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## Total System Electric Generation

### 2016 Total System Electric Generation in Gigawatt Hours

Fuel Type	California In-State Generation (GWh)	Percent of California In-State Generation	Northwest Imports (GWh)	Southwest Imports (GWh)	California Energy Mix (GWh)	California Power Mix
Coal	324	0.16%	373	11,310	12,006	4.13%
Large Hydro	24,410	12.31%	3,367	1,904	29,681	10.21%
Natural Gas	98,831	49.86%	41	7,120	105,992	36.48%
Nuclear	18,931	9.55%	0	7,739	26,670	9.18%
Oil	37	0.02%	0	0	37	0.01%
Other (Petroleum Coke/Waste Heat)	394	0.20%	0	0	394	0.14%
Renewables	55,300	27.90%	11,710	6,952	73,961	25.45%
Biomass	5,868	2.96%	659	25	6,553	2.26%
Geothermal	11,582	5.84%	96	1,038	12,717	4.38%
Small Hydro	4,567	2.30%	229	1	4,796	1.65%
Solar	19,783	9.98%	0	3,791	23,574	8.11%
Wind	13,500	6.81%	10,725	2,097	26,321	9.06%
Unspecified Sources of Power	N/A	N/A	26,888	14,937	41,825	14.39%
<b>Total</b>	<b>198,227</b>	<b>100.00%</b>	<b>42,378</b>	<b>49,963</b>	<b>290,567</b>	<b>100.00%</b>

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Source: [CEC-1304 Power Plant Owners Reporting Form](#) and SB 1305 Reporting Regulations.

In-state generation is reported generation from units one megawatt and larger.

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Data as of June 23, 2017

Total system electric generation is defined as the annual energy delivered from wholesale power plants, including self-generation supply, to meet annual demand. It was formerly referred to as Total System Power.

### The Year in Review

In 2016, total system electric generation for California was 290,567 gigawatt-hours (GWh), down 1.6 percent from 2015's total generation of 295,405 GWh. California's non CO2 emitting electric generation categories (nuclear, large hydroelectric, and renewable generation) accounted for 50 percent of total in-state generation for 2016, compared to 40 percent in 2015. While California's in-state electric generation was up by 1.0 percent at 198,227 GWh compared to 196,195 GWh in 2015, net imports were down by 6,869 GWh to 92,341 GWh leading to an overall decrease in total generation for the year. This decline is consistent with the recently published California Energy Demand Updated Forecast, 2017-2027.

*"For statewide electricity consumption, the new forecast begins about 1 percent below CED 2015 in 2015, reflecting less actual economic growth in California than predicted early in 2015 for the early years of the forecast, particularly in the Northern and Central Valleys. While economic growth was more modest for the near-term forecast horizon, consumption in the updated mid scenario grows at a slightly higher rate through 2026 as compared with the CED 2015 mid demand scenario due to more optimistic long-term economic growth expectations. Updated statewide non-coincident weather-normalized peak demand is around 1 percent lower than predicted in the CED 2015 mid case in 2016 and grows at a slightly higher rate from 2016-2026 in the new mid case for the same reason as consumption—more modest expectations for near-term growth but an optimistic long-term outlook."<sup>1</sup>*

As mentioned in the Total System Electric Generation summary for 2015, lower baseline per capita electricity consumption resulting from federal appliance efficiency standards and higher self-generation from behind-the-meter roof-top solar photovoltaic (PV) power systems continue to reduce total retail sales that, in turn, reduce total energy delivered from traditional utility-scale power plants as measured by Total System Electric Generation.<sup>2</sup>

## Temperatures and Precipitation

Temperatures in California were above normal during all of 2016. Bakersfield recorded its second warmest calendar year with an average temperature of 68.2° Fahrenheit (F), 3° F above normal. The summer months were the warmest in 122 years of record keeping since 1895. Similarly, the contiguous US recorded the warmest June on record with an average temperature of 71.8° F, about 3.3° F above average.<sup>3</sup> Average temperatures are derived from the daily mean of the maximum and minimum temperatures observed on each calendar day.

