



California Solar Initiative Annual Program Assessment June 2012



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June 2012

Prepared by the
California Public Utilities Commission

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1. Executive Summary

1.1 Introduction

In January 2007, California began an unprecedented \$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 (CPUC or the Commission) portion of the solar effort is known as the California Solar Initiative (CSI) Program. CSI, the country's largest solar program, has a \$2.2 billion budget and a goal of 1,940 MW of solar capacity by the end of 2016.

This Annual Program Assessment meets statutory requirement for an annual report to the Legislature on the progress of the CSI Program.¹ Other state authorized programs, including the New Solar Homes Partnership (NSHP) and publicly-owned utilities' solar offerings, are not included in this report.²

The market for solar generating equipment in California has grown at a rapid pace since the beginning of the CSI Program. The annual rate of new solar installations and the cumulative installed capacity both provide evidence that California is well along the path of achieving the installed capacity goals set forth by Senate Bill (SB) 1 in 2006, the legislation that authorized the CSI Program.

1.2 Key Report Contents

This report contains current information on distributed solar energy systems in California, including systems installed through the CSI Program and those installed through other incentive programs. In addition, this report provides detailed information on CSI 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 report also includes information on Net Energy Metering and other relevant policy updates.

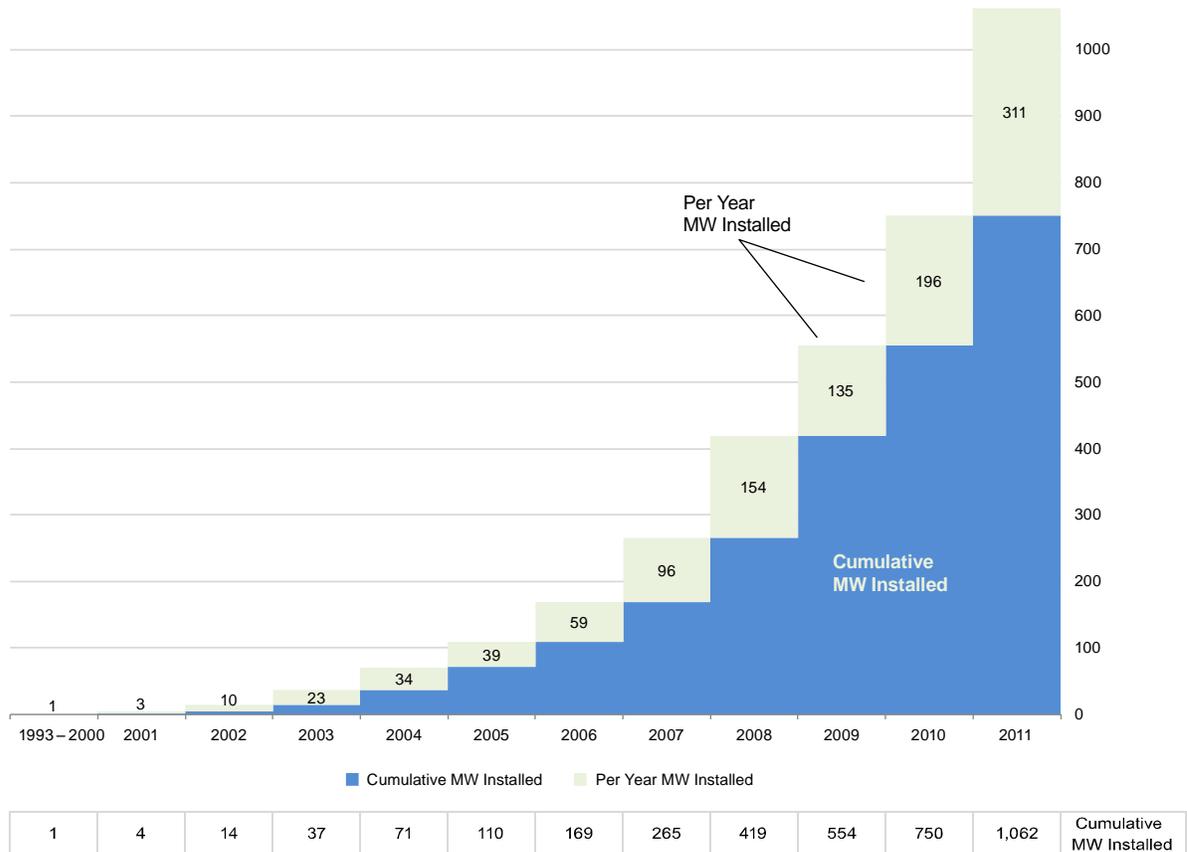
¹ PU Code 2851 (c)(3) states, "On or before June 30, 2009, and by June 30th of every year thereafter, the commission shall submit to the Legislature an assessment of the success of the California Solar Initiative program." The CPUC submitted the first CSI Annual Program Assessment on June 30, 2009, available at: <http://www.cpuc.ca.gov/PUC/energy/Solar/apa09.htm>.

² Information on non-CPUC jurisdictional solar programs is available at www.gosolarcalifornia.ca.gov.

1.2.1 Statewide Installed Solar Highlights

- In 2011, California became the first state in the U.S. to surpass the gigawatt (1,000 megawatts) mark for installed customer generated solar capacity. Today, 115,000 sites across the state host solar systems to serve on-site load.
- A record 311 megawatts (MW) were installed statewide in 2011 alone.

Figure 1: Customer-Sited Solar in IOU Territories by MW, 1993 – 2011



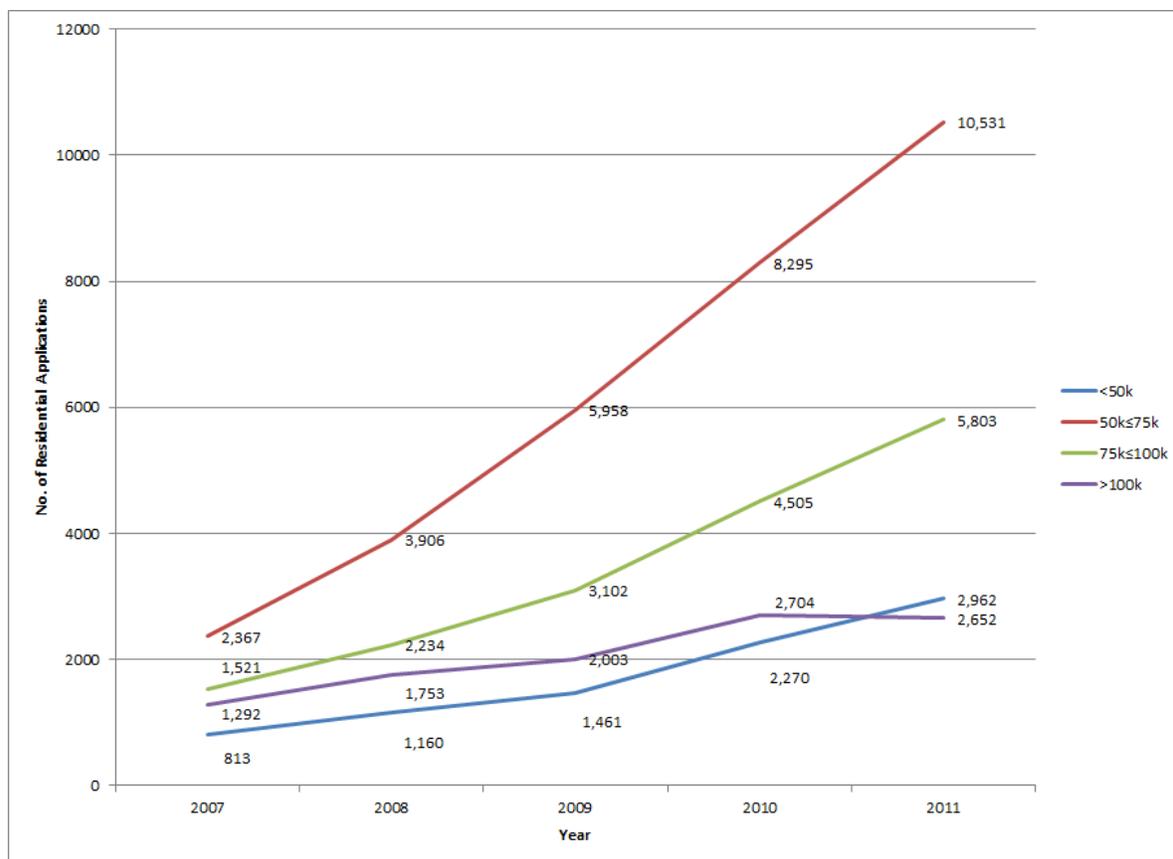
Data is through December 31, 2011. It Includes CSI, NSHP, ERP and SGIP data, but not POU or RPS data.

1.2.2 CSI General Market Program Highlights

- The California Solar Initiative program maintained record growth in 2011 and into 2012, despite cooling market effects of declining incentives.
 - In 2011, the CSI Program installed a record 261 MW, with another 97MW installed in 2012.

- Based on the rate of installation in the first quarter of 2012, the CSI Program is on track to reach 1,000 MW in installations by the end of the year.
- Five years into the program, CSI General Market program shows the following trends:
 - A tremendous growth in third party owned residential projects;
 - A 28 percent decrease in systems costs since 2007; and
 - An increase in solar projects in low and middle income markets, as shown in Figure 2 below. Specifically,
 - The number of CSI projects in low income markets (i.e., areas with median incomes of less than \$50,000) has increased by 364 percent since 2007.
 - The number of CSI projects in middle income markets (i.e., areas with median incomes between \$50,000 and \$100,000) has increased by 445 percent since 2007, comprising the majority of applications received in 2011.

Figure 2: CSI Applications Received by Income Level



Sources: www.CaliforniaSolarStatistics.ca.gov, data through May 30, 2012. 2000 U.S. Census data.

1.2.3 Other Program Components Highlights

- **Single-Family Affordable Solar Homes (SASH)**
 - Nearly 1,500 low-income home owners,³ with help from the SASH program, have installed solar panels to generate energy and improve their monthly cash flow.
 - The SASH Program installed nearly 1,200 systems by the end of last year, surpassing their goal installing over 1000 projects to low-income families by 2011.

- **Multi-family Affordable Solar Housing (MASH)**
 - The MASH program is fully subscribed once again, even after a Commission Decision in 2011 that moved money from the program’s Track 2 grant program into the primary incentive track for common and tenant areas, Track 1A&B.
 - As of April 30, 2012, MASH has 181 completed projects with a capacity of 9.1 MW.
 - Virtual Net Metering⁴ has allowed thousands of tenants to receive the direct benefits of solar as reductions in their monthly electric bills.

- **CSI-Thermal Program**
 - The CSI-Thermal program launched a statewide marketing and public relations campaign to drive awareness of solar water heating technologies in both residential and commercial customer sectors.
 - In just over two years of operation, the program has received 704 applications for \$4.87 million in incentives
 - In March 2012, the CSI-Thermal Low Income program began accepting applications. The program provides higher incentives for solar water heating systems installed in single and multifamily low income residences.

- **Research, Development, Demonstration and Deployment (RD&D) Program**
 - The third round of CSI RD&D grant proposals were received in September, 2011, with primary focus areas in grid integration of solar energy, improved

³ CSI Program Forum, May 16, 2012. Presentation available at http://www.cpuc.ca.gov/NR/rdonlyres/6C3D96CF-26EB-4F55-810A-9C9731322DCA/0/CSIPublicForum_Slides_120516.pdf

⁴ Virtual Net Metering was first approved by the Commission when the MASH Program was adopted in D.08-10-036. VNM is a tariff which allows the bill credits from a single solar system to be shared among multiple customer accounts.

photovoltaic (PV) production technologies, and business development and deployment.

- Seven research grants were approved by the Commission for a total of \$7.6 million.
- Facility construction at the Helios Solar Energy Research Center, a joint effort of Lawrence Berkeley National Laboratory (LBNL) and U.C. Berkeley whose primary goal is to develop methods to “store” solar energy in the form of renewable transportation fuel, is expected to begin in summer of 2012.

1.3 Net Energy Metering

- In May 2012, the CPUC adopted a decision⁵ which established a methodology for calculating the cap on participation in the Net Energy Metering (NEM) program. Per statute,⁶ the NEM cap is defined as five percent of the utility’s “aggregate customer peak demand.” The decision clarifies that “aggregate customer peak demand” should be interpreted as the aggregation, or sum, of individual customers’ peak demands, i.e., their non-coincident peak demands.
 - This new interpretation of “aggregate customer peak demand” increases the number of MW that may be installed under the NEM cap.
- The decision also directs Energy Division to oversee a study on the costs and benefits of NEM to be completed by October 2013.

⁵ Decision (D.) 12-05-036.

⁶ Public Utilities (PU) Code 2827.

2. Introduction

2.1 Background on California Solar Initiative (CSI)

The California Solar Initiative (CSI or CSI Program) is the solar rebate program for California investor-owned utilities: Pacific Gas and Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E).

The goals of the CSI Program are to:

- Install 1,940 MW of distributed solar energy system generation capacity or the equivalent 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;
- Transform the market for solar energy systems so that it is price competitive and self-sustaining.

