



California Energy Commission – Tracking Progress

Renewable Energy – Overview

Advancing the use and availability of renewable energy is critical to achieving California's ambitious climate change goals. Established by Governor Edmund G. Brown Jr. through an executive order, then codified through legislation, California has set ambitious requirements to reduce the state's greenhouse gas (GHG) emissions 40 percent below 1990 levels by 2030. To support these goals, California has pursued a suite of policies and programs aimed at advancing renewable energy in California and ensuring all Californians, including low-income and disadvantaged communities, benefit from this transition.

The information provided here presents the state's renewable energy goals and progress in meeting these goals as reflected in the achievement of Renewables Portfolio Standard (RPS) targets, the addition of utility-scale renewable energy capacity, and the growth of distributed generation. A summary of the state's progress toward achieving California's renewable energy goals is followed by sections with detailed information on each topic. A summary of pertinent legislation is included at the end of this document.

Renewable Energy Goals - Renewables Portfolio Standard

Established by legislation in 2002¹ and accelerated and expanded by subsequent legislation, California's RPS is one of the most ambitious renewable energy policies in the nation. The RPS establishes increasingly progressive renewable energy procurement targets for the state's load-serving entities, requiring both retail sellers and local publicly owned electric utilities to increase their procurement of eligible renewable energy resources to 33 percent of retail sales by 2020 and 50 percent by 2030.

California's load-serving entities (LSEs) are ahead of schedule for meeting the RPS targets, based on an approximation of generation from RPS-eligible sources divided by retail sales. The Energy Commission estimates that about 30 percent of 2017 retail electricity sales in California were served by renewable energy facilities, (**Figure 1**) such as wind, solar, geothermal, biomass, and small hydroelectric (**Figure 2**).² This is an increase from the 29 percent of 2016 retail electricity sales met with renewable energy, as reported in the August 2017 Tracking Progress.

¹ Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002).

² For definitions of all RPS eligible renewable energy generation types, see the *RPS Eligibility Guidebook, Ninth Edition*, Adopted April 27, 2017, available at <https://efiling.energy.ca.gov/getdocument.aspx?tn=217317>.



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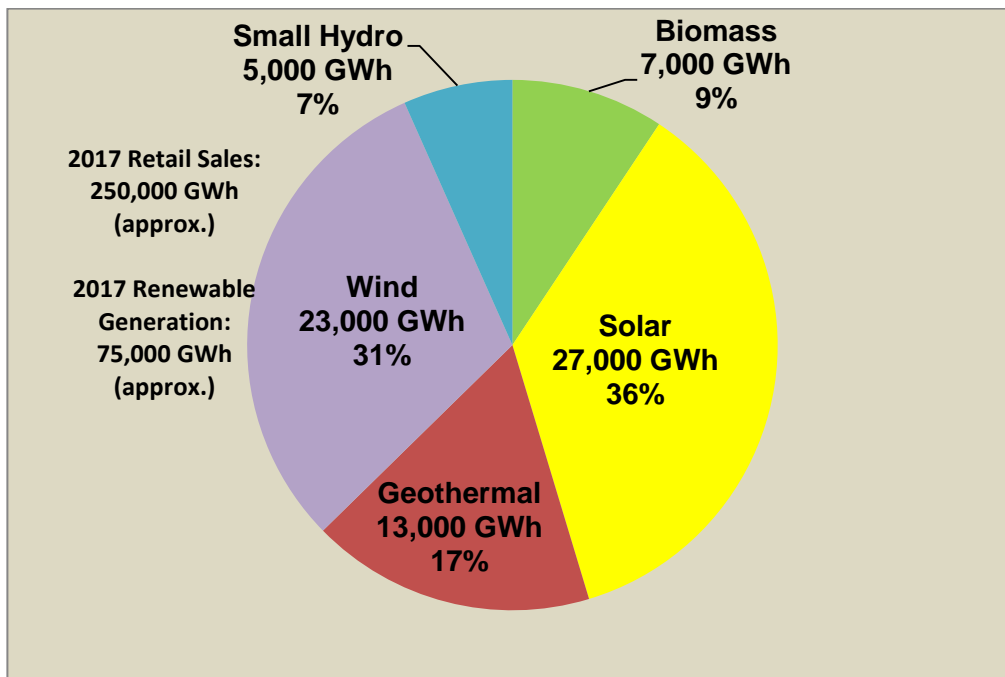
Figure 1: Progress Toward Meeting California's Renewable Energy Goalsⁱ



Source: California Energy Commission, November 2017

Figure 2 shows the estimated proportions of generation from each RPS-eligible renewable technology type in 2017. As shown here, wind and solar together account for more than 67 percent of all renewable electricity generation, with geothermal, biomass, and small hydroelectric generators accounting for the remainder. The data shown in Figure 2 do not include unbundled renewable energy credits (RECs).³

Figure 2: 2017 Estimated RPS Eligible Generation (In-State and Out-of-State)ⁱⁱ



Source: California Energy Commission, November 2017

³ *Unbundled RECs* are those that do not include the physical delivery of the energy attached to the REC. Staff does not include unbundled RECs or other power procured through short-term contracts for 2017 because the procurement of these resources has not yet been fully reported to the Energy Commission. These values will be verified in 2018.



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The estimates reflected in Figures 1 and 2 are based on an estimate for 2017 adjusted retail sales of 250,000 gigawatt-hours (GWh) developed using the *California Energy Demand 2018-2028 Preliminary Forecast* mid case, less excluded entities and pumping loads.^{4, 5} The estimate is also based on 2017 estimated renewable energy generation of 75,000 GWh—developed using data from the Energy Commission’s Quarterly Fuels and Energy Report, Power Source Disclosure Program, and Wind Performance Reporting System.⁶

Figures 1 and 2 reflect estimates that are a proxy for California’s progress toward meeting RPS goals as the underlying data do not reflect the RPS eligibility and accounting rules. Actual RPS compliance percentages achieved by LSEs are calculated and verified every three to four years based on full RPS compliance periods. Additional information on RPS progress is provided in the more detailed sections of this document.

Renewable Capacity in California

Increasing renewable energy capacity in the state was critical to achieving the goals of the RPS.⁷ To support this growth and to help expand California’s economy, Governor Brown established an overall goal of adding 20,000 megawatts (MW) of renewable capacity by 2020, composed of 8,000 MW of large-scale renewable generation and 12,000 MW of renewable distributed generation.

Distributed generation is defined here as projects that are 20 MW or smaller – including both self-generation and projects that do not directly serve a home or business and are interconnected “in front of the meter” to generate energy to be sold to LSEs or on the wholesale market. *Self-generation* is defined as distributed generation systems installed at a utility customer’s facility, business, or home. These systems serve primarily on-site load or export excess power back to the grid through net-energy metering. As used in this report, *behind-the-meter* is a subset of self-generation that refers to smaller residential or commercial systems that use net-energy metering.

California has well exceeded the 8,000 MW goal for large-scale renewables with roughly 10,460 MW added since January 2011, for a total of more than 17,210 MW of large-scale renewable energy capacity installed in-state. Progress toward the distributed generation goals is discussed below.

4 Total adjusted retail sales is rounded to the nearest 10,000 GWh. Estimates reported here of total generation and renewable energy capacity do not include large hydroelectric facilities (above 30 MW), as they are not eligible for California’s RPS with a few exceptions noted in the *RPS Eligibility Guidebook*. Roughly 10 to 15 percent of California’s energy generation in any given year is from large hydroelectric generation.

5 Self-generation from sources such as rooftop solar is not included in the Figure 1 estimate of renewable energy generation, although it does lower retail sales of electricity, thus decreasing overall RPS compliance.

6 Total generation value is rounded to the nearest 10,000 GWh.

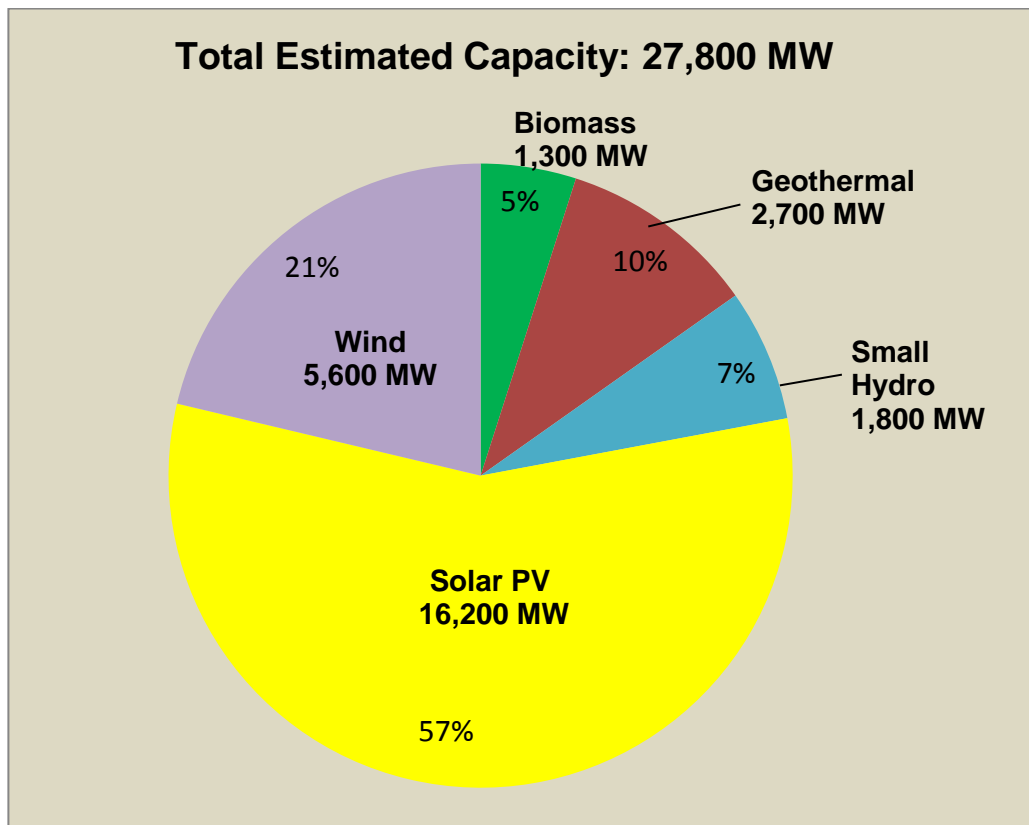
7 *Capacity* refers to the maximum electric output a generator can produce under specific conditions, while *generation* refers to the amount of electricity a generator actually produces over a specific period.



