every code cycle. Additional tiers will be voluntary and represent a "reach" standard for advanced levels of energy efficiency. The intent of the advanced, voluntary tiers is to provide the industry and marketplace with a framework for differentiating highly energy-efficient buildings from standard buildings and to pilot these enhanced features in the field to see how well they work before determining which of the measures should be included in future mandatory standards. This proceeding will be the first standards update cycle where mandatory and reach levels of standards will be developed in parallel.

5 California Energy Commission. 2015. *Existing Buildings Energy Efficiency Action Plan*. Publication Number: CEC-400-2015-013-F, http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015_20150904T153548_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf.

6 California Energy Commission, "Background on the 2016 Building Energy Efficiency Standards," (web page), available at <http://www.energy.ca.gov/title24/2016standards/background.html>.



California Energy Commission – Tracking Progress

Two significant steps toward increased building energy efficiency were taken since 2014. First, the 2013 revisions to the *Building Energy Efficiency Standards* became effective on July 1, 2014, and are being implemented statewide. Second, the Energy Commission adopted the 2016 revisions to the *Building Energy Efficiency Standards* on June 10, 2015, which include four major measures that move homes closer to the ZNE goals, including high-performance attics, high-performance walls, instantaneous water heaters, and high-efficacy lighting with controls throughout the home. These standards become effective on January 1, 2017.

Appliance Standards to Reduce Plug Load

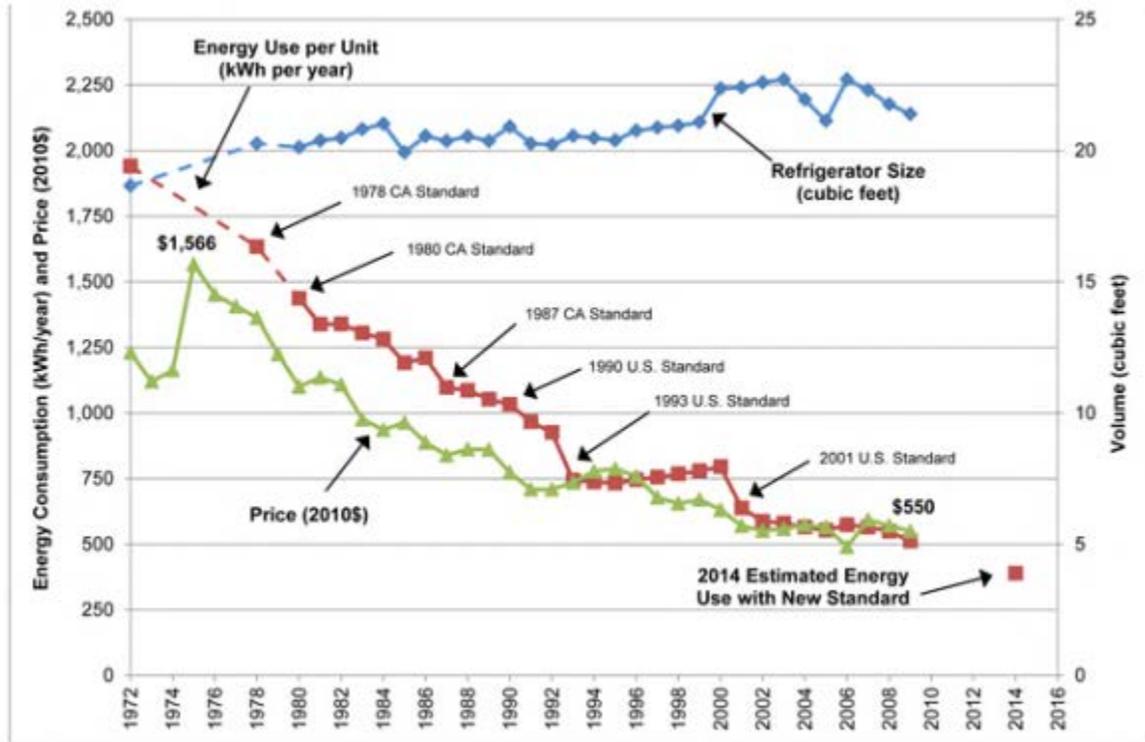
Appliance standards (Title 20 of the California Code of Regulations) are aimed at reducing plug loads and play a critical role in reducing energy consumption. *Plug loads* represent energy consumed by devices that are plugged into power outlets and result from electronic products such as computers, televisions, and networking equipment; household appliances such as refrigerators and clothes washers; and miscellaneous equipment such as vacuums, power tools, and battery chargers. Reducing plug-load energy consumption is a key part of reducing the energy footprint of existing buildings and will be critical for meeting the state's ZNE goals for new buildings.

