

**California Center for  
Sustainable Energy**

**Solar Water Heating  
Pilot Program:**

**Preliminary Evaluation  
Results**

**White Paper**

Submitted to:

California Center for Sustainable Energy  
8690 Balboa Avenue, Suite 100  
San Diego, California 92123

Prepared by:

Itron, Inc.  
601 Officers Row  
Vancouver, Washington 98661

August, 2008

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# 1

## Executive Summary

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There are five purposes to this white paper. The first purpose is to provide a report on the status on the California Center for Sustainable Energy's (CCSE) Solar Water Heating (SWH) Pilot Program (herein referred to as the SWHPP). The second purpose is to identify the extent to which the design (incentive structure, contractor requirements, etc.) of the SWHPP is representative of SWH programs elsewhere. The third purpose is to identify current market barriers in California and make recommendations on how to address these barriers. The fourth purpose of this white paper is to provide information on equipment and installation costs recorded by the SWHPP and identify unique business practices that may increase cost-effectiveness. Lastly, this white paper will outline future evaluation analyses which will be part of an enhanced Interim Evaluation Report to be completed in September 2008. A key objective of the SWHPP is to determine the cost-effectiveness of SWH before embarking on a statewide program. As such, this white paper also introduces possible ways for policy makers and the solar water industry to take steps that will ensure a sustainable California SWH market.

Results presented in this paper are based on interviews with CCSE SWHPP participants, CCSE workshop attendees, contractors throughout California, manufacturers of SWH equipment located in California, program administrators of other SWH incentive programs nationwide, and market actors located nationwide. Additionally, cost data are based on data requested by CCSE during the incentive application process. The results presented in this paper are preliminary results, as not all of the surveys have been conducted yet. Therefore, an in-depth analysis of survey results is not feasible at this point. Section 5 of the white paper discusses the remainder of the work to be completed for the Interim Evaluation Report due in September 2008.

## 1.1 CCSE SWHPP Activity during its First Year

As of June 30, 2008, there were 36 residential participants who had been paid an incentive and an additional 50 applications in process. There were 13 commercial projects with applications in process. Table 1-1 summarizes the number of applications and total incentives paid under the program as of June 30, 2008.

**Table 1-1: Summary of SWHPP Activity through June 30, 2008**

Application Type	Number of Applications	Total Incentive Amount
Residential Completed	36	\$44,142
Residential In-Process	50	\$61,263
Commercial In-Process	13	\$36,240
<b>Total</b>	<b>99</b>	<b>\$141,645</b>

The majority of the residential systems installed to date has been thermosyphon systems (43 percent) or active glycol systems (30 percent). Forty percent of the residential systems installed had an electric backup water heater, while 60 percent had either a natural gas or propane backup water heater. About 89 percent of single-family homes in California have natural gas water heaters.<sup>1</sup> SWH is more cost-effective when offsetting electricity or propane use than when offsetting natural gas use, therefore this is the likely reason that the percentage of electric backup systems in the program is greater than the percentage of single-family homes in California with electric water heaters.

The general opinion of the survey respondents of the administration of the program has been positive. While the program has not been fully subscribed, this is likely a result of market barriers which are specific to the SWH technology and the increasing costs in materials, rather than barriers that could be attributed to the program administration. Market barrier issues are discussed in more detail below.

### **CCSE SWHPP Participants**

Itron's Computer Assisted Telephone Interviewing (CATI) Center interviewed 40 residential SWHPP applicants. Participants were asked about their household characteristics and their decision-making process.

#### **Household Characteristics**

The majority of the respondents to the survey had two people living in the household (55 percent). Only one participant had only one individual in the household. A little more than

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<sup>1</sup> KEMA-XENERGY, Itron, and RoperASW. 2003 California Statewide Residential Appliance Saturation Survey. Publication # 400-04-009. Prepared for California Energy Commission. 2004.

one-third (38 percent) of the surveyed participants lived in a household with three or more individuals. None of the participants lived in a household with more than six individuals. The majority (60 percent) of SWHPP participants had lived in their house for more than 10 years. Over half of the participants stated that their household income was more than \$100,000 per year.

### **Decision Factors**

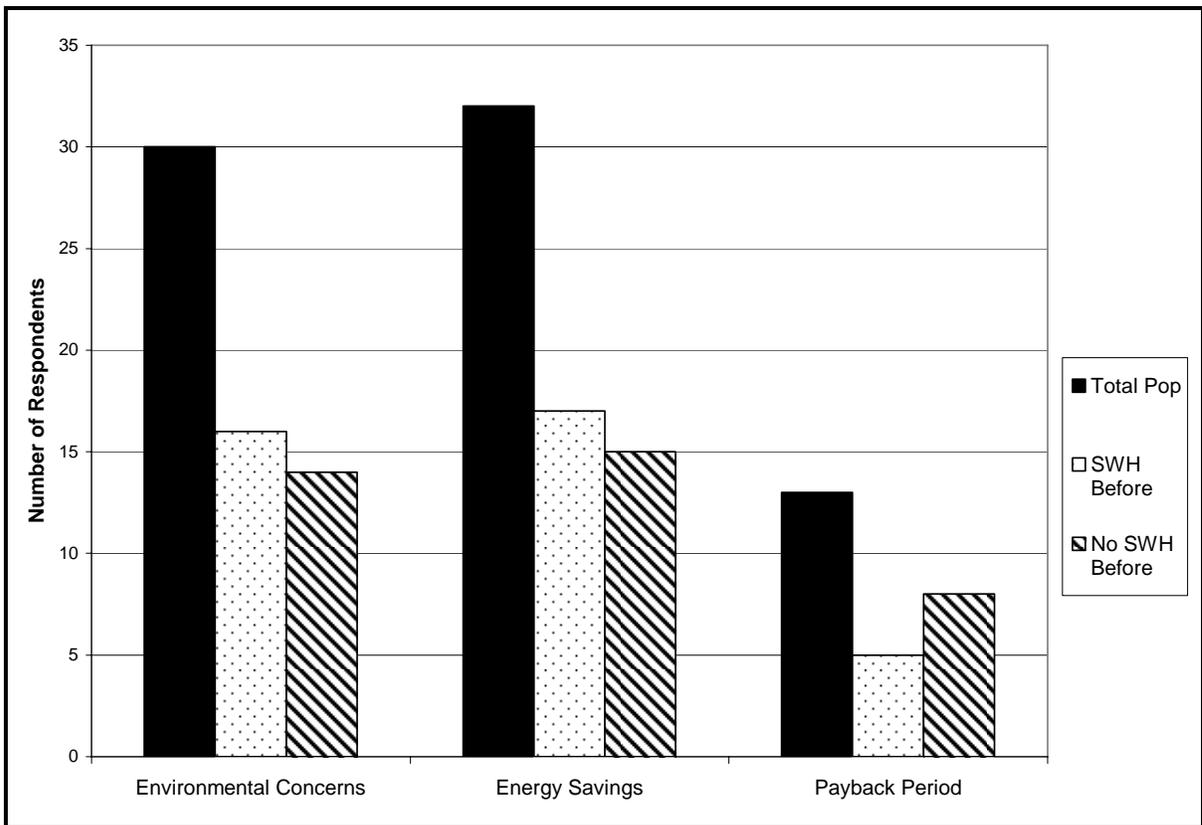
Identifying the factors that most influenced a homeowner's decision to participate in the SWHPP is key in determining what factors may influence the decision of homeowners across the state to purchase SWH systems.