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Figure 3 shows total installed/operational renewable capacity by resource type for resources located in California, which was roughly 27,800 MW as of October 31, 2017.⁸ This total includes a little more than 6,000 MW of self-generation capacity from homes and businesses throughout the state.⁹

Figure 3: Renewable Capacity by Resource Type in California, Includes Self-Generation ⁱⁱⁱ



Source: California Energy Commission, all on-line capacity as of 10/31/17

Renewable Distributed Generation Capacity

Distributed renewable resources have also been a key focus of state laws, and exponential progress has been made in growing California's distributed renewable capacity. Senate Bill 1 (Murray, Chapter 132, Statutes of 2006) set an ambitious goal for 3,000 MW distributed solar energy systems to be installed on new and existing residential and commercial sites by 2017 and for solar energy systems to be placed on 50 percent of new homes by 2020. Past and current renewable distributed generation incentive programs include utility feed-in tariffs for the investor-owned utilities' (IOUs) procurement of small-scale renewables, such as bioenergy, along with state-mandated self-generation incentives such as the Self-Generation Incentive Program, the

⁸ Total installed capacity based on rounded values.

⁹ The capacity values in Figure 3 are based on facility "nameplate" capacity.



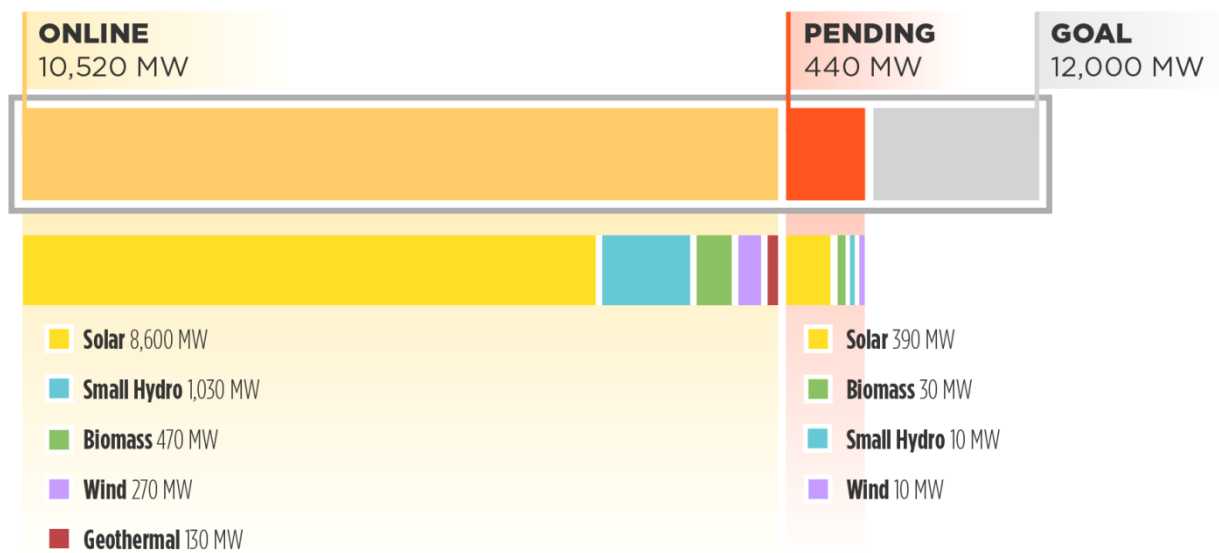
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California Solar Initiative, publicly owned electric utility (POU) solar programs, and the Emerging Renewables Program. These programs collectively have led to the interconnection of thousands of MW of self-generation or behind-the-meter resources.

Figure 4 shows more detail on the progress toward meeting California's 12,000 MW distributed generation goal. As of November 1, 2017, almost 10,520 MW of distributed generation capacity was operating or installed in California, with an additional 440 MW pending.¹⁰ The data include about 5,900 MW of behind-the-meter solar, which far exceeds the state's California Solar Initiative (CSI) goal of 3,000 MW on residential and commercial sites by the end of 2016.

California's existing programs aimed at supporting renewable distributed generation could add another 1,600 MW if fully subscribed.

Figure 4: Renewable Small-Scale and Distributed Generation Capacity in California (20 MW or Smaller)^{iv}



Source: California Energy Commission. Updated November 2017.

Ensuring the Benefits of Renewables Reach All Californians

California has undertaken several specific initiatives to ensure that the benefits of California's clean energy transformation are realized by all Californians, including low-income residents and those in the most vulnerable communities. Senate Bill 350 (De León, Chapter 547, Statutes of 2015) directed the Energy Commission to identify opportunities across state energy programs to ensure they benefit low-income customers and disadvantaged communities. The resulting report,

¹⁰ Pending projects include projects either with incentive funding reserved from a self-generation incentive program or with a power purchase agreement.



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Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-Income Customers and Small Business Contracting Opportunities in Disadvantaged Communities (Barriers Study), was published in December 2016 after extensive stakeholder engagement. The Energy Commission is working closely with other affected agencies to implement the 12 recommendations of the report and enhance current programs to meet the disadvantaged community goals of SB 350. A summary on progress toward reaching low-income and disadvantaged communities with some of the state's energy initiatives can be found in a separate Tracking Progress document focused on Energy Equity Indicators, which will be released in draft form for public comment in December 2017.



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Renewable Energy – Detailed Information

The following pages revisit the same general areas summarized above, with additional data and explanations. This section includes detailed information on California utilities' progress toward the RPS, growth in retail choice, total installed renewable capacity, renewable energy cost trends, grid observations, and permitting and construction of new renewable energy generation in California.

Renewables Portfolio Standard

California is on target to meeting the 2020 33 percent RPS goal. As discussed above and shown in **Figure 2**, Energy Commission staff estimates that in 2017, California's electricity consumption was about 30 percent renewable, which is a proxy for measuring progress toward the RPS. New generation came on-line in 2017, and the state's 2017 load forecast¹¹ was adjusted downward significantly compared to 2016, thus increasing the overall percentage of renewable resources from 29 percent in 2016. Final statewide load and generation will not be verified until the end of year. This estimate does not reflect a compliance determination. Some of the differences between the annual accounting to estimate statewide RPS progress and the actual RPS procurement requirements used to evaluate compliance are as follows:

- Staff has taken efforts to include only RPS-eligible power plants in this analysis, but in some cases staff may have accepted claims of eligibility.
- Renewable energy percentages shared in this report should not be taken as an indication of compliance with the RPS, but rather a snapshot of renewables as a percentage of retail sales for the specified year. An accurate accounting of the state's progress toward the 33 percent and 50 percent renewable mandates cannot be completed until after the close of each multiyear compliance period.

Renewables Portfolio Standard Compliance

The RPS establishes multiyear compliance periods in recognition of the temporal variability of renewable resources. The RPS requires all LSEs in the state to achieve the following targets for retail electricity sales from renewable sources:

- An average of 20 percent in 2011-2013
- 25 percent by the end of 2016
- 33 percent by the end of 2020
- 40 percent by the end of 2024
- 45 percent by the end of 2027
- 50 percent by the end of 2030
- No less than 50 percent in each multiyear compliance period thereafter

¹¹ *California Energy Demand 2018-2028 Preliminary Forecast*.
<https://efiling.energy.ca.gov/getdocument.aspx?tn=220615>.



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LSEs are required to procure a “balanced portfolio” of resources under the RPS.¹² LSEs can use RECs to meet their obligation for multiyear compliance periods. A REC represents 1 megawatt-hour of electricity generation from renewable sources. Renewable generation facilities that generate RECs may be located anywhere within the Western Electricity Coordinating Council (WECC) region and sell energy and/or RECs to a California LSE to meet its RPS obligation, provided the facility meets all RPS-eligibility criteria established by the Energy Commission.

RPS Compliance Period 2011-2013

LSEs were required to procure renewable electricity for an average of 20 percent of retail sales for the 2011-2013 compliance period. The Energy Commission has adopted verified results for 21 retail sellers and 42 POUs for the 2011–2013 compliance period.^{13, 14} California’s three largest IOUs collectively served 22.7 percent of their 2013 retail electricity sales with renewable power.¹⁵ The 42 POUs with verified results procured a combined 18.6 percent for the 2011–2013 compliance period. RPS compliance for the 2011-2013 period was determined by the CPUC for retail sellers and will be determined by the Energy Commission for POUs.

RPS Compliance Period 2014-2016

LSEs were required to procure renewable electricity equal to 25 percent of retail sales by December 31, 2016. California’s three largest IOUs collectively served a reported 35 percent of their 2016 retail electricity sales with renewable power. The 43 POUs reported a combined 21.4 percent of renewable procurement during 2014-2016, exceeding their aggregate, or combined, 2014-2016 target of 21.2 percent. Final verification of eligibility for 2014-2016 claims is scheduled to be completed by the Energy Commission in 2018. Compliance results for the 2014-2016 compliance period will be determined by the CPUC for retail sellers and by the Energy Commission for POUs.

