Renewable Energy

Advancing the use and availability of renewable energy is critical to achieving California’s ambitious climate goals. With this in mind, California has pursued a suite of policies and programs aimed at advancing renewable energy and ensuring all Californians, including low-income and disadvantaged communities, benefit from this transition. This report presents the state’s progress in meeting its renewable energy goals and provides an updated analysis through 2018 of renewable energy generation, installed renewable capacity, and a discussion of the trends, opportunities, and challenges associated with the renewable energy transition. More detailed figures and tables are included in the appendix.1

Renewable Energy Serving California Consumers

Annual Renewable Percentage: Renewables Portfolio Standard Progress

An increasing percentage of energy consumed by Californians comes from renewable sources. A key mandate advancing the use of renewable energy has been the Renewables Portfolio Standard (RPS), which requires California load-serving entities2 (LSEs) to increase their procurement of eligible renewable energy resources (solar, wind, geothermal, biomass, and small hydroelectric) to 33 percent of retail sales by 2020 and 60 percent of retail sales by 2030. Based on reported electric generation from RPS-eligible sources divided by forecasted electricity retail sales for 2019, the California Energy Commission (CEC) estimates that 36 percent of California’s 2019 retail electricity sales was served by RPS-eligible renewable resources as shown in Figure 1. Although this number is not a final RPS determination, it is an important indicator of progress in achieving California’s RPS goals.

Figure 1: Estimated Current Renewables Portfolio Standard Progress

The annual renewable percentage estimated by the CEC has continued to increase in recent years, often ahead of the timelines envisioned by prior legislation. Figure 2 shows the historical estimated renewable percentage values.

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1 Renewable Tracking Progress Appendix.

2 LSEs are defined in the CEC’s RPS Eligibility Guidebook as “a term used to refer to retail sellers, POUs, and all other entities serving retail sales of electricity in California that are obligated to participate in California’s RPS” (https://efiling.energy.ca.gov/getdocument.aspx?tn=217317, p. 82).
In 2019, large hydroelectric and nuclear generation were a significant source of California electricity. Estimated large hydroelectric generation for 2019 indicates increased usage from 2018 generation quantities. Figure 3 shows that when sources of carbon-free energy such as large hydroelectric generation and nuclear are included with RPS-eligible renewables, 63 percent of the state’s electricity retail sales came from non-fossil fuel sources in 2019. However, trends involving large hydroelectric generation are not consistent given the substantial year-to-year hydroelectric generation variability.

Renewables Portfolio Standard
On September 10, 2018, former Governor Edmund G. Brown Jr. signed Senate Bill (SB) 100 (De León, Chapter 312, Statutes of 2018) increasing California’s RPS target to 60 percent by 2030 and adding a planning target of 100 percent renewable and zero-carbon electricity by 2045. LSEs demonstrate compliance with the RPS through the retirement of renewable energy

3 Senate Bill 100 (De León, Chapter 312, Statutes of 2018), https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100
credits (RECs), certificates of proof associated with the generation of 1 megawatt-hour (MWh) of electricity from a California RPS-certified renewable energy resource.

The RPS establishes multiyear compliance periods in recognition that given resources may not be continuously or cost-effectively available or both, and a utility’s procurement may vary to some degree from one year to another. For each compliance period, the RPS requires all LSEs in the state to achieve escalating procurement targets. LSEs are also required to procure a “balanced portfolio” of resources over each compliance period. In Compliance Period (CP) 3, which covers 2017-2020, LSEs are required to procure increasing amounts of renewable electricity each year ramping up to achieve at least 33 percent of retail sales by December 31, 2020. An LSE’s compliance with RPS requirements will be determined based on the aggregated retail sales and procurement over the entire four-year period. Figure 4 provides the increased renewable energy soft targets and legislative targets until 2030. After 2030, the 60 percent RPS requirement continues along with the added SB 100 goal to supply renewable and zero-carbon resources for the remaining 40 percent of California delivered electricity.

Figure 4: Additive California RPS Requirements Through 2030

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4 Compliance period targets for POUs are defined in California Code of Regulations (CCR) Title 20, Section 3204(a) and in California Public Utilities Commission Decision D. 11-12-020 for retail sellers. The CEC has formally amended the CCR Title 20, Section 3204 to incorporate the statutorily defined targets for 2024, 2027, and 2030.