Incentives under the CSI Program are available to solar PV systems as well as 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.⁷

The CSI Program focuses exclusively on solar energy systems used by IOU customers who want to offset some or all of their own 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 hot water program, the solar energy systems reduce the customer's gas or electricity consumption, depending on 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; nor does it contribute toward the utilities' Renewable Portfolio Standard (RPS) obligations.⁸

⁷ The electric-displacing portion of CSI Program, which covers solar PV and some solar thermal systems, was authorized by the California Public Utilities Commission (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 Senate Bill (SB) 1 (Murray, 2006). The gas-displacing solar thermal portion of the CSI was authorized by the Legislature in Assembly Bill (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.

⁸ The California utilities contract for a variety of renewable resources, including large and small solar power plants as part of the RPS Program. Updates on the progress of the RPS program can be found at <http://www.cpuc.ca.gov/PUC/energy/Renewables/>.

2.2 CSI Program Components

The overall CSI Program has two funding streams, depending on whether the rebated technology displaces natural gas or electricity. 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). AB 1470 (Huffman, 2007) authorized \$250 million in additional spending on thermal technologies through 2017 to be collected from gas ratepayers, which will be used to fund gas-displacing technologies, such as solar water heaters, in the CSI-Thermal program.

The CSI Program has several program components, as shown in Table 1, each with its own Program Administrator and budgets overseen by the California Public Utilities Commission (CPUC or Commission):

- **The CSI General Market Solar Program** provides incentives for residential and non-residential systems between one-kilowatt to one-megawatt. The general market program administrators (PAs) are PG&E, SCE, and the California Center for Sustainable Energy (CCSE) in SDG&E territory. The goal of the general market rebate program is to incentivize 1,750 MW of demand-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.
- **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 robust job training to hundreds of volunteers and workforce development participants, and offers competitive opportunities for solar installers through a subcontractor program.
- **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 innovative Virtual Net Metering (VNM) tariffs, which allow a system owner to share bill credits for solar production with the building's tenants.
- **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 on whether the project is electric-displacing or gas-displacing. There are five 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, SCG and SDG&E administer the Program for the gas-displacing portion. In mid-April 2012, the CSI-Thermal program launched a \$5 million, 2-year public relations contract to spotlight the benefits of solar thermal technologies to targeted end users. The CSI-Program now consists of two subcomponents: residential program, low-income program and commercial/multi-family program.

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 | 95 MW |
| Multifamily Affordable Solar Housing (MASH) | \$108 | 95 MW |
| Research, Development, Demonstration, and Deployment (RD&D) | \$50 | ~ |
| Solar Water Heating Pilot Program (SWHPP) | \$2.6 | 750 SWH systems |
| Sub-Total: CSI Electric Budget (Electric Displacing) | \$2,167 | 1,940 MW |
| CSI Thermal Program (Gas-Displacing) | \$250 | 585 million therms⁹ |
| Total CSI Budget | \$2,417 | |

Source: CPUC D.06-12-033, FOF 15, 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).

Note: The CPUC decisions on MASH and SASH did not explicitly adopt a 95 MW per program goal; however, the CPUC did adopt a total CSI program goal of 1,940 MW in D.06-12-033. The CPUC is currently considering revising the MW goals for the MASH and SASH Programs.

2.3 CSI Program Regulatory Process

Between 2006 and 2012, the Commission adopted a number of regulatory decisions establishing the CSI Program, as well as various CSI Program components.¹⁰ Rules and

⁹ The CSI-Thermal goal of 585 million therms is the equivalent of 250 SWH residential systems.

procedures pertaining to Distributed Generation, including the CSI Program, are currently developed within Rulemaking (R.)10-05-004.

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.¹¹

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.¹² As a result, the CPUC has revised and reissued the CSI Program Handbook numerous times per year since the program first began.

2.3.1 CSI Program Decisions--General Market

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.
- 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 California Solar Initiative.
- D. 10-09-046 modifies the CSI general market budget, shifts \$40 million from the program administration budget into the incentive budget as partial mitigation for higher than anticipated performance payments under the “PBI” mechanism.

¹⁰ 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.

¹¹ Information on the CSI Program Forums can be found at

<http://www.cpuc.ca.gov/PUC/energy/solar/forum.htm>

¹² [G.O. 96-B](#)

- D.11-07-031 modifies prior CSI decisions, including D. 06-08-033 and 08-10-036, based on a comprehensive staff proposal.
- D.11-12-019 modifies the CSI budget requirement, as adopted in D. 06-08-028, D. 10-09-046 and D.11-07-031, in response to SB 585 (Kehoe, 2011).

2.3.2 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 establishes the Low-Income Solar Water Heating Component of the CSI-Thermal program.
- D. 11-11-005 establishes the eligibility of propane-displacing technologies for the CSI-Thermal Program.

3. Solar Installed Through 2011

This section of the report summarizes data on the cumulative installed capacity¹³ and number of solar projects installed in California investor-owned utility territories and provides a table showing all distributed solar installed statewide.

3.1 Investor-Owned Utility Territory Solar Installations

In 2011, California reached a major milestone in exceeding 1 gigawatt of new customer-sited solar in California’s investor-owned utility (IOU) territories. Specifically, customer-generated solar capacity totaled 1,061 MW at 104,274 sites in IOU territories of PG&E, SCE, and SDG&E. This data includes solar projects interconnected under any of the IOU solar programs, including CSI, NSHP, Emerging Renewables Program (ERP), and the Self-Generation Incentive Program (SGIP). IOU data does not include solar projects installed in

¹³ 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 megawatts (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.

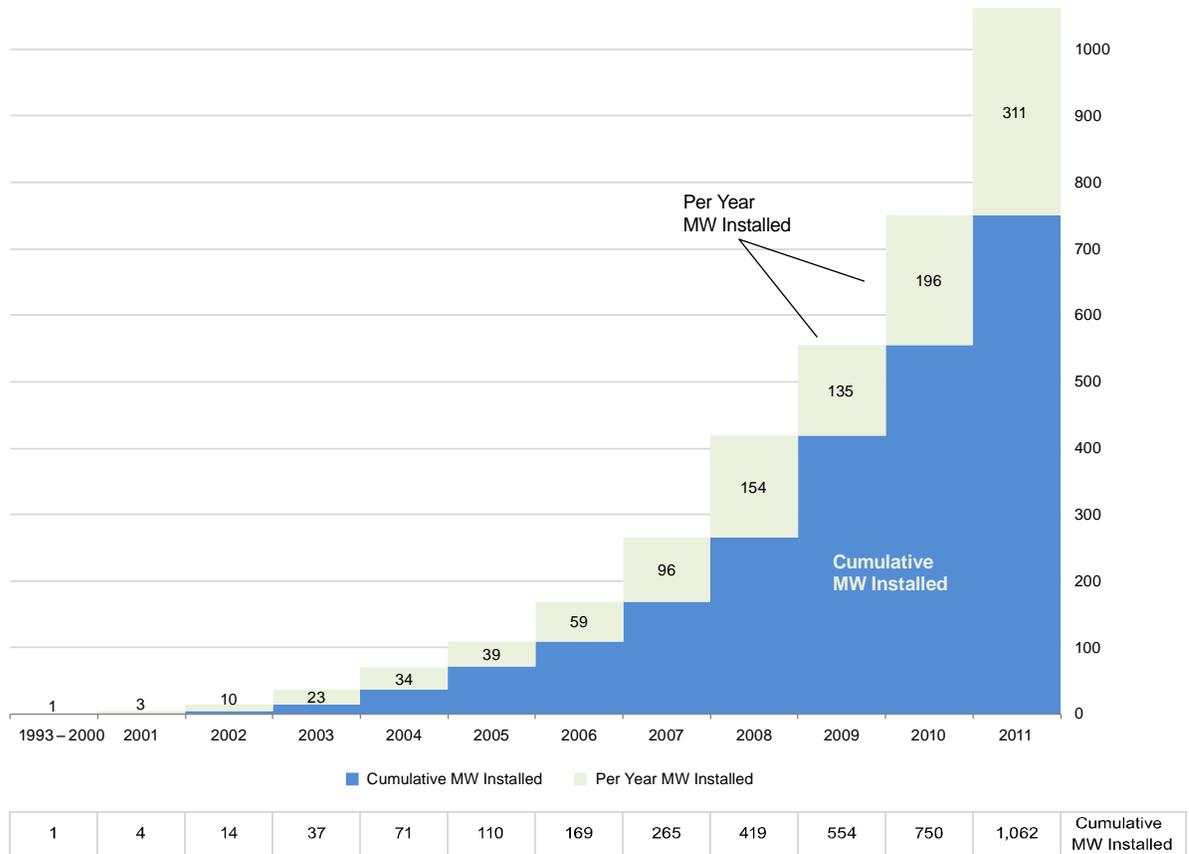
Publicly-Owned Utility (POU) areas, such as Los Angeles Department of Water and Power or Sacramento Municipal Utility District, nor data from multi-jurisdictional utilities, such as the Pacific Power California Solar incentive Program.¹⁴ CSI Program-only data is featured in Section 4.1.2.

Figure 3 shows the amount of solar capacity installed by year in IOU territories, with 311 MW installed in 2011, a growth of 60 percent from 2010. 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 4 uses the same data as Figure 3 but shows the data as the number of installations. Figure 4 shows that there were 27,336 solar projects installed in IOU territories in 2011, a growth of 38 percent from 2010. All of the solar capacity identified in Figure 3 and Figure 4 is installed on customer sites, and thus the data does not include solar power plants installed on the wholesale side of the meter for use in compliance with the Renewables Portfolio Standard (RPS).

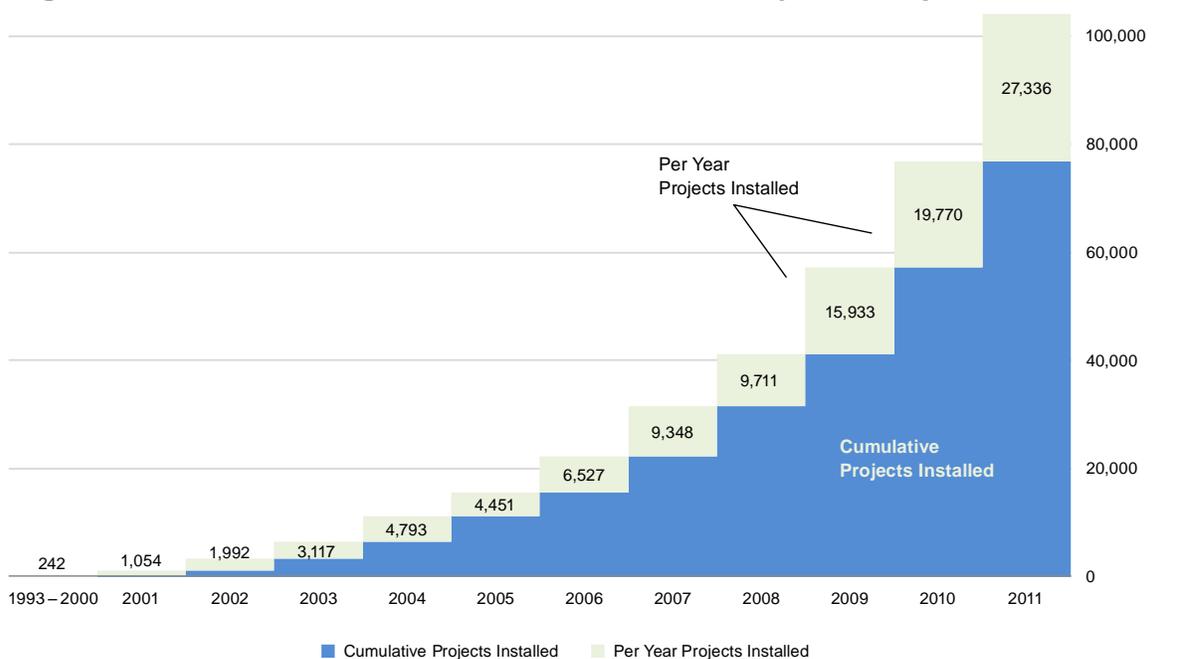
¹⁴ In compliance with its program application, A.10-02-003, Pacific Power will submit its first annual report to the Commission by July 31, 2012. The PPCSIP program is authorized to provide incentives for 4 MW of solar energy in the next five years.

Figure 3: Customer-Sited Solar in IOU Territories by MW, 1993-2011



Data is through December 31, 2011. It Includes CSI, NSHP, ERP and SGIP data, but not POU or RPS data.

Figure 4: Customer-Sited Solar in IOU Territories by # of Projects, 1993 – 2011



| | | | | | | | | | | | | |
|-----|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|---------|---------------------|
| 242 | 1,296 | 3,288 | 6,405 | 11,198 | 15,649 | 22,176 | 31,524 | 41,235 | 57,168 | 76,938 | 104,274 | Cumulative Projects |
|-----|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|---------|---------------------|

Data is through December 31, 2011. It Includes CSI, NSHP, ERP and SGIP data, but not POU or RPS data.