Increased Retail Choice and the Changing Electricity Market

Following the 2001-2002 California energy crisis and the subsequent rollback of retail electricity choice, the vast majority of Californians have received bundled electricity service from regulated utilities. In recent years, however, this landscape has begun to shift, largely due to the increase in self-generation and the rise of community choice aggregators (CCAs), which are local government agencies created by city or county ordinance that can directly develop and buy electricity on behalf of their customers. Many CCAs have formed with a goal to procure more

12 Public Utilities Code Sections 399.16 and 399.30.

13 McCollough, Brian, et al. 2016. *Renewables Portfolio Standard 2011-2013 Retail Sellers Procurement Verification* Lead Commissioner Report. California Energy Commission, Renewable Energy Division. Publication Number: CEC-300-2016-004-CMF.

14 *Renewables Portfolio Standard Verification Results Lead Commissioner Reports* for POUs for Compliance Period 1 (2011-2013), adopted January 25, 2017. Verification results for Los Angeles Department of Water and Power have not yet been finalized, due to a pending appeal before the Energy Commission.

15 California Public Utilities Commission 2015, 2016, 2017 Annual RPS Reports.

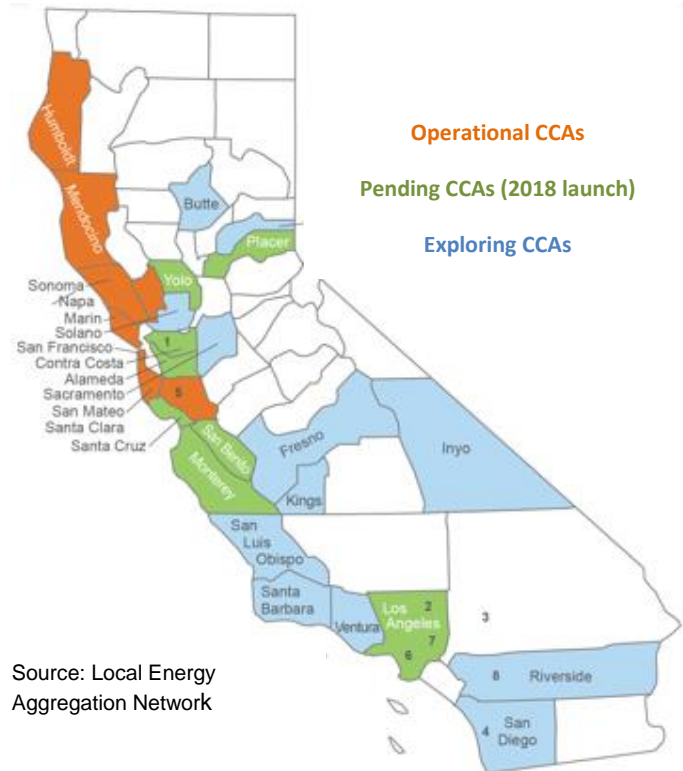


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renewable energy than is required by the RPS, and many have specific goals to procure local distributed generation resources.

Figure 5: Operational, Pending, and Potential CCAs^V

The formation of CCAs was authorized by legislation in 2002.¹⁶ A CCA is created through a local city or county ordinance and automatically enrolls all customers in its service area, unless the customer opts out. While the CCA is responsible for electricity procurement, the local IOU retains responsibility for transmission and distribution, metering, billing, and customer service. CCA benefits have been cited as providing consumer choice, cost savings to customers, and increased accountability through local governance, as well as allowing cities and counties the flexibility to pursue more aggressive renewable energy goals. Though the CPUC implements the enabling legislation for CCAs, its authority is limited.¹⁷ For instance, it is the CCA's elected officials that set rates and determine procurement strategies within certain parameters, including the RPS mandates. However, the CPUC is considering changes to the rules that govern forward capacity procurement by CCAs.¹⁸ Also, to limit the impact of departing load on IOU customers and to minimize the financial impact of stranding assets originally procured to serve a larger load, CCA customers pay exit fees known as the Power Charge Indifference Adjustment, set by the CPUC.



At the end of 2017, eight CCAs were operating in California and collectively serving more than 900,000 customers: Apple Valley Choice Energy, Clean Power SF, Marin Clean Energy (MCE),

¹⁶ Established by Assembly Bill 117 (Migden, Chapter 838, Statutes of 2002) and later expanded in 2011 by Senate Bill 790 (Leno, Chapter 599, Statutes of 2011)

¹⁷ The following is an excerpt from a report by the CPUC titled, *California's Renewables Portfolio Standard, Annual Report*, November 2017, available at http://www.cpuc.ca.gov/uploadedFiles/CPUC_Website/Content/Utilities_and_Industries/Energy/Reports_and_White_Papers/Nov%202017%20-%20RPS%20Annual%20Report.pdf.

"As additional CCAs are formed, the CPUC will oversee a significantly smaller percentage of renewable procurement in the State, as the CPUC has limited jurisdiction over the procurement activities of CCA or ESP providers. If the IOUs lose such large portions of their customer demand, the result will be that the CPUC will not have the authority to monitor most renewable energy procurement activities in as much detail, as it has traditionally done for RPS."

¹⁸ Draft Resolution E-4907 (12/11/17), available at <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M200/K492/200492306.PDF>.



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Lancaster Choice Energy, Peninsula Clean Energy, Redwood Coast Energy Authority, Sonoma Clean Power, and Silicon Valley Clean Energy. RPS compliance reports submitted by all the operational CCAs during the first and/or second RPS compliance period indicate that they have met current RPS targets.¹⁹

Seven CCAs are expected to launch in 2018: City of Solana Beach, City of San Jose, Contra Costa County (as part of MCE), East Bay Community Energy, Los Angeles Community Choice Energy, Monterey Bay Community Power, Sierra Valley Energy, and Valley Clean Energy Alliance. An additional 13 CCAs are known by the authors to be prospective or under exploration as of the date of this report. Recent estimates predict that as much as 25 percent of IOU retail electric load could be served by CCAs, self-generation, and electric service providers; this percentage could reach 85 percent in the next decade or as many as 15 million to 20 million customers.²⁰ The potential widespread growth of CCAs presents both opportunities and challenges for renewable development, as well as raising broader considerations of reliability, load uncertainty, and cost allocation.

Renewable Capacity Located Across the State

To support achievement of California's RPS, the Governor established the Clean Energy Jobs Plan and set a goal for 8,000 MW of utility-scale renewable capacity.²¹ As shown in **Table 1**, the goal has been far surpassed, with more than 21,800 MW of wholesale facilities on-line in California. **Table 1** shows both the quantity of wholesale RPS eligible generators and the total capacity of those generators, broken down by county for in-state facilities, and by state for out-of-state facilities. **Table 1** is based on data collected by the Energy Commission from power plants with a total nameplate capacity of 1 megawatt (MW) or more that are within California or physically located out of state with a first point of interconnection into a California balancing authority.²² Facilities with a first point of interconnection in a California balancing authority are aggregated and listed by state at the bottom of the table. This table includes all interconnected facilities as of October 31, 2017, and includes 533 MW of generation that came on-line in 2017.

19 CPUC 2017 Annual RPS Report. During RPS Compliance Period 1, only MCE was operational. The other CCAs listed came on-line during Compliance Period 2, except Silicon Valley Clean Energy, which came on-line in 2017 and therefore has not yet been subject to compliance reporting.

20 California Public Utilities Commission Staff White Paper: *Consumer and Retail Choice, the Role of the Utility, and an Evolving Regulatory Framework*, May 2017, available at http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/Retail%20Choice%20White%20Paper%205%208%2017.pdf.

21 Governor Jerry Brown, *Clean Energy Jobs Plan*, 2011, available at https://www.gov.ca.gov/docs/Clean_Energy_Plan.pdf.

22 A *balancing authority* maintains the electricity balance between supply and demand within its region. "California balancing authority" refers to a balancing authority located primarily in California with more than 50 percent of its end-use electric load physically located within the political boundaries of California. This includes balancing authority areas operated by the California Independent System Operator Corporation, Los Angeles Department of Water and Power, Balancing Authority of Northern California, Imperial Irrigation District, and Turlock Irrigation District.



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Table 1: Number and Total Capacity of RPS Eligible Wholesale Facilities On-Line as of November 1, 2017^{vi}

	Biomass		Geothermal		Small Hydro		Solar PV		Solar Thermal		Wind		Total	
County	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW
Alameda	4	24					12	15			3	182	19	221
Amador	1	23			2	15	1	2					4	39
Butte	1	2			10	70	9	10					20	82
Calaveras					7	32	1	2					8	33
Colusa	1	29											1	29
Contra Costa	2	7					11	31			1	38	14	76
El Dorado					8	69							8	69
Fresno	2	56			2	35	45	647					49	738
Glenn					1	5	2	3					3	8
Humboldt	3	61			2	3							5	64
Imperial			20	718	8	93	15	1,078			1	265	44	2154
Inyo			3	302	13	156	2	6					18	464
Kern	3	124			5	75	88	2,395			49	3281	145	5875
Kings							22	466					22	466
Lake			5	396	2	6	3	3					10	404
Lassen	1	36			1	30							2	65
Los Angeles	13	214			21	216	145	952					179	1382
Madera	2	38			12	72	4	25					18	135
Marin	1	4					2	3					3	6
Mariposa					1	9								
Mendocino					4	14	4	7					8	21
Merced	2	13			5	33	12	140			1	18	20	204
Mono			3	40	3	21							6	61
Monterey	3	8					7	9			2	2	12	19
Napa	1	1					2	2					3	3
Nevada					10	81							10	81
Orange	6	85			3	12	1	3					10	100
Placer	3	52			11	92	4	6					18	149
Plumas	2	40			4	28							6	67
Riverside	3	59			7	51	30	1,131	1	250	30	643	71	2134
Sacramento	1	9			1	14	38	133					40	156
San Benito							4	6					4	6
San Bernardino	1	3			11	38	87	653	11	999	3	7	113	1699
San Diego	12	44			4	13	28	155			2	51	46	263
San Francisco	1	2					8	14					9	17
San Joaquin	5	82			1	11	6	10			2	4	14	106
San Luis Obispo	2	3			1	4	14	812					17	819
San Mateo	1	11											1	11
Santa Barbara	3	7											3	7
Santa Clara	2	3			1	0	21	30					24	33
Santa Cruz	2	5					2	3					4	7



