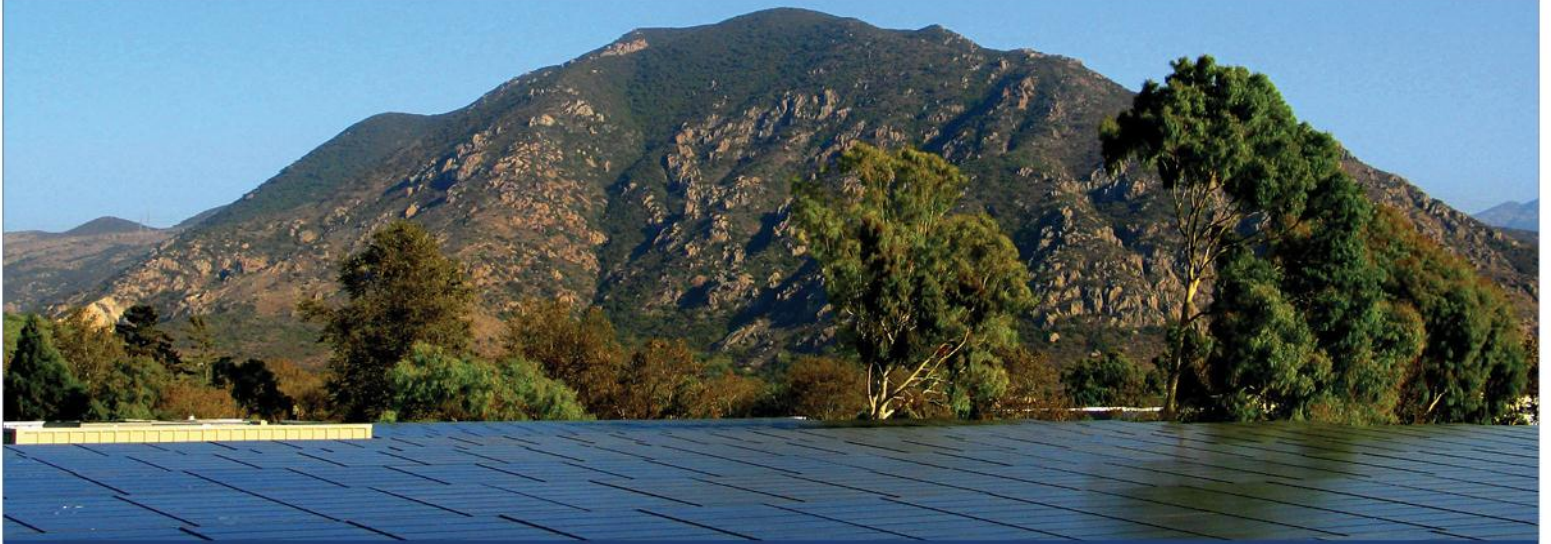




California Public Utilities Commission

California Solar Initiative Annual Program Assessment



June 2014



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Prepared by the
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1. Executive Summary

1.1. Introduction

In January 2007, California began a \$3.3 billion ratepayer-funded effort to install 3,000 megawatts (MW) of new solar over the next decade and transform the market for solar energy by reducing the cost of solar generating equipment. The California Public Utilities Commission's (CPUC) portion of the solar effort is known as the California Solar Initiative (CSI) Program. The CSI program goal is to install 1,940 MW¹ of solar capacity by the end of 2016, and, along with other statewide solar programs, transition the solar industry to a point where it can be self-sustaining without subsidies.

This Annual Program Assessment meets the statutory requirement for an annual report to the Legislature on the progress of the CSI Program.² Other state authorized programs, including the New Solar Homes Partnership (NSHP) and publicly-owned utilities' solar offerings, are not included in this report.³

The market for solar generating equipment in California has grown at a rapid pace since the beginning of the CSI Program. As evidenced by increasing annual rates of new solar installations and cumulative installed capacity over the life of the program, California is well along the path to achieving the installed capacity goals set forth by the legislation authorizing the CSI Program, Senate Bill (SB) 1 (Murray, 2006).

1.2. Key Report Contents

This report contains current information on distributed solar energy systems in California, including systems installed through the CSI General Market Program, and those installed through other incentive programs. In addition, this report provides detailed information on CSI General Market Program participation, installed capacity, equipment costs, and program impacts. The report also includes information on the progress of other CSI Program components, including the Single-Family Affordable Solar Homes Program (SASH); the Multifamily Affordable Solar Housing Program (MASH); the CSI-Thermal Program; the CSI-Thermal Low Income Program; and the Research, Development and Demonstration (RD&D) Program. This

¹ This goal includes the CSI General Market Program goal of installing 1,750 MW of capacity by the end of 2016.

² Public Utilities (PU) Code Section 2851 (c)(3) states, "On or before June 30, 2009, and by June 30th of every year thereafter, the commission shall submit to the Legislature an assessment of the success of the California Solar Initiative program." The CPUC submitted the first CSI Annual Program Assessment on June 30, 2009, available at: <http://www.cpuc.ca.gov/PUC/energy/Solar/apa09.htm>.

³ Information on non-CPUC jurisdictional solar programs is available at www.gosolarcalifornia.ca.gov.

report also includes information on Net Energy Metering (NEM) and other relevant policy updates.

1.2.1 Installed Solar Highlights

- Through the end of the first quarter of 2014, an estimated 2,139 MW⁴ of solar capacity has been installed on the customer side of the meter at 227,141 customer sites in the large investor-owned utility (IOU) territories.
- A record 620 MW were installed in 2013, a growth of 73 percent from capacity installed in 2012.

1.2.2 CSI General Market Program Highlights

- To date, the CSI General Market Program has installed 1,455 MW, or 83 percent of its 1,750 MW program goal, with another 225 MW, or 13 percent of the goal, reserved in pending projects.
- Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E)⁵ territories have reserved and installed enough solar capacity to reach their goals in the residential sector.⁶
- PG&E and SDG&E territories have achieved the most installations in the non-residential (commercial, industrial, government, non-profit, and agricultural properties) sector, having met or nearly met 100 percent of their non-residential installation goals.
- The lowest installation rates for the non-residential sector are in SCE territory, where 55 percent of the sector's goals have been met.
- As the CSI Program phases out, NEM tariffs and the Federal Income Tax Credit (ITC) are playing a larger role relative to available CSI incentives.

1.2.3 Other Program Highlights

- **Assembly Bill (AB) 217**
 - In October 2013, Assembly Bill (AB) 217 (Bradford) was signed into law by Governor Brown. AB 217 extends the SASH and MASH programs with \$108

⁴ The installed capacity data cited in this report does not include solar capacity installed on the system side of the meter through the Renewables Portfolio Standard (RPS). The most recent RPS quarterly report can be found at <http://www.cpuc.ca.gov/PUC/energy/Renewables/>.

⁵ The California Center for Sustainable Energy (CCSE) administers the CSI program in SDG&E's service territory.

⁶ In response to a Petition to Modify, the Commission issued Decision (D.)13-10-026, which allowed for a reallocation of program goals between the residential and non-residential programs, effectively re-opening CCSE's residential program. PG&E's and SCE's residential programs remain closed.

million in new funding, to run until the additional incentives are claimed or until 2021, whichever is earlier. AB 217 sets a capacity target of 50 MW of additional solar capacity on affordable housing across the three IOU territories. In addition, AB 217 requires that these programs be designed to maximize overall benefit to ratepayers, enroll participants in the Energy Savings Assistance Program if eligible, and provide job training and employment opportunities in the solar energy and energy efficiency sectors of the economy. These program changes will be implemented in the Commission’s Rulemaking (R.)12-11-005 distributed generation proceeding.

- **Single-Family Affordable Solar Homes (SASH)**

- Since the program was launched in December of 2008, SASH has received a total of 4,232 applications which have resulted in 11.1 MW of installed capacity on eligible homes, with another 1.6 MW currently in progress.
- SASH applicants have received or reserved a total of \$77 million of the available \$92 million incentive budget in support for their residential solar systems.

- **Multifamily Affordable Solar Housing (MASH)**

- As of May 9, 2014, MASH had 340 completed projects, representing a total capacity of 22.1 MW. There are an additional 62 MASH projects in process, for a total capacity of 8.2 MW.
- MASH applicants have received or reserved 100 percent of the available \$95 million MASH incentive budget.
- Virtual Net Metering⁷ (VNM) has allowed thousands of tenants to receive the direct benefits of solar as reductions in their monthly electric bills.

- **CSI-Thermal Program**

- In just over four years of operation, the program has approved 1,665 applications for \$22.7 million in incentives of the available \$205 million CSI-Thermal incentive budget.
- D.13-08-004, adopted in August of 2013, allowed the program to offer incentives for non-single family swimming pools.

- **Research, Development, Demonstration and Deployment (RD&D) Program**

- The CSI RD&D Program has conducted five project solicitations since its inception, resulting in grant funding for 36 projects, totaling \$44.4 million. Funded projects have focused on the following areas:
 - Integration of solar photovoltaics (PV) into the electricity grid

⁷ VNM was first approved by the Commission when the MASH Program was adopted in D.08-10-036. It has since been expanded to include all multi-tenant, multi-meter properties. VNM is a tariff which allows the bill credits from a single solar system to be shared among multiple customer accounts.

- Energy generation technologies and business development
- Grid integration and production technologies
- No additional project solicitations are planned.

1.2.4 Net Energy Metering (NEM)

- All but 163 MW, or 9 percent, of solar capacity interconnected to the grid in the three large IOU territories is signed up for NEM.
- In October 2013, in compliance with AB 2514 (Bradford, 2012), the Commission released a study on the costs and benefits of the NEM program.⁸
- Signed by the Governor on October 7, 2013, AB 327 (Perea) required that, among other requirements, the existing NEM tariff be extended beyond 2014, and that the CPUC develop a successor tariff to the existing NEM tariff.
- In March 2014, the Commission adopted D.14-03-041, in compliance with AB 327 (Perea, 2013), establishing a 20-year transition period for customer-generators to be eligible to receive service under the currently applicable NEM tariffs.

⁸ See, http://www.cpuc.ca.gov/PUC/energy/Solar/nem_cost_effectiveness_evaluation.htm

2. Introduction

2.1. Background on California Solar Initiative (CSI)

The CSI Program is the solar rebate program for California investor-owned utilities: PG&E, SCE, and SDG&E. Incentives under the CSI Program are available for solar PV systems and solar thermal technologies. Existing residential homes, as well as all commercial, industrial, government, non-profit, and agricultural properties within the service territories of the large electric and gas IOUs are eligible for CSI Program participation.⁹

The goals of the CSI Program are to:

- Install 1,940 MW of distributed solar generation capacity in the large electric IOU service territories, and displace 585 million therms of natural gas usage, or the equivalent output of 200,000 solar thermal systems; and
- Transform the market for solar energy systems so that it is price competitive and self-sustaining.

The CSI Program focuses exclusively on solar energy systems used by IOU customers who want to offset some or all of their onsite energy consumption. In the case of the solar PV program, the solar energy systems funded under the program reduce the customer's electricity consumption from the grid. In the case of the solar thermal program, the solar energy systems reduce the customer's gas or electricity consumption, depending upon the customer's energy source for their existing hot water system. The CSI Program does not fund wholesale solar power plants, which are designed to serve the electric grid and contribute to the state's RPS requirement. The electricity generated by CSI systems, however, does contribute indirectly to the RPS by reducing demand when serving customer load. In addition, the owner of the CSI system owns the renewable energy credits (RECs) associated with the system's generation and may sell the RECs to retail sellers to contribute to the RPS targets.

2.2. CSI Program Components

The CSI Program has several program components, as shown in Table 1, each with its own Program Administrator for each large IOU territory, and budgets overseen by the CPUC:

⁹ The electric-displacing portion of CSI Program, which covers solar PV and some solar thermal systems, was authorized by the CPUC in a series of regulatory decisions between 2006 and 2011. In addition, the Legislature expressly authorized the CPUC to create the CSI Program in 2006 in SB 1 (Murray, 2006). The gas-displacing solar thermal portion of the CSI was authorized by the Legislature in AB 1470 (Huffman, 2007) and implemented by the CPUC in early 2010 after the required evaluation of a pilot program in the San Diego area.