The majority of the residential participants in the CCSE SWHPP appear to be "early-adopters." Almost half of the residential participants that were surveyed had previously owned SWHs. In addition, these residential participants were already seeking out information about solar thermal prior to receiving information regarding the SWHPP. While the information provided below is helpful in understanding the factors which influence these particular customers' decisions, the results should not necessarily be extrapolated to a wider population as the characteristics that these "early-adopters" share may not be the same as the characteristics of the general population.

The influence of the availability of an incentive on the decision to purchase a SWH system was examined. Thirty of the 40 survey respondents stated that they had considered installing a SWH before learning about the SWHPP. However, 14 respondents replied that they would have installed their SWH at a later time. Eighteen of the respondents indicated they were hesitant to purchase a SWH because of the initial costs, and four of the respondents were hesitant to purchase a SWH because they needed more information about the technology or the costs.

The surveys also tried to identify the factor that most influenced a homeowner’s decision to purchase a SWH system. Consequently, program participants were asked which factors influenced their decision to install a SWH and were able to choose more than one response. Figure 1-1 shows the three most important factors in the homeowner’s decision to install a SWH system. The chart also compares those participants who previously had a SWH (dotted) to those who did not (diagonal stripes). The total number of respondents is given in shown in black. The most common reason for deciding to install a SWH was the energy savings; however, environmental concerns were also very important. The payback period was more important to program applicants who did not previously have a SWH.

**Figure 1-1: Major Influencing Factors in Purchasing a SWH System**



**CCSE Solar Water Heating Basics for Homeowners Workshop Attendees**

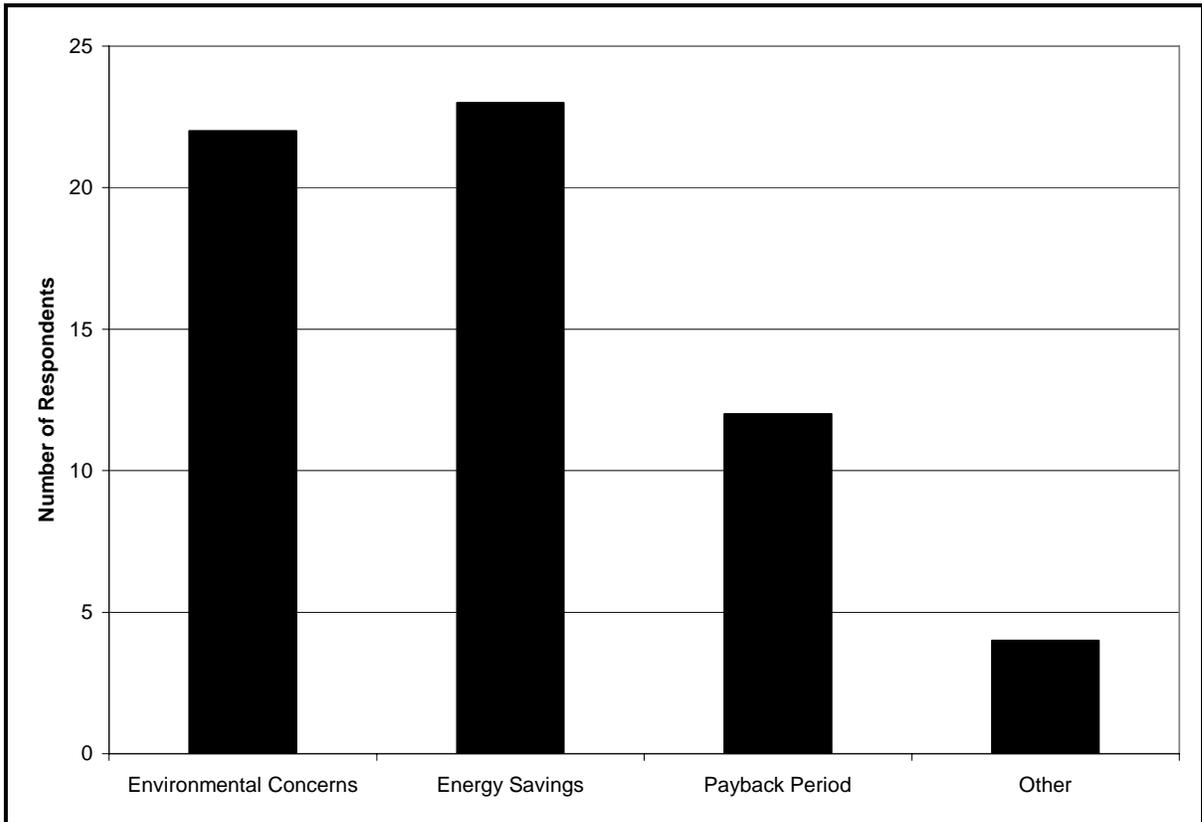
The Itron CATI Center interviewed 30 homeowners who had attended one of the CCSE Solar Water Heating Basics for Homeowners workshops, but who had not submitted an application to the program. Twenty-nine of the 30 respondents were San Diego Gas & Electric (SDG&E) customers while the last respondent owned a home elsewhere in California. The majority of the respondents had three or more people living in the household (46 percent). Five respondents (17 percent) had only one individual in the household. About 37 percent of the surveyed participants had two people living in their household. None of the participants

lived in a household with more than five individuals. Forty percent of the respondents had lived in their house for six to 10 years and 23 percent of the respondents had lived in their house for more than 10 years. Twenty-six percent of the survey respondents had an annual household income of more than \$100,000. Three respondents had already installed a photovoltaic (PV) system.

**Reasons for Interest in SWH**

The surveys tried to identify the factors that might most influence a homeowner’s decision to purchase a SWH system. Consequently, workshop attendees were asked why they were interested in installing a SWH and were able to choose more than one response. Figure 1-2 shows the three most important factors in the homeowner’s interest in installing a SWH system. The two most important reasons for workshop attendees’ interest in SWH were environmental concerns and energy savings, which is consistent with the responses from the SWHPP participants. Other reasons included complementing their solar electric system, upgrading an old system, and having first-hand knowledge of how they work to be able to better inform clients.