5 Public Utilities Code Sections 399.16 and 399.30.

6 Soft targets are “… an amount equivalent to the percentage of retail sales for a single year within a compliance period that is used to calculate the RPS procurement target for that compliance period.” CCR Title 20, Sec. 3201(ee)
Overall, California LSEs have been successful in meeting the RPS requirements. According to the California Public Utilities Commission (CPUC), which oversees the RPS compliance of retail sellers, 14 retail sellers, including the three large investor-owned utilities (IOUs) that served the majority of California’s sales, were in compliance in CP 1. The remaining six retail sellers were noncompliant. In CP2, which covers 2014-2016, 23 retail sellers were compliant. Two of the remaining three retail sellers were non-compliant and a third has requested a waiver. The CEC oversees compliance for 43 local publicly owned electric utilities (POUs). Of the 41 POUs in compliance for the 2011–2013 period to date, 26 met the procurement targets and portfolio balance requirements (PBR), and 15 POUs applied optional compliance measures to satisfy one or more procurement requirements. In CP 2, 37 POUs met the procurement targets and 43 met the PBR, while 6 POUs are applying to use optional compliance measures to satisfy their RPS procurement requirements. Over the past two compliance periods, fewer LSEs have been out of compliance. However, this trend may not continue as the RPS requirements change. Figure 5 summarizes POU and retail seller compliance in Compliance Periods 1 and 2.

Figure 5: Summary of POU and Retail Seller Compliance for Compliance Periods 1 and 2

Source: CEC staff analysis, December 2019

7 Two retail sellers found out of compliance in CP 1 have waivers pending before the CPUC that could excuse noncompliance, if approved.
9 PBR refers to a minimum and maximum amount of certain REC category requirements.
10 The CEC cannot make a compliance determination for the Los Angeles Department of Water and Power until its verified results are adopted at a Commission business meeting. Port of Stockton was found out of compliance.
Statewide Renewable Generation

For 2019, solar continues to represent the largest portion of renewable generation serving California load. Solar and wind generation together accounted for more than 62 percent of all renewable electricity generation, not including behind-the-meter (BTM) or off-grid solar generation.

Figure 6 shows renewable generation from power facilities serving California load from 1983 through 2019 by resource type, including grid-connected BTM solar resources. The estimated 2019 total renewable generation, including out-of-state generation delivered to California and BTM solar generation, is 105,559 gigawatt-hours (GWh), including an estimated 16,306 GWh of BTM solar. In the past five years, solar generation has increased over 350 percent, and BTM solar resources have increased by nearly 120 percent. These generation estimates do not include generation from BTM wind resources. Figure 6 also shows key policy changes in 2002, 2006, 2011, 2015, and 2018 that have supported renewable resource adoption.

Figure 6: Total Renewable Generation Serving California Load by Resource Type

Source: CEC staff analysis, December 2019
California Installed Renewable Capacity

Figure 7 shows California installed renewable electricity capacity totaled an estimated 34,112 MW for 2019. This total includes nearly 9,460 MW of solar BTM capacity (excluding very small amounts of BTM wind and biomass) from homes and businesses throughout the state. Large-scale renewables make up about 60 percent of total statewide capacity, or about 19,950 MW. Along with the utility-scale renewables, BTM solar resources have grown significantly. Solar represents most of the renewable capacity installed in the state.

Figure 7: Annual Cumulative Installed Renewable Capacity Since 1983
(Including BTM Solar)

11 Total installed rounded values Ibid.
12 Large-scale renewables are renewable generation facilities larger than 20 MW in capacity.
California Reaches One Million Solar Roofs

In 2006, the landmark Million Solar Roofs Initiative was codified under Senate Bill 1 (Murray, Chapter 132, Statutes of 2006), which set forth a goal of installing solar photovoltaic systems on 1 million roofs throughout California.

In the first half of 2019, California surpassed the million solar roofs goal. Since 2006, there has been steady progress, doubling the number of installations every two to three years. CEC staff estimates the current number of solar systems installed across California at more than 1 million through June 2019. Rapid solar photovoltaic system installation cost reductions have contributed to reaching the million solar roofs goal. Figure 8 shows the continuous growth in California distributed solar installations and the concurrent decline in the installed cost of residential solar systems since 2000.13