- **The CSI General Market Solar Program** provides incentives for residential and non-residential systems from one kilowatt (kW) to one MW. The General Market Program Administrators are PG&E, SCE, and CCSE in SDG&E territory. The goal of the general market rebate program is to incentivize 1,750 MW of customer-side solar capacity using a ten-year budget of \$1.9 billion for both incentives and program administration. The General Market solar program funds solar PV and solar thermal technologies through the end of 2016.
- **The CSI Single-Family Affordable Solar Homes (SASH) Program** provides solar incentives to qualifying single-family, low income housing owners. The SASH Program is administered through a statewide Program Manager, GRID Alternatives, with a budget of \$108 million. The SASH program offers job training to hundreds of volunteers and workforce development participants, and offers competitive opportunities for solar installers through a subcontractor program. As described above, AB 217 extends funding for this program until 2021 at the latest.
- **The CSI Multifamily Affordable Solar Housing (MASH) Program** provides solar incentives to multifamily low income housing facilities. The MASH Program also has a \$108 million budget and is administered through the same Program Administrators as the General Market solar program: PG&E, SCE, and CCSE. The popularity of this fully subscribed program has resulted in the recent expansion of the VNM tariffs, which allow a system owner to share bill credits for solar production with the building's tenants. Like the SASH Program, the MASH Program has been extended by the Legislature until 2021 at the latest, through AB 217.
- **The CSI Research, Development, Demonstration and Deployment (RD&D) Program** provides grants to develop and deploy solar technologies that can advance the overall goals of the CSI Program, including achieving targets for capacity, cost, and a self-sustaining solar industry in California. The RD&D Program is administered through the RD&D Program Manager, Itron, Inc., and has a budget of \$50 million.
- **The CSI-Thermal Program** provides solar thermal incentives to eligible systems such as gas or electric-displacing solar water heaters. The CSI-Thermal program is funded separately depending upon whether the project is electric-displacing or gas-displacing. There are four Program Administrators for the CSI Thermal Program. PG&E, SCE and CCSE administer the electric-displacing portion of the Program in their respective territories, and PG&E, Southern California Gas Company (SoCalGas) and CCSE administer the Program for the gas-displacing portion. In mid-April 2012, the CSI-Thermal program launched a \$5 million, two-year public relations contract to spotlight the benefits of solar thermal technologies to targeted end users. The CSI-Thermal Program now consists of three subcomponents: single-family residential, multifamily/commercial, and low income.

2.3. CSI Program Budget

The CSI Program has two funding streams, depending upon whether the rebated technology displaces electricity or natural gas. The electric portion of the CSI Program has a 10-year budget of \$2.2 billion, collected from electric ratepayers as authorized by SB 1 (Murray, 2006). In AB 217 (Bradford, 2013), the Legislature extended the CSI low income programs with \$108 million in new funding, to continue until the incentives are claimed or 2021, whichever is earlier. The natural gas-displacing portion of the CSI Program, known as CSI-Thermal, is funded by AB 1470 (Huffman, 2007), which authorized \$250 million in incentives for solar thermal technologies through 2017 to be collected from gas ratepayers.

Table 1: CSI Budget by Program Component

Program Component	Budget (\$ Millions)	Goal
General Market Solar Program (includes PV and electric displacing solar thermal technologies)	\$1,897	1,750 MW
Single-family Affordable Solar Homes (SASH)	\$108	TBD*
Multifamily Affordable Solar Housing (MASH)	\$108	TBD*
Research, Development, Demonstration, and Deployment (RD&D)	\$50	N/A
Solar Water Heating Pilot Program (SWHPP)**	\$2.6	750 systems
Sub-Total: CSI Electric Budget (Electric Displacing)	\$2,167	1,940 MW
CSI Thermal Program (Gas-Displacing)	\$250	585 million therms ¹⁰
Total CSI Budget	\$2,417	

Source: CPUC D.06-12-033, p. 28 established goal of the General Market Program as 1,750 MW. In addition, D.10-01-022 established the CSI-Thermal Program pursuant to AB 1470 (Huffman, 2008) and SB 1 (Murray, 2006).

*The CPUC decisions on MASH and SASH did not explicitly adopt a MW program goal; however, the CPUC did adopt a total CSI program goal of 1,940 MW in D.06-12-033. The Legislature, via AB 217, set a goal of installing an additional 50 MW total. The CPUC will address the revised goal in its implementation of AB 217 later this year.

**The SWHPP was a pilot program that preceded the CSI-Thermal Program, and is now closed.

In most cases, the budget is allocated across the Program Administrators in proportion with their annual electric sales: PG&E at 43.7 percent, SCE at 46.0 percent, and SDG&E at 10.3 percent.

Weekly and daily budget updates for the General Market incentive buckets are available online (http://www.californiasolarstatistics.ca.gov/reports/budget_forecast/). The online reports display the program capacity goals, original dollar allocations, and capacity and dollars confirmed, under review, and still available. They also break down the dollars confirmed, in payment, and paid,

¹⁰ The CSI-Thermal goal of 585 million therms is the equivalent of 200,000 SWH residential systems.

according to the type of project: Expected Performance-Based Buydown (EPBB), Performance-Based Incentive (PBI), or thermal electric (electric-displacing CSI-Thermal program dollars come out of the General Market budget).

2.4. CSI Program Regulatory Process

Between 2006 and 2014, the Commission adopted a number of regulatory decisions establishing the CSI Program, as well as various CSI Program components.¹¹ Rules and procedures pertaining to distributed generation, including the CSI Program, are currently developed within Rulemaking (R.)12-11-005.

In addition to formal regulatory decisions, the CPUC and CSI Program Administrators have made numerous CSI Program changes based on regular informal feedback from program stakeholders and in response to issues that arise during program implementation. To gather feedback on the program, the CSI Program Administrators host quarterly public CSI program forums to discuss potential program changes with stakeholders.¹²

The Program Administrators periodically file program rule changes via advice letters, consistent with the CPUC-established CSI Program Handbook process. These are processed by Energy Division staff in accordance with General Order (G.O.) 96-B.¹³ As a result, the CPUC has revised and reissued the CSI Program Handbook numerous times since the program first began.

2.4.1 CSI General Market Program Decisions

Key decisions related to the CSI Program include (but are not limited to):

- D.06-01-024 adopted the CSI Program.
- D.06-08-028 adopted Performance Based Incentives, an administrative structure, and other program start-up elements.
- D.06-12-033 modified earlier decisions to conform to SB 1.
- D.07-05-007 modified the incentive adjustment mechanism to account for program dropouts.
- D.07-05-047 established interim marketing and outreach objectives for the program.

¹¹ The Commission has developed the CSI program in a series of Rulemakings (R) since 2006, including R.08-03-008 and R.06-03-004, with precedents from even earlier proceedings like R.04-03-017. Each of the decisions noted herein occurs in one of those dockets, unless otherwise noted.

¹² Information on the CSI Program Forums can be found at: <http://www.cpuc.ca.gov/PUC/energy/solar/forum.htm>

¹³ See, [General Order 96-B here: http://docs.cpuc.ca.gov/PUBLISHED/GENERAL_ORDER/164747.htm](http://docs.cpuc.ca.gov/PUBLISHED/GENERAL_ORDER/164747.htm)

- D.07-07-028 and D.08-01-030 modified metering and performance monitoring requirements for the program.
- On July 29, 2008, the Assigned Commissioner issued a Ruling establishing a Program Evaluation Plan for the CSI.
- D.10-09-046 modified the CSI General Market budget, and shifted \$40 million from the program administration budget into the incentive budget as partial mitigation for higher than anticipated performance payments under the “PBI” mechanism.
- D.11-07-031 modified prior CSI decisions, including D.06-08-033 and D.08-10-036, based on a comprehensive staff proposal.
- D.11-12-019 modified the CSI budget requirement, effectively adding \$200 million in rebate funding, in response to SB 585 (Kehoe, 2011).
- D.13-10-026 modified the CSI budget requirement in response to a petition for modification submitted by the California Center for Sustainable Energy.

2.4.2 Other CSI Program Component Decisions

- D.06-08-028 established the Solar Water Heating Pilot Program in SDG&E territory.
- D.07-09-042 established the CSI RD&D program.
- D.07-11-045 established the CSI SASH program.
- D.08-10-036 established the CSI MASH program.
- D.10-01-022 established the CSI-Thermal Program to provide solar water heating incentives statewide.
- D.11-10-015 established the Low Income Solar Water Heating Component of the CSI-Thermal program.
- D.11-11-005 established the eligibility of propane-displacing technologies for the CSI-Thermal Program.
- D.12-08-008 modified incentives for the CSI-Thermal Program.
- D.13-02-018 established a performance-based incentive structure for the CSI-Thermal Program and expanded program eligibility to process heat, solar cooling and combination systems.
- D.13-08-004 established the eligibility of swimming pool technologies for the CSI-Thermal Program.

3. Solar Installed Through 2013

This section of the report summarizes data on the cumulative installed capacity¹⁴ and number of solar projects installed in California IOU territories and provides a table showing all distributed solar installed statewide.

3.1. Investor-Owned Utility Territory Solar Installations

Through the end of 2013, there were 1,982 MW of solar capacity installed at 207,931 sites in the state's IOU territories. This data includes solar projects interconnected under any of the IOU solar programs, including CSI, New Solar Homes Partnership (NSHP), Emerging Renewables Program (ERP), and the Self-Generation Incentive Program (SGIP). IOU data does not include solar projects installed in Publicly-Owned Utility (POU) areas, such as Los Angeles Department of Water and Power (LADWP) or Sacramento Municipal Utility District (SMUD), nor does it include data from multi-jurisdictional utilities, such as the Pacific Power California Solar Incentive Program.¹⁵ CSI Program-only data is featured in Section 4.

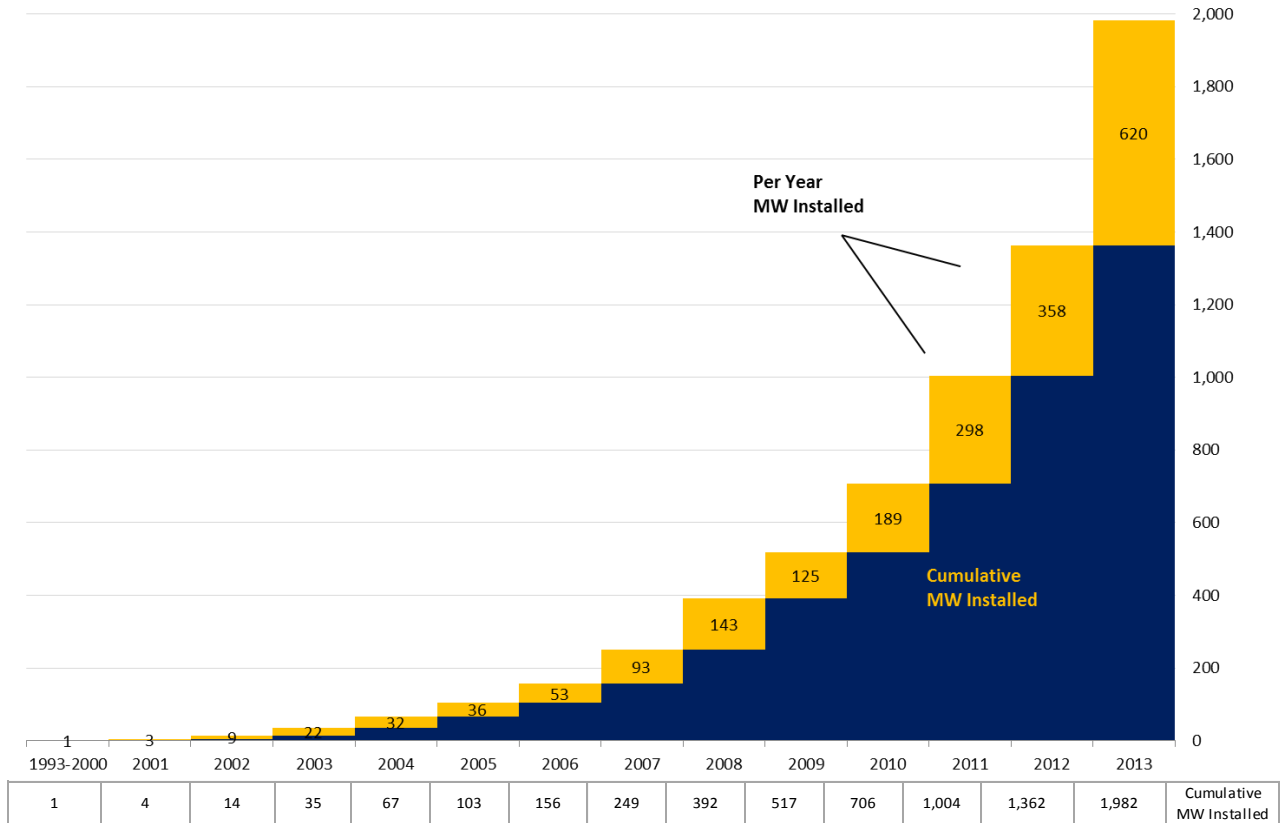
Figure 1 shows the amount of solar capacity installed by customers by year in IOU territories, with 620 MW installed in 2013, the represents a growth of 73 percent from 2012. This figure relies on interconnection data submitted to the CPUC by the utilities (rather than data specific to the CSI Program featured elsewhere in this report), and it does not distinguish which solar program provided funding for the solar project.

Figure 2 uses the same data as Figure 1, but shows the data as the number of installations. There were 66,097 solar projects installed in the IOU territories in 2013, a growth of 73 percent from 2012. All of the solar capacity identified in Figure 1 and Figure 2 is installed on customer sites, and does not include solar power plants installed on the wholesale side of the meter for use in compliance with the RPS.