**Figure 1-2: Reasons for Interest in Installing a SWH**

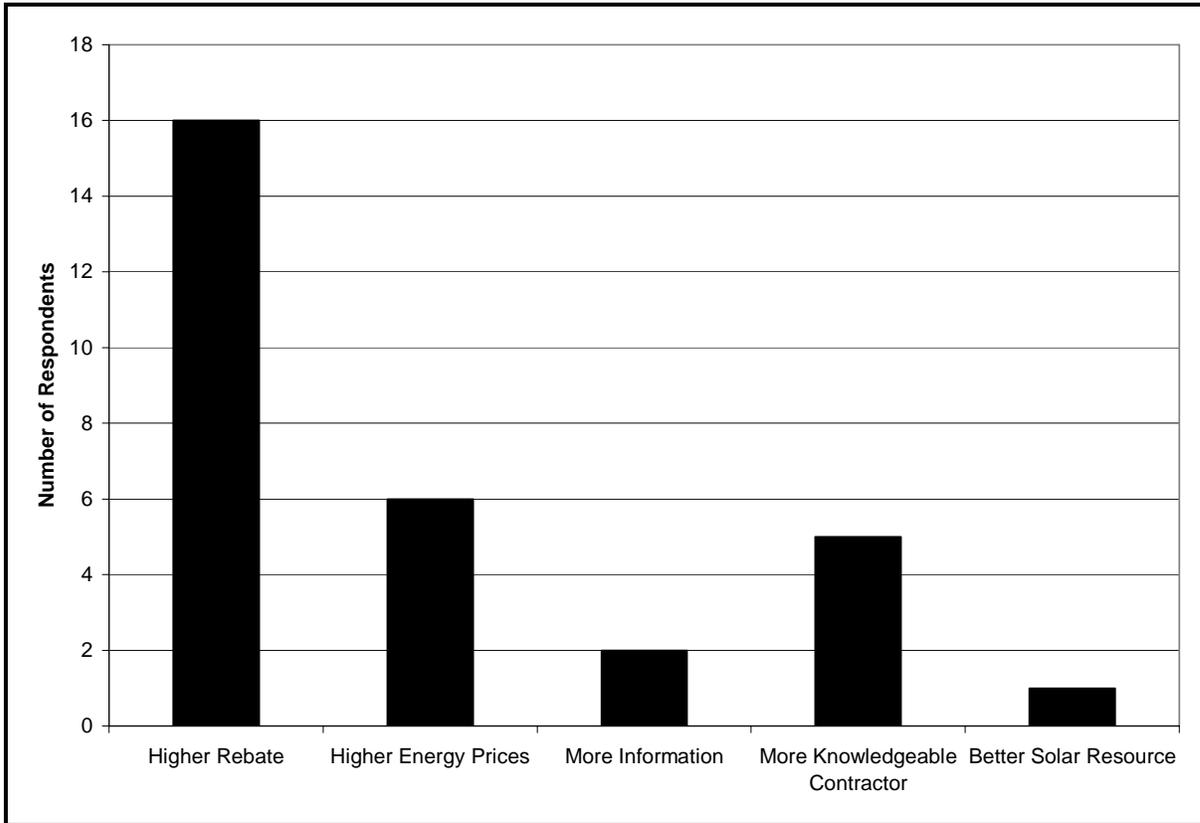


**Reasons Why They Have Not Yet Installed a SWH**

Workshop attendees were asked to identify the factors that were causing them to wait to install a SWH and were able to choose more than one answer. Although 12 respondents were concerned about the initial cost, 21 of the respondents stated other reasons such as their roof does not have an optimal orientation, their roof is shaded, they are in the middle of a remodel, they are moving soon, or they are currently renting their home. Several commented that they would like to install the system themselves and so they are waiting to take a class on how to do it. One respondent mentioned that two separate contractors that were listed on the CCSE website would not install the system through the CCSE rebate program because there were too many requirements. A couple of other respondents replied that they would be installing a photovoltaic system in addition to or instead of the SWH.

Workshop attendees were asked to choose the single most influential scenario that would affect their decision to install a SWH. The scenarios included a higher rebate, a low interest loan, higher energy prices, a friend's recommendation, more information, better solar resource, and a more knowledgeable contractor. Respondents could only choose one answer. Over 50 percent of the attendees said that they would be more likely to install a SWH if there was a higher rebate. Others would be more likely to install a SWH if energy prices were higher or if they could find a more knowledgeable contractor.

**Figure 1-3: The Most Influential Factors on Decision to Install a SWH**



***SWHPP Marketing Effectiveness***

Program implementation can influence participation rates in an incentive program. For example, positive marketing and favorable “word-of-mouth” conversations regarding a program can increase interest and participation. Program participants and CCSE Solar Water Heating Basics for Homeowners workshop attendees were asked about the marketing materials they had seen.

**Program Participants**

Twenty-five of the program participants first heard about the SWHPP through the contractor they selected to perform the installation. Six participants had seen either a television spot or a newspaper article that mentioned the CCSE SWHPP. Two more participants heard about the program when visiting the CCSE website. Three of the participants were in the solar business and, therefore, knew about the program through their work. One respondent heard about the program at a home show. The last respondent learned about the program through word-of-mouth. In general, those participants that had seen marketing materials for the program liked the marketing materials. Ten respondents commented that CCSE needs to do even more advertising for the program and recommended utility bill inserts, radio and television spots, and billboard advertisements.

**CCSE Solar Water Heating Basics for Homeowners Workshop Attendees**

Over 50 percent of the workshop attendees found out about the workshop through the CCSE mailing list or through the CCSE website. Two respondents mentioned a flyer at a food cooperative in Ocean Beach. Two others heard about the workshop through word-of-mouth. When asked about what marketing materials the respondents had seen, 18 of the 30 said that they had not seen any marketing. The other 12 mentioned radio and television spots, newspaper articles, bill inserts, brochures, and the solar expo during the American Solar Energy Society conference held in San Diego in May 2008. In general, the respondents liked the marketing materials that they saw.

## **1.2 Comparison of the CCSE SWHPP to Other Residential Incentive Programs**

Program administrators (PAs) within California and nationwide were surveyed in order to gather information on the design of other SWH incentive programs compared to the design of the SWHPP and to determine which factors were important to creating a successful program and a sustainable SWH market. PAs from four programs within California and five programs in the rest of the United States were interviewed.

Table 1-2 shows the number of residential installations to date for each of the programs interviewed. The number of installations through the CCSE SWHPP in the past year is about 50 percent of the installations done by the Sacramento Municipal Utility District (SMUD), but is much larger than the number shown by other incentive programs in California. However, the Santa Clara program has not been active since the early 1980s and the Redding Electric Utility (REU) program installed most of its systems in 2002. That being said, the CCSE program has performed similarly to other SWH incentive programs across the country, with the exception of the Hawaii Electric Company (HECO) program. The HECO program has been around since 1996 and was cited by many survey respondents as being the model SWH incentive program. Besides designing a successful rebate program, Hawaii also offers a generous state tax rebate and does not have a state or local rebate for PV. This combination of factors has created a healthy SWH market in Hawaii. EWEB has the second most installations as a result of its incentive program, however, in the last two years, the number of systems installed has decreased and only 42 installations occurred in 2007-2008.

**Table 1-2: Number of Residential Installations to Date**

<b>Program Name</b>	<b>Total Number of Customers</b>	<b>Average Residential Rate</b>	<b>Year Started</b>	<b>Number of Installations to-date</b>	<b>Average Number of Installations per year*</b>
Lakeland Electric	100,000	\$0.05 - \$0.06 per kWh	1997 - 2002	60	12
Arizona Public Services (APS)	1.1 million	\$0.08 - \$0.14 per kWh	2002 - 2007	258	51
Hawaii Electric Company (HECO)	440,000	\$0.21 per kWh	1996	39,000	1,773
Eugene Water and Energy Board (EWEB)	86,000	\$0.078	1990	1,030 <sup>†</sup>	57
National Grid	3.4 million (gas only)	\$1.08 - \$1.25 per therm	August 2007	30	30
Sacramento Municipal Utility District (SMUD)	560,000	\$0.08 – \$0.16 per kWh	2005 <sup>2</sup>	200	67 <sup>‡</sup>
Santa Clara		n/a	1977	20	4 <sup>§</sup>
<b>CCSE SWHPP</b>	<b>1.4 million</b>	<b>\$0.11 - \$0.12 per kWh; \$1.45 per therm</b>	<b>July 2007</b>	<b>36</b>	<b>36</b>
Marin County	248,742	\$0.16 per kWh <sup>  </sup>	June 2005	8	3
Redding Electric Utility (REU)	86,000	\$0.09 per kWh	January 2002	29	20 <sup>#</sup>

\* The average was calculated by dividing the number of installations to-date by the number of years the program had been in existence unless other information was known.

† EWEB reported 42 installations in 2007-2008

‡ SMUD reported receiving an average of 15-20 applications a month, so an average of 67 installations per year may not be representative of the current market in SMUD’s service territory.

§ Santa Clara is one exception to this, as it is known that the majority of the systems were installed in the early 1980s.

|| Marin County’s average residential rate is based on PG&E’s average residential electricity rate.