Figure 8: Status of California’s Million Solar Roofs Through June 2019

13 Residential installation costs shown in Figure 7 come from Lawrence Berkeley National Laboratory’s 2019 Tracking the Sun Report preliminary analyses discussed in this report and represented in Figure 14.
SB1 and other legislation created the basis for a suite of incentive programs offered by the CEC, the CPUC, and the state’s POUs. These efforts are also broadly referred to as the California Solar Initiative (CSI). The overall goals for all CSI incentive efforts was 3,000 MW of solar energy systems on homes and businesses by the end of 2016. As part of the CSI the CEC’s incentive program, the New Solar Homes Partnership (NSHP), was established with a 360 MW goal for installation of distributed solar on newly constructed homes. NSHP payment claims need to be submitted by August 1, 2021, and funds must be dispersed by December 31, 2021. Figure 9 shows the progress made toward achieving the NSHP and the overall CSI capacity goals.

**Figure 9: California Solar Initiative Capacity Goals Achieved**

![Diagram showing progress towards NSHP and overall CSI capacity goals](source.png)

Source: CEC staff analysis, September 6, 2019.

Building on the success of the NSHP, which supported reductions in the cost for solar and adoption of solar in the building industry, in May 2018, the CEC adopted the 2019 Building Energy Efficiency Standards requiring the installation of solar photovoltaic systems on the majority of new homes starting January 1, 2020. With continuing solar cost declines, solar is now cost-effective for new home construction across the state. Upward trends in solar and energy efficiency have consequently been reducing the amount of delivered electricity and the amount of revenue collected in the energy portion of electricity bills. To stabilize revenues and better align fixed costs with account billing, utilities have been exploring shifting portions of energy charges to fixed components of solar customers’ bills. The state’s commitment to building highly energy-efficient housing served by on-site or community-based solar photovoltaic systems will play an important role in California achieving the goal of a zero-net-carbon economy by 2045.

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Renewable Capacity Across the State

Capacity from large-scale renewable facilities, also referred to as wholesale capacity, has expanded across California, with regional resources and available transmission playing a role in the development patterns. California has also seen significant growth in installed distributed generation, typically under a “net-energy-metering” (NEM) agreement.

In 2019, California is estimated to have more than 24,600 MW of wholesale renewable capacity\(^\text{16}\) of which more than 1,000 MW of capacity came on-line in 2019. Nearly all of the new renewable capacity is large scale solar. The wholesale renewable capacity in Figure 10 is based on data collected by the CEC from power plants within California and is presented by county.\(^\text{17}\)

There are also roughly 9,460 MW of renewable energy projects that have received permits to build in California but are not yet operational, as shown in Figure 10.\(^\text{18}\) These include projects with and without secured purchase contracts. Most of these proposed projects seek to interconnect to the California Independent System Operator (California ISO)-controlled grid.\(^\text{19}\)

In addition to showing RPS-eligible wholesale facilities and permitted projects, Figure 10 also shows the geographic capacity across California counties for on-line distributed generation systems, including BTM (as of June 30, 2019), as represented by the beige through orange shading. Leading the state in installed renewables, Kern County has 5,870 MW of installed wind and solar renewable generation and has another 2,452 MW of renewables projects with environmental permits.

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16 Capacity whose generation is bought and sold in California wholesale markets.

17 Power facilities with a first point of interconnection outside a California balancing authority are aggregated, or collected, and listed by state at the bottom of Appendix Table 2.

18 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 statuses often are amended. The information presented in Figure 9 reflects only the current status of the project.

19 To interconnect with the California ISO-controlled grid, generation operators must submit an interconnection request, which is then placed into an assessment queue for resource interconnection studies. The California ISO interconnection studies provide grid conditions affecting the interconnection decision, including deliverability status, project size, and meeting the interconnection financial security posting requirements.
Figure 10: Map of California Renewable Capacity for On-Line Distributed Generation Systems, RPS-Eligible Wholesale Facilities, and Permitted Projects

Source: CEC staff analysis, June 2019
Renewable Benefits and Opportunities

As the amount of renewable energy increases and new technologies are introduced, California’s electricity grid operations are changing. The amount of renewable generation and the variable nature of solar and wind resources require an updated approach to managing the grid to ensure safety, reliability, and cost-effectiveness in a high-renewable-energy future.

**The 100 Percent Clean Energy Act of 2018**

In September 2018, California adopted the 100 Percent Clean Energy Act, which set a 2045 goal for all delivered electricity to be eligible renewable or zero carbon. This ambitious goal sets a high bar for California’s electricity sector to meet and is expected to lead to significantly lower GHG emissions. In 2018, the rise in California renewables and the availability of low carbon generation in the WECC led to a significant GHG emissions decline in the electricity sector.