3.2 Net Energy Metering Data

The majority of the projects and capacity shown in Table 2 and Table 3 are enrolled in Net Energy Metering (NEM) tariffs, pursuant to Public Utilities Code 2827. The CSI Program supports onsite solar installations between 1kW -1MW designed to offset some or all of the customer’s electrical load, but not wholesale generation projects designed to sell electricity to the utility grid.¹⁵ CSI Program participants are eligible for utility interconnection and NEM tariffs that facilitate solar by allowing solar customers to feed temporary amounts of excess electricity into the grid. NEM customers receive bill credits (in dollars) for any excess generation (in kWh) for a given billing period. Soon general market participants in multi-tenant buildings will be able to enroll in Virtual Net Energy Metering tariffs, initially piloted in the MASH program, described in section 4.3 of this report.

Some solar projects, especially those with a solar system that is small relative to total load, opt to take utility service under a non-NEM tariff. Table 2 shows the total solar

¹⁵ The Renewable Portfolio Standard (RPS) Program supports large scale solar power plants through the procurement of such plants to serve wholesale electrical demand. Information on solar procured by large IOUs to meet RPS requirements can be found at: <http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm>.

interconnections compared to the customers on solar NEM tariffs. There is about 67 MW, or 6 percent, of solar capacity in the state that is not signed up for NEM tariffs.

Table 2: Solar Interconnections and Solar NEM Customers by Utility

| | MWs Interconnected | Customers Interconnected | MWs on NEM tariffs | Customers on NEM Tariffs |
|------------------|---------------------------|---------------------------------|---------------------------|---------------------------------|
| PG&E | 597 MW | 60,329 | 559 MW | 57,630 |
| SCE | 341 MW | 28,446 | 311 MW | 28,314 |
| SDG&E | 123 MW | 15,499 | 121 MW | 15,340 |
| Total | 1,061 MW | 104,274 | 991 MW | 101,284 |

Data is from December 2011. It Includes CSI, NSHP, ERP and SGIP data, but not POU or RPS data.

In May 2012, the CPUC adopted a decision¹⁶ which established a methodology for calculating the cap on participation in the Net Energy Metering (NEM) program. Per statute,¹⁷ the NEM cap is defined as five percent of the utility’s “aggregate customer peak demand.” The decision clarifies that “aggregate customer peak demand” should be interpreted as the aggregation, or sum, of individual customers’ peak demands, i.e., their non-coincident peak demands. This new interpretation of “aggregate customer peak demand” increases the number of MW installed under the NEM cap. The decision also directs Energy Division to oversee a study on the costs and benefits of NEM to be completed by October 2013.

3.3 California Statewide Solar Installations

Through the end of the first quarter of 2012, California has an estimated 1,255 MW of installed solar capacity at 122,516 sites, a 38 percent increase in solar capacity and a 29 percent increase in the number of properties going solar from the year prior. As detailed in Table 3, this statewide solar data combines the best available information on (1) IOU interconnections thru 2011; (2) IOU installed solar in 2012 based on CSI Program Data; and (3) POU solar data thru 2010. The CPUC tracks IOU interconnection data on a quarterly basis and the CSI program data is available weekly. However, data on POU solar projects is collected by the CEC, and, to date, the information is only available annually. The snapshot shown in Table 3 provides the best available estimate of California statewide solar installations.

¹⁶ Decision (D.) 12-05-036.

¹⁷ Public Utilities (PU) Code 2827.

Table 3: California Statewide Solar Installations

| Data Source and Dates | Total MWs | Total Projects |
|--|-----------|----------------|
| Solar Installations in California IOU Territories | | |
| All IOU Interconnections, 1993-2011 | 1,061 | 104,274 |
| CSI Program Data Only, 1/1/2012 through 4/1/2012 | 98 | 6,360 |
| Solar Installations in California POU Territories | | |
| CEC through 2010 | 96 | 11,882 |
| Total California Solar Installations | | 1,255 |
| | | 122,516 |

4. CSI Program Components

4.1 General Market Solar Program

4.1.1 Program Background

The CSI “general market” solar program is the most well known CSI Program component. It offers incentives to all eligible customers in large IOU territories who install solar systems. These incentives are based on either the actual or calculated performance of a solar system, such that higher performing systems receive a larger incentive than lower performing systems. Solar system performance is affected by design considerations, which include module efficiency, tilt, orientation, shading, and level of system monitoring and maintenance. 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 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."

4.1.1.1 Incentive Types

The CSI 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 Expected Performance-Based Buydown (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 calculator¹⁸ that considers major design characteristics of the system, such as panel type, installation tilt, shading, orientation, and solar insolation available by location.

The Performance Based Incentive (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. In the beginning of the CSI Program, all systems 100kW and greater were required to take the PBI incentive. In January 2008, all systems 50kW and greater were required to take the PBI incentive. As of January 2010, all systems 30kW and greater are required to take the PBI incentive. These two incentive types are explained in more detail in Table 4 below.

Table 4: CSI Incentive Types

| Expected Performance-Based Buydown (EPBB) Paid in \$/watt | Performance-Based Incentive (PBI) Paid in cents/kWh |
|--|--|
| Ideal for residential and small business customers | Ideal for larger commercial, government & non-profit customers |
| Systems smaller than 30 kW | Mandatory for all systems 30 kW and greater Systems less than 30kW can opt-in to PBI |
| Incentive paid per Watt based on your system’s expected performance (factors include CEC-AC rating, location, orientation and shading) | Incentive paid based on the actual energy produced by the solar system, measured in kilowatt-hours |
| One-time, lump sum upfront payment | 60 monthly payments over five years |

4.1.1.2 Incentive Level Design

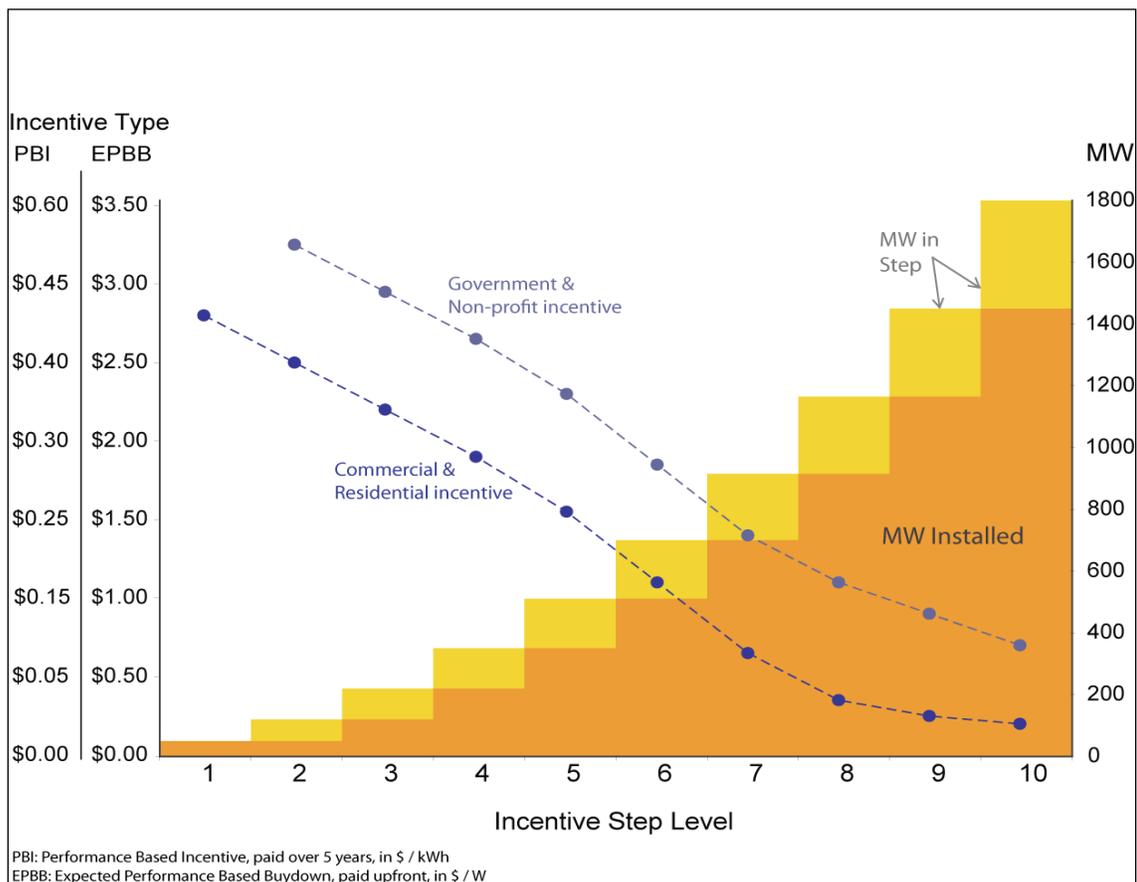
The CSI Program offers financial incentives that decline as more capacity is installed. The incentive level design is intended to anticipate economies of scale in the California solar market – as the solar market grows, it is expected that total solar system costs will fall. The incentive scheme is designed to decline in parallel with the expected market cost-declines.

The capacity targets in each incentive step level are assigned across the whole program, as shown in Figure 5. Each step offers a certain number of MWs, shown in yellow, and the cumulative capacity of all MWs expected to be installed in the program for all steps are

¹⁸ The EPBB calculator is publicly available at <http://www.csi-epbb.com/>. The EPBB calculator estimates the expected performance of a solar system based various factors including the tilt, azimuth, location, PV module type and mounting type of a specific system.

shown in orange. The dotted blue lines are the incentive levels available at each step. The dotted blue line for government and non-profit participants is higher at every step to compensate for their ineligibility for the 30 percent Federal Investment Tax Credit available to other taxable entities.

Figure 5: Overview of the CSI Step Level Changes



Note: See www.csi-epbb.com for a table listing of the incentive levels per step.

The capacity targets per incentive step were further broken down into allocations across customer type (approximately one-third residential and two-thirds non-residential) and across the three IOU service territories. The targets per IOU territory are set in proportion to each utility’s contribution to CPUC-regulated electricity sales. 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 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 | | 43.70% | | 46.00% | | 10.30% | |

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.

4.1.1.3 Current Incentive Steps

Figure 6 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. It is important to note that 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.

Figure 6: Current Statewide Solar Incentive Step Levels

| Program Administrator | Customer Class | Current Step | EPBB Incentive Value (\$/Watt) | PBI Incentive Value (\$/Watt) (a) (b)* | MW Remaining in Step | MW Under Review |
|-----------------------------|---------------------------|--------------|--------------------------------|--|----------------------|-----------------|
| CCSE (San Diego) | Residential | 10 | \$0.20 | \$0.025 | 9.26 | 0.74 |
| | Nonresidential | 8 | \$0.35 | \$0.05 (a)/ \$0.044 (b) | 12.10 | 1.33 |
| | Government/ Tax-exempt | | \$1.10 | \$0.15 (a)/ \$0.139 (b) | | |
| PG&E | Residential | 9 | \$0.25 | \$0.03 (a)/ \$0.032 (b) | 5.10 | 2.21 |
| | Nonresidential | 10 | \$0.20 | \$0.025 | 90.29 | 3.68 |
| | Government/ Tax-exempt | | \$0.70 | \$0.088 | | |
| SCE | Residential | 8 | \$0.35 | \$0.05 (a)/ \$0.044 (b) | 23.97 | 0.53 |
| | Nonresidential | 8 | \$0.35 | \$0.05 (a)/ \$0.044 (b) | 53.54 | 4.56 |
| | Government/ Tax-exempt | | \$1.10 | \$0.15 (a)/ \$0.139 (b) | | |

Data as of 6/28/2012.

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. Steps 8a and 9a are the original CSI incentive rates, while 8b and 9b are the revised rates.

4.1.2 Program Progress

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.¹⁹ In addition, the CSI Program releases a Data Annex, available online, each quarter with key program application processing metrics, such as application processing times.²⁰ The CSS website and the Data Annex are discussed further in Section 5.1.

¹⁹ California Solar Statistics can be accessed here: www.californiasolarstatistics.ca.gov.

²⁰ The CSI Program releases a Data Annex each quarter. The Q1 2010 Data Annex was released in June 2010. See <http://www.cpuc.ca.gov/PUC/energy/Solar/news.htm>.

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. The CSI Measurement and Evaluation (M&E) program component performs more detailed analysis, including cost benefit analyses, impact analyses, and other studies intended to help understand and improve the Program's performance.²¹ The progress of the M&E component is reported in Section 5.2.

4.1.2.1 General Market Program Trends

Five years into the ten year General Market CSI program, there have been changes in the solar market that have impacted the CSI. Specifically, the program has seen several trends emerge since the program's inception in 2007 including:

- A significant increase in participation from customers in lower and medium income areas.
- A dramatic rise in third-party owned systems.
- An over 20 percent drop in PV system costs.