The Energy Commission adopted the first energy efficiency standards in the nation with standards for refrigerators taking effect in 1978. Both Congress and the U.S. Department of Energy have subsequently required standards for these and many other appliances at a national level that are based on the California standards, expanding the expected energy savings in California to everyone in the nation. The Energy Commission continues to develop energy efficiency standards for appliances that are not regulated by the U.S. Department of Energy (DOE), but is often preempted by the U.S. DOE's authority. For example, the U.S. DOE set standards for refrigerators, dish-washers, and clothes dryers, among other appliances, which preempts the Energy Commission from adopting standards for these appliances. The Energy Commission incorporates these federal standards into its state regulations for the convenience of manufacturers and to ensure that the standards remain in effect in the event of a repeal of the federal standards. When the Energy Commission has adopted standards for appliances that were not preempted, it has often set the stage for regional and national standards. **Figure 3** shows the impact of California standards on the energy use, price, and volume of refrigerators since the early 1970's and the shift to national standards for refrigerators beginning in 1990.



California Energy Commission – Tracking Progress

Figure 3: Effects of Appliance Standards on Refrigerator Energy Use, Cost, and Size



Source: <http://refrigerators.reviewed.com/features/everything-you-need-to-know-about-the-new-energy-star-fridge-standards>

Notes:

- Data includes standard size and compact refrigerators
- Energy consumption and volume reflect the DOE test procedure published in 2010.
- Volume is adjusted volume, which is equal to the fresh food volume + 1.76 * freezer volume.
- Prices represent the manufacturer selling price (excluding retail markups) and reflect products manufactured in the United States.

Appliance standards implemented by the Energy Commission have shifted the marketplace toward more efficient products and practices, providing significant savings to California consumers over nearly four decades. Since 1975, the Energy Commission's energy efficiency standards have saved Californians more than \$75 billion in reduced electricity bills.⁷

California approved the nation's first energy efficiency standards for televisions and battery chargers commonly used to power cell phones, laptop computers, power tools, and other devices. The television standards became fully effective on January 1, 2013, and will reduce the energy consumption of televisions by an average 49 percent. Compliance with the battery

⁷ This estimate reflects the gross efficiency savings in 2012 dollars. The estimate is based on average utility rates and does not take into account costs associated with developing or complying with building and appliance standards. California Energy Commission, 2013, *2013 Integrated Energy Policy Report*, Publication Number: CEC-100-2013-001-CMF.



California Energy Commission – Tracking Progress

charger standards began February 1, 2013, and will reduce waste from these appliances by 40 percent. The battery charger standards are projected to save almost 2,200 GWh a year in energy that was wasted as excess heat once batteries are fully charged. At a rate of \$0.14 per kilowatt hour (kWh), these standards will save consumers an estimated \$306 million a year in utility costs.⁸

Since then, the Energy Commission has launched proceedings for several appliance types that present the most potential for energy and water savings. On March 15, 2015, the Energy Commission put forward a draft staff analysis of potential energy efficiency standards for computers and monitors. When grouped together, computers and monitors are among the leading users of energy in California. Most sit idle while not in use, wasting energy and money. These potential standards will save purchasers of desktop computers hundreds of millions of dollars every year in energy costs. It is estimated that a \$2 increase in manufacturing costs to improve energy efficiency will return \$69 to consumers in reduced energy costs. Although many manufacturers already choose to build relatively efficient models, the Energy Commission has determined that efficiency improvements from the proposed standards could result in savings equivalent to the energy consumption of all homes in the cities of San Francisco and Santa Clara combined.⁹