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	Biomass		Geothermal		Small Hydro		Solar PV		Solar Thermal		Wind		Total	
County	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW
Shasta	4	144			26	89	5	8			1	101	36	342
Sierra					4	14							4	14
Siskiyou	1	13			5	72							6	86
Solano	2	10					14	18			13	1,035	29	1,063
Sonoma	3	8	12	1,238	1	3	12	14					28	1,263
Stanislaus	2	26			6	21	4	48					12	95
Sutter							4	4					4	4
Tehama					4	22	11	9			1	1	16	32
Trinity					6	10							6	10
Tulare	2	14			7	38	30	297					39	349
Tuolumne	2	33			8	193	1	2					11	228
Ventura	3	6			3	3	2	4					8	13
Yolo	2	31			1	12	7	10			1	1	11	54
Yuba	1	3			3	1	1	1					5	5
In-State Total	106	1333	43	2694	235	1,773	721	9,164	12	1,249	110	5,630	1,226	21,833
Out of State														
Arizona							5	854					5	854
Nevada			1	61			5	751					6	812
Utah											2	304	2	304
Mexico (Baja)											1	155	1	155
Total	106	1333	44	2755	235	1,773	731	10,769	12	1,249	113	6,089	1,240	23,958

Source: California Energy Commission

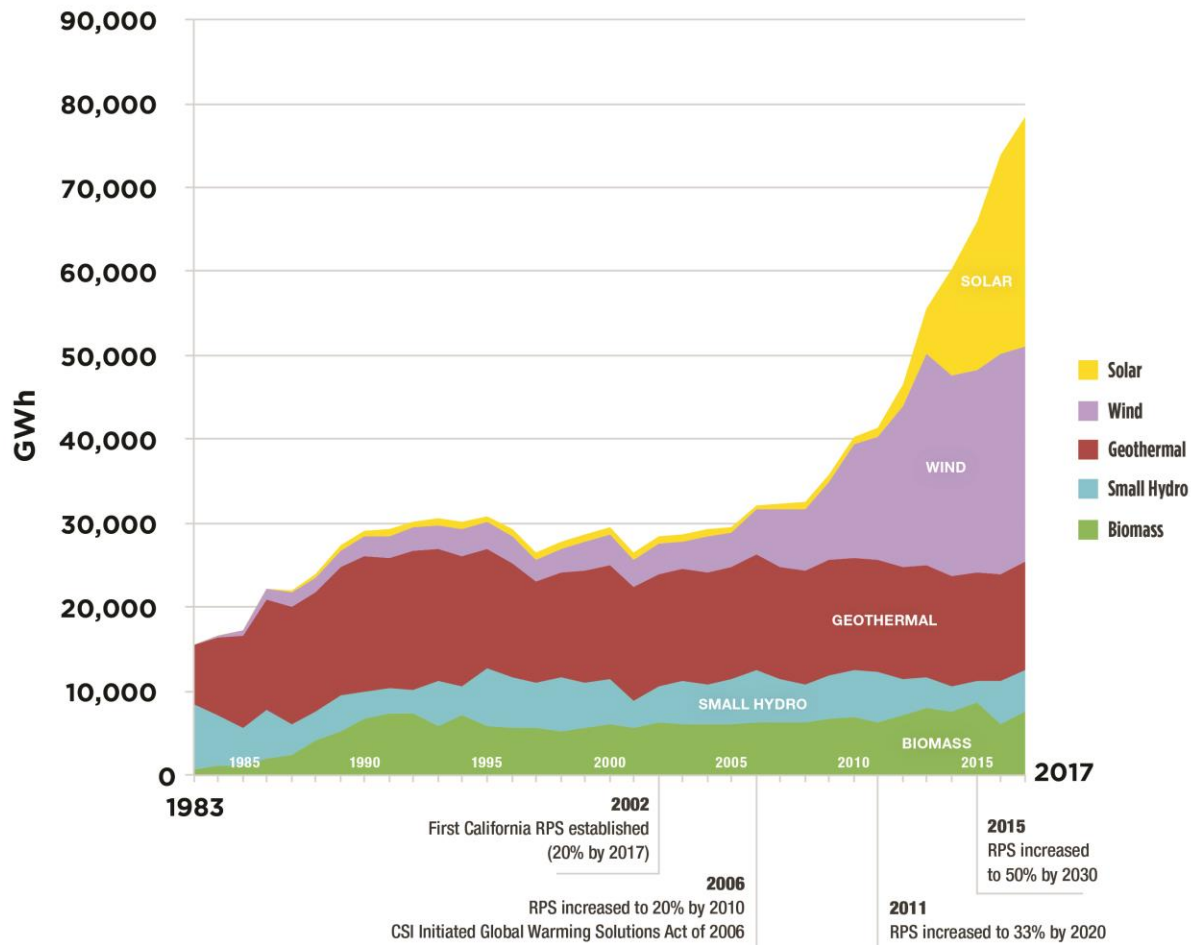
Renewable Generation: Continued Progress

Figure 6 shows renewable generation procured by California utilities from 1983–2016 by resource type. This figure uses the same data for 2017 contained in **Figure 2**, which represents only RPS eligible generation. It does not include behind-the-meter or self-generation. **Figure 6** also shows key policy changes in 2002, 2006, 2011, and 2015 to advance renewable development.



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Figure 6: Renewable Energy Generation 1983-2017 by Resource Type ^{vii}



Source: California Energy Commission. Data sources: Quarterly Fuels and Energy Report [8], 2016 Power Source Disclosure Filings [11], S-2 Filings [D2], EIA Electric Power monthly [D15], CPUC compliance filings [12], and Energy Commission RPS Compliance Filings [13]. Updated November 2017

Renewable Generation Profiles

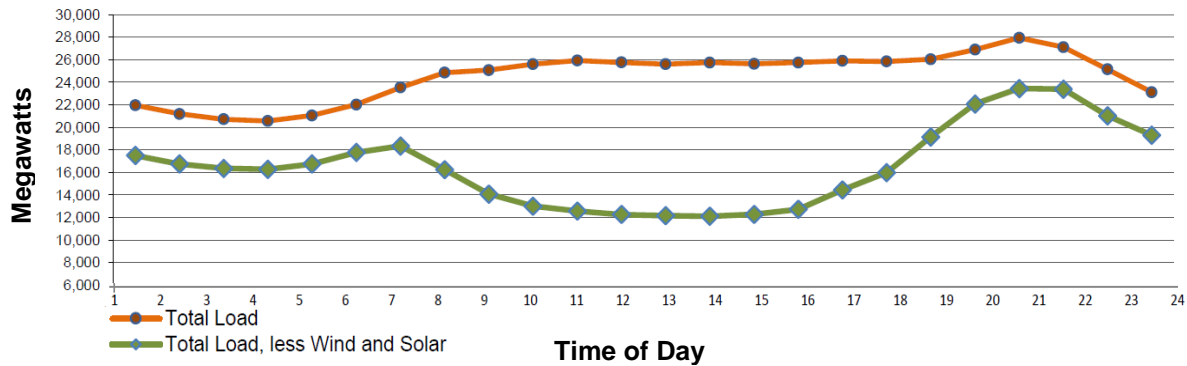
The growth in renewables, particularly solar generation, has dramatically changed California's generation profile, and California's grid operators have had to adapt to these changes. The grid managed by the California Independent System Operator (California ISO) experienced a new generation record from wind and solar resources on May 16, 2017. **Figure 7** shows the total load and the total load without wind and solar (net load) on May 16. On this date, there were more than 14,000 MW of wholesale wind and solar resources serving the grid simultaneously. **Figure 8** shows the California ISO's 24-hour snapshot of the overall resource profile on May 16,



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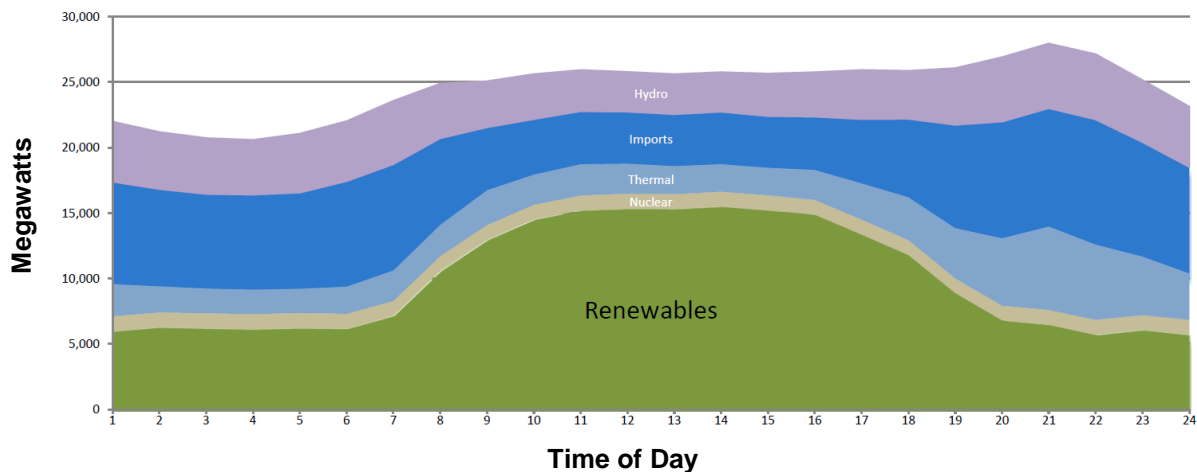
demonstrating how much of the state's overall production capacity on that day came from renewables.