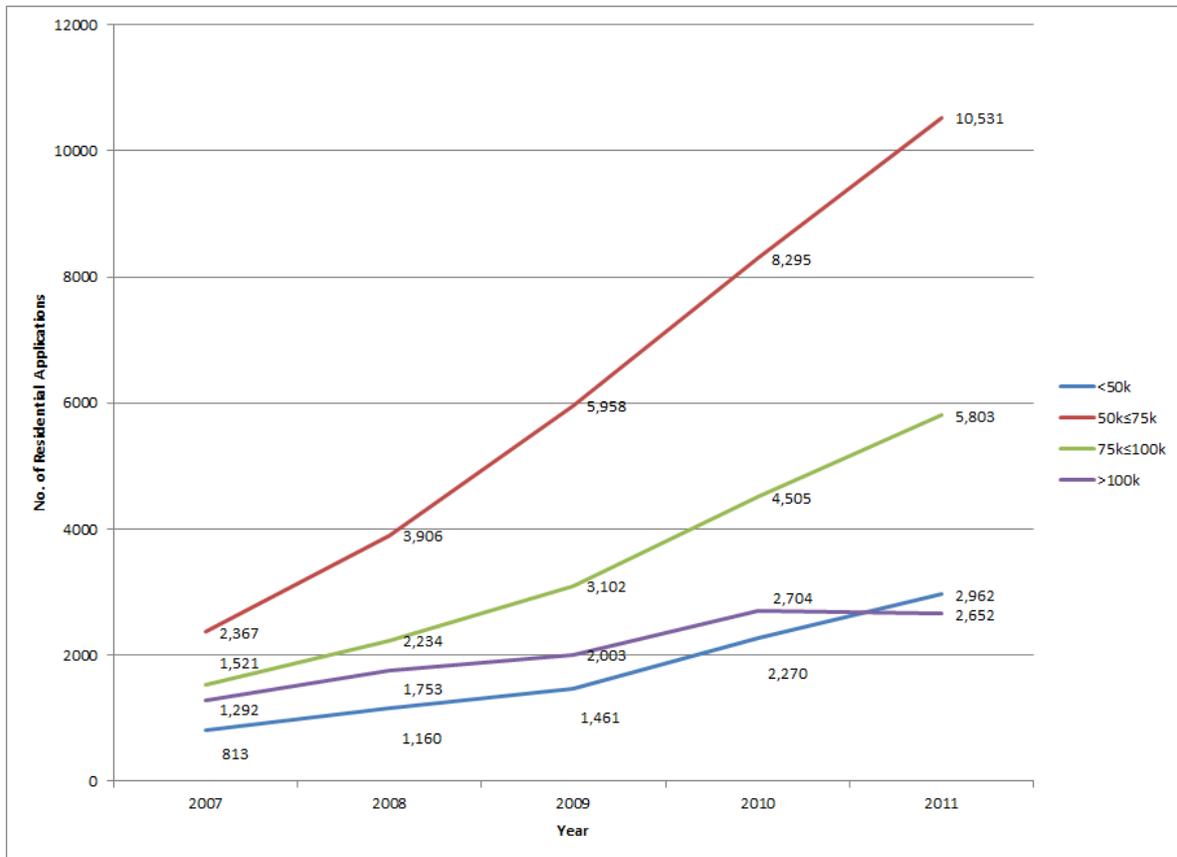
These market trends, discussed in more detail below, suggest that the CSI Program is approaching its goal of stimulating widespread adoption of solar and creating a self-sustaining market free of ratepayer subsidies.

4.1.2.1.1 Increased CSI Participation in Lower and Middle Income Areas

The general market CSI Program has seen a sharp increase in the number of projects in lower and middle income areas. Figure 7 below shows CSI applications received from 2007 through 2011 in zip codes with median household incomes that range from less than \$50,000 to \$100,000 and above. As shown in Figure 7, the number of CSI systems in lower income zip codes — with median incomes of less than \$50,000 — has increased 364 percent since 2007, and the number of systems of middle income zip codes — with median incomes between \$50,000 and \$75,000 — has increased 445 percent since 2007. While there has also been steady growth in areas with median incomes between \$75,000 and \$100,000, the program participation in zip codes with median incomes of \$100,000 or greater has decreased since 2010.

²¹ All CSI Program Measurement and Evaluation reports are available at: <http://www.cpuc.ca.gov/PUC/energy/Solar/evaluation.htm>

Figure 7: CSI Applications Rec'd by Income Level



Sources: www.CaliforniaSolarStatistics.ca.gov, data through June 6, 2012. 2000 U.S. Census data.

The upward trend in CSI participation lower and middle income areas is likely due to a sharp increase in third party owned systems that have received CSI incentives. Third party ownership models, such as solar leases and power purchase agreements (PPAs), allow households who cannot afford to own a PV system to go solar.

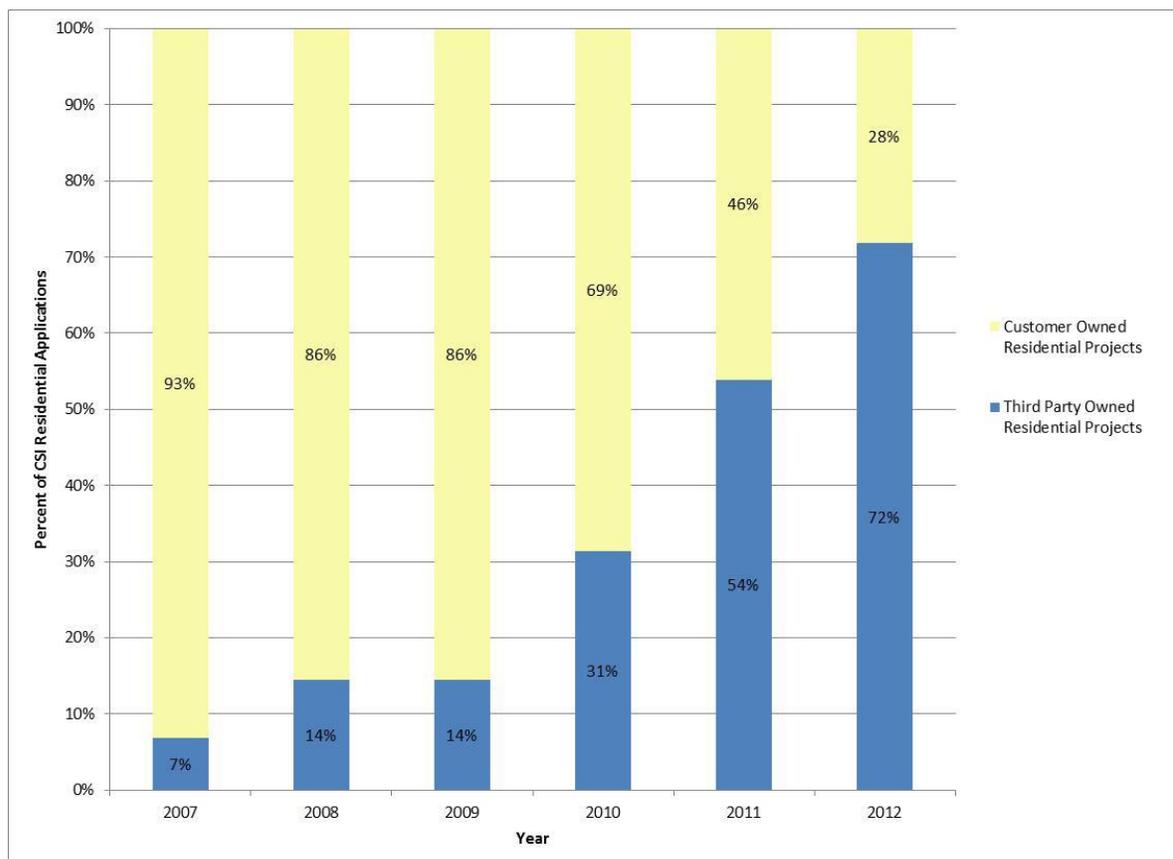
4.1.2.1.2 Third Party Owned Systems

Third party owned systems are PV systems that are owned, maintained and operated by a company or developer but they are installed on the roof of a utility customer’s home or business. The third party owner has a financial arrangement with the utility customer, typically in the form of a solar lease or PPA.

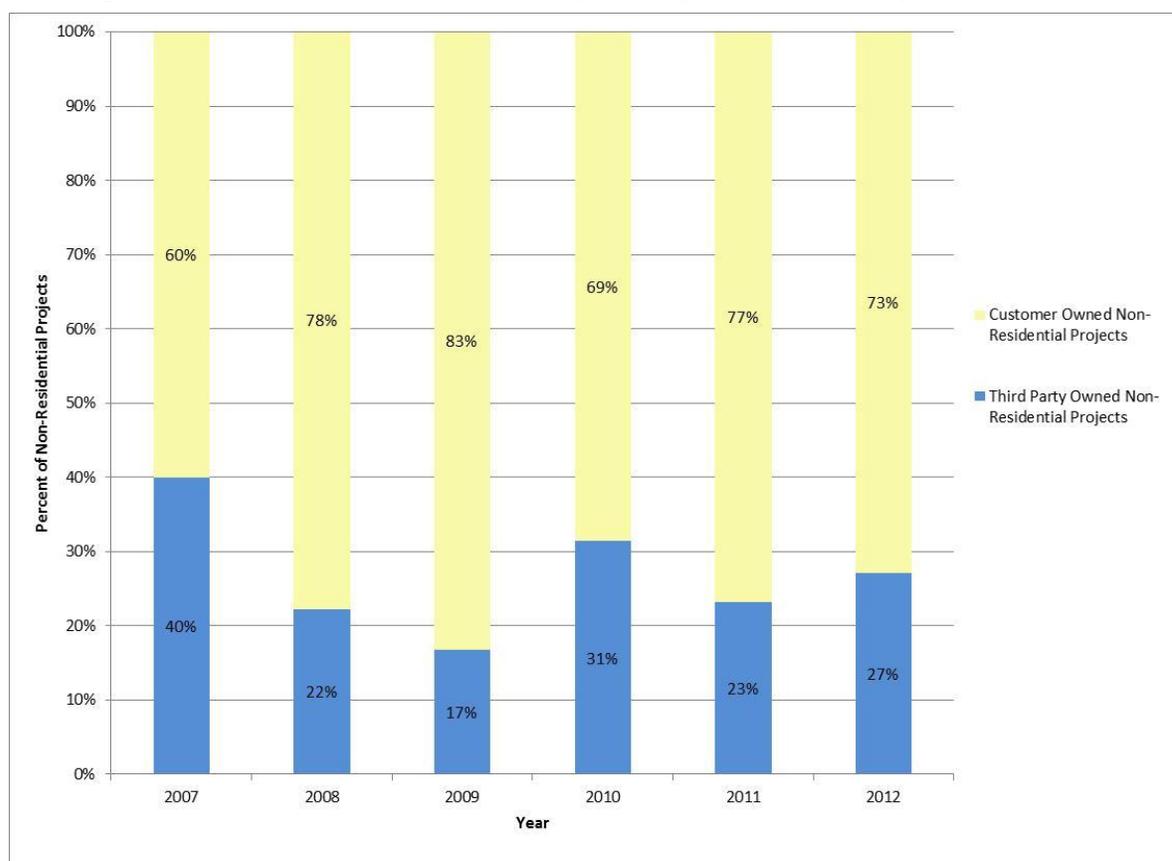
At the beginning of the CSI Program, the vast majority of third party owned systems were non-residential systems. In the past five years, due to the increased popularity of third party ownership models in the residential solar market, there has been a rise in the number of third party owned residential projects in the program.

Figure 8 below shows the percent of CSI residential projects received each year by ownership type (i.e., third party owned or customer-owned). As shown in Figure 8, there has been a steep increase in the number of third party owned residential systems in the program. In the past five years, the number of third party owned systems on residences has jumped from 7 percent to 72 percent in 2012. Figure 9 shows that the number of third party owned non-residential systems has fluctuated over the years. It should be noted that the number of non-residential systems has decreased from an all-time high of 40 percent in 2007 to 27 percent in 2012.

Figure 8: CSI Residential Projects by Ownership Type, 2007-2012



Source: www.CaliforniaSolarStatistics.ca.gov, data through May 21, 2012.