**Figure 11** shows the cumulative increase in renewable generation serving California’s load and the decreasing electricity sector GHG emission since 2000. In the last 10 years, GHG emissions from imported electricity are estimated to have declined by more than 60 percent, while emissions from in-state generation have declined by nearly 30 percent. With California environmental policies like the 100 Percent Clean Energy Act of 2018, renewables and zero-carbon resources will continue to increase, and sectoral GHG emissions should continue to drop.

**Figure 11: Increasing Renewable Installations and Decreasing Electricity Sector GHG Emissions**

![Figure 11: Increasing Renewable Installations and Decreasing Electricity Sector GHG Emissions](image)

**Sources:** California Air Resources Board and CEC staff analysis, December 2019

**Benefits of California’s Clean Energy Transition**

Renewable generation offers numerous benefits to Californians, including a safer and more reliable grid, reduced air pollution, reduced GHG emissions, a more diverse generation portfolio, and stable electricity rates. Along with the expansion of California solar and wind generation, there are new opportunities to better use these resources, including the Western Energy...
Imbalance Market (Western EIM)\textsuperscript{20} and the expanded use of energy storage systems. Other opportunities could include leveraging available renewable solar and wind resources for grid operation.

\textbf{California ISO Solar and Wind Oversupply}

As California’s renewable generation has continued to grow, the amount of delivered electricity, or retail sales, has decreased. This decrease in retail sales is partially due to increasing energy efficiency and increasing amounts of solar distributed generation serving on-site load. As the amount of renewables has increased, the amount of oversupply has also increased during certain times of the day. This oversupply has led to an increase in the amount of solar and wind electricity that can be captured in the Western EIM.\textsuperscript{21} \textit{Avoided curtailment} refers to the amount of solar and wind generation that was exported as part of the Western EIM, which would have otherwise been curtailed. \textbf{Figure 12} shows the amount of avoided solar and wind curtailment due to Western EIM and the amount of curtailed solar and wind generation.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{western_eim_curtailments}
\caption{Western Energy Imbalance Market Avoided Curtailments and Solar and Wind Curtailments}
\end{figure}

\textbf{Transmission Planning}

Transmission expansion plays a vital role in enabling the interconnection and deliverability of renewable energy to meet demand and support load-serving entities in meeting the state’s RPS

\textsuperscript{20} The Western EIM is a California ISO established real-time market to buy and sell generation through the western region, and export excess renewable generation.

\textsuperscript{21} \textit{Western Energy Imbalance Market}, https://www.westerneim.com/Pages/About/default.aspx.
requirements. The California ISO conducts its transmission planning process annually to identify system upgrades needed to meet grid reliability requirements, projects that could bring economic benefits to consumers, and projects needed for policy reasons, such as to meet California’s renewable and clean energy goals. Transmission constraints inhibit the ability of California to export excess generation, like midday solar, or import generation, such as afternoon wind from out of state. Both actions help balance regional resources during steep afternoon ramp periods when demand grows and solar generation declines. Furthermore, expanded transmission may increase opportunities for broader participation in the Western EIM.

**Energy Storage**

Storage is another tool that can maximize the benefits of renewable energy resources and help ensure the reliability of the electric grid. Energy storage technologies capture potential energy, electricity, or heat for later use, which can be particularly helpful to balance times when there is too much or not enough electricity to meet demand. The state is seeing significant growth in the installation of energy storage at large generation facilities, commercial sites, and even homes. The variety of storage technologies in commercial use or in the research and development phase is also growing. Grid-connected storage is also growing for many of the same reasons. In July 2019, Los Angeles Department of Water and Power announced the intent to approve a 400 MW solar and 300 MW battery project at a record-setting price of $0.01997 per kWh. Figure 13 provides a summary of co-located storage facilities seeking RPS-certification in California, which demonstrates a trend of facility applications with much higher energy storage nameplate capacities (from the single digits of MWs to the 1000s of MW—including one rated/estimated up to 1,800 MW). (See the Energy Storage Tracking Progress.)