# This number is a maximum number in one year as it is known that 70 percent of their systems were installed in 2002.

Incentive structures of the different SWH incentive programs were also analyzed and are shown in Table 1-3. The incentive offered by CCSE seems to be on a par with incentives offered by other programs. However, it is important to note that the other programs are mainly serving electric customers who will see a faster payback period, whereas SDG&E customers mainly have natural gas water heaters.

<sup>2</sup> The current version of the program has been in place since 2005. However, SMUD has offered a SWH incentive program since the 1980s.

**Table 1-3: Incentive Structure of SWH Incentive Programs**

<b>Program Name</b>	<b>Incentive Structure</b>	<b>Incentive Calculation Method</b>	<b>Maximum Incentive Allowed</b>	<b>Typical Incentive Amount</b>	<b>Loan Availability</b>
Lakeland Electric	Lease Program	n/a	n/a	n/a	n/a
Arizona Public Services (APS) (2008 program)	Performance Based*	\$0.75 per kWh of estimated first-year savings	50% of total system cost	\$1,200 - \$2,600	None
Hawaii Electric Company (HECO)	Fixed	\$1,000	\$1,000	\$1,000	0 – 2 % interest for low-income participants only
Eugene Water and Energy Board (EWEB)	Fixed	\$600	\$600	\$600	Zero-interest
National Grid	Percentage of Cost	15% of project cost	\$1,500	\$900 - \$1,350	None
Sacramento Municipal Utility District (SMUD)	Fixed†	\$1,500	\$1,500	\$1,500	7.5% interest
Santa Clara	Lease Program	n/a	n/a	n/a	n/a
<b>CCSE SWHPP (SDG&amp;E customers)</b>	<b>Performance Based*</b>	<b>Function of the SRCC rating and the Solar Orientation Factor</b>	<b>\$1,500</b>	<b>\$800 - \$1,500</b>	<b>Zero-interest‡</b>
Marin County	Fixed	\$300	\$300	\$300	None
Redding Electric Utility (REU)	Fixed amount per collector	First collector: \$1,000 Second collector: \$500 Third collector: \$250	50% of total system cost	\$1,000 - \$1,500	None

\* Performance Based applies to both estimated and metered energy savings and is measured on a per kWh basis.

† The SMUD program is changing its incentive structure to a three-tiered incentive.

‡ SDG&E recently extended their On-Bill Financing program to include projects with a 10-year payback period.

Of the nine program administrators that were interviewed, two of the programs involved installations of SWH systems by the utility rather than the customer. Of the remaining seven programs, four programs allow customers to self-install SWH systems under varying

conditions, the most restrictive of which is that the installation of the SWH system by the homeowner must be overseen by a licensed contractor.

Of the program administrators surveyed, seven of the nine programs only offered incentives for SWH that used electric backup water heaters. The exceptions were National Grid and Marin County. Both of these programs are described in more detail in Section 3; however, a couple of key points are discussed here. National Grid is an electric and natural gas utility that covers multiple states, including New Hampshire, New York, Massachusetts, and Rhode Island. The SWH incentive program being offered by National Grid started in August 2007 and provides residential customers with an incentive of 15 percent of the total cost up to \$1,500. Incentive amounts and participation rates have been comparable to the CCSE SWHPP; however, natural gas rates are higher in San Diego.

The common elements from the interviews with the various PAs include the following:

- Inspections are important; however, the percentage of systems being inspected per contractor can be reduced if the contractor has a good track record
- Building and maintaining strong relationships with contractors is necessary for program success
- Equipment and contractor certification provides increased confidence in SWH systems
- Business models of program administrators need to be adaptive
- Home shows seem to be the most successful marketing tool

The foundation of a successful incentive program is requiring certified equipment and properly licensed installers. Many negative experiences for SWH incentive programs in the past were caused by installation of inappropriate equipment by inexperienced contractors. Creating equipment and contractor requirements will help ensure quality installations. However, the requirements cannot be too burdensome and the incentive amount must account for the additional requirements. A good relationship with the local contractors and willingness to adapt the program requirements in response to their concerns is key to achieving this balance. The CCSE SWHPP has been very successful in establishing relationships with contractors and working with the Technical Advisory Committee to identify which program requirements need to be changed and adapting the program to better serve the market.

### 1.3 Contractor Business Models

Itron interviewed 23 contractors in two separate rounds. The first round of questions was completed in December 2007 and concentrated mainly on contractor satisfaction with the SWHPP; therefore, the sample group consisted of contractors who had attended a CCSE Installer workshop. The second round of interviews is currently in-process. For the second round, contractors statewide are being interviewed about their opinion on the SWHPP design and on their business models. The sample group for the second round is made up of 20 contractors who have attended a CCSE Installer workshop for either the SWHPP or the new Palo Alto program, and 10 contractors found on either the California Solar Energy Industries Association (CalSEIA) website or the Find Solar website<sup>3</sup>. Thirteen contractors were interviewed in the first round and twelve have been interviewed so far for the second round. Two of the contractors that were interviewed in the previous round were interviewed in the current survey as well, resulting in a total sample of 23 contractors.

The most commonly cited market barrier for contractors was the difficulty and expense associated with obtaining a permit. Based on information from the SWHPP data, the cost of a SWH permit depends on the city but the reported range was from \$100 to \$400 and the average cost reported for a SWH permit was \$220. On average, SWH permits account for 3 percent of the total cost of the system.

#### ***Business Characteristics***

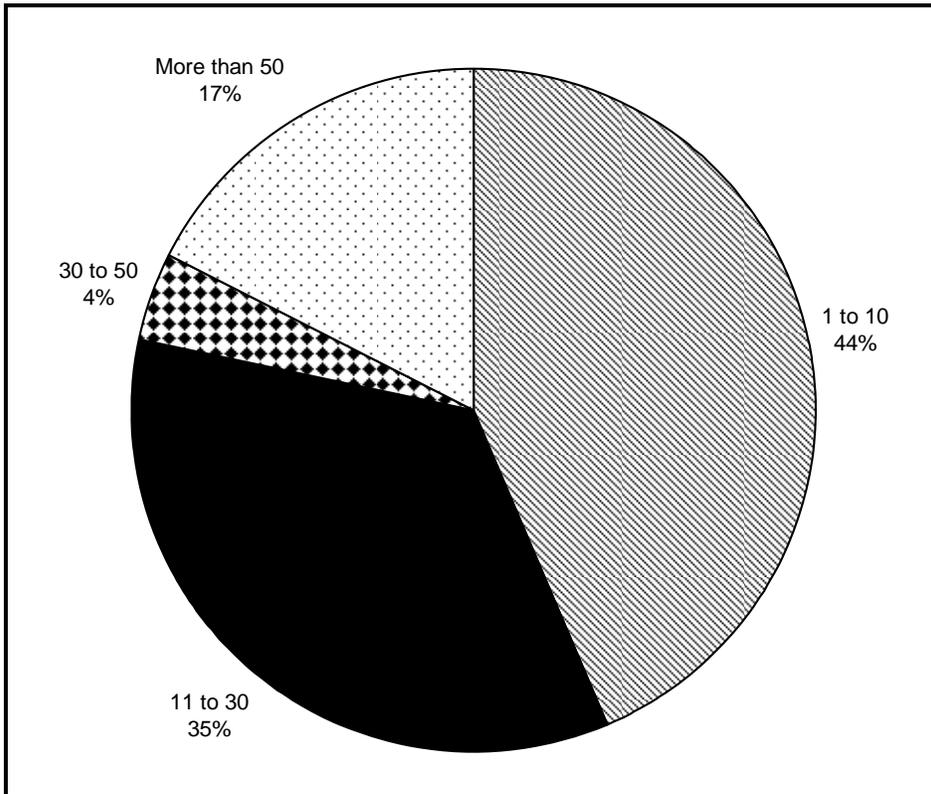
Eleven of the 23 interviewed contractors stated that their primary business was installing PV systems. Many of the contractors also install SWH for pools. One company reported that its main business was repairing SWH systems. Only one contractor indicated that the majority of SWH installations were in the commercial sector.