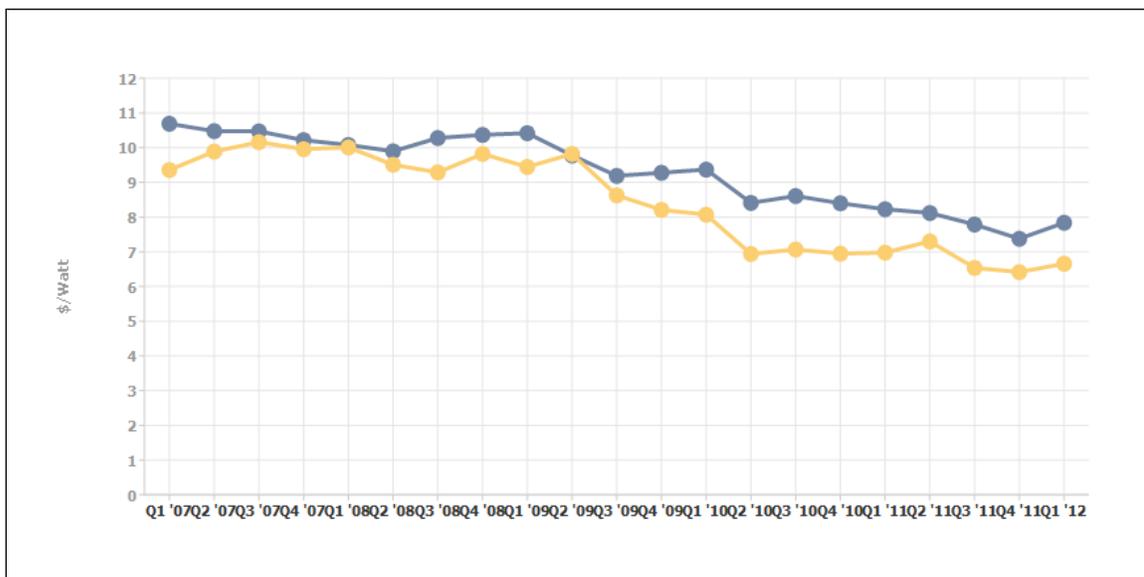
Figure 9: CSI Non-Residential Projects by Ownership Type, 2007-2012

Source: www.CaliforniaSolarStatistics.ca.gov, data through May 21, 2012.

4.1.2.1.3 Average System Costs for Program Participants

Since 2007, the average cost of residential systems has decreased 27 percent from \$10.69 per watt to \$7.84 per watt. The average cost of non-residential systems has decreased 29 percent from \$9.36 per watt to \$6.66 per watt. While residential costs descended from \$8.12 per watt in Q1 2011 to \$7.38 per watt in Q4 2011 (a 9% drop), costs increased to \$7.84 per watt in Q1 2012. There is a similar, though less pronounced, trend for non-residential systems. To some extent, the recent increase is likely due to the way the data are gathered. Because the data include only systems that are completed, and yet are allocated to a quarter based on when they are reserved, the data for systems in the most recent quarter typically only include systems that were reserved and completed within that quarter. Thus, the number of projects included to calculate the average cost per watt in Q1 2012 represent a smaller range of costs than those of earlier quarters.

Figure 10: CSI System Costs by Quarter, 2007 – 2012



Source: www.CaliforniaSolarStatistics.ca.gov, data through May 21, 2012.

Since July 2010, the CSI program has imposed a “soft cap” on per watt system costs to encourage an ongoing reduction in system costs. This cost cap was previously set at the twelve month system average plus one standard deviation. As of May 23, 2012, the value for the soft cap is \$9.68 per watt. If an application comes in above this value, (a) the applicant must submit an explanation for the high cost, (b) the host customer must acknowledge that he or she knows that the project is significantly higher than typical, and (c) the PA must find the explanation reasonable.

In response to SB 585 (Kehoe, 2011), which required that cost caps be put in place for residential and non-residential systems based on state and national trends, the Commission’s Energy Division issued a resolution which proposed cost caps for systems above and below 10 kW. Finally, while the cap will apply to all applications, it will be based only on host customer-owned systems. The resolution was adopted by the Commission in May 2012.

The current cost per watt data available for California Solar Initiative projects present difficulties when comparing host customer-owned and third-party-owned systems. The reported costs for host customer-owned systems are straightforward, as they reflect the purchase price inclusive of parts, labor, permitting fees, overhead, and profit. Third-party-owned systems are more challenging, as they are reported in a variety of ways and may also capture the embedded costs for additional services like financing.

There are at least three different ways third-party owners are reporting their system costs:

1. If the third-party owner buys the system from a contractor, the third-party owner may report that sale price as the system price to the CSI Program. This value, however,

- does not include the overhead and profit of the third-party owner, which are actually passed through to the host customer.
2. Alternatively, the third-party owner may report the "Fair Market Value" (FMV) of the system, a figure reported in tax filings. FMV is an estimate of the market value of a property, based on what a knowledgeable, willing, and unpressured buyer would probably pay in an arm's-length transaction.
 3. Lastly, the third-party owner may report the appraised sum of cost inputs.

In addition, most third-party-owned systems also include the cost of inverter replacements, and some even include roofing replacements - services not typically included in the price of a host customer-owned system.

Because of the challenges in reporting costs for third party owned systems, Energy Division is contracting with a consultant to look at ways to better understand third party owned systems as part of the upcoming Market Transformation Study. Further, the California Solar Statistics (CSS) website has added a feature which now allows users to filter the cost data for either host customer-owned systems or third party owned systems.

4.1.2.2 General Market Program Activity

The general market CSI Program is making significant progress towards meeting the program's goal of 1,750 MW to be installed by 2017. Table 6 shows the program's current activity. Based on the current installation rates, the CSI Program is on track to install 1 gigawatt (GW) of solar in 2012.

Breakdowns of the data by Program Administrator and customer sector are provided in Section 4.1.2.5.

Table 6: All CSI Projects Pending and Installed

| Installed Projects | |
|-----------------------------|------------------|
| Applications | 73,586 |
| Capacity (MW) | 839 MW |
| Incentive \$ million | \$1,355 M |
| Pending Projects | |
| Applications | 14,180 |
| Capacity (MW) | 348 MW |
| Incentive \$ million | \$ 262 M |
| Total CSI Activity | |
| Applications | 87,766 |
| Capacity (MW) | 1,186 MW |
| Incentive \$ million | \$1,617 M |

Source: www.CaliforniaSolarStatistics.ca.gov, data through May 30, 2012

4.1.2.3 Progress Toward Goals

The CSI Program has installed 48 percent of its total program goal, with another 20 percent of the goal reserved in pending projects, as shown in Table 7. The CSI Program has 32 percent of the program goal remaining. The CPUC did not establish annual targets for the program when it was adopted, and the CPUC did not expect that the program would install an equal number of projects each year. Rather, the expectation is that solar installations will increase annually, in response to market growth and development.

As detailed in Table 7, the utilities are progressing towards their goals at varying rates, depending on the utility and customer sector. The residential sectors lead the way in PG&E and SDG&E territory, which have 71 percent and 74 percent of their installation goals complete. The lowest installation rates for the residential sector are in SCE territory, where 41% of the sector's goals are complete. PG&E has the most installations in the non-residential sector, having reached 54% of their goal in installations. SDG&E and SCE have lower non-residential installation rates at 39% and 33%, respectively.

Table 7: CSI Progress Towards Program Goal of 1,750 MW

| Customer Class | Installed | Pending | Remaining | Goal |
|-----------------------------|------------|------------|------------|--------------|
| SCE | | | | |
| Non-Residential (MW) | 180 | 101 | 258 | 540 |
| Non-Residential (% of Goal) | 33% | 19% | 48% | |
| Residential (MW) | 109 | 33 | 123 | 266 |
| Residential (% of Goal) | 41% | 12% | 46% | |
| PG&E | | | | |
| Non-Residential (MW) | 279 | 154 | 80 | 514 |
| Non-Residential (% of Goal) | 54% | 30% | 16% | |
| Residential (MW) | 180 | 27 | 45 | 252 |
| Residential (% of Goal) | 71% | 11% | 18% | |
| SDG&E (CCSE) | | | | |
| Non-Residential (MW) | 47 | 26 | 49 | 120 |
| Non-Residential (% of Goal) | 39% | 21% | 40% | |
| Residential (MW) | 44 | 7 | 8 | 59 |
| Residential (% of Goal) | 74% | 12% | 14% | |
| Total (MW) | 845 | 348 | 557 | 1,750 |
| Total (% of Goal) | 48% | 20% | 32% | |

Source: www.CaliforniaSolarStatistics.ca.gov, data through May 30, 2012.

4.1.2.4 CSI Program Activity for 2011 and 2012

CSI Program activity continued to grow in 2011 and early 2012, with 256 MW in applications received in that year. While there has been a decrease in non-residential applications since 2010, residential applications increased by 20 percent.

Table 8: CSI 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 |

Source: www.CaliforniaSolarStatistics.ca.gov, data through December 31, 2011.

Table 9: CSI Program Activity, first quarter of 2012

| | New Applications Received |
|--------------------|----------------------------------|
| Capacity (MW) | 94 MW |
| Number of Projects | 8,028 projects |

Source: www.CaliforniaSolarStatistics.ca.gov. Data through April 1, 2012

In 2012, the CSI Program has seen an increase in applications compared with the corresponding period of 2011, and the demand for new applications now averages more than 2,000 applications per month. Even though CSI Program demand is not keeping up with the record pace of last year, program activity is still robust. There have been over 8,000 applications for new solar projects, with a total capacity of 94 MW received between January and April, 2012.

However, 2012 is likely to be strong year for projects installed under the CSI Program. In the first quarter of 2012, CSI has installed 97 MW of new distributed solar. Based on the installation rate in Q1 2012, the CSI Program is on track to install 1,000 MW by the end of 2012.

Table 10: Capacity of CSI Projects Installed by Year

| Year | Residential | Non-Residential | Total |
|-------------------------------|--------------------|------------------------|--------------|
| 2007 | 15 | 13 | 28 |
| 2008 | 35 | 85.7 | 121 |
| 2009 | 59 | 77 | 136 |
| 2010 | 79 | 73 | 152 |
| 2011 | 97 | 163 | 260 |
| 2012 (through April 1) | 28 | 69 | 97 |

Source: www.CaliforniaSolarStatistics.ca.govs thru April 1, 2012.

4.1.2.5 CSI Program Activity by Program Administrator and Customer Sector

Table 11, Table 12, and Table 13 provide a snapshot of Program Activity by Program Administrator and Customer Sector by capacity, incentives, and number of applications, respectively.

Table 11: CSI Installed and Pending Capacity (MW) by PA and Sector

| Application Type | Program Administrator | | | Total |
|------------------------|-----------------------|------------|------------|--------------|
| | CCSE | PG&E | SCE | |
| Residential | 51 | 207 | 143 | 401 |
| Installed | 44 | 180 | 109 | 334 |
| Pending | 7 | 27 | 33 | 68 |
| Non-Residential | 72 | 432 | 282 | 785 |
| Installed | 47 | 279 | 180 | 505 |
| Pending | 26 | 154 | 101 | 280 |
| Total Megawatts | 123 | 639 | 424 | 1,186 |
| Installed | 91 | 458 | 290 | 839 |
| Pending | 32 | 181 | 135 | 348 |

Source: www.CaliforniaSolarStatistics.ca.gov, data through May 30, 2012.

Table 12: CSI Pending and Installed Incentives (\$ millions) by PA and Sector

| Application Type | Program Administrator | | | Total |
|------------------------|-----------------------|--------------|--------------|----------------|
| | CCSE | PG&E | SCE | |
| Residential | \$46 | \$196 | \$182 | \$425 |
| Installed | \$44 | \$190 | \$163 | \$397 |
| Pending | \$1.6 | \$6.8 | \$19 | \$28 |
| Non-Residential | \$125 | \$587 | \$480 | \$1,193 |
| Installed | \$100 | \$479 | \$379 | \$958 |
| Pending | \$25 | \$109 | \$101 | \$234 |
| Total Incentive | \$171 | \$784 | \$663 | \$1,617 |
| Installed | \$145 | \$668 | \$542 | \$1,355 |
| Pending | \$26 | \$116 | \$121 | \$262 |

Source: www.CaliforniaSolarStatistics.ca.gov, data through May 30, 2012.

Table 13: Number of Pending and Installed CSI Applications by PA and Sector

| Application Type | Program Administrator | | | Total |
|-------------------------------------|-----------------------|---------------|---------------|---------------|
| | CCSE | PG&E | SCE | |
| Residential | 10,855 | 43,198 | 28,960 | 83,013 |
| Installed | 9,576 | 37,503 | 23,015 | 70,094 |
| Pending | 1,279 | 5,695 | 5,945 | 12,919 |
| Non-Residential | 460 | 2,798 | 1,495 | 4,753 |
| Installed | 330 | 2,083 | 1,079 | 3,492 |
| Pending | 130 | 715 | 416 | 1,261 |
| Total Number of Applications | 11,315 | 45,996 | 30,455 | 87,766 |
| Installed | 9,906 | 39,586 | 24,094 | 73,586 |
| Pending | 1,409 | 6,410 | 6,361 | 14,180 |

Source: www.CaliforniaSolarStatistics.ca.gov, data through May 30, 2012.

4.1.3 Marketing and Outreach Efforts

The overall budget for CSI Marketing and Outreach (M&O) was established in D.11-07-031 at \$21,625,000, and the CPUC provides guidance for statewide M&O activities. Such activities include free monthly training for professionals and consumers on a wide range of solar-related topics at various level of technical expertise. The program administrators also issue a monthly electronic newsletter, now distributed to more than 10,000 subscribers. Sponsorships and solar promotions provide opportunities for program representatives to interact with various solar audiences. The program features a main solar web site, www.GoSolarCalifornia.ca.gov, and each PA maintains a website with information specific to their particular territory. Collateral materials such as fact sheets and direct mail to targeted consumers reinforce the message that solar is easy to use and more affordable than ever. 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.