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Nonutility Support for Renewable Energy Development

As renewable energy resources become more cost-competitive and sustainability and environmental programs expand, corporations and other nonutility entities are accelerating their direct purchasing of renewable power. Many corporations, academic institutes, and military bases are committed to increasing the use of renewable electricity, and their actions are contributing to the growth of renewable energy in California. In IOU territories, corporations and other entities participate in the existing limited Direct Access program,25 negotiate custom renewable products from their host utility, purchase unbundled RECs, and enter into virtual power purchase agreements (VPPAs). VPPAs are contracts between a corporate buyer who does not own and is not responsible for electricity. It is simply a financial transaction for the purchase of RECs and not the associated electricity. The buyer’s relationship with its utility at the retail level does not change.26

These accelerated renewable energy direct purchases are bolstered by initiatives such as RE100, uniting companies committed to using 100 percent renewable electricity to power their

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business operations. RE100 members include some of California’s largest companies, such as Apple, Google, and Salesforce, and membership has diversified in recent years to include more than just technology companies. The Business Renewables Center reports corporations purchased 6.53 GW of clean energy nationally in 2018, which exceeds the 2.78 GW contracted in 2017 and nearly doubles the previous record of 3.22 GW contracted in 2015. Figure 14 shows the annual quantity of new contracted corporate renewable power purchase agreements and the associated number of transactions, excluding on-site generation and contracts with operating plants.

![Figure 14: 2014 to 2018 Contracted Corporate Renewable Power Purchases and Transactions](source)

Organizations from the public sector are also taking action that has a direct effect on increasing the state’s use of renewable energy. Academic and military organizations have increased their procurement of renewable resources by contracting for RECs directly. The University of California system announced in September 2018 that it is committing to 100 percent clean electricity supplies by 2025, 20 years ahead of the new goal established by SB 100. This

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27 RE 100. "Overview." http://there100.org/re100.
commitment will cover all 10 of its campuses and related facilities.29 The military is also a strong advocate of renewable energy, and California military installations have been early adopters in developing on-site renewable generation to serve their electricity needs directly, fueled by the understanding that national security and energy security are connected. Military procurements of renewables are expected to increase over the coming years, with the U.S. Department of Defense having a stated goal of producing or procuring at least 25 percent of its total facility energy use from renewable sources by 2025.30

Corporate procurements in California include Kaiser Permanente, which announced in September 2018 that it finalized a VPPA that will provide the financial certainty to enable construction of 180 MW of utility-scale renewable capacity, including a 131 MW solar-integrated-with-storage facility in Riverside County.31 According to a National Renewable Energy Laboratory (NREL) analysis, California had 822 MW of renewable energy purchased by corporations as of September 2017.32 Furthering this trend toward direct corporate purchase of renewables, an analysis by Baker McKenzie found that in the United States in 2017, the volume of offtake agreements33 signed with corporations exceeded the total number of contracts signed with all other offtakers, including utilities.34 The demand for renewable generation from corporate offtakers is expected to increase as corporations look to decarbonize their full supply chains and support the use of renewables to fuel energy-intensive operations, such as data centers.

Globally, according to REN21, corporate entities sourced 465 terawatt-hours (TWh) of renewable electricity through 2017. While tracking and measuring corporate sourcing options and initiatives can be difficult, corporate offtakers and direct investors can be credited with spurring renewable energy generation more rapidly than would have happened without them.35


Continued cost declines in 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 by system size. Preliminary results from the most recent LBNL report shows that for projects completed in 2018, there have been dramatic price declines over time. From 2000-2018, the average price decline was roughly $0.4/W per year in the three customer categories shown below, averaging 2 percent per year for residential, 3 percent for small (≤500 kW) nonresidential systems, and 7 percent for large (>500 kW) nonresidential systems.

As Figure 15 shows, the prices declines were not steady but instead marked by periods of steep drops and leveling off. In 2009, prices began to decline again, steeply at first, an approximate average of $1/W per year through 2013. These price drops have slowed considerably with median prices falling by $0.2/W (5 percent) for residential systems, $0.3/W (6 percent) for small nonresidential, and $0.2/W (5 percent) for large nonresidential systems. This pace of decline has been consistent since 2014. Figure 15 displays median installed system costs (solid line) and the 20th-80th percentile range (shaded areas) for residential systems, small non-residential systems (≤100 kW), and large non-residential systems (>100 kW).36

The installed cost of wind has also decreased over time. The DOE reported that for projects completed in 2017, the national average capacity-weighted installed cost was about $1.61/watt, down $0.80/watt from 2010.37

36 Preliminary 2019 Tracking the Sun results provided by Naim Dargouth, July 26, 2019.
The wholesale cost for renewable electricity has also seen large reductions between 2007 and 2018, as the price of utility-scale solar contracts reported to the CPUC has gone down 78 percent. Between 2007 and 2018, reported prices of RPS contracts declined an average of 11.5 percent per year. Further, in 2018, the trend of falling contract costs resumed and reached a historic low price of $38/MWh for average annual RPS eligible energy contracts for all technology types. These wholesale price declines have made solar and wind cost-competitive with traditional energy resources promoting broader adoption.