¹⁴ All data in this assessment are for grid-tied solar PV (i.e. interconnected to the utility grid), unless otherwise noted. All solar in this report is customer-side of the meter self-generation designed to serve onsite load. All references to capacity are reported in “CEC-AC” units, which is the industry standard for net electricity output in MW based on the California Energy Commission’s Alternating Current rating of solar panels. The “CEC-AC” rating tends to be slightly less than the nameplate capacity.

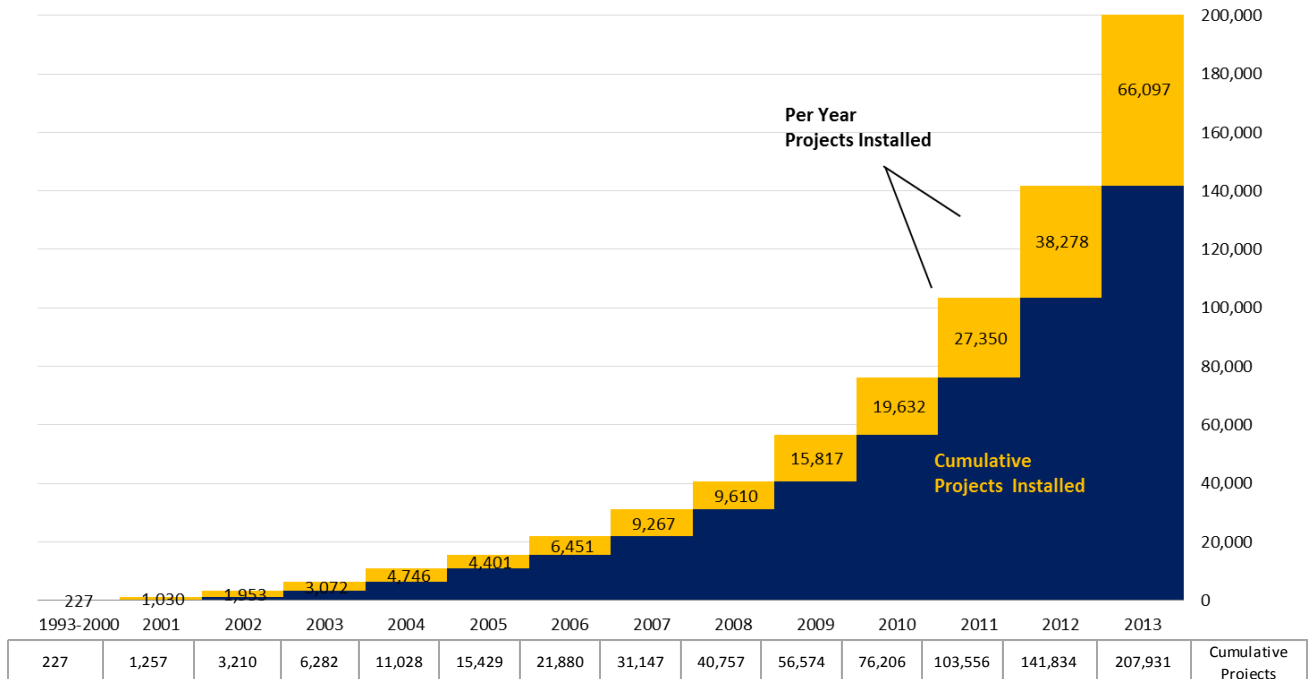
¹⁵ The PPCSIP program is authorized to provide incentives for 4 MW of solar energy through July 1, 2015.

Figure 1: Customer-Sited Solar Capacity Installed in CA's IOU Territories, 1993-2013



Data is through December 31, 2013. It Includes CSI, NSHP, ERP and SGIP data, but not POU or RPS data.

Figure 2: Customer-Sited Solar Projects Installed in CA's IOU Territories, 1993-2013



Data is through December 31, 2013. It Includes CSI, NSHP, ERP and SGIP data, but not POU or RPS data.

3.2. Net Energy Metering

3.2.1 Program Background

The majority of solar customers are enrolled in NEM tariffs, pursuant to PU Code Section 2827. The NEM Program supports onsite solar installations up to 1 MW in capacity designed to offset a portion, or all, of the customer’s electrical load. CSI Program participants are eligible for utility interconnection and NEM tariffs that facilitate solar by allowing solar customers to feed limited amounts of excess electricity into the grid. Under NEM, customers receive a bill credit (in dollars) based on the full retail rate (including generation, transmission, and distribution rate components) for any excess generation (in kWh) that is exported back to the grid. In periods when a customer’s bill is negative (because the value of the energy produced by the distributed generation facility exceeds the value of the energy consumed on site), the negative balance is carried forward up to one year, at which point customers may elect to receive net surplus compensation for any electricity produced in excess of on-site load, or apply the net surplus compensation credit towards future consumption.

Some solar projects, especially those with a solar system that is small relative to total load, so that exports to the grid would be unlikely, opt to take utility service under a non-NEM tariff. Table 2 shows the total solar interconnections compared to the customers on solar NEM tariffs. Only 163 MW, or 9 percent, of solar capacity in the state is not signed up for NEM.

Table 2: Solar Interconnections and Solar NEM Customers by Utility

	MWs Interconnected	Customers Interconnected	MWs on NEM tariffs	Customers on NEM Tariffs
PG&E	1,041 MW	106,494	977 MW	106,196
SCE	706 MW	69,482	616 MW	69,395
SDG&E	235 MW	31,955	226 MW	31,916
Total	1,982 MW	207,931	1,819 MW	207,507

Data is through December 2013. It Includes CSI, NSHP, ERP and SGIP data, but not POU or RPS data.

3.2.2 2013 California NEM Ratepayer Impacts Evaluation

On October 28, 2013, the Commission issued a report on the costs and benefits of the NEM program, in compliance with AB 2514 (Bradford, 2012).¹⁶ The study evaluated the costs and benefits of the NEM program using two separate measures: a cost-benefit analysis, which estimates the net benefits (or costs) of a demand-side resource or program from the perspective of non-participating customers, and a cost of service test, which compares the utility cost of serving NEM customers with their actual bill payments. Though the estimates contained in the report are subject to certain methodological limitations, the analysis suggests that NEM generation resulted in a net cost to ratepayers of \$79 to \$252 million in 2013, and would reach costs of \$370 million to \$1 billion per year in 2020 under a complete build-out of systems to the 5 percent NEM program cap.¹⁷ The report also notes that the costs of NEM are largely a function of retail rates designs, since NEM customer-generators receive benefits in the form of bill credits valued at the full retail rate, and that any future changes to the retail rate structure would have a significant impact on the results.¹⁸ With regard to the cost of service analysis, the study finds that NEM customers appear to be paying slightly more than their full cost of service.

3.2.3 NEM Program Cap

Pursuant to AB 327, every large electrical corporation is required to make NEM available to eligible customer-generators until July 1, 2017, or the date when a utility reaches its 5 percent NEM program cap, whichever is earlier. Table 3 shows the current progress towards the 5 percent NEM cap.

Table 3: Progress Towards the 5 Percent NEM Cap

	MWs on NEM Tariffs	Aggregate Customer Peak Demand	Progress towards 5 Percent NEM Cap
PG&E	1,050 MW	48,177 MW	2.18%
SCE	704 MW	44,807 MW	1.57%
SDG&E	270 MW	12,134 MW	2.23%

Data through March 2014.

AB 327 also directs the Commission to establish a transition period for customers enrolled in the current NEM program, and adopt a successor tariff or contract to NEM by December 31, 2015.

¹⁶ California Net Energy Metering Ratepayer Impacts Evaluation, Prepared by California Public Utilities Commission Energy Division and Energy and Environmental Consultants, October 28, 2013 (NEM Evaluation). <http://www.cpuc.ca.gov/NR/rdonlyres/75573B69-D5C8-45D3-BE22-3074EAB16D87/0/NEMReport.pdf>.

¹⁷ The 5 percent NEM program cap is calculated by the amount of installed NEM capacity relative to a utility's highest non-coincident peak demand, or the sum of each individual customer's peak demand, in any given calendar year.

¹⁸ Pursuant to AB 327, the CPUC is in the process of examining residential rate designs that more accurately reflect the true cost of utility service in its residential rate rulemaking, Proceeding R.12-06-013.

In March 2014, the Commission adopted D.04-03-041, establishing a 20-year transition period for customers to remain on NEM tariffs.¹⁹ Specifically, the decision established a transition period of 20 years, beginning on the year the system was interconnected, during which time systems already enrolled in NEM tariffs on the earlier of July 1, 2017, or the date when a utility reaches its statutorily required 5 percent NEM cap, may continue to take service under NEM.

3.3. California Statewide Solar Installations

Through the end of the first quarter of 2014, California has an estimated 2,302 MW of installed solar capacity at 246,666 customer sites. As detailed in Table 4, this statewide solar data combines the best available information on IOU interconnections through March 2014, and POU solar data through 2012. The CPUC tracks IOU interconnection data on a quarterly basis and CSI program data is available weekly. Data on POU solar projects is collected by the California Energy Commission (CEC), and, to date, the information is only available annually every July for the previous year. The statistics shown in Table 4 provides the best available estimate of California statewide solar installations.

Table 4: California Statewide Solar Installations

Data Source and Dates	Total MWs	Total Projects
Solar Installations in California IOU Territories		
All IOU Interconnections, 1993-Q1 2014	2,139.8	227,141
Solar Installations in California POU Territories		
CEC through 2012	162.3	19,525
Total California Solar Installations	2,302	246,666

4. CSI Program Components

As of March 31, 2014, the CSI Program has achieved a total of 1,488 MW of installed capacity since program inception. This was achieved through installations in the General Market, SASH and MASH programs. Those programs are discussed in more detail below.

4.1. General Market Solar Program

4.1.1 General Market Program Background

The CSI General Market solar program is the largest CSI Program component. It offers incentives to all eligible customers in the large IOU territories who install solar PV systems on their property. These incentives are based on either the actual or calculated

¹⁹ <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M089/K386/89386131.PDF>

performance of a solar system, such that higher performing systems receive a larger incentive than lower performing systems. The heavy emphasis on performance in the CSI Program is designed to optimize California ratepayer investment in solar. In addition, the CSI Program requires program participants to complete energy efficiency audits before installing their systems to encourage applicants to invest in cost-effective energy efficiency measures prior to sizing their solar system, consistent with the state's Energy Action Plan and "loading order."²⁰

The General Market program is divided into residential and non-residential programs and is administered by three program administrators: PG&E, SCE and CCSE. CCSE administers the program in SDG&E's service territory.

4.1.1.1 General Market Incentive Types

The CSI General Market Program pays solar consumers an incentive based on system performance. The incentives are either an upfront lump-sum payment based on expected performance, or a monthly payment based on actual performance over five years.

The EPBB is the upfront incentive available only for smaller systems. The EPBB incentive is a capacity-based incentive that is adjusted based on expected system performance calculated using an EPBB calculator²¹ that considers major design characteristics of the system, such as panel type, installation tilt, shading, orientation, and solar insolation available by location.

PBI is paid based on actual measured performance over the course of five years. The PBI is paid on a fixed dollar per kilowatt-hour (\$/kWh) of generation basis and is the required incentive type for larger systems, although smaller systems may opt to be paid based on PBI. Beginning in January 2010, all systems 30 kW and larger have been required to take the PBI incentive. Because PBI systems are large solar arrays that primarily serve commercial and institutional customers, cumulative payments to PBI system owners sometimes exceed one million dollars per project. The average reserved incentive for PBI systems is \$450,000, as of March 2014.

4.1.1.2 General Market Incentive Level Design

The CSI Program's financial incentives decline in steps as more capacity is installed. The declining incentives, required by PU Code Section 2851, are intended to help the program meet the goal of creating a self-sustaining solar industry by reducing rebates as the solar industry grows. Each step has an installed MW target that triggers the subsequent step down in incentives. The capacity targets per incentive step are further broken down into allocations

²⁰ The "loading order" was introduced in the Energy Action Plan (EAP), which was adopted in 2003, which is a joint effort by the CPUC, the California Energy Commission and the California Power Authority. The EAP adopted a loading order of preferred energy resources - the first of which is energy efficiency.

²¹ The EPBB calculator is publicly available at <http://www.csi-epbb.com/>.

across customer type and across the three IOU service territories. Table 5 presents the capacity target by utility territory and customer class, showing how all of the incentives were originally allocated over the expected 10-step life of the program. Actual allocations by step will vary due to dropouts and other factors.

Table 5: CSI General Market MW Targets by Utility and Customer Class

Step	MW in Step	PG&E (MW)		SCE (MW)		SDG&E (MW)	
		Res	Non-Res	Res	Non-Res	Res	Non-Res
1	50	--	--	--	--	--	--
2	70	10.1	20.5	10.6	21.6	2.4	4.8
3	100	14.4	29.3	15.2	30.8	3.4	6.9
4	130	18.7	38.1	19.7	40.1	4.4	9
5	160	23.1	46.8	24.3	49.3	5.4	11
6	190	27.4	55.6	28.8	58.6	6.5	13.1
7	215	31	62.9	32.6	66.3	7.3	14.8
8	250	36.1	73.2	38	77.1	8.5	17.3
9	285	41.1	83.4	43.3	87.8	9.7	19.7
10	350	50.5	102.5	53.1	107.9	11.9	24.2
Subtotals (Res and Non-Res)		252.4	512.3	265.6	539.5	59.5	120.8
Totals		764.8		805		180.3	
Percent		43.7%		46.0%		10.3%	

Source: D.06-12-033, Appendix B, Table 11.