4.2 Single-Family Affordable Solar Homes (SASH) Program

4.2.1 Program Background

The Single-Family Affordable Solar Homes Program (SASH), 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.²² 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.

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.

The SASH Program provides consumer education on solar and energy efficiency technologies to the diverse volunteer base that contributes to SASH installations. Over 200 volunteers per month participate 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 some cases, GRID Alternatives sub-contracts with qualified solar contractors to install SASH projects through the SASH Sub-Contractor Partnership Program (SPP).

4.2.1.1 SASH Program Budget

The SASH budget is \$108.3 million, allocated according to the information in Table 14 and Table 15.

Table 14: 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 | \$108.3 |

Source: D.07-11-045

²² 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).

Table 15: 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 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 2852 (described further below). PU Code 2852 allows owner-occupied residences that are part of a larger multi-family complex to qualify under certain conditions. GRID Alternatives 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 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 their eligibility for the California Alternate Rates for Energy (CARE)²³ program. The SASH incentive does not decline over time as in the general market CSI 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 and six highly-subsidized incentive payment levels 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 16 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 Incentive Structure

The following incentive structure is available to customers whose total household income is below 80% 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

²³ CARE provides a 20% to 30% discount on the energy bills of qualifying low-income customers

Manager will work with the Applicant to enroll them into CARE. Table 16 shows the sliding-scale incentive rates:

Table 16: 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.

4.2.2 Program Progress

Throughout 2011, the SASH Program 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 Alternatives 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

SASH began accepting applications in December 2008 and by the end of Q1 2012, the SASH program has received 2,256 applications totaling 6.9MW capacity and over \$42 million in incentives. The SASH Program had a goal of installing over 1000 projects to low-income families in 2011, and has so far surpassed this goal by installing PV on more than 1,000 low income homes by the end of 2011. Table 17 summarizes the current status of SASH applications.

Table 17: SASH Applications by Status and Service Territory

| Application Status | Number of Applications | | | | Total kW, (CEC-AC) | Total Incentives \$ millions |
|--|------------------------|------------|------------|--------------|-----------------------|------------------------------------|
| | PG&E | SCE | SDG&E | Totals | | |
| STEP 1: Applications under review | 238 | 177 | 46 | 461 | 1,336.9 | \$8.02 |
| STEP 2: Confirmed Applications/ Reservations | 200 | 130 | 17 | 347 | 1,201.2 | \$7.51 |
| STEP 3: Completed/Installed | 733 | 525 | 190 | 1,448 | 4,332.2 | \$27.19 |
| TOTALS | 1,171 | 832 | 253 | 2,256 | 6,870.3 | \$42.72 |

Source: SASH Data collected 4/4/2012.

Nearly all of the completed SASH installations were made at no cost to the homeowners. GRID Alternatives accomplished this by leveraging funding from local jurisdictions, project sponsorships, and through general non-profit fundraising. Since the SASH incentive does not cover 100% 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.

The SASH Program, as currently structured, will provide job training and volunteering opportunities totaling over 1 million hours of hands-on solar installation experience. GRID reserves at least twenty percent (20%) 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.

4.2.3 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.

The robust growth of SPP continues to be a focus of SASH as the volume of applications and installations increases throughout the program. In 2011, SASH experienced a surge in installations as a result of SPP.

For more information on the SASH program, see the SASH Q1 2012 Program Status Report on the CPUC website at <http://www.cpuc.ca.gov/PUC/energy/Solar/sash.htm>.

4.3 Multifamily Affordable Solar Housing (MASH) Program

4.3.1 Program Background

The second low income solar program in the California Solar Initiative targets affordable multi-tenant housing. In October 2008, Commission D.08-10-036 established the \$108.3 million Multifamily Affordable Solar Housing (MASH) Program for solar installations on existing multifamily affordable housing that meet the definition of low income residential housing established in PU Code 2852.²⁴

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 general market CSI Program. The MASH Program was intended to operate until January 1, 2016, or

²⁴ D.08-10-036, Appendix A, *mimeo.*, p. 1

until all funds available from the program’s incentive budget have been allocated, whichever event occurs first.

4.3.1.1 MASH Incentive Types

As shown in Table 18, 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 18: 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.

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 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 Program Eligibility

The MASH Program is open to multifamily affordable housing properties that meet the definition of “low income residential housing” per PU Code 2852 and have an occupancy permit of at least two years, and deed restrictions on file with the County Assessor verifying that at least 20 percent of the tenants are low income.

The MASH Program also provides eligibility for certain pre-identified tenant units to enroll with their utility’s Virtual Net Metering tariffs. In PG&E territory, any tenant in a qualifying affordable housing property listed by the applicant may enroll in VNM; in SCE and SDG&E

territories, tenants eligible for enrollment in VNM tariffs must take service at the same single service delivery point that serves the solar system generation meter.

4.3.1.3 Virtual Net Metering (VNM)

Multitenant buildings are a challenging segment for solar PV because of the problem of distributing 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 Virtual Net Metering (VNM).²⁵

The MASH program piloted the VNM tariffs, which allows individually metered tenants to receive credits on their electric bills for the energy production of a solar system installed on buildings or multi-family housing complex. Based on the merits of these tariffs, the Commission expanded VNM to the general market, and included all NEM-eligible technologies for eligibility.

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 intent of VNM is to help low income multifamily residents receive direct benefits of the building's solar system, and is available to all tenants and meters in a defined affordable housing property.

4.3.1.4 Program Budget

The budget and allocations for MASH, shown in Table 19 and Table 20 were adopted by the CPUC in D.08-10-036.

Table 19: 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 | \$108.3 |

Source: D.08-10-036.

²⁵ D. 08-10-036

Table 20: 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 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 April 30, 2012, MASH has 181 completed projects with a capacity of 9.1 MW. There are 156 reserved MASH projects awaiting completion, for a total capacity of 12.6 MW. Program Administrators are reviewing 13 applications, worth about 3.3MW of capacity. Currently, all program administrators have waitlists for incentives, which to date are fully subscribed.

Table 21: MASH Program Progress as of April 30, 2011

| Status of Application | | Total | CCSE | PG&E | SCE |
|------------------------------|---------------|---------|--------|--------|--------|
| Completed | Number | 181 | 34 | 98 | 49 |
| | Capacity (MW) | 9.1 | 1.5 | 4.5 | 3.1 |
| Reserved | Number | 156 | 5 | 79 | 72 |
| | Capacity (MW) | 12.6 | 0.6 | 6.3 | 5.7 |
| Review | Number | 13 | 0 | 1 | 12 |
| | Capacity (MW) | 3.3 | 0 | 0.03 | 3.3 |
| Waitlist | Number | 56 | 10 | 37 | 9 |
| | Capacity (MW) | 5.84 | 1.60 | 2.76 | 1.481 |
| Average Project costs (\$/W) | | \$ 7.48 | \$7.04 | \$7.68 | \$7.71 |

Source: MASH Program Administrators, Data as of April 30, 2012.

4.4 CSI-Thermal Program

4.4.1 Program Background

The CSI-Thermal Program was established by legislative language in SB 1. SB 1 (Murray, 2006) contains a provision which allows up to \$100.8 million of total 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 SWH systems in homes and businesses that displace the use of natural gas by the end of 2017.

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 SWH 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 SWH 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.

4.4.2 CSI-Thermal Budget

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 utilities based on the percentages in Table 25.

Table 22: 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 23.

Table 23: 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.

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 27.

Table 27: 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.

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 24.

Table 24: 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 ²⁶ | \$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: D.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.

4.4.3 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.

²⁶ Because AB 1470 established the low income program, the CSI-Thermal Program only provides incentives for natural gas displacing SWH systems.

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 residential housing definition CPUC code Section 2861 (e). 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 residential housing occupied by ratepayers participating in a Commission-approved and supervised gas corporation Energy Savings Assistance Program (formerly known as LIEE). Participants could either occupy a single-family home or occupy at least 50 percent of all units in a multifamily unit. Additionally, the Commission mandates that SWH systems installed on low-income properties remain low-income residential properties for at least 10 years.

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.

For systems that displace natural gas, incentives initially start at \$1,500 for the typical single-family system and decline in four steps to \$550 for the typical systems. Incentives are capped at 125% of the average incentive for a typical system. Multi-family 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 25.

Table 25: CSI-Thermal Incentive Step Table

| Step | Incentive for Average Residential SWH System | Funding Amount | Incentive per Therm Displaced | Therms Displaced Over System Life |
|--------------|--|----------------------|-------------------------------|-----------------------------------|
| 1 | \$1,500 | \$50,000,000 | \$12.82 | 97,500,000 |
| 2 | \$1,200 | \$45,000,000 | \$10.26 | 109,687,500 |
| 3 | \$900 | \$45,000,000 | \$7.69 | 146,250,000 |
| 4 | \$550 | \$40,000,000 | \$4.70 | 212,727,275 |
| Total | | \$180,000,000 | | 566,164,775 |

Source: D.08-12-044.

Incentives for qualifying single-family low-income customers are 200% of the applicable CSI-Thermal SWH incentive level. Incentives for qualifying SWH installations on multi-family housing are 150% of the applicable CSI-Thermal SWH incentive level. Incentives will decline as incentives in the larger CSI-Thermal Program decline.

Table 26: 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.

Electric-displacing systems are incentivized at a lower level than natural gas displacing systems to account for the higher cost of water heating with electricity (and thus better cost-effectiveness of those systems). Incentives for electricity displacing systems also decline in four steps, but those incentive declines are triggered by step changes on the natural gas side, since the much larger natural gas market is likely to drive the industry. Incentives for electric-displacing systems are as shown in Table 27.

Table 27: Electric-Displacing Solar Thermal Incentives

| Step Level | Electric-Displacing Incentive (\$/kWh) | Incentive for Average Residential System | kWh Savings |
|------------|--|--|-------------|
| 1 | \$0.37 | \$1010 | 2,730 |
| 2 | \$0.30 | \$820 | 2,733 |
| 3 | \$0.22 | \$600 | 2,727 |
| 4 | \$0.14 | \$380 | 2,714 |

Source: D.08-12-044.

4.4.4 Program Participation

The CSI-Thermal Program began taking applications from single-family customers on May 1, 2010 and from multi-family and commercial customers on October 8, 2010. In just over two years of operation, the program has received 704 applications for \$4.87 million in incentives (See Table 28).

Table 28: CSI-Thermal Applications by Sector and Displaced Fuel

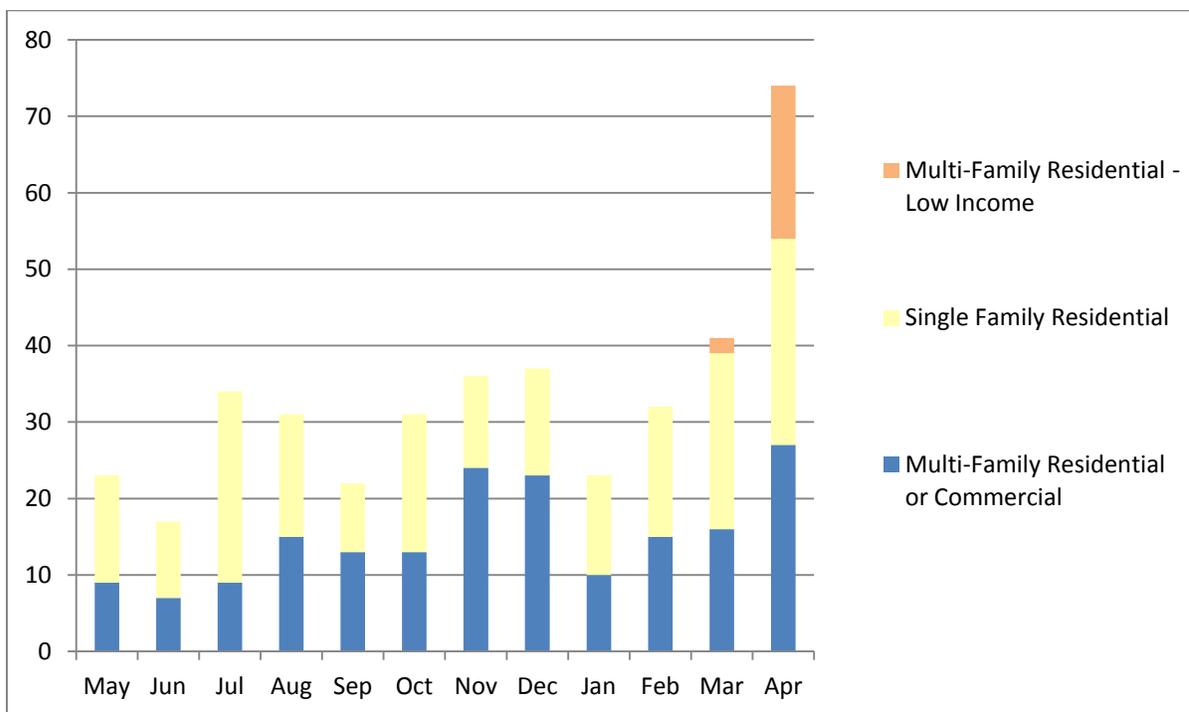
| Sector | Number of Applications | Incentive Amount (\$ thousands) | Project Cost (\$ thousands) | Therms/kWh Saved |
|--|------------------------|---------------------------------|-----------------------------|------------------|
| Multi-Family/ Commercial | 273 | \$6,654 | \$21,799 | |
| Gas | 271 | \$6,638 | \$21,732 | 517,785 |
| Electric | 2 | \$16 | \$66 | 43,243 |
| Single Family Residential | 399 | \$484 | \$3,358 | |
| Gas | 229 | \$316 | \$2,047 | 517,785 |
| Electric | 163 | \$160 | \$1,249 | 432,432 |
| Propane | 7 | \$8 | \$63 | 21,622 |
| Multi-Family Residential – Low Income | 32 | \$998 | \$2,458 | |
| Gas | 32 | \$998 | \$2,458 | 51,898 |
| Electric | 0 | \$0 | \$0 | 0 |
| Subtotal Gas | 532 | \$7,952 | \$26,237 | 1,087,467 |
| Subtotal Electric | 165 | \$176 | \$1,315 | 475,676 |
| Subtotal Propane | 7 | \$8 | \$63 | 21,622 |
| Total | 704 | \$4,866,846 | \$27,614,877 | |

Source: www.csithermal.com/public_export; data through May 14, 2012

Although the single-family sector has received 30% more applications than the multi-family/commercial (MF/C) sector, single-family applications account for only 7% of incentive dollars, indicating that the market for SWH on single-family properties is lagging. To some extent, it is not surprising that the MF/C sector has far outpaced the single-family sector in incentive claims, since the economics of larger projects are more attractive than smaller ones. However, because D. 10-01-022 sets aside 40% of the incentive dollars for the single-family sector, that sector may need extra attention from the market facilitation effort in order to meet program goals.