Figure 1-4 shows the distribution of the number of employees per company that participated in both the current survey and the previous survey. The predominant business type is a business with less than 10 employees; however, there is also a relatively large group of businesses with more than 50 employees (17 percent of all survey respondents). Of the twelve contractors surveyed regarding whether they were planning to expand their business, eight contractors stated that they would expand. One contractor stated that the decision to expand was dependent on the economy and the federal tax credit. Only one contractor explicitly stated that they would not be expanding their business.

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<sup>3</sup> <http://findsolar.com>

**Figure 1-4: The Distribution of the Number of Employees per Business Interviewed**



The contractors were asked how many employees in the company had more than one year of experience with SWH. The percent of experienced employees ranged from 10 percent of the total company to one company with all of their employees having more than one year experience with SWH. For six of the twelve contractors, only one-third of their total staff had more than one year of experience in SWH. For two of the twelve contractors surveyed, over half of their staff had more than one year of experience.

Seven of the 23 interviewed contractors did not have dedicated sales staff; however, three of the seven contractors stated that all staff act as sales staff as their goal is to finalize the sale of the system. The majority of the contractors surveyed had one to two sales staff, with one respondent claiming to have over six sales staff employees. Of interest is that the larger companies, in terms of number of employees, did not necessarily have more sales employees. Combined with survey results from the first round of surveys, over 60 percent of the contractors had either one or two sales staff. Many of the respondents indicated that the sales staff works on at least partial commission.

### **Hiring and Training New Employees**

The most common ways of attracting new employees included word-of-mouth (networking) and either the company's website or a job search website. The question regarding hiring practices was only asked during the Round 2 survey. Of the 12 contractors surveyed, five of the 12 used networking, and four of the 12 used the internet to find new employees, whether they hire through the company website or through job search and posting sites. The remaining firms either were not actively recruiting or used alternative methods. Of the twelve contractors surveyed, all reported that new employees are trained on the job. Three of twelve contractors indicated that they also are required to go through manufacturer training and one contractor required their employees to attend the CCSE training.

### **Marketing Strategies**

Two of the 11 respondents do not do any marketing for SWH or PV. The other nine respondents reported using marketing channels such as home, trade, or energy shows; magazines; direct mail; word-of-mouth; the company website; and the Yellow Pages. The most commonly reported marketing tools were the company website and word-of-mouth. The contractors did not report marketing to any specific segment of the population or a specific type of SWH system. Preliminary cost survey results show that contractors typically spend around \$10,000 per year on marketing.

According to over half of the contractors interviewed, the number of direct customer contacts has increased during the past year. None of the contractors interviewed said they sell fewer SWH systems now than they did a year ago.

### **Best Practices**

Given the limited sample size and the variety of business characteristics of the contractors who were interviewed, it is difficult at this time to distinguish which business practices to consider best practices. Businesses having the most success with the SWHPP are those who can easily comply with the city permitting requirements; however, improvements are needed in the permitting process. Practices taken from the PV and wind industry that could be applicable to the SWH industry and could decrease costs include:

- Installation of cookie-cutter systems
- Implementation of plug-and-play technologies
- Increased training of installers
- Optimized design/install logistics
- Buying and/or selling in bulk

Installing cookie-cutter systems or plug-and-play systems can reduce system design and installation time. Increased training of installers will decrease system design and installation

time and will result in higher quality installations with few call-backs for repairs. Optimized design and install logistics will also save installation time. Buying in bulk can reduce equipment costs, and selling systems to community cooperatives or similar groups could result also result in lower equipment and installation costs.

One alternative business model is discussed below.

### ***Alternative Business Model***

One contractor mentioned that there are companies that focus only on initiating the sale and the initial site visit, but they do not install the SWH. These companies will size the system and provide the customer with a cost estimate and then sell the installation job to the lowest bidding contractor. In this scenario, the company installing the system is fully liable for the finished product, and some companies are not comfortable accepting liability for another company's system design. However, building this type of relationship between companies has the potential to reduce installation costs if the company that completed the site visit accurately sizes the system. Otherwise, the contractor that completes the work may have to absorb additional costs due to changes that need to be made.

## **1.4 Market Barriers**

In the interviews conducted with PAs, contractors, market actors, manufacturers, program participants, and CCSE workshop attendees, the following market barriers were mentioned most often:

- Lack of knowledge about the technology
- Competition between PV systems, energy efficiency, and SWH
- Initial installation cost
- Building permits can be difficult and expensive to obtain

From the industry perspective, there is a lack of knowledge about SWH amongst the general public, and the technology is often confused with PV. The existence of a PV incentive program and rebates on tankless water heaters has increased public awareness of these two technologies and has steered the consumer away from SWH. SWHPP participants and workshop attendees cited the number one reason for their hesitation to install a SWH was the upfront cost. A statewide incentive program could address both these issues by decreasing the upfront cost of the system and by creating a statewide marketing campaign for SWH.

One of the largest complaints from contractors was that permitting SWH systems is difficult and expensive. In the SWHPP, on average the permit accounted for five percent of the total installed system cost. Some city employees do not understand the technology. The result is

a lengthy wait-time to have the project approved and, in the worst case, the permit being denied. Some contractors reported an unwillingness to install SWH systems in some cities because of the difficult permitting process. A statewide program would increase the number of SWH systems being installed. As city employees become more experienced with dealing with SWH permit applications, the permitting process could become easier and less expensive.

Recommendations for addressing these market barriers are discussed as part of Section 1.5.

## **1.5 Recommendations for Creating a Sustainable SWH Market in California**

This section summarizes the overall recommendations for addressing market barriers in California and designing a statewide incentive program that were received from all the groups of stakeholders that were interviewed, including PAs, contractors, market actors, manufacturers and distributors, program participants, and CCSE workshop attendees. Suggestions for non-rebate solutions to market barriers are discussed. After that, recommendations are made for addressing market barriers through a statewide incentive program and the discussion includes insights into designing an incentive structure, contractor requirements, and system requirements.

### ***Non-Rebate Program Solutions***

There are several non-rebate solutions that would help in addressing several of the market barriers. These include a statewide marketing campaign, offering low- or no-interest loans, and requiring training for city officials who are permitting SWH systems.

#### **Statewide Marketing Campaign**

A statewide marketing campaign would increase public knowledge of the technology. As part of the education process, an emphasis could be made to explain how SWH systems act as a hedge against increasing energy prices. With the sudden increase in gasoline prices, customers may be more receptive to the idea that prices of fossil fuels can change rapidly and that installing a SWH would provide protection against the volatility of natural gas prices. Additionally, the marketing campaign could explain how much of California's electricity needs are met by natural gas and will continue to increase given the requirements of AB 32 to reduce greenhouse gas emissions. By showing that the supply of natural gas is fixed and the demand is increasing, a solid case can be made that the price of natural gas is only expected to increase over time.

In addition to marketing to customers, effort should be put into educating builders and building permit inspectors to ensure that these groups also have a thorough understanding of

SWH. To be successful, each group which represents manufacturing, distributing, installing, and end-use customers should be included in the marketing campaign.