Notes: The MWs for Incentive Step 1 were reserved under the Self-Generation Incentive Program in 2006. Non-Residential (Non-Res) includes commercial, government, and non-profit facilities.

Table 6: CSI EPBB Rebate Levels per Incentive Step

Step	Incentive in Step (EPBB, \$/Watt)		
	Residential	Commercial	Government Non-profit
1	n/a	n/a	n/a
2	\$2.50	\$2.50	\$3.25
3	\$2.20	\$2.20	\$2.95
4	\$1.90	\$1.90	\$2.65
5	\$1.55	\$1.55	\$2.30
6	\$1.10	\$1.10	\$1.85
7	\$0.65	\$0.65	\$1.40
8	\$0.35	\$0.35	\$1.10
9	\$0.25	\$0.25	\$0.90
10	\$0.20	\$0.20	\$0.70

Source: <http://www.csi-trigger.com/>

For comparison, the average installed cost for PV systems below 10 kW is \$5.71 per watt, as of May 7, 2014 (see <http://www.californiasolarstatistics.ca.gov/> for current average system costs).

4.1.1.3 General Market Current Incentive Steps

Table 7 shows the current steps for each service territory for all customer classes and incentive types. Once the incentives reserved for each customer class within a utility territory reach the capacity target for a given step, the incentive level offered drops to the next lower step. These drops occur independently of one another – for example, reservations made in PG&E’s residential step do not affect the level of incentives offered to PG&E’s non-residential customers, nor do they affect other territories. This creates a demand-driven program that adjusts solar incentive levels based on local solar market conditions. It is important to note that the EPBB rebates in step 10 for residential and commercial are less than 5% of the average system installed cost.

Table 7: Current General Market Statewide Solar Incentive Step Levels

Program Administrator	Customer Class	Current Step	EPBB Incentive Value (\$/Watt)	PBI Incentive Value (\$/kWh)	MW Remaining in Step	MW Under Review
CCSE (San Diego)	Residential	10	\$0.20	\$0.025	7.15	14.74
	Commercial	9	\$0.25	\$0.032	13.37	2.31
	Government/ Tax-exempt		\$0.90	\$0.114		
PG&E	Residential	Program Fully-Subscribed				
	Commercial					
	Government/ Tax-exempt					
SCE	Residential	10	\$0.20	\$0.025	N/A	7.29
	Commercial	9	\$0.25	\$0.032	57.34	14.98
	Government/ Tax-exempt		\$0.90	\$0.114		

Data as of 5/12/2014.

N/A: the PG&E programs have successfully used up their funding pools and are no longer accepting applications. The SCE residential program funds are nearly exhausted and the program is accepting applications to join a waitlist. Note: * Per Senate Bill 585, PBI payments have been revised to reflect a 4% discount rate which creates new PBI rates for Steps 8, 9, & 10.

For comparison of the size of the current incentives relative to current system costs, the average installed cost for PV systems below 10 kW is \$5.71 per watt, as of May 7, 2014 (see <http://www.californiasolarstatistics.ca.gov/> for current average system costs).

4.1.2 General Market Program Progress

Five of the six General Market programs have substantially reached their targets, while the final remaining program (SCE's non-residential) is expected to do so before 2017. Both PG&E's residential and non-residential programs have expended their funds and are closed. After receiving Commission authorization to place more funds in its fast-moving residential program, the program in SDG&E territory once again has both residential and non-residential programs open and accepting applications, although residential funds will likely be exhausted soon.

The charts and tables in this section illustrate the CSI General Market solar program progress to date, with data from the California Solar Statistics (CSS) web page.²² In addition, the CSI Program releases a Data Annex each quarter with key program application processing metrics,

²² California Solar Statistics can be accessed here: www.californiasolarstatistics.ca.gov/.

such as application processing times.²³ The CSS website and the Data Annex are discussed further in Section 5.1.

There are many ways to measure the progress of the CSI general market program, including progress towards the two stated goals of the Program: 1) Install 1,750 MW of solar PV capacity; and 2) Transform the market for solar so that it is price competitive and sustainable. This section reports on the installations, pending and complete, the solar price trends, program participation rates, and program budgets, as well as the program’s effect on the transformation of the solar market. The CSI Measurement and Evaluation (M&E) program component performs more detailed analyses, including cost benefit analyses, impact analyses, and other studies intended to help understand and improve the Program’s performance.²⁴ The progress of the M&E component is reported in Section 5.2.

4.1.2.1 General Market Program Trends

Several trends have emerged since the CSI Program’s inception in 2007, suggesting that the program is approaching its goal of stimulating widespread adoption of solar and creating a self-sustaining market, free of direct cost-support in the form of program rebates.²⁵

4.1.2.1.1 Average System Costs for Program Participants

Between the last quarter of 2008 and the last quarter of 2013, the average cost of installed residential systems has decreased 48 percent from \$10.64 per watt to \$5.50 per watt (CEC-AC, with figures adjusted for inflation). In the same time period, non-residential systems have decreased 52 percent from an average of \$10.08 per watt to \$4.86 per watt. These significant cost declines point to the success of the CSI in contributing towards a sustainable solar industry in California. It is worth noting, however, that even greater PV system cost declines have been witnessed in Germany, where the cumulative residential MW installed capacity dwarfs that of California.²⁶

Since July 2010, the CSI program has imposed a “soft cap” on per watt system costs to encourage an ongoing reduction in system costs. If an application comes in above the cap, the applicant must submit an explanation for the high cost; the host customer must acknowledge that the project is higher than the cap; and the PA must find the explanation reasonable.

²³ The current Data Annex can be accessed here: http://www.californiasolarstatistics.ca.gov/reports/data_annex/

²⁴ All CSI Program Measurement and Evaluation reports are available at: <http://www.cpuc.ca.gov/PUC/energy/Solar/evaluation.htm>

²⁵ The solar industry may continue to require the support of Federal Tax Credits and Net Energy Metering, or a successor tariff, for a longer term before achieving self-sustainability.

²⁶ See, <http://emp.lbl.gov/publications/why-are-residential-pv-prices-germany-so-much-lower-united-states-scoping-analysis>

As directed by SB 585, the CPUC revised the methodology to calculate the system cost cap to be based on national and state installed cost data. Originally set at two standard deviations above the program's average cost per watt, the cost cap was lowered by Resolution E-4476²⁷ to \$1.00 per watt above the 12-month rolling average of CSI system costs. In addition, the Commission set separate cost caps for residential and non-residential projects by calculating this average cost for systems under 10 kW (largely residential projects) and for those over 10 kW (largely non-residential projects). These average cost figures are recalculated and published on www.californiasolarstatistics.ca.gov on a weekly basis. National solar installation cost data are reviewed annually by the Energy Division to keep CSI system costs in line with national trends.

4.1.2.1.2 Inspections in the Performance-Based Incentive Program

In late 2012, the CSI Program Administrators—PG&E, SCE, and CCSE—recognized that a number of PBI systems were producing noticeably more kilowatt-hours than expected. Based on projections developed by technical consultant Energy Solutions, Energy Division staff flagged 36 PBI systems for inspection by the Program Administrators in 2013. These inspections provided useful insights into the performance of large distributed solar installations in the field. For 29 of the 36 projects, the discrepancy was traced to system characteristics that were incorrectly recorded on the application, or system efficiencies above and beyond what was initially expected by the CSI Program's EPBB calculator. Interestingly, 12 PBI systems located on carport structures or on cool roofs produced more kilowatt-hours than expected, perhaps explained by the fact that their solar panels stay cooler during the day than conventional roof-mounted systems.

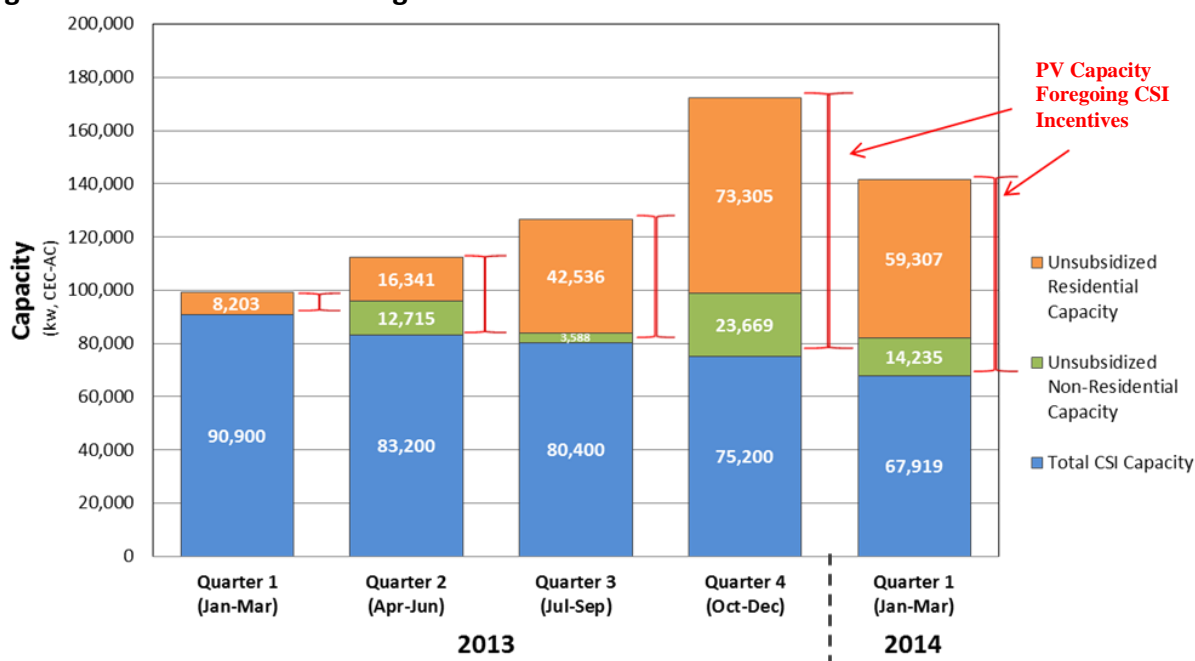
Most importantly, these inspections revealed seven instances of improper metering or unauthorized solar panel additions beyond what was reported in the incentive application, prompting quick corrective action by the Program Administrators. Payment adjustments to these seven projects are projected to preserve \$1.18 million in ratepayer incentive funds by the end of the program, which can be used to pay future customer-generators.

²⁷ See, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_RESOLUTION/167385.PDF

4.1.2.1.3 Solar Installations Outside the CSI Program

Since the publication of the 2013 Annual Program Assessment, the Energy Division has observed that a significant portion of customer-side solar NEM installations have interconnected in the three large IOU territories without having participated in the CSI Program, as many of the CSI sub-program incentives have been exhausted.²⁸ Figure 3 below shows that the proportion of customer-side solar NEM installations not participating in the CSI Program in 2014 has grown dramatically since the first two quarters of 2013.²⁹ Most of the capacity being installed without CSI incentives comes from the residential sector, with a smaller proportion coming from the non-residential sector. A sizeable portion of these projects are located in PG&E territory, where customer-side solar installations have continued to increase despite the close of the CSI incentive program.

Figure 3: Trends in Non-CSI Program Customer-Side Solar Installations



According to these estimates, a little less than half (48 percent) of the customer-side solar NEM capacity installed in the first quarter of 2014 received CSI incentives. Given that one of the principal goals of the CSI Program is to create a self-sustaining solar market, the fact that roughly half of all customer-side solar projects, by capacity, are being installed without CSI

²⁸ Note: Participation in the CSI Program is not a requirement for customer generators installing solar panels. However, since 2007 the vast majority of customer-side solar projects have applied for and received CSI incentives.
²⁹ This figure compares the capacity figures reported by the three IOUs in their quarterly Net Energy Metering (NEM) data submissions to the publicly-available CSI data located on California Solar Statistics. Although these two data sources are not identical either in terms of what date is used to represent the “installation” dates or individual project records, nearly all customer-side solar capacity is interconnected under NEM tariffs, making it possible and useful to compare the cumulative size of participating CSI installations to the total amount of customer-side NEM solar capacity installed in a given period.

incentives may be an important turning point. Unfortunately, because of the smaller amount of information collected in the current NEM interconnection process, valuable data about these unsubsidized solar installations is not being collected. In the R.12-11-005 proceeding, the Commission is considering potential solutions to this problem, including expanding the fields of data collected about customer-generation projects in the NEM interconnection process.