On October 15, 2015, the Energy Commission published proposed standards for small-diameter directional lamps and general service light-emitting-diode (LED) lamps. Until recently, there were no efficient substitutes for incandescent, halogen, and halogen infrared small-diameter directional lamps. Now, LED small-diameter directional lamps are available in the marketplace. They offer comparable, cost-effective performance for significantly less energy. By replacing the existing inefficient, energy-wasting incandescent and halogen lamp stock with energy-efficient LED lamps, the proposed small-diameter directional lamp standard will save California 2,285 gigawatt-hours (GWh) annually by 2029.¹⁰

General service LED lamps also offer savings. These are found as white light LED replacement lamps and retrofit kits. General service LED lamps are rapidly becoming more efficient while offering high-quality performance, providing an opportunity for standards to ensure that Californians receive the benefit of highly efficient, high-performing LED bulbs. The proposed general service LED standard would save 859 GWh per year in 2029.

The Energy Commission is also responsible for tracking the impacts of the drought on the energy sector and improving drought resiliency and energy efficiency through the adoption of water efficiency standards. Such standards are designed to reduce the water consumption of

⁸ California Energy Commission staff, *Staff Analysis of Battery Chargers and Self-Contained Lighting Controls*, staff report, October 2011.

⁹ California Energy Commission staff, *Analysis of SDDL and General Service LED Lamp Efficiency Opportunities*, 2015 staff report, October 16, 2015.

¹⁰ Ibid.



California Energy Commission – Tracking Progress

appliances that use a significant amount of water on a statewide basis. Executive Order B-29-15 authorized the Energy Commission to adopt emergency regulations establishing standards that improve the efficiency of water appliances for sale and installation in new and existing buildings. Within seven days of the Governor's executive order, the Energy Commission adopted standards for toilets, kitchen and lavatory faucets, and urinals. These standards are projected to save 10.3 billion gallons of water, 30.6 million therms of natural gas, and 218 GWh of electricity each year after the regulations are in effect. Over 10 years, the regulations will save an estimated 730 billion gallons of water.¹¹

On August 12, 2015, the Energy Commission also adopted tiered showerhead standards. Tier I reduces the maximum flow rate from 2.5 gallons per minute to 2.0 gallons per minute, and Tier II requires showerheads to use no more than 1.8 gallons per minute. The combined tiered standards will save 38 billion gallons of water annually once all existing stock is replaced. The Energy Commission also amended its residential lavatory faucet standards to immediately implement a 1.5 gallon-per-minute requirement, saving an additional 730 million gallons of water and delaying the 1.2 gallon-per-minute standard for six months to give manufacturers sufficient time to comply and allowing retailers the ability to better manage the turnover and change-out of existing stock.¹²

Still, there remains the potential for significant water and energy savings from many other water- and energy-consuming appliances. The Energy Commission continues to consider standards for the appliances identified in its 2012 Order Instituting Rulemaking, prioritizing them based on water and energy savings potential. Moreover, the Energy Commission is involved in an ongoing process to identify, study, and realize appliance efficiency opportunities that conserve vital state resources: electricity, natural gas, and water. This effort is especially important with California facing one of the most severe droughts on record.¹³

The Energy Commission also actively participates in federal appliance efficiency rulemaking proceedings. Since 2008, the U.S. DOE has set energy conservation standards for 29 categories of appliances. By the end of 2016, the U.S. DOE plans to set energy efficiency standards for 20 additional appliance/equipment categories, including commercial package air conditioners, central air conditioners and heat pumps, and furnace fans, among many other things. The U.S. DOE is also considering potential standards for general service light-emitting diode lamps, dedicated purpose pool pumps, and computers, making the Energy Commission's rulemakings on these topics potentially influential in the federal process.

11 California Energy Commission, *Draft Integrated Energy Policy Report*, October 12, 2015.

12 California Energy Commission, *Draft Integrated Energy Policy Report*, October 12, 2015.

13 California Energy Commission, *Notice of Pre-Rulemaking Schedule*, California Energy Commission, 2014. http://www.energy.ca.gov/appliances/documents/pre-rulemaking_schedule.pdf.