Figure 7: Average Hourly Net Load in California ISO on 5/16/17^{viii}



Source: http://content.caiso.com/green/renewrpt/20170516_DailyRenewablesWatch.pdf

Figure 8: Hourly Average Breakdown of Total Production by Resource Type on 5/16/17^{ix}



Source: http://content.caiso.com/green/renewrpt/20170516_DailyRenewablesWatch.pdf

Potential Additional Capacity - Renewable Energy Facility Siting in California

This section contains information on planned renewable projects in California. Utility-scale renewable energy facilities proposed in California must receive environmental permits in compliance with the California Environmental Quality Act (CEQA). The Energy Commission has statutory responsibility for licensing thermal power plants 50 MW and larger, along with all associated infrastructure, such as transmission lines to the first point of interconnection with the grid, fuel supply lines, and water pipelines. Typically, local jurisdictions like counties and cities are responsible for permitting solar photovoltaic (PV) and wind projects. For projects proposed on



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federal lands, federal agencies like the U.S. Bureau of Land Management or the U.S. Forest Service may be responsible for renewable energy project permitting.

**Table 2: New Renewable Capacity Expected On-Line in 2018
(Not Including Self-Generation)^x**

Resource/Technology	Capacity (MW)	Percent of Total
Solar PV	1,140	90%
Wind	130	10%
Total	1,270	100%

Source: California Energy Commission. As of October 31, 2017

As shown in **Table 2**, about 1,270 MW of capacity is estimated to come on-line by the end of 2018. These resources have been permitted and have received power purchase agreements.

More broadly, there are 8,140 MW of renewable energy projects that have received permits to build in California but are not yet operational, as shown in **Table 3**. These include projects with and without secured purchase contracts. Most of these proposed projects seek to interconnect to the California ISO-controlled grid.²³

Due to frequent changes in project circumstances (for example, loss of developer financing, delays obtaining power purchase agreements, and inability to meet other agencies' permitting requirements), project status data are fluid. Therefore, the renewable energy siting information presented in **Table 3** reflects a snapshot in time.

Belridge Solar Project

A large and unique project is under development by Aera Energy and Glasspoint Solar in Kern County that will incorporate a solar thermal plant and a solar PV plant to create both steam for oil extraction and electricity. The developer anticipates that it will be California's largest solar energy project with 850 MWt of solar thermal energy output (producing 12 million barrels of steam from sunlight reflected by mirrors) and 26.5 MW of electricity from the solar electric plant. The developer estimates that replacing the use of natural gas to produce steam will offset roughly 376,000 tons of carbon dioxide emissions. Project construction is expected to begin in 2019 with steam and electricity generation beginning in 2020. For more information see <https://www.glasspoint.com/belridgesolar/>

²³ Operators of generation resources interested in interconnection to the California ISO-controlled grid submit an interconnection request to the grid operator. The California ISO regularly performs clustered interconnection studies in phases, which inform the interconnection customer about grid conditions that might affect decisions about deliverability status, project size, meeting the interconnection financial security posting requirements, and so forth. Resources in the interconnection queue are reassessed annually.



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Table 3: Non-Operational Renewable Projects With Environmental Permits^{xi}

County	Biomass/ Landfill Gas		Solar PV		Solar Thermal		Geothermal		Wind		Small Hydro		Total	
	Count	MW	Count	MW	Count	MW	Count	MW	Count	MW	Count	MW	Count	MW
Alameda			1	20					1	90			2	110
Colusa			1	20									1	20
Contra Costa			1	11									1	11
El Dorado											1	3	1	3
Fresno			15	371									15	371
Glenn	1	2											1	2
Humboldt			1	1									1	1
Imperial			13	1,022			3	212					16	1,234
Inyo			1	1									1	1
Kern			19	1,066					9	1,144			28	2,209
Kings			4	292									4	292
Lassen			1	5									1	5
Los Angeles			16	324							1	4	17	328
Madera	1	2	2	71									3	73
Merced			3	205									3	205
Mono							1	33					1	33
Monterey	1	4	4	284					1	2			6	290
Napa			1	7									1	7
Orange			4	7									4	7
Placer	1	2											1	2
Riverside			6	1,462									6	1,462
Sacramento			2	8									2	8
San Benito			1	247									1	247
San Bernardino	1	3	11	341	1	50							13	394
San Diego			3	127					1	200			4	327
San Joaquin			4	25									4	25
Santa Barbara			1	40									1	40
Santa Clara	1	3	7	16									8	19
Solano			1	1									1	1
Sonoma							3	137					3	137
Stanislaus			4	220									4	220
Tulare	1	2	1	46									2	48
Ventura			2	5									2	5
Yolo			1	2					1	2			2	3
Yuba			1	1									1	1
Grand Total	7	17	132	6,244	1	50	7	381	13	1,437	2	7	162	8,140

Source: California Energy Commission

Distributed and Behind-the-Meter Renewable Capacity Continues to Grow

California has seen significant growth in the amount of distributed generation, including smaller-scale facilities that sell electricity to the market, as well as systems installed primarily to provide electricity “onsite” but that also export excess power back to the grid, often under a “net-energy-metering” agreement. Facilities are included in the definition of distributed generation that are 20 MW or smaller – including self-generation and projects that do not directly serve a home or business and are interconnected “in front of the meter” to generate energy to be sold to LSEs or

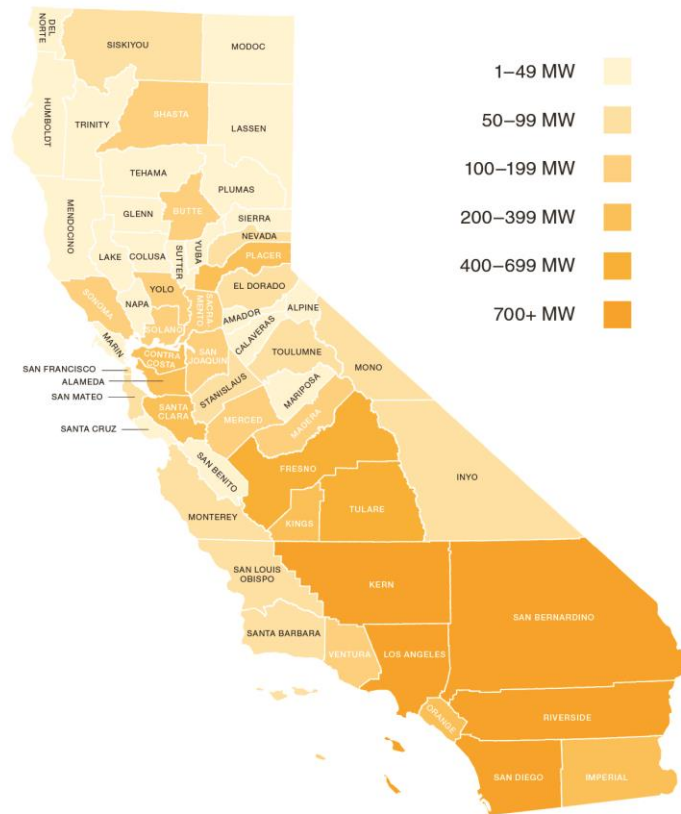


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on the wholesale market. As discussed earlier, self-generation systems serve primarily on-site load while exporting excess power back to the grid. Data presented below as behind-the-meter are a subset of self-generation that refers to smaller residential or commercial systems that use net-energy metering.

Figure 4 in the overview shows progress toward the Governor’s goal of 12,000 MW of renewable distributed generation by 2020. **Figure 9** shows the geographic breakdown of distributed generation capacity, as well as small-scale renewable capacity currently on-line and expected to come on-line in 2018.

Figure 9: Map of On-Line and Pending Renewable Small-Scale and Distributed Generation Capacity, by County^{xii}



Source: California Energy Commission. Updated November 2017

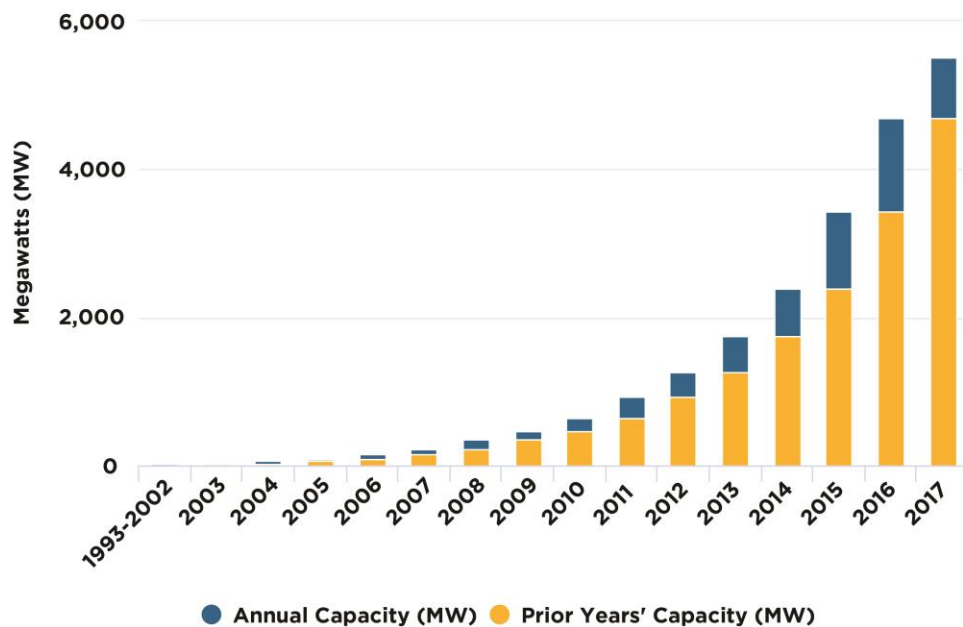


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California Achieves the Goal of 3,000 Megawatts of Behind-the-Meter Solar Systems

Figure 10 shows how rapidly the installed capacity of behind-the-meter solar has increased statewide. The graph shows the exponential growth of new distributed solar interconnected annually in both IOU and POU territories through both net-energy-metering (NEM) and self-generation incentive programs. **Figure 10** does not include all 2017 interconnections.²⁴ Of the more than 5,900 MW of behind-the-meter solar installed statewide, nearly 5,000 MW has been installed since 2011. More than 500 MW of the solar energy systems shown in **Figure 10** were installed through programs administered by POUs.²⁵ The total capacity shown in **Figure 10** represents more than 725,000 behind-the-meter solar systems installed on homes and businesses across California.²⁶

Figure 10: Total and Incremental Behind-the-Meter Solar Capacity by Year^{xiii}



Source: California DG Stats, www.californiadgstats.ca.gov, captured November 2017

²⁴ IOU interconnections reported as of September 2017. No POU interconnections for 2017 are shown here.