4.1.2.2 General Market Program Activity

The CSI General Market Program is making significant progress towards meeting the program goal of installing 1,750 MW by 2017. Table 8 shows the program’s current activity. As of the end of the first quarter of 2014, the CSI General Market was closing in on 1,500 MW of installed capacity with over 200 MW of applications pending approval.

Table 8: All CSI General Market Projects Pending and Installed

Installed Projects	
Applications	131,435
Capacity (MW)	1,455
Incentive \$ million	\$1,665
Pending Projects	
Applications	12,610
Capacity (MW)	225
Incentive \$ million	\$92
Total CSI Activity	
Applications	144,045
Capacity (MW)	1,680
Incentive \$ million	\$1,757

Source: www.CaliforniaSolarStatistics.ca.gov, data through March 31, 2014

CSI General Market Program activity continued to grow in 2014 despite the declining incentive levels per watt of installed capacity. This suggests that the CSI program design of incentive levels that decline as the market matures has been successful. In the final steps of the CSI, NEM and the Federal Income Tax Credit (ITC) provide a much greater level of financial support to solar projects than the CSI incentives.

Table 9: CSI General Market Applications received by year (MW)

Year	Residential	Non-Residential	Total
2007	30	105	134
2008	43	65	108
2009	64	89	152
2010	91	283	373
2011	109	147	256
2012	48	141	149
2013	177	142	320

Source: www.CaliforniaSolarStatistics.ca.gov, data through December 31, 2013.

Table 10: CSI General Market Program Activity, first quarter of 2014

	New Applications Received
Capacity (MW)	56
Number of Projects	6,101

Source: www.CaliforniaSolarStatistics.ca.gov, data through March 31, 2014.

4.1.2.3 General Market Progress Toward Goals

The CSI General Market Program has installed 83 percent of its total program capacity goal, with another 13 percent of the goal reserved in pending projects. The Program Administrators are progressing towards their individual goals at varying rates, depending on the utility territory and customer sector. As noted above, PG&E’s residential and non-residential programs have substantially reached their targets,³⁰ exhausted their funding, and closed. After the residential sector in SDG&E territory reached its target and exhausted its funds, the Commission authorized a transfer of incentive funding from the non-residential to the residential program to allow CCSE to meet its overall program capacity goals. SCE has also recently submitted a request to the Commission for a similar transfer.

³⁰ For projects receiving performance passed incentives (PBI), the PAs leave some funds in reserve, for the eventuality that projects perform above expectations.

Table 11: CSI General Market Progress Toward IOU Program Goals

Customer Class	Installed	Pending	Remaining	Goal
SCE				
Non-Residential (MW)	296	79	138	539
Non-Residential (% of Goal)	55%	15%	27%	
Residential (MW)	285	48	-67	266
Residential (% of Goal)	107%	18%	-25%	
PG&E				
Non-Residential (MW)	453	56	30	512
Non-Residential (% of Goal)	88%	10%	6%	
Residential (MW)	278	0	-26	252
Residential (% of Goal)	110%	0%	-10%	
SDG&E (CCSE)				
Non-Residential (MW)	69	19	7	96
Non-Residential (% of Goal)	72%	20%	8%	
Residential (MW)	74	21	-10	85
Residential (% of Goal)	87%	25%	-12%	
Total (MW)	1,455	223	70	1,750
Total (% of Goal)	83%	13%	4%	

Source: www.CaliforniaSolarStatistics.ca.gov, data through March 31, 2014.

4.1.2.4 Impacts of Tax Credits and Net Energy Metering

The Federal Investment Tax Credit (ITC), which was expanded in 2008 by the Energy Improvement and Extension Act and by the 2009 American Recovery and Reinvestment Act, provides a tax credit of up to 30 percent of the total installed cost of solar systems. Since 2008, California has received an estimated \$2.9 billion of ITC support for solar projects. At 30 percent of total installed cost, the ITC is now a much more significant incentive for customer-sited solar projects than that provided by the CSI in most program areas. Similarly, in the 2013 NEM Ratepayer Impacts Evaluation Report,³¹ it was found that NEM represents an ongoing incentive equivalent to approximately \$5.04 per watt (on average, accounting for the total generation over the lifetime of the system), in addition to any rebates received under the CSI program. The value of the ITC and NEM credits can be compared to the current CSI per watt rebates, which range from \$0.20 to \$0.25 per watt for residential and commercial customers.

³¹See, <http://www.cpuc.ca.gov/NR/rdonlyres/75573B69-D5C8-45D3-BE22-3074EAB16D87/0/NEMReport.pdf>

4.1.2.5 CSI Program Impact on Solar PV Market Transformation

One of the goals of the CSI Program is to create a self-sustaining solar PV market in California. In 2013, the CPUC engaged Navigant consulting to evaluate the extent of the transformation of California’s customer-side solar PV market since the adoption of the CSI Program, and to assess the degree to which the customer-side solar PV market will be sustainable after the CSI Program sunsets.³² The study, released in April 2014, found:

- The customer-side solar PV market has shown significant progress toward market transformation since the initiation of the CSI Program;
- While other regulatory and global market factors played an important role, the CSI Program played an indispensable role in transforming the solar PV market in California, especially in terms of creating a long-term policy signal to in-state suppliers of customer-sited solar PV products and services; and
- The long-term sustainability of the solar PV market in California will be reliant on the next phase of NEM regulation and the retail rate reform process that is currently before the Commission.

The study also provided recommendations for continuing to ensure the sustainability of the transformation going forward, which included resolving uncertainty related to the future of NEM regulation as quickly as possible and continuing to ensure that market data is collected and publicly provided once the CSI Program sunsets.

4.1.3 Marketing and Outreach Efforts

The CPUC provides guidance for statewide CSI Marketing and Outreach (M&O) activities. The overall M&O budget was established in D.11-07-031 at \$21,625,000. M&O activities include free trainings for professionals and consumers on a wide range of solar-related topics at various level of technical expertise. The Program Administrators also issue a quarterly electronic newsletter, distributed to thousands of subscribers. Sponsorships and solar promotions provide opportunities for program representatives to interact with various solar audiences, and the program features a main solar web site, www.GoSolarCalifornia.ca.gov. Each Program Administrator also maintains a website with information specific to their particular territory. Program Administrators actively promote integration with other demand-side programs, particularly in the development of online customer decision making tools like online energy analyzers, as well as “welcome kits” that cover the range of energy services available to new utility customers.³³

³² See, http://www.cpuc.ca.gov/PUC/energy/Solar/California_Solar_Initiative_Market_Assessment_Studies.htm.

³³ For more details on the specific marketing and outreach activities being pursued by the CSI Program Administrators, please consult the approved annual marketing and outreach plans available on the Commission’s website at: <http://www.cpuc.ca.gov/PUC/energy/Solar/outreach.htm>

4.2. Single-Family Affordable Solar Homes (SASH) Program

4.2.1 SASH Program Background

The SASH Program, one of the two low income components of the CSI Program, provides incentives for solar PV systems for eligible low income homeowners. The CPUC approved the SASH Program in November 2007 in D.07-11-047 as part of the CSI Program. GRID Alternatives (GRID) was selected as the statewide Program Manager for the SASH Program.³⁴ GRID is a non-profit providing renewable energy services, equipment, and training in low income communities throughout California since 2001. As Program Manager for the SASH Program, GRID identifies eligible low income households, markets the SASH program, and installs PV systems for eligible SASH participants.³⁵

The SASH Program is designed to be a comprehensive low income solar program. In addition to providing incentives, SASH is structured to promote or provide energy efficiency services, workforce development and green jobs training opportunities, and broad community engagement with low income communities. To achieve this, the SASH Program provides consumer education on solar and energy efficiency technologies to the diverse volunteer base that contributes to SASH installations. To date, GRID has trained over 13,720 volunteers statewide in these solar orientation programs. This outreach helps further the broader goals of promoting the use of PV-solar technology statewide and helping build broad-based community support for solar electric technologies and energy efficiency. In addition, GRID Alternatives sub-contracts with qualified solar contractors to install SASH projects through the SASH Sub-Contractor Partnership Program (SPP).

As mentioned in the Program Highlights section of this report, AB 217 (Bradford, 2013) has extended the SASH and MASH programs until 2021 with new funding and program design requirements. Implementation details will be determined in the Commission’s R.12-11-005 proceeding.

³⁴ D.07-11-045 ordered the SASH Program to be administered by a single statewide program manager to “ensure consistency and equity in program delivery statewide while working with a diverse group of stakeholders and service providers.” (p. 45, Conclusion of Law 10).

³⁵ For more information about the SASH Program, including GRID Alternatives’ latest quarterly program status report, see: <http://www.cpuc.ca.gov/PUC/energy/Solar/sash.htm>. For more details on the SASH program’s rules and requirements, see Appendix D to the CSI Handbook, available at: http://www.cpuc.ca.gov/NR/rdonlyres/DF8FE0E6-E528-44E0-AA85-6315987A421F/0/201304CSI_Handbook.pdf

4.2.1.1 SASH Program Budget

The SASH budget is \$108.3 million, allocated according to the information in Table 12 and Table 13.

Table 12: SASH Budget Allocations by IOU Service Territory

Utility	PG&E	SCE	SDG&E	Total
Percentage	43.7%	46%	10.3%	100%
Total Budget (millions)	\$47.3	\$49.8	\$11.2	\$108.34

Source: D.07-11-045

Table 13: SASH Budget Allocations by Functions

Function	Allocation
Administration	10%
Marketing and Outreach	4%
Measurement and Evaluation	1%
Incentives	85%

Source: D.07-11-045

4.2.1.2 SASH Program Eligibility

The SASH Program is open to customers of the large electric IOUs who qualify as single-family, low income households as defined in PU Code Section 2852 (described further below). PU Code Section 2852 allows owner-occupied residences that are part of a larger multifamily complex to qualify under certain conditions. GRID has created a statewide database of eligible homes in collaboration with the California Housing Partnership Corporation (CHPC), which is instrumental in the effort to establish relationships and identify resources within targeted local jurisdictions.

4.2.1.3 SASH Program Incentives

The SASH incentives are higher than the CSI general market on a \$/watt basis, and vary depending on the household's income level and eligibility for the California Alternate Rates for Energy (CARE)³⁶ program. The SASH incentive does not decline over time as in the market-transforming CSI General Market Program.

Eligible participating households are provided a one-time payment under the CSI EPBB structure to help reduce the up-front cost of installation. The SASH Program has one *fully-subsidized* (i.e. covers the full installed cost of the system) and six highly-subsidized incentive payment levels

³⁶ CARE provides a minimum of a 20 percent discount on the energy bills of qualifying low-income customers.

based on the applicant’s income compared to the area median income (AMI), tax liability, and eligibility for the CARE program. The incentive rates shown in Table 14 are intended to provide low income residents who have no federal tax liability with a positive cash flow in the first year of solar installation.

4.2.1.3.1 SASH Incentive Structure

The following incentive structure is available to customers whose total household income is below 80 percent of the area median income. The incentive is calculated on a sliding-scale that is based on the homeowner’s tax liability and the customer’s eligibility in the CARE program. If the Applicant qualifies for the CARE program but is not currently enrolled, the Program Manager will work with the Applicant to enroll them into CARE.

Table 14 shows the sliding-scale incentive rates:

Table 14: SASH Incentive Rates in \$/watt

Federal Income Tax Liability	Low income CARE-Eligible	Low income Residents Not Eligible for CARE
\$0	\$7.00	\$5.75
\$1 – \$1000	\$6.50	\$5.25
\$1001 +	\$6.00	\$4.75

Source: D.07-11-045.

For comparison, the average installed cost for PV systems below 10 kW is \$5.71 per watt, as of May 7, 2014(see <http://www.californiasolarstatistics.ca.gov/> for current average system costs).

4.2.2 SASH Program Progress

The SASH Program has experienced heavy growth in program applications and made significant progress in key areas including: expanding the Sub-Contractor Partnership Program (SPP); increasing marketing and outreach efficiency; building partnerships with volunteers and job training/workforce programs; and broadening the affordable housing client database. GRID currently has seven offices located in Oakland (PG&E), Carson (SCE), San Diego (SDG&E), Fresno (SCE/PG&E), Atascadero (SCE/PG&E), Riverside (SCE), and Chico (PG&E).

4.2.2.1 SASH Program Data

Since the SASH program was launched in December of 2008, SASH has received a total of 4,232 applications, which have resulted in 11.1 MW of installed capacity on eligible homes, with another 1.6 MW currently in progress. These applicants have received or reserved a total of \$77 million in SASH support for their residential solar systems.³⁷

³⁷ Data presented here come from GRID Alternatives’ Q1 2014 Program Status Report, available at <http://www.cpuc.ca.gov/PUC/energy/Solar/sash.htm>.

Nearly all of the completed SASH installations were made at no cost to the homeowners. In addition to ratepayer funding, GRID leverages funding from local jurisdictions, project sponsorships, and through general non-profit fundraising. Since the SASH incentive does not cover 100 percent of installation costs, identifying gap financing from third-party sources is critical to achieving the long-term goals of SASH since individual homeowners are unable to fund the additional incremental costs.