Drought conditions that had persisted for the past four years finally came to an end by the close of 2016. Mild temperatures in early 2016 combined with increased precipitation in January and March resulting from El Niño conditions resulted in some concerns over the possibility of an early-melting snowpack if drought conditions returned. However, above-average precipitation throughout the spring continued to replenish the state's reservoirs; by year's end, a series of Pacific storms changed those concerns from drought to flooding. Statewide precipitation for 2016 ranked above average as the 28th wettest year in the past 122 years. It was also the first above-normal snowpack season since 2011. By February 1, 2017, parts of California had snowpack levels of more than 180 percent of normal.<sup>4</sup> Accordingly, on April 7, 2017, Governor Brown declared an official end to California's four-year drought.<sup>5</sup>

## Hydroelectric, Solar, and Wind Generation Displacing Natural Gas

California's in-state hydroelectric generation doubled from 13,992 GWh in 2015 to 28,977 GWh in 2016 as a result of a series of Pacific storms and improved snowpack conditions. As hydroelectric generation increased in 2016, natural gas-fired electric generation was similarly displaced. The combined total gas-hydro mix for California in 2016 was down by 2.8 percent (3,674 GWh) to 127,808 GWh from 131,482 GWh in 2015. This deficit was made up by significant double digit growth rates in both solar PV generation and wind generation. Total in-state solar generation increased 31.5 percent (4,737 GWh) from 2015 levels to 19,783 GWh. Wind generation increased 10.8 percent (1,324 GWh) to 13,500 GWh in 2016.

Net energy imports from the Northwest and Southwest decreased by 6.9 percent from 2015 levels based on reported imports and exports by California balancing authorities. Balancing authorities control power flowing across transmission ties between different regions within the Western Electricity Coordinating Council. The following four California balancing authorities reported their annual energy imports and exports to the Energy Commission: Balancing Authority of Northern California (BANC, formerly SMUD), California Independent System Operator, Imperial Irrigation District, and the Los Angeles Department of Water and Power. Net energy imports were 92,341 GWh in 2016, down 6,869 GWh from 2015.

Reporting requirements for total system electric generation are limited to projects rated at 1 MW and larger. Because most solar PV systems on residential households and businesses are less than 1 MW, data on these installations are not collected through QFER. With over 5,100 MW of installed self-generation solar PV for California in 2016, these systems represent a range of 6,000 GWh to 8,000 GWh per year of avoided electric generation from the system grid.<sup>6</sup>

<sup>1</sup> Source: *California Energy Demand Updated Forecast, 2017-2027, Page 13, January 2017 CEC-200-2016-016-CMF*, [http://docketpublic.energy.ca.gov/PublicDocuments/16-IEPR-05/TN215745\\_20170202T125433\\_FINAL\\_California\\_Energy\\_Demand\\_Updated\\_Forecast\\_20172027.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-IEPR-05/TN215745_20170202T125433_FINAL_California_Energy_Demand_Updated_Forecast_20172027.pdf).

<sup>2</sup> Source: California Energy Demand Update Forecast, 2016-2026, Page 19, January 2016 CEC-200-2016-001-V1 [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-03/TN207439\\_20160115T152221\\_California\\_Energy\\_Demand\\_20162026\\_Revised\\_Electricity\\_Forecast.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-03/TN207439_20160115T152221_California_Energy_Demand_20162026_Revised_Electricity_Forecast.pdf)

<sup>3</sup> NOAA National Centers for Environmental Information, State of the Climate: National Climate Report for Annual 2016, published online January 2017, retrieved on June 23, 2017 from <https://www.ncdc.noaa.gov/sotc/national/201613>.

<sup>4</sup> NOAA National Centers for Environmental Information, State of the Climate: National Snow & Ice for Annual 2016, published online January 2017, retrieved on June 23, 2017 from <https://www.ncdc.noaa.gov/sotc/national/201613>.

<sup>5</sup> Executive Order B-40-17, State of California, retrieved on June 23, 2017 from [https://www.gov.ca.gov/docs/4.7.17\\_Exec\\_Order\\_B-40-17.pdf](https://www.gov.ca.gov/docs/4.7.17_Exec_Order_B-40-17.pdf).

<sup>6</sup> Effective solar PV capacity factor assumed to range from 14 percent to 18 percent for residential fixed roof-mounted panels This is significantly lower than capacity factors for utility-scale solar PV installations that range from 20 to 30 percent.

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## Additional Years - Total System Electric Generation

Current | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 | 2001

Note: 2002 - 2006 called "Gross System Power"

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## What is Unspecified Energy?

Unspecified energy is the amount of energy not specifically claimed by a utility under the Power Source Disclosure Program. This category includes spot market purchases, wholesale power purchases, and purchases from pools of electricity where the original source of fuel can no longer be determined. It can also include "null energy," energy from a certified renewable facility that has been separated from its renewable attributes (Renewable Energy Credits, or RECs) and sold separately.

Prior to 2009 there was no category allowed for unspecified sources of energy in the development of both Gross System Power and the Net System Power Report – all energy was allocated to a specific fuel category. Accordingly, the Electricity Analysis Office (EAO) developed an electric generation profile mix of the Northwest and Southwest. Essentially, EAO calculated a Gross System Power profile for each region. From these profiles, EAO identified specified claims by utilities and then prorated the remainder of the resource mix for the unspecified energy category into specific fuel categories. The problem with this methodology was that it treated all unspecified energy imports as if they were made up of a known mix of resources. This method combined both baseload energy and marginal energy equally.