More emphasis needs to be made on the comparable benefits of SWH and the lower initial cost and shorter payback period when compared to PV systems. Many of the interviewed contractors stated that their customers have already decided what type of system they want when they arrive. The public is very informed regarding PV, including the concept of net metering, which is an idea that is very easy and appealing to conceptualize. In order to make a meaningful decision, customers need a thorough understanding of the economic and environmental benefits of SWH systems, particularly with respect to other renewable energy and energy efficiency options.

### **Initial Installation Costs**

Methods for dealing with the initial installation cost include offering low-interest loans and providing homeowners with advice on the timing of their installation. The EWEB program offers a zero-interest loan of up to \$4,000 which can be paid back monthly as part of the customer's utility bill. SDG&E has also recently expanded its loan program to include projects with a 10-year payback period.

Other factors beyond cost may be influencing the decision of whether to install a SWH system. The CCSE workshop attendees stated a number of reasons for why they were not participating in the program, including roofs that had the wrong orientation, shading issues, and remodeling concerns. A statewide incentive program should explore the possibility of providing an easy, inexpensive screening device to determine whether a particular home is a suitable location for a SWH system. Additionally, the marketing materials should also provide guidance about when would be a good time to install a SWH with respect to remodels or replacement of roofs.

### **Permitting Issues**

Training sessions which target city and county building inspectors who explain the structure and issues of the systems could help familiarize the inspectors with the technology and decrease the amount of on-site inspection time. Coordination with local governments to require this training and include it as employee training time would be a means by which attendance could be encouraged.

### **Rebate Program Recommendations**

There was consensus among the survey respondents that a statewide incentive program is key to developing a sustainable SWH market in California. A statewide incentive program would address many of the market barriers discussed in Section 1.3. A statewide marketing campaign would increase public knowledge of the technology, and a utility-backed incentive

would add legitimacy to the technology. The presence of a rebate would also reduce competition with PV systems and energy efficiency measures, which already have incentives available. A statewide incentive program would decrease the initial installation cost. With an increase in SWH system installations, permits would be requested more often and as the city employees become more experienced in dealing with these types of permits, the process would become more streamlined and, perhaps, more uniform between different cities.

### **Incentive Structure**

The incentive structure will be the key to a successful program which “jump-starts” the SWH market. The rebate structure should be designed to meet the state’s goals. It needs to be decided if the program will encourage a high quantity of low efficiency (and less expensive) systems or a lower quantity of high efficiency (and more expensive) systems.

It was recommended by almost all market actor survey respondents that the rebate amount be based on the estimated energy that will be produced by the system. This method may help encourage customers and contractors to adopt SWH systems that provide the greatest return in terms of natural gas displacement; however, there also needs to be a cap incentive so that systems are not oversized. The CCSE incentive amount is calculated using a function of the system’s solar fraction, and, therefore, is based on the estimated amount of energy that will be produced by the system. Contractors have commented that using an equation based on solar fraction is too complicated for a residential application. An alternative is to use a tiered incentive structure, which provides the same incentive amount for all systems that fall within a defined solar fraction range. Additionally, many of the survey respondents thought that the rebate amount needs to be higher than that currently offered by CCSE. However, Table 1-3 shows that rebates offered by other incentive programs were similar to or less than the amount offered by CCSE, although it is important to keep in mind that the other incentive programs mainly serve electric customers who will see a faster payback than natural gas customers. Survey respondents also recommended that the incentive be higher at the beginning of the 10-year program in order to stimulate interest, but that the incentive be gradually reduced over the life of the program as the market develops.

Offering a no-interest or low-interest loan to both residential and commercial customers may encourage those who are worried about the initial cost to install the SWH sooner rather than later. Although the workshop attendees did not report that a low-interest loan would be the number one factor in changing their decision, programs that also offer no-interest or low-interest loans have seen that more than 75 percent of program participants will take advantage of the loan, and these programs have also seen an increase in participation rates.

The majority of survey respondents felt that incentives should be provided for replacement or repair of systems only under certain conditions. The program should encourage homeowners

with existing SWH systems to repair them when it is less expensive than replacing the entire system. However, the program should not provide an incentive for repairs which are still under warranty. The criteria for providing incentives for repairs need to be well thought out.

### **Contractor Requirements**

Survey respondents believed that there should be no requirements for contractors other than what was required by state law; however, other certifications such as the North American Board of Certified Energy Practitioners (NABCEP) should be strongly encouraged. One survey respondent also believed that it was necessary to require the contractors to attend a workshop on the program requirements before allowing them to participate in the rebate program. Respondents pointed out that if there are too many new requirements beyond what the contractor was already doing, this will increase costs for the contractors and will discourage them from participating in the program.

When implementing a statewide program, it may be useful to include a “fast-track” process similar to that used by HECO. A fast-track approval process makes it possible for the contractor to receive the incentive prior to meeting all of the application requirements (such as obtaining a permit) and would only be available to contractors who met certain criteria. For example, contractors eligible for the fast-track approval process under the HECO program have to install a certain number of systems per quarter and must have a proven track record of quality installations. The fast-track process may help alleviate any cash flow issues the contractors may face upon waiting to receive incentive payments from numerous projects at once. Another recommendation made was that contractors with a proven track record would not be required to have 100 percent of their installations inspected by the program administrator.

### **Equipment Requirements**

The foundation of a successful incentive program is requiring certified equipment and freeze-protection requirements for different climate zones. Many negative experiences of SWH incentive programs in the past were caused by installation of inappropriate equipment by inexperienced contractors. Respondents agreed that equipment should be certified OG-300 for residential systems and OG-100 for commercial systems. One commented that residential installs should be “cookie cutter” systems in order to standardize the industry and ensure quality work. Another respondent added that an appropriate system for that climate zone should be installed, and program requirements should err on the side of caution when it comes to preventing freezing or overheating of systems. One respondent recommended that the program require a minimum production level requirement that is consistent with the Federal Energy Star requirement (i.e., the SWH is required to provide 50 percent of the energy needs for heating water).

With the introduction of new products from abroad and through local research and development programs, policy needs to be created to address reliability and longevity of equipment. The SWHPP is considering a measure that requires new products to the market to have one year of commercial availability in order to qualify for the program. Products available for a year or more on the international market would qualify.

### **Technical Advisory Committee**

Several survey respondents pointed out the importance of an advisory committee on the technical requirements of the program. The CCSE SWHPP is advised by a Technical Advisory Committee made up of a variety of stakeholders with a wide breadth of experience in the SWH industry. The existence of the Technical Advisory Committee and the flexibility of CCSE has allowed the SWHPP to be very adaptive and to change in relation to issues and concerns identified by both participating and nonparticipating contractors.

## **1.6 Further Evaluation Work**

This white paper presents preliminary findings of the SWHPP evaluation work. Information gaps exist in a number of areas due to the somewhat limited number of completed applications at the time of writing. An Interim Evaluation Report will be completed in September 2008 that will present a more complete analysis of all of the survey results, including a more in-depth look at the cost components of SWH and an analysis of the cost-effectiveness of SWH. Additionally, the Interim Evaluation Report will address concerns or issues that may be voiced at the CPUC workshop to be held on August 26, 2008.

# 2

## Introduction

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There are five purposes to this white paper. The first purpose is to provide a report on the status of the California Center for Sustainable Energy's (CCSE) Solar Water Heating (SWH) Pilot Program (herein referred to as the SWHPP). The second purpose is to identify the extent to which the design (incentive structure, contractor requirements, etc.) of the SWHPP is representative of SWH programs elsewhere. The third purpose is to identify current market barriers in California and make recommendations on how to address these barriers. The fourth purpose of this white paper is to provide information on equipment and installation costs recorded by the SWHPP and to identify unique business practices that may increase cost-effectiveness. Lastly, this whitepaper will outline future evaluation analyses which will be part of an enhanced interim evaluation. A key objective of the SWHPP is to determine the cost-effectiveness of SWH before embarking on a statewide program. As such, this white paper also begins introducing possible ways for policy makers and the solar water industry to take steps that will ensure a sustainable California SWH market.