4.2.2.2 SASH Workforce Development Efforts

Every SASH installation provides workforce development opportunities. In implementing the SASH Program, GRID Alternatives provides opportunities for job trainees and local volunteers to assist with installations, to engage their communities, and to participate in the California solar and energy efficiency programs. As a result of these training sessions, many participants have gone on to receive NABCEP (North American Board of Certified Energy Professionals) certifications, the gold standard for PV installation work.

GRID reserves at least 20 percent of all SASH installations for solar-installer job trainees, often targeting low income communities. This becomes a double benefit to low income communities, since GRID recruits job trainees from the same communities that the SASH Program aims to serve. The SASH Program, to date, has filled over 29,800 workday positions with volunteer participants and has dedicated an additional 4,200 workday positions specifically for job trainees.

4.2.3 SASH Sub-Contractor Partnership Program

The SASH Sub-Contractor Partnership Program (SPP) provides opportunities for licensed California contractors to participate in SASH installations, not limited to GRID employees, volunteers and workforce program trainees. Qualified contracting companies agree to a reduced cost model and commit to hiring at least one eligible job trainee for each SASH installation. Though the SASH Program requires contractors to hire only one eligible job trainee per installation, some sub-contractors have exceeded this expectation by having more than one eligible trainee on their SASH installations.

4.3. Multifamily Affordable Solar Housing (MASH) Program

4.3.1 MASH Program Background

The second low income solar program in the California Solar Initiative targets affordable multi-tenant housing. In October 2008, the Commission adopted D.08-10-036, which established the \$108.3 million MASH Program for solar installations on existing multifamily affordable housing

that meet the definition of low income residential housing established in PU Code Section 2852.³⁸

The goals of the MASH Program are to: (a) Stimulate adoption of solar power in the affordable housing sector; (b) Improve energy utilization and overall quality of affordable housing through application of solar and energy efficiency technologies; (c) Decrease electricity use and costs without increasing monthly household expenses for affordable housing building occupants; and (d) Increase awareness and appreciation of the benefits of solar among affordable housing occupants and developers.

Like the SASH Program, MASH incentives do not decline over time as they do in the CSI General Market Program. The current MASH Program was designed to operate until January 1, 2016, or until all funds available from the program’s incentive budget were allocated, whichever event occurred first. As mentioned in the Program Highlights section of this report, AB 217 (Bradford, 2013) has extended the MASH and SASH programs until 2021 with new funding and program design requirements. Implementation details will be determined in the Commission’s R.12-11-005 proceeding.

4.3.1.1 MASH Incentive Types

As shown in Table 15 the Commission originally adopted a two-track incentive structure: Track 1, which provides up front incentives to systems that offset either common area (Track 1A) or tenant load (Track 1B), and Track 2, which provides an opportunity every six months to compete for higher incentives through a grant program. As mentioned above, D.11-07-031 eliminated Track 2 in favor of a more robust Track 1 incentive budget.

Table 15: MASH Incentive Tracks, Revised as of D.11-07-031

Track 1A PV System Offsetting Common Area Load	Track 1B PV System Offsetting Tenant Area Load	Track 2 (Grant) PV System Providing Enhanced Tenant Benefits NOW CLOSED
\$1.90/Watt	\$2.80/Watt	\$/Watt not specified; determined by proposal

Source: D.11-07-031.

For comparison, the average installed cost for PV systems below 10 kW is \$5.71 per watt, as of May 7, 2014 (see <http://www.californiasolarstatistics.ca.gov/> for current average system costs).

Track 1 incentive funding in all three service territories was quickly absorbed and new applications were placed on waitlists. To augment this popular incentive track, the Commission eliminated the Track 2 grants, which were proving less effective and more difficult to manage

³⁸ D.08-10-036, Appendix A, *mimeo.*, p. 1

than expected, and moved the remaining \$11 million in Track 2 incentives to Track 1. Another step to reinforce Track 1 involved the reduction of the incentive levels (\$/Watt) from \$3.30 to \$1.90 for Track 1A (serving common area load) and from \$4.00 to \$2.80 for Track 1B (serving tenant load.)

4.3.1.2 MASH Program Eligibility

The MASH Program is open to multifamily affordable housing properties that meet the definition of “low income residential housing” per PU Code Section 2852, which requires that at least 20 percent of the on-site tenants are low income.

The MASH Program also provides eligibility for certain pre-identified tenant units to enroll with their utility’s VNM tariffs, as described in the VNM section below.

4.3.1.3 MASH Program Budget

The budget and allocations for MASH, shown in Table 16 and Table 17 were adopted by the CPUC in D.08-10-036.

Table 16: MASH Budget Allocations by Utility Territory

Utility	PG&E	SCE	SDG&E	Total
Percentage	44%	46%	10%	100%
Total Budget (millions)	\$47.3	\$49.8	\$11.2	\$108.34

Source: D.08-10-036.

Table 17: MASH Budget Allocations by Function

Function	Allocation
Administration and Marketing and Outreach	10%
Measurement and Evaluation	2%
Incentives	88%

Source: D.08-10-036.

4.3.2 MASH Program Progress and Project Attributes

Since the MASH Track 1 incentives are fully subscribed, the progress of the program has been measured in terms of reserved projects reaching completion and waitlisted projects being brought into the incentive reservation queue when additional funds are made available via system resizing and project dropouts.

As of March 31, 2014, MASH had 325 completed projects representing a total capacity of 21.2 MW. There are an additional 64 MASH projects in process, for a total capacity of 8.2 MW.

Table 18: MASH Program Progress

Status of Application		Total	CCSE	PG&E	SCE
Completed	Number	325	41	157	127
	Capacity (MW)	21.2	2.6	9.1	9.5
Pending	Number	64	0	48	16
	Capacity (MW)	8.2	0	4.3	3.9
Average Project costs (\$/W) ³⁹		\$ 6.73	\$6.39	\$6.77	\$6.78

Source: MASH Program Administrators, Data as of March 31, 2014.⁴⁰

4.4. Virtual Net Metering (VNM)

Multi-tenant buildings are a challenging segment for uptake of solar PV because of the problem of distributing the benefits of system output among individually metered occupants. PV systems could be connected to a common area meter, or to individual tenant meters, but distribution of energy from a single system among multiple meters was not allowed under previous tariff structures. To solve this issue, the Commission directed the IOUs to file tariffs for VNM in 2008.⁴¹

Under VNM, the utility meters the PV system's output, then allocates energy credits for the energy produced by the PV system to the building owners' and/or tenants' individual utility accounts, based on a pre-arranged allocation agreement. The MASH program piloted the VNM tariffs; the original intent of VNM was to help low income multifamily residents receive direct benefits of the building's solar system, and as of January 2014, over 8,600 tenant units had taken service under VNM tariffs through the MASH program.

Based on the merits of these tariffs, the Commission expanded VNM to all multi-tenant, multi-meter properties in 2011 and included all NEM-eligible technologies for eligibility. As of March 2014, in PG&E and SDG&E's service territory there were 64 projects with a combined 3.1 MW of solar capacity on the VNM tariff who are not participants in the MASH program. There have been no such projects to date in SCE's service territory, though several applications are pending.

³⁹ Cost data from completed projects only, taken from CSI Working Data Set as of March 31, 2014.

⁴⁰ For more information, please visit the MASH application status report on California Solar Statistics, available at http://www.californiasolarstatistics.ca.gov/reports/application_status/?source=mash. In addition, the MASH Semi-Annual report is available at <http://www.cpuc.ca.gov/PUC/energy/Solar/mash.htm>

⁴¹ D.08-10-036

Table 19: VNM Projects Outside of the MASH Program by Utility Territory

Utility	PG&E	SCE	SDG&E	Total
Projects on NEM-V Tariff	56	-	8	64
Total Capacity (kW, CEC-AC)	2,234	-	900	3.134

Source: Energy Division Data Request to IOU Regulatory Staff, Data as of March 31, 2014.

4.5. CSI-Thermal Program

4.5.1 CSI-Thermal Program Background

4.5.1.1 CSI-Thermal Program Overview

The CSI-Thermal Program is an incentive program for solar water heating (SWH) technologies that displace natural gas, electricity or propane usage. The Commission has established three primary program elements corresponding to the type of water heating fuel being displaced by solar technologies. The CSI-Thermal Program consists of:

- 1) Incentives for natural gas-displacing systems (including swimming pools);
- 2) Incentives for natural gas-displacing systems serving low-income customers, and;
- 3) Incentives for electric or propane-displacing systems.

Incentives for natural gas-displacing systems come from a statewide budget of \$250 million, as described in detail below. Incentives for electric or propane-displacing systems are drawn from the CSI PV budgets in each utility territory, which are either fully reserved already or will be relatively soon.

The four Program Administrators of the CSI-Thermal Program are: PG&E, SoCalGas, SCE,⁴² and the CCSE on behalf of SDG&E.

4.5.1.2 CSI-Thermal Legislative History and Commission Decisions

The CSI-Thermal Program was established by legislative language in SB 1, which contains a provision that allows for up to \$100.8 million of CSI funds to be used for incentives for solar thermal technologies that displace electricity. SB 1 also directed the CPUC to implement a Solar Water Heating Pilot Program (SWHPP). AB 1470 (Huffman, 2007) authorized the creation of a \$250 million incentive program to promote the installation of 200,000 solar water heating systems in homes and businesses that displace the use of natural gas by the end of 2017.

⁴² Note: As an electric-only utility, SCE only offers incentives for electric or propane-displacing systems in their service territory. Similarly, as a gas-only utility, SoCalGas only offers incentives for natural gas-displacing systems in their service territory.

Following the successful implementation of the SWHPP, the Commission established the CSI-Thermal Program in January 2010 in D.10-01-022. The CSI-Thermal Program aims to promote the market for solar water heating and other solar thermal technologies through up-front incentives, technical training, marketing and outreach. The Program began accepting applications from single-family residential customers that install solar water heating on May 1, 2010 and from multifamily and commercial customers on October 8, 2010. In March 2012, the CSI-Thermal Low Income Program, which provides higher incentives for low income single and multifamily residences, began accepting applications. In 2013, the Commission issued two decisions authorizing new incentives. D.13-02-018 allowed incentives for process heat, for chilling, and for space heating. D.13-08-004 allowed incentives for non-single family swimming pools. Because both programs are just getting underway, participation levels will not be reviewed in this report.

4.5.2 CSI-Thermal Budget

4.5.2.1 Natural Gas-Displacing Program

For the natural gas displacing portion of the program, the \$250 million program budget will be collected during the duration of the Program by the three gas investor-owned utilities based on the percentages in Table 20.

Table 20: CSI-Thermal Gas-Displacing Budget Allocation

Utility	Budget Allocation	Total Program Collections (in millions)
PG&E	39%	\$97.5
SDG&E	10%	\$25.0
SoCalGas	51%	\$127.5
Total	100%	\$250 million

Source: D.08-12-044.

The gas-displacing program budget is divided as shown in Table 21.

Table 21: CSI Thermal Gas Displacing Program Budget

CSI Thermal Program Elements	CSI Thermal Program Sub-Elements	Budget (\$ Millions)
Incentives	General Market Incentive	\$180
	Low income Incentive (10% of total funds)	\$25
	Subtotal	\$205
Market Facilitation	Marketing & Outreach	\$25
	Subtotal	\$25
Program Administration	General Administration	\$15
	Measurement and Evaluation	\$5
	Subtotal	\$20
Total		\$250

Source: D.08-12-044.

4.5.2.2 Low Income (Natural Gas-Displacing) Program

For the low income program, \$25 million in incentives are intended to promote the installation of gas-displacing SWH systems. The program budget will be collected by the three gas utilities based on the percentages in Table 22.

Table 22: CSI-Thermal Low income Program Budget Allocation

Utility	Budget Allocation	Total Program Collections (in millions)
PG&E	39%	\$9.75
SDG&E	10%	\$2.50
SoCalGas	51%	\$12.75
Total	100%	\$25 million

Source: D.08-12-044.

4.5.2.3 Electric or Propane-Displacing Program

The electric-displacing program budget of \$100.8 million, if utilized, reduces the amount of incentives available for PV, and shall be allocated as shown in Table 23. Because the CSI General Market PV program is nearing exhaustion, the amount of funds available for the electric displacing CSI-Thermal program is constrained.

Table 23: CSI Thermal Electric Displacing Program Budget

CSI Thermal Program Elements	CSI Thermal Program Sub-Elements	Budget (\$M)
Incentives	General Market Incentive	No more than \$100.8
	Low income Incentive ⁴³	\$0
	Subtotal	\$100.8
Market Facilitation	Marketing & Outreach	\$6.25
	Subtotal	\$6.25
Program Administration	General Administration	Subject to the overall CSI budget, but tracked separately
	Measurement and Evaluation	\$1.25
	Subtotal	\$1.25
Total		\$108.3 + CSI Admin Budget Costs

Source: Decision 08-12-044.