The averaging methodology applied to the old Net System Power reports was widely recognized as flawed because it overestimated the role of baseload plants in the Western spot market. Baseload plants selling to California are/were tied to long-term contracts. Most of the unspecified energy imports prior to 2009 were spot market sales that represented about 50 percent of California's energy imports. These sales primarily occur when there is surplus generation on the market that is less expensive than variable costs of some California plants.

System averaging does not reflect rate based utility portfolios, dispatch dynamics and short-term market transactions. Surplus, or marginal generation, is what typically serves the spot market. Hydro and coal served as the marginal resource through the mid-1990's but load growth surpassed coal generation capacity. Generally, hydroelectric and natural gas-fired electric generation are considered the marginal generation sources in the interconnected Western electricity system. There may be some surplus coal energy available during off-peak periods, but California generators are usually at minimum load levels during these periods.

Generally, the unspecified energy category would be comprised of short-term market purchases from those power plants that do not have a contract with a California utility. Much of the Pacific Northwest spot market purchases are served by surplus hydro and newer gas-fired power plants. The Southwest spot market purchases would be comprised of new combined cycle energy and some coal-based energy. Overall, a marginal supply approach for the determination of spot market supply would yield the most accurate assessment of energy included in the unspecified energy category.

## Total System Electric Generation: Definition and Calculation Methodology

The California Code of Regulations (Title 20, Division 2, Chapter 2, Section 1304 (a)(1)-(2)) requires owners of power plants that are 1 MW or larger in California or within a control area with end users inside California to file data on electric generation, fuel use, and environmental attributes. Filings are submitted to the Energy Commission on a quarterly and annual basis. These filings cover all types of electric generation: wind, solar, geothermal, natural gas, hydroelectric, coal, and others. The reporting requirement includes facilities that have generation for onsite use and non-retail generation with reversible turbines used to pump water; some of these facilities use electricity to store water in later months, while others pump water at night to generate electricity during subsequent daytime hours. Energy Commission staff collect and verify these reports to compile a statewide accounting of all electric generation serving California.

Balancing authorities, formerly known as Control Area Operators, are also required to report net amounts of energy flowing across transmission ties from other balancing authority areas.<sup>3</sup> Quarterly data reports submitted by balancing authorities for energy imports and exports are used to determine the net energy imports for California. The net energy imports are separated into two geographical regions: the Northwest and the Southwest based on the location of the balancing authority area. The Northwest includes Alberta, British Columbia, Idaho, Montana, Oregon, South Dakota, Washington, and Wyoming. The Southwest includes Arizona, Baja California, Colorado, Mexico, Nevada, New Mexico, Texas, and Utah. This allocation of fuel types for imported energy is determined by utility reports under the Power Source Disclosure Program, described more fully below.

Total system electric generation is the sum of all in-state generation plus net electricity imports. Total system electric generation cannot be used to track the state's progress for the Renewable Portfolio Standard (RPS) program due to the special accounting requirements of the RPS legislation. For more information on the RPS program, see the Renewable Portfolio Standard (RPS) page. <sup>3</sup> The boundaries of electrical California's balancing authority areas do not correspond precisely with the state's geographic boundaries.

## Power Source Disclosure Program

The [Power Source Disclosure](#) provides current and historical information about the program, requiring retail electricity providers report purchase and sales information to the Energy Commission and their retail customers. The Power Source Disclosure Program was authorized by Senate Bill 1305 (Stats. 1997, Chapter 796, Statutes of 1997), and revised in October 2009 by Assembly Bill 162 (Stats. 2009, Chapter 313). Consistent with the original legislation, retail suppliers of electricity are required to disclose to consumers "accurate, reliable, and simple-to-understand information on the sources of energy that are (being) used..."; (Public Utilities Code Section 398.1(b)).

The statutes require electricity suppliers inform their consumers about the types of generation resources used to provide their electricity. Suppliers are required to use a format developed by the Energy Commission called the Power Content Label. The statutes also require utilities to submit a detailed report of their fuel mix to the Energy Commission.

Currently, Assembly Bill 1110 (Ting, Chapter 656, Statutes of 2016) modifies Power Source Disclosure reporting by also requiring disclosure of the greenhouse gas emissions intensity associated with the electricity serving retail customers. To maintain consistency with the California Air Resources Board's key greenhouse gas emissions reporting and compliance programs, staff has proposed a methodology to construct a retail supplier's greenhouse gas emissions intensity factor largely based on data reported through and methods used by the Mandatory Greenhouse Gas Reporting Regulation. The Energy Commission will initiate a rulemaking to amend the Power Source Disclosure regulations in accordance with AB 1110 in early 2018.