This white paper will first present a brief overview of the SWHPP and provide an update on the status of the Program. We will then summarize the results from interviews conducted with SWHPP participants, SWHPP workshop attendees, contractors throughout California, market actors, manufacturers/distributors, and program administrators of other SWH incentive programs. Interviews were conducted to obtain information on the success of the SWHPP in meeting the needs of the various stakeholders; identify practices that have worked well and those which need to be refined; and distinguish special practices that appear to lower costs of SWH systems. This will be followed by an analysis of the survey data with particular attention being paid to the installation and equipment costs; contractor and manufacturer business models; and other successful utility incentive program designs. The last section will discuss further analysis and evaluation work to be performed.

### 2.1 Program Overview

The CCSE SWHPP was created under California Public Utilities Commission (CPUC) Decision 06-01-024 under the California Solar Initiative (CSI). It began in July 2007 as an 18-month SWH incentive program implemented in the San Diego Gas and Electric (SDG&E) territory and was administered by the CCSE.

The CPUC established the SWHPP to “promote the use of that (solar water heating) technology and reduce demand for natural gas.” However, the CPUC noted that there were mixed results from past SWH programs where incentives seemed to drive up the cost of SWH technologies. Therefore, the CPUC stated that one of the objectives of the SWHPP was to “test incentives for solar water heaters.” More specifically, the CPUC called for “an evaluation of the impacts of the pilot on equipment prices, demand and cost-effectiveness.” Based on results from the SWHPP, the CPUC would consider expanding SWH incentives across the state. A 10-year and \$250 million statewide incentive program for SWH has been proposed under AB 1470, where natural gas is used as the back-up water heater fuel. The goal of the statewide incentive program is to install 200,000 SWH systems in homes and businesses by 2017.

The CPUC modified its original decision on the SWHPP in a July 2, 2008 Decision. The Decision contains a number of key program changes, including: 1) the pilot program is extended through December 2009 or until the funding is exhausted; 2) new residential and commercial construction is eligible for the program; 3) the market research evaluation work is expanded beyond the San Diego region; 4) unspent funds from the pilot can be used for the expanded market research work; 5) the incentives remain limited to SDG&E customers through the length of the pilot; and 6) the CPUC Energy Division will hold a workshop on the pilot program evaluation plan within 60 days of the ruling.

The July 2, 2008 Decision also states that the CPUC “cannot design a statewide incentive program for solar water heating until it makes certain findings after an evaluation of the pilot program.” More specifically, the Decision indicates the statewide program can only be established “after a public hearing that a solar water heating program is cost-effective for ratepayers and in the public interest.” Lastly, the Decision encourages “CCSE, and other interested parties, to work with the Energy Division as described above to augment the pilot evaluation with additional research into what type of market interventions are needed to drive greater adoption of solar water heating systems in California”. Because the Decision specifically addresses “market intervention”, one of the goals of the SWHPP evaluation is to determine to what extent a statewide incentive program for SWH should be viewed as a market transformation program, and, by extension, whether the evaluation of cost-effectiveness and rate payer benefit should be determined relative to a 2017<sup>4</sup> timeframe rather than immediately.

The market potential for solar-assisted natural gas water heating in California appears to be substantial and could provide significant air quality, energy, and financial benefits across the state. The California Air Resources Board AB 32 Scoping Plan for reducing greenhouse gas emissions estimates a potential reduction of 0.1 MMTCO<sub>2</sub>E from SWH installed through AB

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<sup>4</sup> AB 1470 calls for any statewide incentive program for SWH to be completed by 2017

1470 by 2020. However, as pointed out in the comments of the Administrative Law Judge (ALJ) in Interim Decision 06-03-004, SWH incentives provided in the past may not have been required to stimulate increased sales and may, in fact, have had the inadvertent impact of increasing SWH prices at the public’s expense. Moreover, as demonstrated by sales of solar photovoltaic (PV) systems, people invest in renewable technologies for a host of reasons, even when faced with high first-time costs. Understanding attitudes and perceptions and how those may influence a statewide SWH incentive program will be crucial to determining the future of a SWH program. Understanding the practices of SWH contractors in the promotion, sale, and installation of SWH systems will also be important in designing an effective statewide program. Similarly, pinpointing performance and energy savings from systems installed under the SWHPP will be important in determining the overall success of the SWHPP, and will be critical in evaluating the types of modifications that may be required to translate the program statewide.

## 2.2 Summary of SWHPP Activity during its First Year

This section summarizes the activity of the SWHPP from its start in July 2007 through the end of June 2008. The number of residential and commercial participants who have completed projects and the additional number of reserved incentives are presented, as well as a summary of the types of systems that are being installed. An overview of changes in program requirements over the first year is then discussed.

### **Number of Participants**

As of June 30, 2008, there were 36 residential participants who had been paid an incentive and an additional 50 applications in process. There were 13 commercial projects with applications in process. This participation rate is on a par with many other SWH incentive programs nationwide, as will be presented in the discussion about other programs.

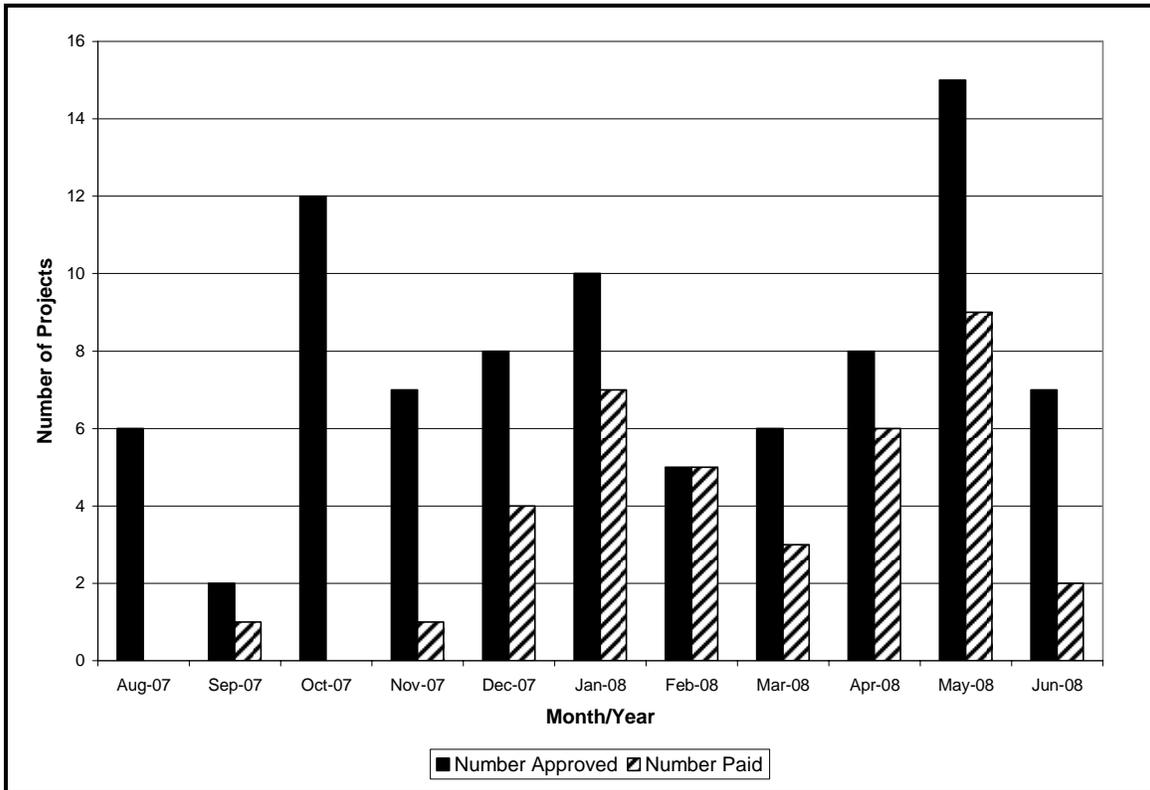
**Table 2-1: Summary of SWHPP Activity through June 30, 2008**