The Program Administrators perform marketing and measurement and evaluation activities for all SWH systems, whether they displace gas or electricity. The Program Administrators fund these activities on a 4:1 ratio, so that for every \$4 spent from the gas-displacing budget, \$1 is spent from the electric-displacing budget.

4.5.3 CSI-Thermal Program Eligibility

The CSI-Thermal Program provides incentives to customers who install solar hot water heating systems that have received a certification from the Solar Rating and Certification Corporation (SRCC) or from the International Association of Plumbing and Mechanical Officials (IAPMO). Single-family residential, multifamily and commercial customers may apply for incentives. Contractors are required to be certified by the Contractor State Licensing Board, and all installers (self-installers and contractors) must complete a one-day training course provided by the utilities. Contractors must also submit to random inspections of projects by Program Administrators and ensure that those systems are properly installed to remain in good standing.

Eligibility for the low income program requires all of the above mentioned requirements. However, in addition the low income program requires that applicants meet the low income

⁴³ Because the funds for the low income portion of the CSI-Thermal Program come from natural gas ratepayers, and because separate low income programs exist for electricity generation (the SASH and MASH programs), the low income CSI-Thermal Program only provides incentives for natural gas displacing SWH systems. See Decision 11-10-015 for more information.

residential housing definition PU Code Section 2861 (e). PU Code Section 2861 (e) includes multifamily housing units and individual residences that are subject to resale restriction or an equity sharing agreement.

The program also extends eligibility to participants in the Energy Savings Assistance Program (ESAP) on the condition that the participants either occupy a single-family home or at least 50 percent of all units in a multifamily unit.

Incentives are paid based on expected first-year energy displacement of the SWH system. Incentives are divided between the single-family and commercial/multifamily sectors, with 40 percent of incentives on the natural gas side reserved for single-family customers.

4.5.3.1 CSI-Thermal Natural Gas-Displacing Program

For systems that displace natural gas, incentives initially start at \$2,175 for the typical single-family system and decline in four steps to \$380 for the typical systems. Incentives are capped and cannot be more than 25 percent higher than the incentive for an average system. Multifamily commercial projects are incentivized at the same rate per therm displaced, with a maximum incentive of \$500,000 per project. Incentive levels decline when the total incentive budget for a particular step has been exhausted.

Step incentive levels for natural-gas displacing systems are as follows in Table 24.

Table 24: CSI-Thermal Incentive Step Table

Step	Incentive for Average Residential SWH System	Funding Amount	Incentive per Therm Displaced	Therms Displaced Over System Life
1	\$2,175	\$50,000,000	\$18.59	97,500,000
2	\$1,535	\$45,000,000	\$13.11	109,687,500
3	\$900	\$45,000,000	\$7.69	146,250,000
4	\$380	\$40,000,000	\$3.23	212,727,275
Total		\$180,000,000		566,164,775

Source: D.08-12-044.

4.5.3.2 CSI-Thermal Low Income (Natural Gas-Displacing) Program

Incentives for qualifying single-family low income customers are 200 percent of the applicable CSI-Thermal SWH incentive level. Incentives for qualifying SWH installations on multifamily

housing are 150 percent of the applicable CSI-Thermal SWH incentive level. Incentives will decline as incentives in the larger CSI-Thermal Program decline.

Table 25: CSI-Thermal Low Income Incentive Step Table

Step	Single-Family Low income Incentive per therm displaced	Incentive Cap for Single-Family Low Income Projects	Multifamily Low Income Incentive per therm displaced	Incentive Cap for Multifamily Low Income Projects
1	\$25.64	\$3,750	\$19.23	\$500,000
2	\$20.52	\$3,000	\$15.39	\$500,000
3	\$15.38	\$2,250	\$11.53	\$500,000
4	\$9.40	\$1,376	\$7.05	\$500,000

Source: D.08-12-044.

4.5.3.3 CSI-Thermal Electric or Propane-Displacing Program

Electric-displacing systems are incentivized at a lower level than natural gas displacing systems to account for the fact that electric displacing systems are generally less expensive. Incentives for electricity displacing systems also decline in four steps, but those incentive declines are triggered by step changes in the natural gas program, since the much larger natural gas market is likely to drive the industry. Incentives for electric-displacing systems are as shown in .

Table 26.

Table 26: Electric-Displacing Solar Thermal Incentives

Step Level	Single-Family Incentive (\$/kWh)	Incentive for Average Residential System	kWh Savings
1	\$0.54	\$1,467	2,730
2	\$0.38	\$1,048	2,733
3	\$0.22	\$602	2,727
4	\$0.10	\$263	2,714

Source: D.08-12-044.

4.5.4 CSI-Thermal Program Participation

4.5.4.1.1 CSI-Thermal Program History and Application Statistics

The CSI-Thermal Program began taking applications from single-family customers on May 1, 2010 and from multifamily and commercial customers on October 8, 2010. In just over four

years of operation, the program has approved 1,606 applications for \$22.6 million in incentives (See Table 27). As seen below, the residential sector has produced a greater number of applications. However due to their much larger average project size, the commercial/non-profit sectors represent a larger portion of incentive amounts, project costs, and energy savings.

Table 27: CSI-Thermal Applications by Sector and Displaced Fuel

Sector	Number of Applications	Incentive (\$ thousands)	Project Cost (\$ thousands)	Annual energy savings
Multifamily/ Commercial	388	\$11,300	\$33,776	
Gas	383	\$11,270	\$33,582	836,186 therms
Electric	5	\$30	\$194	76,182 kWh
Single Family	922	\$1,406	\$8,362	
Gas	634	\$1,065	\$6,080	72,156 therms
Electric	241	\$267	\$1,877	662,393 kWh
Propane	47	\$74	\$405	177,135 kWh
Multifamily Low Income -- Gas	291	9,856	21,724	519,890 therms
Single Family – Low Income -- Gas	5	13	16	524
Subtotal Gas	1313	\$22,203	\$61,404	1,428,756
Subtotal Electric	246	\$297	\$2,070	738,575
Subtotal Propane	47	73	405	177,135
Total	1,606	\$22,574	\$63,880	

Source: www.csithermal.com/public_export; data through March 31, 2014

Nevertheless, participation in the overall program has been slow, as described in the next section.

4.5.4.1.2 Report on the Status of the CSI-Thermal Program

Pursuant to AB 2249 (Huffman, 2012), the Energy Division prepared a report on the status of the CSI-Thermal Program, released in January 2014.⁴⁴ This staff report found that there has been moderate success with multifamily and commercial installations, but very little participation among single-family natural gas customers, despite the Commission increasing incentive levels through D.12-08-008. One prominent reason for current levels of participation comes from outside market forces; declining natural gas prices in recent years make the economics of solar water heating projects that displace natural gas less attractive, especially in the residential

⁴⁴ CPUC Energy Division, “Review of the Incentive Levels and Progress of the California Solar Initiative-Thermal Program,” submitted to the California Legislature as directed by Section 2867.1(b) of the PU Code and in accordance with Section 9795 of the Government Code. Electronic version and transmittal letter available at <http://www.cpuc.ca.gov/PUC/energy/Solar/swh/csithermalnews.htm>.

market. In addition, solar water heating installation costs have not declined as expected, impeding the market transformation the Commission anticipated.

The AB 2249 report concludes that given present participation trends, achievement of the program’s overall goal of 585 million therms displaced is unlikely to be reached by 2017, although the new offering of incentives for non-single-family swimming pools may increase program participation. Finally, the report discusses possible options for future program modification. In particular, the report noted that further modifications to rebate levels may be needed to ensure more robust program participation. However, beyond somewhat limited program-level changes the Commission could make in the R.12-11-005 proceeding including rebate level adjustments, any broader changes to address the lack of market transformation for solar water heating technologies would require new legislation.

4.5.4.2 CSI-Thermal Program Administration

4.5.4.2.1 CSI-Thermal Incentives Received

As mentioned above, the CSI-Thermal Program is jointly administered by PG&E, SoCalGas, SCE and CCSE. While PG&E and CCSE administer incentives for both natural gas and electric-displacing systems, SCE only administers incentives for electric-displacing systems, and SoCalGas only administers incentives for natural gas-displacing systems. As shown in Table 28, PG&E has received the most applications, followed by SoCalGas, CCSE, and SCE.

Table 28: CSI-Thermal Program Applications by PA

Program Administrator	Pending and complete applications	Total Incentive (\$ thousand)
PG&E	625	9,230
CCSE	267	4,660
SCE	43	62
SoCalGas	671	8,623
Total	1,606	\$22,576

Source: www.csithermal.com/public_export; data through March 31, 2014.

Although most water in California is heated with natural gas, the economics are much more favorable for electric-displacing solar water heating, and indeed, one quarter of the applications received so far have been for electric-displacing solar water heating (see Table 27).

4.5.4.2.2 CSI-Thermal Market Facilitation

D.10-01-022 sets aside \$25 million from the \$250 million natural gas budget and \$6.25 million from the electric budget for market facilitation activities, particularly marketing and outreach, consumer education, workforce training, and reaching out to permitting officials to raise awareness. After the issuance of D.10-01-022, the four Program Administrators, the Energy Division and other stakeholders debated and discussed the market facilitation plans filed in April 2010. These discussions resulted in an Energy Division guidance memo issued in November 2010 directing the Program Administrators to collaborate on hiring a professional marketing firm to run a statewide coordinated marketing campaign aimed at increasing consumer awareness of solar thermal, which eventually ran in April 2012 with some success.

Since the initial market facilitation plans were filed in 2010, the four Program Administrators have filed several subsequent market facilitation plans. Due to the delayed launch of the program, which resulted in under-spending of marketing and outreach dollars in the early years of CSI-Thermal, in late 2013 the Program Administrators filed extensive 2014 market facilitation plans with the Energy Division. In these plans, the Program Administrators proposed another ambitious statewide media campaign and significant overhauls to the program's online presence. After staff review and submission of a requested supplement detailing specific low income marketing strategies, the Program Administrators began implementing these plans in early 2014. For more on the details of CSI-Thermal market facilitation activities, please see the Commission's CSI Marketing and Outreach webpage.⁴⁵

4.5.4.2.3 CSI-Thermal Measurement and Evaluation

Unlike the CSI Solar PV Programs, where generation performance can be evaluated at the meter, CSI-Thermal technologies offset electric or gas consumption. This requires evaluation of kilowatt-hour and therm savings to assess whether the program is meeting its goals.

D.10-01-022 adopted a \$6.3 million total budget for measurement and evaluation (M&E) of the CSI-Thermal Program. In February 2014, when program participation had risen to a level warranting M&E expenditures, the Commission released a detailed M&E plan for the program. This plan, available on the Commission's website, outlined both the field performance data to be collected from a sample of CSI-Thermal systems, and the program evaluation studies to be performed with this data.⁴⁶ Evaluation activities are expected to begin before the end of 2014.

⁴⁵ This page, which includes market facilitation plans under the CSI-Thermal header, is available at: <http://www.cpuc.ca.gov/PUC/energy/Solar/outreach.htm>.

⁴⁶ The CSI-Thermal Measurement and Evaluation Plan is available at: <http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M087/K267/87267269.PDF>.

4.6. Research, Development, Demonstration & Deployment

4.6.1 RD&D Program Background

The purpose of the CSI Research, Development, Demonstration and Deployment (RD&D) Program is to identify and support projects that will help reach the CSI Program’s goal of 1,940 MW of installed distributed solar by 2016, and to create a self-sustaining, subsidy-free solar market in the years beyond.

Table 29 details the total CSI RD&D budget by funding area. The Program is administered by Itron, on behalf of the CPUC, who is responsible for developing requests for proposals (RFPs), evaluating grant requests, entering into grant agreements, and monitoring progress on all approved projects. The CSI RD&D Plan, established in September 2007 by D.07-09-042, identifies criteria for the selection and funding of RD&D projects, and sets allocation guidelines for using incentive funds along three targeted areas, including: Grid integration, storage, and metering, energy generation technologies, and business development and deployment. The RD&D portfolio allocation percentages are guidelines meant to help steer funds across a range of diverse projects, and should not be interpreted as firm limits. As required in D.07-09-042, \$10 million of the CSI RD&D grant funding was allocated to support construction of the Helios Solar Energy Research Center at U.C. Berkeley, which will focus on developing low cost solar energy conversion technologies.

Table 29: CSI RD&D Program Budget Allocations

CSI RD&D Program Funding Areas	Estimated Budget (millions)
Administration	\$5.98
Triennial Evaluations	\$1.50
Grants/Incentives	\$42.52
Total	\$50.00

Source: D.07-09-042.

Notes: The estimated budgets for administration and evaluation activities represent maximum amounts, and any unused funds may be reallocated to the grants/incentives budget.

4.6.2 RD&D Program Progress

The CSI RD&D Program has conducted five solicitations for projects since it began: The first program solicitation focused on integrating solar PV into the electricity grid; the second program solicitation had two focus areas: energy generation technologies and business development and deployment; the third program solicitation had a primary focus of grid integration with a secondary focus of production technologies and business development and deployment; the fourth solicitation focused on cost-effective strategies and solutions for integrating large amounts

of PV into distribution systems; and the fifth solicitation focused on leveraging the value of past or current CSI RD&D investments or other publically funded research to address the goals of the CSI RD&D Program.