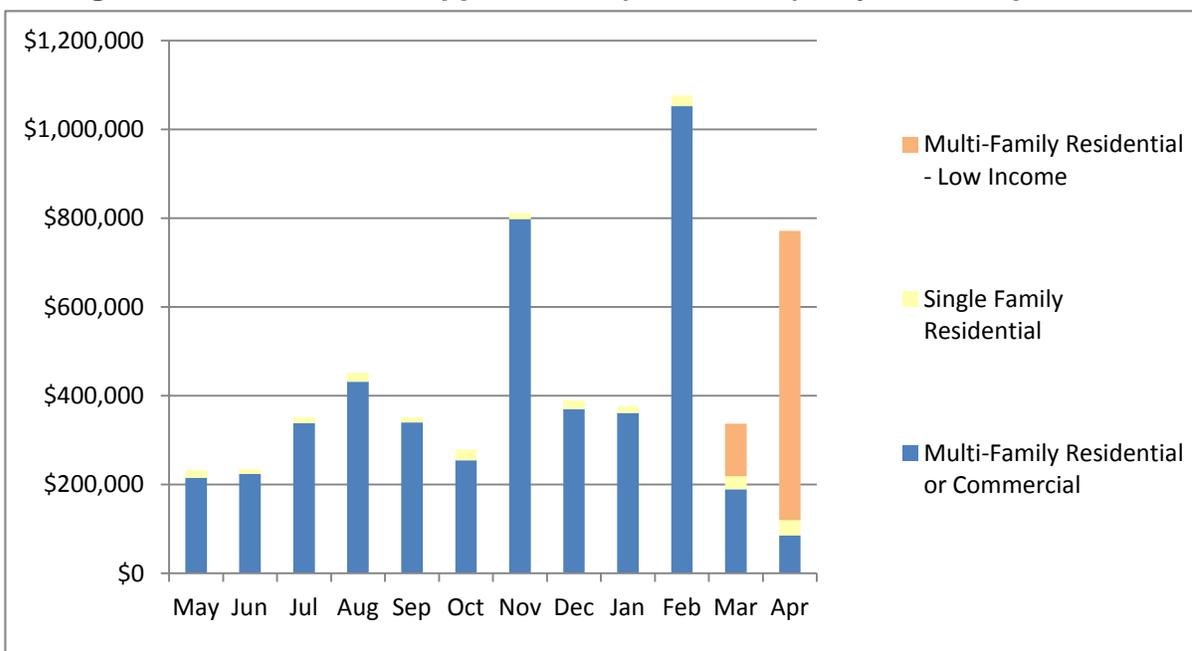
The Commission allowed incentive payments for electric utility customers who were displacing propane. This was expected to be a niche market and so far this has been the case. Figures 7 and 8 show the continued dominance of the MF/C over the single-family program, in terms of incentive dollars. It also shows the immediate popularity of the Low Income program since it became available to the public in February 2012.

Figure 11: CSI-Thermal Applications (number received) May 2011 – April 2012



Source: www.csithermal.com/public_export; data through April 30, 2012

Figure 12: CSI-Thermal Applications (incentive \$) May 2011 – April 2012

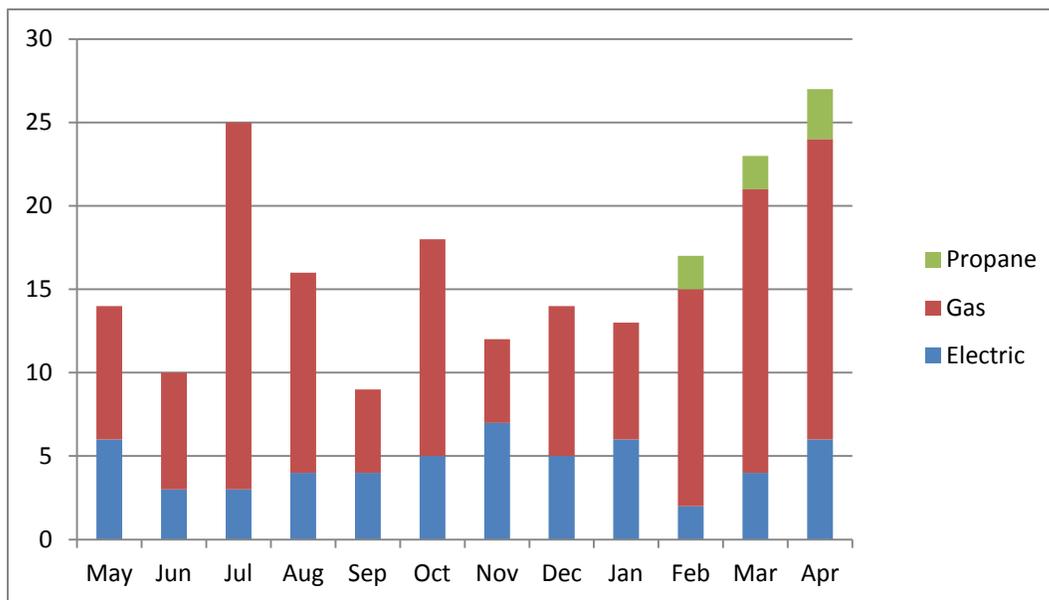


Source: www.csithermal.com/public_export; data through April 30, 2012

Nevertheless, participation in the overall program has been slow. Declining natural gas prices in recent years make the economics of SWH projects that displace natural gas less attractive, especially in the residential market. A comparison of applications for residential incentives between natural gas and electric-displacing SWH illustrates the effect of displaced fuel cost on market viability.

Figure 9 shows total number of electric-displacing and natural-gas displacing SWH applications by month for the second year of the program.

Figure 13: Monthly CSI-Thermal Single-Family Apps By Displaced Fuel Type



Source: www.csithermal.com/public_export; data through April 30, 2012

The CSI-Thermal Low-Income Program began taking applications on March 29, 2012. Although it is too soon to provide information on pending applications, the program has experienced high demand in the multifamily sector. As of early May, SDG&E, SoCalGas, and PG&E have received 11, 4, and 14 multifamily housing applications, respectively.

4.4.4.1 Program Administration

4.4.4.1.1 Incentives Received

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 29, PG&E has received the most incentives by far followed by SoCalGas, CCSE, and SCE.

**Table 29: CSI-Thermal Program Applications by PA
May 2010 through April 2011**

| Program Administrator | Paid | Approved | Review | Canceled | Total |
|-----------------------|------------|-----------|------------|-----------|------------|
| PG&E | 283 | 6 | 83 | 12 | 383 |
| CCSE | 116 | 4 | 1 | 3 | 147 |
| SCE | 12 | 0 | 1 | 1 | 14 |
| SoCalGas | 95 | 31 | 37 | 3 | 166 |
| Total | 505 | 41 | 146 | 19 | 711 |

Source: www.csithermal.com/public_export; data through May 11, 2012

Although most water heating in California is done with natural gas, the economics are much more favorable for electric-displacing SWH, and indeed, one quarter of the applications received so far have been for electric-displacing SWH (see Table 28).

4.4.4.1.2 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, engaging with permitting officials, and other market facilitation activities. On April 1, 2010, each of the four Program Administrators filed a market facilitation plan with Energy Division. On April 28, 2010, the Division of Ratepayer Advocates protested the plans, stating that “Since the plans lack both a unified vision on one hand, and detailed activities on the other, the Commission should require that the plans be improved before the Commission will adopt them.”²⁷

Upon reviewing the plans and based on stakeholder feedback, Energy Division determined that long-term plans for CSI-Thermal Marketing would not be successful without some level of coordination and collaboration among the Program Administrators. Thus, on November 4, 2010, Energy Division issued a guidance memo directing the PAs to re-file their market facilitation plans. The guidance memo contained specific direction for the PAs to collaborate on hiring a professional marketing firm to run a statewide coordinated marketing campaign aimed at increasing consumer awareness of solar thermal.

The PAs hired a marketing firm in June 2011 to develop a state-wide advertising campaign. In April 2012, the PAs have launched a multimedia statewide advertising campaign. The purpose of this marketing effort is to encourage significantly higher participation levels.

²⁷ DRA Protest of Advice Letters PG&E 3108-G/3645-E; SCE AL 2460-E; SOCALGAS AL 4098; AND CCSE ADVICE 11 Seeking Approval of Market Facilitation Plans and Budgets for the California Solar Initiative Thermal Program Pursuant to Decision 10-01-022, April 28, 2010

4.4.4.1.3 Measurement and Evaluation

Unlike the CSI PV Program, where generation performance can be evaluated at the meter, CSI-Thermal technologies offset electric and gas consumption. This requires evaluation of kWh 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 of the CSI-Thermal Program. The decision directs Energy Division to “work in consultation with the assigned Commissioner to establish the CSI Thermal M&E budget and scoping plan through an assigned Commissioner’s Ruling, which will serve as the basis for conducting M&E Studies.”²⁸ The decision also directs Energy Division to oversee the evaluation efforts of the CSI Thermal Program.

4.5 Research, Development, Demonstration, & Deployment

4.5.1 Program Background

The primary 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.

The CSI RD&D Plan, established in September 2007 by D.07-09-042, identifies the goals and objectives of the program, sets forth allocation guidelines for using up to \$50 million in RD&D funds, and establishes criteria for solicitation, selection and funding of RD&D projects. The RD&D portfolio allocation percentages are guidelines and are meant to help steer funds across a range of diverse projects – they should not be interpreted as firm limits. The intent of the RD&D Plan is to provide a flexible framework for the CPUC to select the most promising projects, which is expected to yield the greatest public benefit. As required in D.07-09-042, \$10 million of the CSI RD&D Program was allocated to support construction of the Helios Solar Energy Research Center at U.C. Berkeley. This project leveraged additional funds committed from a variety of sources.

The CSI RD&D Program focuses on implementation of the CPUC’s adopted RD&D Plan which establishes the funding priorities for the program as the following:

- Improving the economics of solar by reducing installed costs and increasing performance

²⁸ D.10-01-022, p. 68.

- Enabling wide-scale deployment of distributed solar technologies by filling knowledge gaps
- Overcoming barriers to technology adoption
- Taking advantage of California’s data from past, current, and future installations
- Providing bridge funding to help promising technologies make the transition to commercial viability
- Supporting efforts to integrate distributed power into the grid and maximize value to ratepayers
- Integrating the above goals with an eye toward issues that directly benefit California and may not be funded by others

The portfolio of RD&D projects are required to reflect diversity across the following RD&D stages:

- Research: Fundamental research to improve performance of energy technologies
- Development: Activities that convert research into working prototypes of improved technologies
- Demonstration: Activities that bring promising technologies closer to market by demonstrating their real-world feasibility to manufacturers
- Deployment: Aiding new technologies in gaining wide-scale adoption or to reach a “tipping point” into widespread commercialization

Within these four stages, project funds will be dispersed across a variety of different activities with distinct risk and result timeframes. The tables below show the guidelines for the RD&D budget targeted by development stages, expected activity (objectives adopted in D.07-09-042), and expected results timeframe.