California Energy Commission – Tracking Progress

Publicly Owned Utilities

Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006) directs public utilities to “first acquire all available energy efficiency and demand reduction resources that are cost-effective, reliable and feasible.” Investor-owned and public utilities are required to treat efficiency as a procurement investment.

Under Senate Bill 1037 (Kehoe, Chapter 366, Statutes of 2005) and Assembly Bill 2021, publicly owned electric utilities report annual energy efficiency savings and expenditures to the Energy Commission on March 15. Starting in June 2007, this legislation required public utilities to update their efficiency potential estimates and revise their 10-year targets every three years. Working with the CPUC to obtain investor-owned utilities’ potential and goals information, the Energy Commission then establishes a statewide efficiency goal.

Table 1 shows the reported net annual electricity savings compared to retail sales for the 15 publicly owned utilities with the largest retail sales in 2014. Electricity savings between 1 and 2 percent of retail sales are considered to be exemplary by the industry. The American Council for an Energy-Efficient Economy (ACEEE) uses 2 percent of electricity sales as its best practice standard.

Table 1: 2014 Reported Electricity Net Savings as a Percentage of Retail Sales

	Reported Net Annual Savings (MWh)	Preliminary 2014 Retail Sales (MWh)	Savings as Percentage of Retail Sales
Los Angeles Department of Water and Power	251,556	23,454,941	1.07%
Sacramento Municipal Utility District	141,979	10,572,551	1.34%
Imperial Irrigation District	23,560	3,392,435	0.69%
Silicon Valley Power	12,275	2,998,000	0.41%
Modesto Irrigation District	7,333	2,501,526	0.29%
Anaheim, City of	32,323	2,272,635	1.42%
Riverside, City of	20,719	2,185,000	0.95%
Turlock Irrigation District	6,094	2,064,515	0.30%
Glendale Water & Power	14,743	1,194,138	1.23%
Roseville Electric	4,774	1,131,904	0.42%
Vernon, City of	2,299	1,131,784	0.20%
Burbank Water and Power	10,809	1,126,809	0.96%
Pasadena Water and Power	18,662	1,011,925	1.84%
Palo Alto, City of, Utilities Department	8,218	953,385	0.86%
Redding Electric Utility	931	750,430	0.12%
Total	556,275	56,741,978	0.98%



California Energy Commission – Tracking Progress

Sources: Savings: California Municipal Utilities Association (CMUA), *Energy Efficiency in California's Public Power Sector, A Status Report*, March 2015; Retail Sales: Energy Consumption Data Management System (ECDMS) <http://www.ecdms.energy.ca.gov/elecbyutil.aspx>

Note: "Net annual savings" represents a portion of gross electricity savings (which are self-reported estimates not independently verified). Net electricity savings are calculated by multiplying the gross savings by the net-to-gross ratio, which is specific to each POU territory. Retail sales are aggregated from Quarterly Fuel and Energy Reports. Retail sales for 2014 are preliminary and may not include corrections that utilities make at the end of the year.

Additional References:

For more information on the *California Energy Demand 2014-2024 Revised Forecast*, see <http://www.energy.ca.gov/2013publications/CEC-200-2013-004/CEC-200-2013-004-V1-CMF.pdf>.

For more information on the *Building Energy Efficiency Standards*, see <http://www.energy.ca.gov/title24/>.

For more information on the *Appliance Standards*, see <http://www.energy.ca.gov/appliances/>.

For more information on public utility energy efficiency reporting, see http://www.energy.ca.gov/pou_reporting/

For more information on the 2016-2024 IOU energy savings goals and the 2015 Potential Goals and Study, see *Decision Re: Energy Efficiency Goals for 2016 and Beyond and Energy Efficiency Rolling Portfolio Mechanics* available on the CPUC website at <http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M154/K225/154225993.PDF> (last modified October 28, 2015)

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California Energy Commission – Tracking Progress

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