The fourth and fifth solicitation grants were awarded in 2014 to the following projects:

Advanced Distribution Analytic Services Enabling High Penetration Solar PV

PI Robert Sherick, Southern California Edison

SCE will develop a streamlined process for identifying the limiting factors and mitigation measures for achieving 50%, 75% and 100% PV penetration levels. Prototype feeders will be identified and analyzed in detail to determine operational limits and mitigation strategies including 1) infrastructure improvements, 2) implementing advanced controls, 3) energy storage and/or 4) Demand Response (DR).

PV Integrated Storage? Demonstrating Mutually Beneficial Utility/Customer Business Partnerships

PI Eric Cutter, Energy and Environmental Economics (E3)

Using the 34 unit Zero Net Energy (ZNE) development in Sacramento, the E3 team will determine benefits of PV integrated with storage and demand response to both the customer and the utility. The results will be a tariff, incentive and program recommendations for utilities and policy makers.

Analysis to Inform California Grid Integration Rules for PV

PI Electric Power Research Institute (EPRI)

Working with the IOUs, CAISO and Smart Inverter Working Group, EPRI team will develop guidelines for smart inverters and recommend settings for the smart inverter functions being considered as part of CA Rule 21.

Standard Communication Interface and Certification Test Program

PI Electric Power Research Institute (EPRI)

The EPRI team will develop and demonstrate standardized inverter communication interface that is compatible with utility communication networks. The project will also develop and make available a standard testing and certification program for advanced inverters including an open source software test tool, test procedures that meet CA Rule 21 and Institute of Electrical and Electronics Engineers (IEEE) 1547a, and field testing certified inverter systems in SCE and Sacramento Municipal Utility District (SMUD) networks.

Comprehensive grid integration of solar power for SDG&E

PI University of California, San Diego (UCSD)

The UCSD and SDG&E team will advance solar forecast and load forecast modeling to 40 hour net load forecast for substations in SDG&E territory. The team will also develop a tool that integrates solar forecasting with planning and simulation software to determine the best locations for energy storage based on system performance and expected solar performance.

Demonstration of Locally Balanced ZNE Communities Using DR and Storage and Evaluation of Distribution Impacts

PI Electric Power Research Institute (EPRI)

The EPRI team will develop ZNE packages including PV, Home Energy Management Systems (HEMS), Storage and DR for inclusion in a Meritage 60 home community in California. Modeling approaches will be used to predict the impacts on distribution systems and mitigation strategies will be developed. The project will demonstrate HEMS, DR and storage and how they can mitigate possible grid issues. The project will also integrate building energy models and distribution models to predict building requirements for desired load shapes.

Sustainable Energy and Economic Development Fund (SEED Fund)

PI Strategic Energy Innovations

Expands the Sustainable Energy & Economic Development Fund (SEED Fund) into the central valley. The fund helps public agencies collaborate on procuring solar.

Monitoring and Evaluation of a Zero Net Energy Retrofit Home with Storage, DR, and HEMS

PI BIRAenergy

Performance of extensive tests and evaluations of the impacts of the ZNE retrofit completed on a home under the CSI-funded CSI Low-Cost Solar Project.

Mitigation of Fast Solar Ramps Through Sky Imager Solar Forecasting and Energy Storage Control

PI University of California, San Diego (UCSD)

Demonstration of forecasting and energy storage controls on the UCSD microgrid, focusing on minimizing ramp impacts and storage costs. Coupling PV ramping to solar forecasting with battery storage controllers, thus using battery charge more efficiently. This will be demonstrated on the UCSD microgrid.

Supervisory Controller for PV & Storage Microgrids

PI Tri-Technic Inc.

Demonstration of a day-ahead optimization and real-time control of charging/discharging schedules for energy storage systems in order to capture the financial benefits of tariff and demand changes. Located at Fort Hunter Liggett in Monterey County.

BEopt Multifamily Modeling Capabilities for ZNE and iDSM in California

PI National Renewables Energy Lab

Development of modelling capabilities for the BEopt tool for multifamily buildings.

Comprehensive System Assessment of the Smart Grid-tied Energy Storage System Using Second-Life Batteries

PI University of California, Davis

Demonstration of a smart grid-tied energy storage system that uses second use lithium batteries and integrates automated DR.

Distributed Solar and Plug-In Electric Vehicles

PI Clean Power Research

Development of an interactive software platform that provides actionable insights regarding solar and electric vehicle (EV) acquisition.

The five CSI RD&D solicitations resulted in grant funding for 36 projects totaling \$34.4 million. With the additional award of \$10 million to the Helios Solar Energy Center at U.C. Berkeley, the total allocation of CSI RD&D funds to date is approximately \$44.4 million. Detailed profiles of all CSI RD&D funded projects, as well as all project documentation and reports can be found at www.calsolarresearch.ca.gov/. The CSI RD&D program has completed all planned grant making activities and will not conduct any more solicitations.

5. Program Reporting and Evaluation

5.1. Program Reporting

5.1.1 Online Reporting

CSI program data is provided online at the “Trigger Tracker”⁴⁷ and at the California Solar Statistics (CSS)⁴⁸ web site. The Trigger Tracker tells the public which incentive step is in effect for a given sub-program, and how many MW are left in that step.

The CSS site, which launched in 2010, is a collaborative effort between the CSI Program Administrators and the CPUC’s Energy Division, and contains a wealth of program data. The website has historically focused on the CSI General Market Program, but recently added data on the MASH and SASH programs. CSS data is populated entirely from PowerClerk, the CSI program’s online database and application interface. The CSS data is updated weekly and includes the following features:

- Data on individual installations (while maintaining customer confidentiality).
 - System costs
 - Manufacturer, model, capacity, and other technical information
 - Geographic location
- A “Find an Active Solar Contractor” feature, which helps prospective solar buyers do just that, as well as a search page that facilitates data queries.
- Weekly (and daily, for the General Market) updates to the budget status of the General Market and the MASH programs.
- A Data Annex, containing information about the efficiency of the program’s administrative processing.

Market participants (installers, third party owners, manufacturers, etc.) have repeatedly told the CPUC how much they value this online data, because it is current (updated weekly), comprehensive (covering the vast majority of California’s distributed generation PV installations), and in-depth (including many data fields).

As the CSI program is nearing completion in the CCSE (SDG&E) and the PG&E territories, there is a natural concern that this source of insight into the distributed generation solar PV market will be lost. For this reason, Energy Division is working, together with the CSI Program

⁴⁷ See, www.csi-trigger.com.

⁴⁸ See, www.californiasolarstatistics.com.

Administrators and the utilities' interconnection departments, to add non-CSI installations to the distributed generation database. The Commission expects to have this in place in 2014. This represents a potentially significant bonus, as the CSS would then extend beyond CSI to cover all distributed generation solar PV in the IOU territories and will track distributed generation PV even after the CSI program ends.

5.1.2 Online CSI-Thermal Reporting

Similar to the Trigger Tracker, the CSI-Thermal “Incentive Step Tracker”⁴⁹ tells the public which incentive steps are currently in effect for the various CSI-Thermal sub-programs, including low income sub-programs. Using the CSS as a model, Energy Division and the Program Administrators are now in the process of developing a similar site, which will post easily accessible data about program installations.

5.1.3 Periodic CSI and CSI-Thermal Reports

A number of periodic reports are filed publicly and posted on the CPUC's CSI website:⁵⁰

- The Annual Program Assessment (APA) to the Legislature (this document), required by statute every year no later than June 30th.
- The Annual CSI Data Annex report. This elaborates on the data annex (e.g. administrative efficiency) information available online, showing trends over time, including trends in NEM participation.
- MASH and SASH semi-annual reports.
- CSI-Thermal Program quarterly reports that tell the story of therms and kWh avoided by program participants as well as incentives disbursed.

5.2. Program Evaluation Plan

The CSI Evaluation Plan measures the CSI Program General Market's progress towards its goals of deploying 1,940 MW of new solar capacity by 2017, and helping to create a self-sufficient solar industry in which solar energy systems are a viable mainstream option for both homes and businesses within 10 years, without ratepayer support.

The current status of CSI M&E is as follows:

⁴⁹ See, <https://www.csithermal.com/tracker/>.

⁵⁰ See, www.cpuc.ca.gov/PUC/energy/Solar/legreports.htm.

- **Net Energy Metering Cost/Benefit Study:** Pursuant to SB 1, the Impacts of Distributed Generation study was published in January 2010.⁵¹ Pursuant to AB 2514 (Bradford, 2012) and D.12-05-036, a second study on the costs and benefits of NEM to ratepayers was published in October 2013.⁵²
- **PV Market Assessment Studies:** Energy Division recently released three studies that address the core question of how much the distributed generation PV market has been transformed, how much we expect it will be transformed after the CSI Program’s market interventions, and how we will know. The studies include:⁵³
 - Third-Party Ownership Market Impact Study: This study found that third-party ownership has accounted for a significant portion of residential solar installs and demand for this model is growing.
 - CSI Market Transformation Study: This study found that significant market transformation has occurred, but that continued health to the industry is dependent in part on a speedy and favorable resolution of Net Energy Metering policies and of the pending residential rate reforms.
 - Solar PV and Residential Roof Study: This study assessed the relationship between roofing and the distributed generation PV market.
- **Impact Evaluations:** Three studies covering 2007-2010 have been published. Energy Division will be issuing a request for proposals for a consultant to conduct the 2011-2012 and 2013-2014 Impact Evaluations this year. These studies will provide up to date information on the CSI Program accomplishments; including energy, capacity, and environmental impacts and PV system performance degradation.
- **Impact of Distributed Generation Reports:** These reports, as mandated in AB 578, are due every two years. The first report was completed in 2010. The second report, delivered in May 2013, showed that, while California’s solar distributed generation installed capacity is large compared to other states, the impact on the distribution and transmission infrastructures is relatively low.
- **External Financial Audit Report:** CPUC audit staff completed the 2007-2008 audit in 2010. The 2010-2011 audit was conducted by an outside firm, and was completed in May

⁵¹ See, http://www.cpuc.ca.gov/NR/rdonlyres/750FD78D-9E2B-4837-A81A-6146A994CD62/0/ImpactofDistributedGenerationReport_2010.pdf.

⁵² See, http://www.cpuc.ca.gov/PUC/energy/Solar/nem_cost_effectiveness_evaluation.htm.

⁵³ See, http://www.cpuc.ca.gov/PUC/energy/Solar/California_Solar_Initiative_Market_Assessment_Studies.htm.

2013.⁵⁴ The audit did not identify any significant issues with administration of the program.

- **CSI Cost Effectiveness Study:** This study, completed in April 2011, looked at cost effectiveness from several perspectives – program administrators, ratepayers, and especially program participants and society as a whole.⁵⁵ Based on participant economics, the study suggested that the residential solar PV market will be self-sustaining by 2017, with a mixed outlook for non-residential customers.

⁵⁴ See, http://www.cpuc.ca.gov/NR/ronlyres/2DAC41AA-F5BE-4A54-ACF1-783BAF94E17E/0/CSIEExternalAudit2010_2011.pdf.

⁵⁵ See, [ftp://ftp.cpuc.ca.gov/gopher-data/energy_division/csi/CSI%20Report Complete E3 Final.pdf](ftp://ftp.cpuc.ca.gov/gopher-data/energy_division/csi/CSI%20Report%20Complete%20E3%20Final.pdf).

6. California Solar Initiative Program Links and Contact Information

The main web portal for the *Go Solar, California!* campaign provides comprehensive solar e-resources for consumers and professionals: www.GoSolarCalifornia.org

The California Public Utilities Commission Energy Division web site provides information related to the CSI program, including regulatory updates and documents for the Distributed Generation Docket (R.)10-05-007: www.cpuc.ca.gov/PUC/Energy/Solar

E-mail for CSI inquiries: energy@cpuc.ca.gov

Telephone for CSI inquiries: 415-355-5586

The CSI-Thermal Program provides program information at www.CSIThermal.com

7. CSI and CSI-Thermal Program Administrator Contacts

PG&E

CSI Program: www.pge.com/csi
E-mail: solar@pge.com
877-743-4112

CSI-Thermal Program:
www.pge.com/csithermal
Email: solar@pge.com
877- 743-4112

California Center for Sustainable Energy (San Diego territory)

CSI Program:
www.energycenter.org
E-mail: csi@energycenter.org
858-244-1177

CSI-Thermal Program:
www.energycenter.org/swh
Email: swh@energycenter.org
877-333-SWHP

Southern California Edison

CSI Program:
www.sce.com/csi/
E-mail Address: CSIGroup@sce.com
866-584-7436

CSI-Thermal Program:
www.sce.com/csithermal
Email: CSIGroup@sce.com
800- 799-4177

So Cal Gas (CSI-Thermal only)

www.socalgas.com/rebates/solar/
Email: swh@SoCalGas.com
1-800-Gas-2000