- Table 30 shows that, per Commission direction, the RD&D portfolio will be heavily focused on demonstration projects, with less emphasis on direct research and even less on development and deployment.
- Table 31 shows that 50 – 65 percent of funds allocated in any RD&D stage should involve grid integration, storage or metering advancements that reflect the priority to integrate solar production into California’s electric grid. A smaller percentage of recipient projects should involve energy generation technologies or business development innovations, designed to reduce solar system costs and/or increase their performance.
- Finally, Table 32 shows that about 60 percent of all project funding should show results in the 1 – 3 year time frame, 20 percent in the 4 – 7 year time frame, and 20 percent in 8 or more years.

Table 30: RD&D Budget by Market Diffusion Stage

| RD&D Stage | Budget % (Range) | Budget Max (\$M) |
|---------------|------------------|------------------|
| Research | 20% | \$8.5 |
| Development | 10 – 15% | \$6.4 |
| Demonstration | 50 – 60% | \$25.5 |
| Deployment | 0 – 15% | \$6.4 |
| Total* | 100%* | \$42.5* |

Source: D.07-09-042.

Note: *Total not to exceed \$42.52 million - not all stages will spend to Maximum \$ amount.

Table 31: RD&D Budget by Target Activities

| Target activities | Budget % (Range) | Budget Max (\$M) |
|--------------------------------------|------------------|------------------|
| Grid integration, storage & metering | 50 – 65% | \$27.64 |
| Energy Generation technologies | 10 – 25% | \$10.63 |
| Business development | 10 – 20% | \$8.50 |
| Total* | 100% | \$42.5* |

Source: D.07-09-042.

Note: *Total not to exceed \$42.52 million - not all target activities will be fully subscribed.

Table 32: RD&D Budget by Results Timeframe

| Results timeframe | Budget % | Budget Max (\$M) |
|-------------------|-------------|------------------|
| 1 – 3 years | 60% | \$25.51 |
| 4 – 7 years | 20% | \$8.50 |
| 8+ years | 20% | \$8.50 |
| Total | 100% | \$42.5* |

Source: D.07-09-042.

Note: *Total not to exceed \$42.52 million- not all stages will be fully subscribed.

The CPUC established the CSI RD&D Program budget in D.06-12-033 and further detailed budget requirements in D.07-09-042. Itron, the CSI RD&D Program Manager, administers the Program with oversight from the CPUC. They are responsible for developing requests for proposals (RFPs), evaluating grant requests, entering into grant agreements, and monitoring progress on all approved projects. The budget breakdown in Table 33 is based on the guidelines established in D.07-09-042.

Table 33: 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.

4.5.2 Program Progress

To read more about the status of the CSI RD&D Program, visit the program website: www.calsolarresearch.ca.gov.

- D.07-09-042 granted \$10 million to the Helios Solar Energy Research Center, a joint effort of Lawrence Berkeley National Laboratory (LBNL) and U.C. Berkeley which will focus on developing low cost solar energy conversion technology using PV and successor materials. Facility construction is expected in summer of 2012.
- CPUC Resolution E-4317 approved eight grants totaling \$9.3 million for the CSI RD&D's first solicitation, which focused on grid integration of solar energy. These eight winners, shown in Table 34, include a variety of academic, industry, national laboratory, and utility participants. In total, these recipients are bringing more than \$6 million in matching funding. Some of these projects are now complete.
- A second round of CSI RD&D grant solicitation was released in November 2009. This round focused on improved PV production technologies and innovative business models. On September 2, 2010, CPUC Resolution E-4354 approved nine grants for a total of \$14.6 million. These nine recipients, who are bringing \$13 million in match funding, are shown in detail in Table 38.
- The third round of CSI RD&D grant recommendations was released on March 8th of 2012 via Resolution E-4470. This solicitation strongly favored proposals with utility partners, and required 50% match funding. Resolution E-4470 approved seven research grants for a total of \$7.6 million. The selected grantees that have \$7.9 million in match funding, are shown in Table 39.
- All of the projects funded are either located in California or have at least one California-based partner.
- In total, matching funding is on a 1:1.5 ratio to ratepayer funding for CSI RD&D projects.

Table 34: CSI RD&D Program Grant Awardees, First Solicitation, March 2010

| Applicant | Proposal title | Funding Request (\$ Millions) | Match Funding (\$ Millions) |
|---|---|--|--|
| Sacramento Municipal Utility District | High Penetration PV Initiative | \$3.0 | \$1.3 |
| Clean Power Research | Advanced Modeling and Verification for High Penetration PV | \$1.0 | \$2.3 |
| National Renewable Energy Laboratory | Beopt-CA (EX): A Tool for Optimal Integration of EE/DR/ES+PV for California Homes | \$1.0 | \$0.3 |
| kW Engineering | Specify, Test and Document an Integrated Energy Project Model | \$0.9 | \$9.2 |
| National Renewable Energy Laboratory | Analysis of High-Penetration Levels of PV into the Distribution Grid in CA | \$1.6 | \$1.4 |
| APEP/UC Irvine | Development and Analysis of a Progressively Smarter Distribution System | \$0.3 | \$0.1 |
| SunPower Corporation | Planning and Modeling for High-Penetration PV | \$1.0 | \$0.3 |
| University of California San Diego (UCSD) | Improving Economics of Solar Power Through Resource Analysis, Forecasting and Dynamic System Modeling | \$0.6 | \$0.1 |
| Total | | \$9.3 | \$6.1 |

Source: Resolution E-4317.

Table 35: CSI RD&D Grant Awardees from Second Solicitation, Sep. 2010

| Applicant | Proposal title | Funding Request (\$ Millions) | Match Funding (\$ Millions) |
|----------------------------------|---|--|--|
| SunPower | PV and Advanced Energy Storage for Demand Reduction | \$1.9 | \$0.9 |
| Amonix | Improved Cost, Reliability, and Grid Integration of High Concentration Photovoltaic Systems | \$2.1 | \$3.2 |
| Solaria | Proving Performance of the Lowest Cost PV System | \$1.2 | \$1.2 |
| Viridity Energy | Innovative Business Models, Rates and Incentives that Promote Integration of High Penetration PV with Real-Time Management of Customer Sited Distributed Energy Resources | \$1.7 | \$0.8 |
| ConSol | Low-Cost, Smart-Grid Ready Solar Re-Roof Product Enables Residential Solar Energy Efficiency Results | \$1.0 | \$1.2 |
| University of California Regents | West Village Energy Initiative | \$2.5 | \$1.2 |
| Solar City | Advanced Grid-Interactive Distributed PV and Storage | \$1.8 | \$1.1 |
| SunLink | Reducing California PV Balance of System Costs by Automating Array Design, Engineering and Component Delivery | \$1.0 | \$0.9 |
| Cogenra Solar | Improved manufacturing and innovative business models to accelerate commercialization in California of hybrid concentrating photovoltaic/thermal tri-generation (CPV/T-3G) technology | \$1.5 | \$2.8 |
| Total | | \$14.6 | \$13.3 |

Source: Resolution E-4354.

Table 36: CSI RD&D Grant Awardees from Third Solicitation, Mar. 2012

| Applicant | Proposal title | Funding Request (\$ Millions) | Match Funding (\$ Millions) |
|--|---|--|--|
| General Electric International, Inc. Energy Consulting | Quantification of Risk of Unintended Islanding and Reassessment of Interconnection Requirements in High-Penetration of Customer-Sited Distributed PV Generation | \$0.6 | \$0.6 |
| Electric Power Research Institute, Inc. | Screening Distribution Feeders: Alternatives to the 15% Rule | \$2.0 | \$2.0 |
| BEW Engineering | Tools Development for Grid Integration of High PV Penetration | \$1.0 | \$1.0 |
| Clean Power Research | Integrating PV into Utility Planning and Operation Tools | \$0.8 | \$0.9 |
| U.C. San Diego | High-Fidelity Solar Forecasting Demonstration for Grid Integration | \$1.5 | \$1.5 |
| Strategic Energy Innovations | Solar Energy & Economic Development Fund (SEED Fund) | \$0.3 | \$0.3 |
| Southern California Edison | Integrating Smart Inverters and Energy Storage into Zero Net Energy Demonstrations | \$1.3 | \$1.4 |
| Total | | \$7.6 | \$7.9 |

Source: Resolution E-4470.

5. Program Reporting and Evaluation

5.1 Program Reporting

There are a number of periodic reports that the Program makes available to the public.

5.1.1 Online Reporting

The California Solar Statistics (CSS) web site,²⁹ which launched in 2010, is a collaborative effort between the CSI PAs 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 will soon include data on the MASH and SASH programs. CSS is updated weekly and includes the following features:

- Tracks the CSI participation.
- Tracks system costs.
- Contains a “Find an Active Solar Contractor” feature which helps prospective solar buyers do just that, and a search page that facilitates data queries.
- Posts a weekly update to the budget status of the CSI General Market program.
- Relies on data from the CSI online database, PowerClerk, which was inaugurated in 2007 and is used to assist in evaluation efforts.

5.1.1.1 Data Annex Now Online

Since 2007, Quarterly Progress reports and Quarterly Data Annex reports are published by the PAs, showing the incentive dollars, number of applications, and capacity installed as well as providing data on administrative performance. The administrative performance data shown in these reports focuses primarily on the speed with which PAs and Program participants pass through application milestones, such as the average time to confirm a submitted reservation, or the average time to process an incentive claim form. The Annual Data Annex report also informs readers about the trainings offered in each PA territory, and tracks the progress of NEM participation.

In 2011, the Data Annex was made available online and can be accessed here:

http://californiasolarstatistics.ca.gov/reports/data_annex/.

²⁹ www.CaliforniaSolarStatistics.ca.gov

5.2 Program Evaluation Plan

The CSI Program goals are to deploy 1,940 megawatts (MW) of new solar capacity by 2016, and to help 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.³⁰ The CSI Evaluation Plan measures the program’s progress towards those goals.

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

- **Impact Evaluations:** three annual studies for 2007-2010 have been published and a 2011 Impact Evaluation is scheduled to be carried out by the end of summer 2012. (see section 5.3 below)
- **CSI PV Market Transformation Studies:** scheduled to begin August 2012.
- **Net Energy Metering Cost/Benefit Study:** first report published January 2010 and, as mentioned in section 3.2, a second study is scheduled to be completed by October 2013.
- **External Financial Audit Report:** CPUC audit staff completed the 2007-2008 audit in 2010. The 2010-2011 audit is scheduled to begin July 2012.
- **Technical Potential for Local Distributed Photovoltaics in California:** released March 2012, this study looks at costs and benefits of various distributed solar PV market segments, including residential rooftop, commercial rooftop, small ground-mount, and larger ground-mount (up to 20 megawatts).³¹

5.2.1 2010 CSI Impact Evaluation Addendum

In June 2011, Itron submitted its 2010 Impact Evaluation final report. Because of the limited time available to complete the data collection and analysis, further work was required. In March of 2012 Itron submitted the Addendum to the final report. This Addendum provides further analysis of two of the topics covered by the original 2010 Impact Evaluation.³² The study quantifies the effects of ownership, incentive type, and module material on PV performance over time using two different methods. The report also provides estimates of PV degradation for each of those groupings. The report also analyzes data from select customers showing the amount of power generated, consumed, and exported/imported from the grid every fifteen minutes. The consultant has gathered additional data to expand the understanding of daily and annual profiles.

³⁰ Public Utilities Code Section 387.5

³¹ The study can be accessed here: <http://www.cpuc.ca.gov/NR/rdonlyres/8A822C08-A56C-4674-A5D2-099E48B41160/0/LDPVPotentialReportMarch2012.pdf>.

³² This study can be accessed here: <http://www.cpuc.ca.gov/PUC/energy/Solar/impactevaluation2010.htm>.

6. CSI Program Budget

6.1 CSI Program Budget Overview

In late 2010, the incentive dollars for the non-residential programs for PG&E and CCSE were nearing depletion. As a result, the programs were suspended even though each program was short of its MW goal. During this period, the PAs allowed non-residential applicants to reserve their place on wait lists. In order to allow these programs to achieve their MW targets, the California Legislature passed, and the Governor signed SB 585 (Kehoe, 2011) in September 2011. This bill:

- Authorized the General Market program's Non-Residential incentive pools to expand by \$200 million;
- Allowed incentive budgets to make use of the interest accrued and of deposits forfeited from cancelled projects;
- Modified PBI incentives incrementally downward, basing them on 4% discount rates rather than 8%; and
- Required that caps be in place for individual system costs (Energy Division had previously put cost caps into place, but SB 585 offered additional guidance).

In December 2011, the Commission approved D. 11-12-019, implementing SB 585. PG&E and CCSE have since re-opened their non-residential programs. D.11-12-019 directed Energy Division to revise the CSI cost caps per SB 585. In 2012, Energy Division issued Resolution E-4476 which revised the CSI cost caps per SB 585. The resolution was adopted by the Commission in May 2012.

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

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/solarleaders

hip/gosolar/solar-thermal/

Email: CSIGroup@sce.com

800- 799-4177

So Cal Gas (CSI-Thermal only)

www.socalgas.com/rebates/solar/

Email: swh@SoCalGas.com

800-Gas-2000