California Trends and Opportunities

Renewable Energy Investments

One factor that contributed to the growth in solar installations and the contemporaneous price decline was the suite of well-designed incentive programs that provided financial support to every housing type throughout the state. The CPUC administered a general-market program for existing commercial and residential buildings in IOU territories, also known as the CSI, and two programs for low-income customers, the Multi-Family Affordable Solar Housing (MASH) and Single-Family Affordable Solar Homes (SASH). The CSI incentive programs were designed to provide a declining-rate incentive structure, recognizing that the earliest adopters would pay the highest prices but that over time the need for incentives to offset costs would decline, ultimately leading to a self-sustaining solar industry in which solar PV could be cost-competitive without subsidy. The programs were also designed to address the specific needs of new versus existing housing, multifamily and affordable housing projects, and certain commercial buildings. The POUs individually administered programs for existing buildings. As mentioned, the CEC administers the NSHP, which focuses on newly constructed residential buildings, including single family, multifamily, and affordable housing components. The CEC also establishes the foundational equipment standards for all CSI programs and maintains equipment lists of eligible PV modules, inverters, and other solar equipment. Table 1 summarizes the status of installed renewable capacity and identified state incentive programs.

https://www.energy.gov/sites/prod/files/2018/08/f54/2017_wind_technologies_market_report_8.15.18.v2.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.


40 While equipment on the lists have undergone tests to achieve minimal safety and performance standards, the CEC does not confirm manufacturers’ self-reported information independently. The CEC and the State of California make no claim or warranty on the equipment and its safety, performance or durability.
## Table 1: Summary of State Incentive Programs

<table>
<thead>
<tr>
<th>Program</th>
<th>Agency</th>
<th>Sector Incentivized</th>
<th>Installed Capacity</th>
<th>Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Solar Initiative (CSI) General Market Program 41</td>
<td>CPUC</td>
<td>Existing buildings in IOU territories</td>
<td>1,900</td>
<td>Closed to new applications as of December 31, 2016. 42</td>
</tr>
<tr>
<td>Multifamily Affordable Solar Homes (MASH) 43</td>
<td>CPUC</td>
<td>Multifamily affordable housing in IOU territories</td>
<td>41.9</td>
<td>Program is fully subscribed and are no longer taking new applications. New applications may be accepted if new funding becomes available due to project cancellations.</td>
</tr>
<tr>
<td>Single family Affordable Solar Homes (SASH) 44</td>
<td>CPUC</td>
<td>Low-income single family homeowners in IOU territories</td>
<td>25</td>
<td>Enrolling new participants.</td>
</tr>
<tr>
<td>New Solar Homes Partnership (NSHP)</td>
<td>CEC</td>
<td>New residential construction in IOU territories</td>
<td>168 (14 affordable housing)</td>
<td>Closed to new applications as of June 1, 2018. Payments through 2021. 45</td>
</tr>
<tr>
<td>SB1 POU Programs</td>
<td>Various POUs 46</td>
<td>All sectors in POU territories</td>
<td>500</td>
<td>Most programs closed to new applications.</td>
</tr>
</tbody>
</table>

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42 Exceeded the 1,750 MW installation goal. For more information, see "[About the California Solar Initiative (CSI).](http://www.gosolarcalifornia.ca.gov/about/csi.php)"


45 In 2015, Senate Bill 83 (Committee on Budget and Fiscal Review Chapter 24, Statues of 2015) extended the life of the NSHP program and required all incentives to be encumbered through the issuance of reservations no later than June 1, 2018, and disbursed no later than December 31, 2021.

46 The POUs are required by SB1 to annually report to the CEC program participation and installations through December 31, 2016.
Ensuring the Benefits of Renewable Energy Reach All Californians

In achieving the state’s climate and renewable energy goals, the CEC is taking steps to ensure that the benefits are realized by all Californians, including low-income residents and those in the most vulnerable communities.