²⁵ POU data can be found at http://www.energy.ca.gov/sb1/pou_reports/.

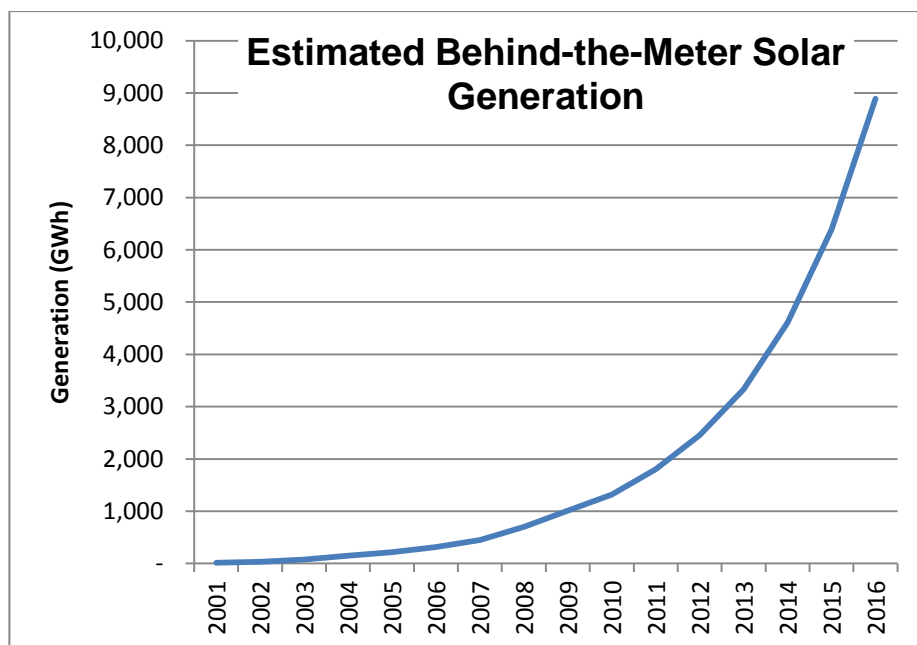
²⁶ This count includes more than 670,000 IOU interconnected systems with a net-metering agreement. IOU data are current as of September 2017. This count also includes nearly 59,000 systems interconnected through POU CSI programs, through 2016.



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Figure 11 shows that the estimated generation from all behind-the-meter solar systems installed statewide has increased from almost zero in 2001 to more than 9,000 GWh in 2016, demonstrating truly exponential growth. In the most recent years estimated, generation from these resources tripled, increasing from 3,000 GWh to 9,000 GWh between 2013 and 2016. Energy Commission staff developed this estimate based on expected solar load profiles for each climate zone in California and the capacity data in **Figure 10**. **Figure 11** also represents the amount of electric load that behind-the-meter solar systems are serving, thus significantly reducing the amount of electricity that Californians buy from utilities.

Figure 11: Estimated Generation From Behind-the-Meter Solar, 2001-2016^{xiv}



Source: California Energy Commission staff analysis, November 2017

California Solar Initiative (CSI)

The CPUC provides oversight to the “general market” CSI commercial and residential incentives program, as well as two affordable housing programs for existing buildings, the Multi-Family Affordable Solar Housing (MASH) and Single-Family Affordable Solar Homes (SASH). The CSI general market program, which closed to new applications on December 31, 2016, exceeded its goal of installing 1,750 MW.²⁷ At the end of 2016, the program had installed 1,837 MW, with another 94 MW reserved in pending projects.²⁸ The Legislature extended the MASH and SASH programs in 2013, receiving \$108 million in additional funding across both programs. Before

²⁷ For more information, see <http://www.gosolarcalifornia.ca.gov/about/csi.php>.

²⁸ CPUC – *California Solar Initiative – Annual Program Assessment*, June 2017, http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/2017CSIAPA_FINAL_06.29.17.pdf.



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exhausting its funding, MASH supported the installation of 29 MW of interconnected solar across nearly 400 projects statewide and has reserved funding for projects totaling an additional 23 MW.²⁹ The SASH program provides incentives for solar PV systems on existing owner-occupied low-income households toward a goal of installing 15 MW by 2021. So far, SASH has supported the installation of more than 6,000 systems and, including pending and reserved projects, is on track to install more than 20 MW of capacity.³⁰ It continues to accept applications.

New Solar Homes Partnership (NSHP) Program

A part of the CSI, but administered by the Energy Commission, the NSHP program provides financial incentives to encourage the installation of eligible solar energy systems on new residential construction. The NSHP Program supports the achievement of the state's distributed solar goals with a specific goal of installing 360 MW of solar on newly constructed homes. The program also supports the state's efforts for zero-net-energy building standards.

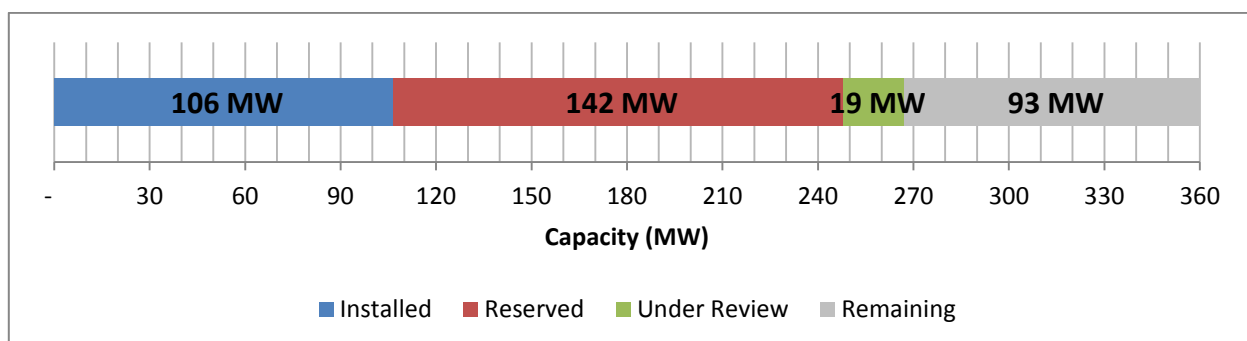
As of November 1, 2017, 106 MW of solar capacity had been installed, and incentive funding for an additional 142 MW had been reserved, for a total of 248 MW (**Table 4**). As shown in **Figure 12**, the program has reserved funds or installed 65 percent of the total capacity goal.

Table 4: NSHP Program Activity^{xv}

	Number of Systems	\$ Millions	MW (AC)
Reserved	36,790	\$89.5	141.6
Installed	33,750	\$177.1	106.4
Total	70,540	\$256.6	248.0

Source: California Energy Commission

Figure 12: Progress Toward NSHP 360 MW Goal^{xvi}



Source: <http://www.gosolarcalifornia.ca.gov/about/nshp.php>. Updated November 2017

29 CSI MASH Program <http://www.cpuc.ca.gov/General.aspx?id=3752>.

30 CSI SASH Program <http://www.cpuc.ca.gov/General.aspx?id=3043>.



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The NSHP program also assists lower-income residents by providing higher per-watt incentives for eligible residential affordable housing projects. Since it began, the NSHP program has funded the installation of more than 7 MW of capacity on low-income developments, with incentives paid totaling more than \$20 million. In 2016 alone, the NSHP program provided more than \$2.58 million in incentives to 22 affordable housing projects across the state. These 2016 affordable housing incentives supported the installation of 1.6 MW of new solar capacity, which helped reduce electricity bills for more than 400 affordable homes either through a net-metering agreement or more commonly through a virtual net-metering agreement. These affordable housing incentives accounted for 12 percent of the total incentives paid through the program in 2016.