In December 2016, the CEC published a report, as mandated by SB 350, 47 that explored the barriers to and opportunities for expanding low-income customers’ access to energy efficiency, weatherization, and renewable energy investments. One of the barriers mentioned in the report was the lack of low-income renters’ ability to participate in and benefit from renewable energy developments. Among a range of suggested actions, the report recommended that the state enable economic advantages of solar to be readily accessible to low-income and disadvantaged populations across California.

Affected state agencies continue to work together closely with the Governor’s Office to implement this and the other recommendations from the report. A summary of efforts and accomplishments for including low-income and disadvantaged communities with the state’s energy initiatives can be found in a separate CEC Tracking Progress document focused on Energy Equity Indicators, which is also available as an interactive Web map and a Tracking Progress page. 48

Several existing programs overseen by the CEC are performing well in providing opportunities for low-income and disadvantaged consumers to participate in the clean energy economy. For example, since the beginning of 2007, the NSHP program has awarded roughly 22 percent of program funding, equivalent to almost $41 million, to projects in low-income or disadvantaged census tracts. 49 Other CEC programs have fared even better in this regard. Looking forward, the recently announced Renewable Energy for Agriculture Program (REAP) aims to develop renewable energy capacity on agricultural lands, with a preference for funding to be awarded to projects in disadvantaged communities. 50

In support of the state’s energy equity goals, the CPUC recently adopted a decision implementing several new programs focused on expanding renewable energy access in low-income communities and disadvantaged communities. Table 2 shows the programs. Other agencies have also announced a range of new programs designed with this priority in mind.

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including the California Department of Community Services and Development’s Community Solar Pilot Program.  

Table 2: CPUC Low-Income and Disadvantaged Community-Focused Renewable Energy Programs

<table>
<thead>
<tr>
<th>Program</th>
<th>Sector Incentivized</th>
<th>Available funding</th>
<th>Capacity Goal or Cap</th>
<th>Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar on Multifamily Affordable Housing (SOMAH)</td>
<td>Multifamily affordable housing in IOU territories</td>
<td>Up to $100 million annually</td>
<td>300 MW by 2030</td>
<td>First year is fully subscribed.</td>
</tr>
<tr>
<td>Disadvantaged Community-Single family Affordable Solar Homes (DAC-SASH)</td>
<td>Low-income residents and disadvantaged communities in IOU territories</td>
<td>No specified budget</td>
<td>158 MW capped enrollment</td>
<td>Launched in September 2019</td>
</tr>
<tr>
<td>Disadvantaged Community-Green Tariff (DAC-GT)</td>
<td>Low-income residents and disadvantaged communities in IOU territories</td>
<td>No specified budget</td>
<td>41 MW capped enrollment</td>
<td>Depending on the utility, customers will be able to participate as early as Spring 2020</td>
</tr>
<tr>
<td>Community Solar Green Tariff (CSGT)</td>
<td>Electricity customers in IOU territories</td>
<td>Utility credit for ECR participation</td>
<td>600 MW capped enrollment</td>
<td>Green Tariff (GT) and Enhanced Community Renewables (ECR) components are both active.</td>
</tr>
<tr>
<td>Green Tariff Shared Renewables (GTSR)</td>
<td>Electricity customers in IOU territories</td>
<td>Utility credit for ECR participation</td>
<td>600 MW capped enrollment</td>
<td>Green Tariff (GT) and Enhanced Community Renewables (ECR) components are both active.</td>
</tr>
</tbody>
</table>

Source: CPUC program websites, August 2019

52 The SOMAH Program Handbook and other information is available on the SOMAH program website, https://www.calsomah.org/.
54 CPUC, “Alternate Decision Adopting Alternatives to Promote Solar Distributed Generation in Disadvantaged Communities,” Order Instituting Rulemaking to Develop a Successor to Existing Net Energy Metering Tariffs Pursuant to Public Utilities Code Section 2827.1, and to Address Other Issues Related to Net Energy Metering, D.18-06-027,” http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M216/K789/216789285.PDF.
California’s Evolving Electricity Markets

Community Choice Aggregators

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 been shifting, largely due to the increase in self-generation and the rise of CCAs, which are local public agencies created by joint powers agreements or city or county ordinance that can directly develop and buy electricity on behalf of their customers.

Many CCAs offer products that are marketed as more renewable than required by the RPS, and many have specific goals to procure local distributed generation resources. The growth of CCAs has increased significantly the number of retail sellers in California and creates the potential opportunity for the procurement of more renewable energy since the CCA model centers upon the value of including renewable and clean energy in customer’s power mix, and offering products with higher percent shares of renewables.