In March 2017, the program guidelines were updated to increase affordable housing participation, including increasing the incentive level for affordable housing, offering an incentive bonus for affordable housing located in disadvantaged communities, and broadening eligibility by removing the tax-exempt status requirement. The Energy Commission expects these changes will boost affordable housing participation in the NSHP program and will augment the benefits of the program for low-income Californians. Additional information on quarterly progress and remaining program budget can be found on the Go Solar California website.³¹

California Is Benefiting From Dramatic Decreases in the Cost of Renewables

Continued cost declines in key renewable energy sources, mainly solar and wind energy, have helped maintain a fast pace of market growth for renewables. As part of the U.S. Department of Energy's (DOE) SunShot program, the Lawrence Berkeley National Laboratory (LBNL) reports the median installed prices for solar energy systems quarterly and annually. These values are broken down by system size. The most recent LBNL report shows that for projects completed in 2016, the cost of installing utility-scale PV (systems greater than 5 MW) has fallen by two-thirds since the 2007–2009 period, to \$2.2/watt alternating current (W_{AC}) (or \$1.7/watt direct current [W_{DC}]), with the median utility-scale installed price in California being marginally higher, at \$2.4/ W_{AC} .³² **Figure 13** displays median installed system costs (solid line) and the 20th-to-80th percentile range (shaded areas) for residential systems (green), small nonresidential systems (≤ 500 kW in red), and large nonresidential systems (> 500 kW in blue).³³

³¹ <http://www.gosolarcalifornia.ca.gov/documents/nsdp.php>.

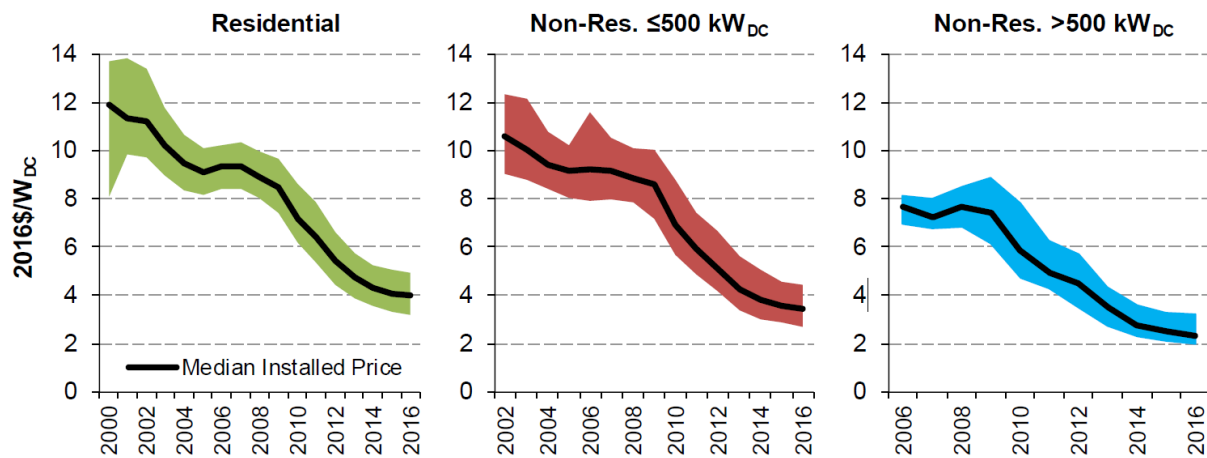
³² Bolinger, Mark, Joachim Seel, and Kristina Hamachi LaCommare. September 2017. *Utility-Scale Solar 2016: An Empirical Analysis of Project Cost, Performance, and Pricing Trends in the United States*. Lawrence Berkeley National Laboratory. https://emp.lbl.gov/sites/default/files/utility-scale_solar_2016_report.pdf.

³³ Barbose, Galen, Na'im Darghouth, Dev Millstein, Kristina LaCommare, Nicholas DiSanti, and Rebecca Widiss. September 2017. *Tracking the Sun 10: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States*. Lawrence Berkeley National Laboratory. Figure 5.



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Figure 13: U.S. Residential and Nonresidential PV System Prices^{xvii}



Source: U.S. Dept. of Energy, *Tracking the Sun 10*

The installed cost of wind has also decreased over time. The DOE reported that for projects completed in 2016, the national average capacity-weighted installed cost was about \$1.59/watt, down \$0.78/watt from 2010.³⁴ The report did not include California-specific values, purportedly because there were not significant installations in 2016.

Additional References:

For more information on the Renewables Portfolio Standard, please see <http://www.energy.ca.gov/portfolio/index.html>. For more information on investor-owned utility, electric service provider, and community choice aggregator progress, see the RPS Quarterly Reports and the Status of RPS Projects, available at http://www.cpuc.ca.gov/RPS_Homepage/.

For further information on all (renewable and nonrenewable) Energy Commission-jurisdictional power plants, see http://energy.ca.gov/sitingcases/all_projects.html.

For more information on RPS-eligibility, see the *Renewables Portfolio Standard (RPS) Eligibility Guidebook*, see <http://www.energy.ca.gov/renewables/documents/>.

³⁴ Wiser, Ryan and Mark Bollinger. August 2017. *2016 Wind Technologies Market Report*, Lawrence Berkeley National Laboratory. https://emp.lbl.gov/sites/default/files/2016_wind_technologies_market_report_final_optimized.pdf. The majority of recent wind installations are in the U.S. interior and not in California. These national costs may not closely track California costs.



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Sources of Clean Energy Goals:

Table 5: California’s Clean Energy Goals

Goals	Source
Reduce GHG emissions 40 percent below 1990 levels by 2030	Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016), Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006)
Increase electricity derived from renewable energy sources to 50 percent by 2030—build on prior RPS mandate of 33% by 2020	Senate Bill 350 (De León, Chapter 547, Statutes of 2015); Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002)
3,000 MW of solar energy at new and existing residential and commercial sites by the end of 2016 -1,940 MW for existing in IOU territory -700 MW for existing in POU territory -360 MW for new in IOU territory	Senate Bill 1 (Murray, Chapter 132, Statutes of 2006)
Solar energy systems placed on 50% of new homes by 2020	Senate Bill 1 (Murray, Chapter 132, Statutes of 2006)
20,000 MW of renewable capacity by 2020 -8,000 MW of large-scale renewables -12,000 MW of distributed generation (defined as “localized” and <20MW)	Governor’s ‘Clean Energy Jobs Plan’ 2011
Ensure climate change and clean energy policies are transparent and equitable, with the benefits reaching disadvantaged communities	Senate Bill 350 (De León, Chapter 547, Statutes of 2015)

Source: California Energy Commission



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Statewide Electricity Retail Sales

California Energy Demand 2018 -2028 Preliminary Forecast.

<https://efiling.energy.ca.gov/getdocument.aspx?tn=220615>

Renewables

The following data sources were used to prepare the figures in this report:

[R1] The Quarterly Fuel and Energy Report is data-collected consistent with California Code of Regulations, Title 20, Division 2, Chapter 3, Section 1304 (a) (1)-(3). For more information, please contact Michael Nyberg, Michael.Nyberg@energy.ca.gov.

[R2] Power Source Disclosure filings (SB 1305). <http://www.energy.ca.gov/pcl/>.

[R3] CPUC RPS compliance filings, <http://www.cpuc.ca.gov/General.aspx?id=3856>.

[R4] California Energy Commission RPS compliance filings.

[R5] Local Publicly Owned Electric Utilities' Reported Renewable Procurement Status for Compliance Period 1, http://www.energy.ca.gov/portfolio/pou_rulemaking/2013-RPS-01/POU_Reported_2011-2013_RPS_Percentage_Table.pdf.

[R6] California ISO Daily Renewables Watch, http://content.caiso.com/green/renewrpt/20170513_DailyRenewablesWatch.pdf.

Distributed Generation

The following data sources were used to prepare the figures:

[D1] California Public Utilities Commission, http://www.cpuc.ca.gov/RPS_Homepage/.

[D2] California Energy Commission, S-2 and S-5 Supply Forms from 2017 available at

<https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=17-IEPR-02>

[D3] Southern California Edison SB 32 procurement
<http://www.sce.com/EnergyProcurement/renewables/crest.htm>.

[D4] Pacific Gas and Electric SB 32 procurement
<http://www.pge.com/b2b/energysupply/wholesaleelectricssuppliersolicitation/standardcontractsforpurchase/>.

[D5] San Diego Gas & Electric SB 32 procurement <http://www.sdge.com/regulatory-filing/654/feed-tariffs-small-renewable-generation>.



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[D6] SMUD: <https://www.smud.org/en/business/environment/solar-for-your-business/feed-in-tariffs.htm>.

[D7] LADWP: https://www.ladwp.com/ladwp/faces/ladwp/commercial/c-gogreen/c-gg-localrenewableenergyprogram?_adf.ctrl-state=ano50oi7c_4&_afLoop=237938105011783.

[D8] Self-Generation Incentive Program (October 30, 2017):
<http://californiadgstats.ca.gov/downloads/>.

[D9] New Solar Homes Partnership
<https://www.newsolarhomes.org/WebPages/Public/Reports.aspx>.

[D10] California Solar Initiative <http://www.californiasolarstatistics.ca.gov/>.

[D11] Senate Bill 1 Solar PV: http://www.energy.ca.gov/sb1/pou_reports/

[D12] Historical generation in California:
http://www.energy.ca.gov/almanac/electricity_data/web_qfer/.

[D13] Data from the California ISO on facilities interconnected in 2016.

[D14] NEM Currently Interconnected Data Set (August 31, 2017):
<http://californiadgstats.ca.gov/downloads/>

[D15] U.S. Energy Information Administration Electric Power Monthly, November 2015, Table 1.17.B. <http://www.eia.gov/electricity/monthly/pdf/epm.pdf>.

[D16] Behind-the-meter solar generation estimates were developed by California Energy Commission staff to support the IEPR demand forecast:
<https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=17-IEPR-03>

Historical References

[H1] California Hydroelectric Statistics and Data. Total Hydroelectricity Production (In gigawatt-hours; includes imports). http://www.energy.ca.gov/almanac/renewables_data/hydro/. (For 1983-1996, small hydropower is estimated as 13 percent of all hydropower reported on this table.)

[H2] California Biomass and Waste-to-Energy Statistics and Data. Biomass and Waste-to-Energy Electricity Production for 1983-1996. These data include two waste-to-energy plants that are not RPS-eligible. http://www.energy.ca.gov/almanac/renewables_data/biomass/.