During the 2011-2013 RPS Compliance Period, only one CCA was serving customers; by the end of the 2014-2016 RPS Compliance Period, that number grew to five. As of the end of 2019, 19 CCAs were serving customers in California, and an additional 5 more CCA launches or expansions are anticipated through 2020.56 Figure 16 shows the entities, by the end of 2019, operating as, anticipating launching, or investigating becoming a CCA. RPS compliance reports submitted by the operational CCAs during the first and second RPS compliance periods indicate that they have met current RPS targets.

The CPUC’s report titled *California Customer Choice, An Evaluation of Regulatory Framework Options for an Evolving Energy Market* reports that by the end of 2018, as much as 25 percent of IOU retail electric load will be served by a combination of rooftop solar, CCAs, and direct access providers. A CPUC staff white paper further predicted that this number could grow to 85 percent in the next decade, which would represent as many as 15 million to 20 million

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The potential widespread growth of CCAs presents opportunities and challenges for renewable development, as well as raises broader considerations of reliability, load uncertainty, and cost allocation. There are also potential uncertainties raised by recent fee changes affecting CCAs. At the same time, the growth of California CCAs could present a significant opportunity to exceed the state-mandated RPS targets. In July 2019, CalCCA could present that CCAs signed more than 2,000 MW of mostly long-term renewable contracts.

Building and Transportation Electrification

The state’s decarbonization goals have spurred a trend toward electrification as a method to reduce emission from the building and transportation sectors. Increased building and transportation electrification will shift uses traditionally reliant on fossil fuels to energy served by renewable and zero-carbon electricity resources.

The ability to implement effective decarbonization techniques in new and existing homes and businesses is needed to achieve California’s carbon emission reduction goals. The transition to electrified buildings will result in the move of space and water heating, cooking, and clothes drying away from higher emitting fossil fuels to renewable and zero-carbon electric generation resources. Commercial building decarbonization may present a bigger challenge because of the size and complexity of commercial buildings but also offers an opportunity to leverage renewables to significantly improve air quality and meet carbon emission reduction goals.


59 CPUC. October 2018. “Alternate Proposed Decision Modifying the Power Charge Indifference Adjustment Methodology, Rulemaking 17-06-026.” http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M232/K161/232161603.PDF.


California’s transportation sector is large and contributes significantly to California’s GHG emissions. There are local and state programs promoting clean alternative fuel vehicles, such as the CEC’s Clean Transportation Program and CARB’s California Vehicle Rebate Program and Low Carbon Fuel Standard. Supported by these programs, the number of California registered plug-in electric vehicles (PEV) is estimated to increase. In 2018, the number of California registered PEVs increased by nearly 40 percent from 2017. Preliminary CEC forecasts indicate the growing number of California PEVs will increase transportation electricity demand nearly five times by 2030 to 16,000 GWh while decreasing the use of fossil fuels and the associated criteria pollutants and GHG emissions. Figure 17 shows the number of PEV vehicles registered in California and the 2019 Preliminary Transportation Electricity Demand forecast. (See the Transportation Tracking Progress.)

Figure 17: Registered California Plug-in Electric Vehicles and Preliminary 2019 Transportation Electricity Demand Forecast

![Graph showing registered California Plug-in Electric Vehicles and Preliminary 2019 Transportation Electricity Demand Forecast.](source: DMV Registration database and CEC staff analysis, August 2019)

Contacts:

- Renewable Energy Tracking Progress report: Malachi Weng-Gutierrez, Malachi.Weng-Gutierrez@energy.ca.gov
- Renewable generation: Hazel Aragon, Hazel.Aragon@energy.ca.gov
- Renewable capacity: Michael Nyberg, Michael.Nyberg@energy.ca.gov
- Behind-the-Meter generation: Sudhakar Konala, Sudhakar.Konala@energy.ca.gov
- Renewable energy facilities permitting: Joseph Merrill, Joseph.Merrill@energy.ca.gov
- Transportation electrification: Mark Palmere, Mark.Palmere@energy.ca.gov

Media inquiries should be sent to the Media and Public Communications Office at (916) 654-4989 or by email at mediaoffice@energy.ca.gov.

The Renewable Tracking Progress appendix provides resources for more information on CEC programs, projects, state energy goals, California electricity retail sales, and data sources used for the figures and tables in this report.