[H3] California Geothermal Energy Statistics and Data. Geothermal Electricity Production. These data used for 1983-1996. http://www.energy.ca.gov/almanac/renewables_data/geothermal/.

[H4] California Solar Energy Statistics and Data. Solar Thermal Electricity Production. These data used for 1983-1996. <http://energyalmanac.ca.gov/renewables/solar/index.html>.



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[H5] California Wind Energy Statistics and Data. Wind Electricity Production. These data used for 1983-1996. <http://www.energy.ca.gov/wind/index.html>.

[H6] California Electrical Energy Generation, 1997 to 2001. Total Production, by Resource Type (gigawatt-hours). http://energyalmanac.ca.gov/electricity/electricity_generation.html. (For 1997-2001 small hydropower is estimated as 13 percent of all hydropower reported on this table).

[H7] Gross System Power From the Net System Power Report (2002-2006) and Revised Total Electricity System Power for California (2007-current). In-state and imports. http://energyalmanac.ca.gov/electricity/electricity_generation.html.

[H8] Status of RPS Projects. CPUC tracks contracts for projects that are on-line, under development, and pending CPUC approval. Withdrawn and cancelled projects are also included. The project list is updated monthly. http://www.cpuc.ca.gov/RPS_Homepage/

[H9] California Energy Commission Energy Facility Status of Power Plant Projects since 1996. http://www.energy.ca.gov/sitingcases/all_projects.html.

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- Renewable capacity and generation: Meredith Alexander, Meredith.Alexander@energy.ca.gov
- Renewable capacity larger than 1 MW nameplate: Michael Nyberg, Michael.Nyberg@energy.ca.gov.
- Self-generation capacity and New Solar Homes Partnership: Eric Ritter, Eric.Ritter@energy.ca.gov
- POU RPS progress: Emily Lemei, Emily.Lemei@Energy.ca.gov
- Renewable energy facilities permitting: Joseph Merrill, Joseph.Merrill@energy.ca.gov

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Next Update: August 2018



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Notes on Figures and Tables:

i **Figure 1**

- Source: California Energy Commission staff.
- Data sources: Quarterly Fuels and Energy Report [R1], 2016 Power Source Disclosure Filings [R2], S-2 Filings [D2], CPUC compliance filings [R3], and Energy Commission RPS Compliance Filings [R4]. Updated Nov. 2017
- Staff estimated 2017 renewable energy generation totaled 79,100 GWh using data from the Energy Commission's Quarterly Fuels and Energy Report, Power Source Disclosure Program and Wind Performance Reporting System, which captures in-state renewable energy generation assumed to have been purchased from California load-serving entities and 2017 out-of-state renewable energy procurement.
- Staff estimated an adjusted statewide 2017 retail sales totaled 249,700 GWh using the *California Energy Demand 2018-2028 Preliminary Forecast* mid case, less excluded entities, and pumping loads.
- The renewables procurement percentage estimate does not represent verified eligible RPS procurements and thus is not an official determination of RPS compliance or progress.

ii **Figure 2**

- Data sources: Quarterly Fuels and Energy Report [R1], S-2 Filings [D2], CPUC compliance filings [R3], and Energy Commission RPS Compliance Filings [R4].
- This chart represents an estimate of all generation in 2017. Power plant owners report actual generation figures during the first two quarters of 2017. Final 2017 numbers will be published in the 2018 update of this tracking progress report.
- These generation values include all in-state RPS eligible resources, all resources with first point of interconnection in California, and all out-of-state resources procured under a long-term contract.
- Electricity generated from self-generation capacity is not included in this estimate of renewable energy generation.

iii **Figure 3**

- Source: California Energy Commission staff, on-line capacity as of 10/31/17.
- Data sources: Quarterly Fuels and Energy Report [R1], and Distributed Generation Sources [D1]-[D14].
- Data include only facilities physically located in California, including some facilities that may have contracted to sell power outside California. The entire nameplate capacity of these facilities is included in the capacity total. See notes for Table 2 for additional information about the data.
- Data do not include 2,125 MW of renewable energy facilities that are physically out of state but have the first point of interconnection in California.
- About 166 MW of solar PV facilities from the Quarterly Fuels and Energy Report [R1] were excluded in Figure 3 to avoid potential double counting because they were from facilities 1 MW or below and may already be included in the IOU NEM Interconnected database [D14].
- Totals may not sum due to rounding.

iv **Figure 4**

- Source: California Energy Commission staff.
- Data sources: Quarterly Fuels and Energy Report [R1] and Renewable Distributed Generation Sources [D1]-[D14].



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- Staff included only facilities from the Quarterly Fuels and Energy Report for facilities with a nameplate capacity between 1 MW and 20 MW.
- Renewable distributed generation sources were cross-referenced with the Quarterly Fuels and Energy Report to remove potential duplicates.
- Pending projects include projects either with incentive funding reserved from a self-generation incentive program or with a power purchase agreement
- Staff attempted to include all installed distributed renewable capacity; however, there may be additional capacity that wasn't included.

^v **Figure 5**

- Source: Local Energy Aggregation Network, November 2017, <http://www.leanenergyus.org/cc-by-state/california/>.

^{vi} **Table 1**

- Source: California Energy Commission staff
- Data sources: California Energy Commission Quarterly Fuels and Energy Report [R1], CPUC RPS contract database [D1], POU S-2 and S-5 Forms for 2014 [D2], utility feed-in-tariff programs [D3]-[D7], and California ISO facility interconnection [D 13].
- QFER collects data 45 days after each calendar quarter for power plants 10 MW and larger and annually for plants from 1-10 MW. Plants under 1 MW are not required to report under QFER.
- “Biomass” does not include generation by natural gas plants using out-of-state landfill and digester gas transported through the natural gas pipeline. Please check the RPS online database for the most up-to-date listings of RPS-certified power plants.
- The “Small Hydro” category includes all RPS-eligible hydroelectric facilities that are rated from 1 MW to 30 MW. It also includes a few larger facilities that may qualify for a load-serving entity's RPS program. Please check the RPS online database for the most up-to-date listings of RPS-certified power plants.
- “Solar PV” does not include PV installed under a net metering agreement such as residential rooftop solar. Data represent on-line capacity from operating plants. Some projects are developed in multiple phases, and the final project may have a larger capacity.
- There may be some overlap between the self-generation projects reported in Table 5 and non-self-generation projects reported here of about 190 MW.
- Totals may not sum due to rounding.

^{vii} **Figure 6**

- Source: California Energy Commission staff.
- Data sources: Quarterly Fuels and Energy Report [R1], 2016 Power Source Disclosure Filings [R2], S-2 Filings [D2], EIA Electric Power monthly [D15], CPUC compliance filings [R3], and Energy Commission RPS Compliance Filings [R4].
- Includes out-of-state resources with first interconnection point in California.
- This does not include large hydropower and does not include self-generation or behind-the-meter generation.

^{viii} **Figure 7**

- Source: California ISO
- http://content.caiso.com/green/renewrpt/20170513_DailyRenewablesWatch.pdf.



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^{ix} **Figure 8**

- Source: California ISO
- http://content.caiso.com/green/renewrpt/20170513_DailyRenewablesWatch.pdf.

^x **Table 2**

- Source: California Energy Commission staff
- The renewable energy siting information presented in Table 3 reflects a snapshot in time relative to the status of projects in the Energy Commission siting database. Due to frequent changes in project circumstances (for example, loss of developer financing, delays obtaining power purchase agreements, and inability to meet other agencies' permitting requirements), project status data are fluid.
- Totals may not sum due to rounding.
- Capacity represents nameplate capacity.
- Solar PV capacity is AC.
- Includes projects in preconstruction or under construction.

^{xi} **Table 3**

- Source: California Energy Commission staff
- The renewable energy siting information presented in Table 4 reflects a snapshot in time relative to the status of projects in the Energy Commission siting database. Due to frequent changes in project circumstances (for example, loss of developer financing, delays obtaining power purchase agreements, and inability to meet other agencies' permitting requirements), project status data are fluid. Data as of October 31, 2017.
- Totals may not sum due to rounding.
- Capacity represents nameplate capacity.
- Solar PV capacity is AC.
- Includes projects in preconstruction or under construction.

^{xii} **Figure 9**

- Source: California Energy Commission staff
- Data sources: [D1]-[D14]

^{xiii} **Figure 10**

- California DG Stats, www.californiadgstats.ca.gov, captured November 2017.

^{xiv} **Figure 11**

- Source: Energy Commission staff analysis completed for the *California Energy Demand 2018-2028 Preliminary Forecast Draft Staff Report*, August 2017. See Appendix A.
- http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-03/TN220615_20170809T083759_California_Energy_Demand_20182028_Preliminary_Forecast.pdf
- Data sources: Behind-the-meter solar generation estimates [D16]
- California Energy Commission staff estimates behind-the-meter solar generation by sorting installed capacity by forecasting zone and then multiplying it by a production factor for each hour of the year for each forecasting zone. Each successive year, staff applies a 0.5 percent degradation factor to the estimated generation and then adds the generation from the newly installed PV systems assuming that no BTM capacity has been retired.



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^{xv} Table 4

- Source: Energy Commission (<http://www.gosolarcalifornia.ca.gov/about/nshp.php>)

^{xvi} Figure 12

- Source: Energy Commission (<http://www.gosolarcalifornia.ca.gov/about/nshp.php>)

^{xvii} Figure 13

- Source: Barbose, Galen, Naïm Darghouth, Dev Millstein, Kristina LaCommare, Nicholas DiSanti, and Rebecca Widiss. Lawrence Berkeley National Laboratory. *Tracking the Sun X: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States*. Figure 5. September 2017.