<b>Application Type</b>	<b>Number of Applications</b>	<b>Total Incentive Amount</b>
Residential Completed	36	\$44,142
Residential In-Process	50	\$61,263
Commercial In-Process	13	\$36,240
<b>Total</b>	<b>99</b>	<b>\$141,645</b>

Figure 2-1 shows the number of residential retrofit applications that were approved and the number of paid incentives by month during the first year of the CCSE SWHPP. Major marketing efforts were put forth during October 2007 and during April 2008 with television

spots and radio advertisements, and these efforts are reflected in the number of applications received and then approved during those months and spilling over into the following months.

**Figure 2-1: Number of Residential Retrofit Approved Applications and Paid Incentives per Month during the First Year of the SWHPP**



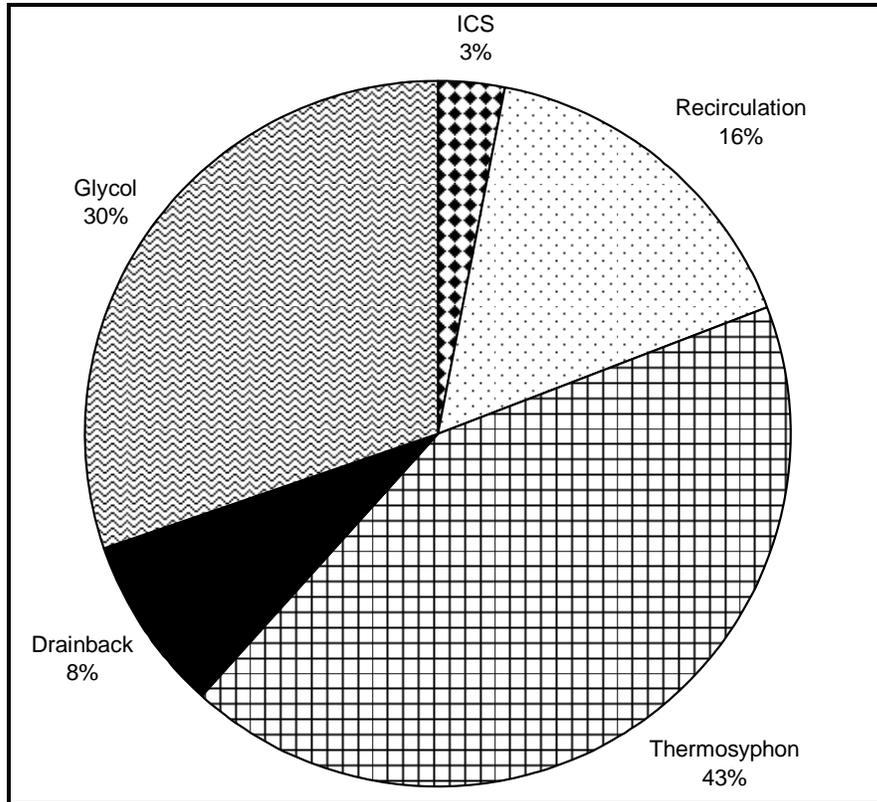
There are currently 12 SWH installation companies actively participating in the SWHPP and that have already received a rebate or have an application in process of receiving a rebate. Three of the 12 companies account for about 80 percent of the residential applications. In addition, there are five self-installers who have applied for or have received a rebate. CCSE continues to hold contractor workshops, which are a prerequisite for all contractors to participate in the program.

**Types of Residential Systems that Have Applied for a SWHPP Rebate**

CCSE has received applications for many different models of SWH systems for the residential sector, and these have been divided into five categories: recirculation, integrated collector and storage (ICS), thermosyphon, drainback, and glycol (includes closed-loop active glycol systems). Figure 2-2 shows that the majority (43 percent) of applications are for thermosyphon systems. Passive systems are generally less expensive, though less efficient than active systems. Active glycol systems were the next popular, with 30 percent of the applications. Recirculation systems, accounting for about 16 percent of the

applications, are only allowed in climate zone 7. ICS systems are allowed in climate zones 7 and 10 and account for three percent of the systems. Drainback systems account for eight percent of the systems installed through the program. Drainback, active glycol, and thermosyphon systems are allowed in climate zones 7, 10, 14, and 15. Therefore, the lower installation rate for recirculation and ICS systems could be due to the fact that they cannot be installed in all locations due to freeze protection concerns.

**Figure 2-2: Types of Residential Systems Applying for SWHPP Rebates**



During the first program year, 66 percent of the residential systems installed had an electric backup water heater, while 34 percent had either a natural gas or propane backup water heater. SWH is more cost-effective when offsetting electricity or propane use; however, about 89 percent of single-family homes in California have natural gas water heaters.<sup>5</sup>

### ***Changes in the Program over Time***

Several changes occurred to the program during its first year. After six months, contractors in the San Diego area were interviewed to find out what they liked about the program and what they did not like. Those who had attended the CCSE workshop for eligibility but were

<sup>5</sup> KEMA-XENERGY, Itron, and RoperASW. *2003 California Statewide Residential Appliance Saturation Survey*. Publication # 400-04-009. Prepared for California Energy Commission. 2004.

not active in the program were asked why they had not submitted any applications. Based on these results, a few issues in equipment requirements were presented to the CCSE Technical Advisory Board. Some of the issues discussed included the anti-scald valve requirement and the restriction of open-loop systems to climate zone 7. It was decided that anti-scald valves would no longer be required by CCSE, but the contractor must use the valve type required by the local code. Additionally, recirculation systems would be allowed in climate zone 7 but would require a five-year equipment and labor warranty from the installing contractor. ICS systems were still only allowed in both climate zones 7 and 10.

In April 2008, CCSE and the California Solar Energy Industries Association (CalSEIA) filed a joint petition for modification of Decision 06-01-024 in order to 1) offer incentives to Pacific Gas & Electric (PG&E) and Southern California Edison (SCE) customers; 2) allow the program to continue through June 30, 2009; 3) allow residential and commercial new construction to be eligible for the program; 4) increase incentive level and program budget for residential systems; and 5) increase administrative budget for extended program timeline. The basis of the petition for modification was concern over possible decline in SWH sales in PG&E and SCE territories for customers waiting for a statewide incentive program. In addition, there were concerns that the San Diego SWH market may not be representative of the state. An extension of the pilot program duration was requested to avoid potential gaps that could occur while the CPUC developed a statewide program. The CPUC ruled to continue the program through December 2009 or until funding is exhausted, and to allow new construction to be eligible for the program. However, incentive levels were not increased and incentives will remain limited to SDG&E customers. Additionally the evaluation work has been expanded to research market characteristics statewide.

## **2.3 Organization of White Paper**

The remainder of this white paper is organized as follows.

- Section 3 summarizes the survey respondent characteristics and provides some preliminary results,
- Section 4 analyzes the survey results, looking in particular at market barriers and business models and also presenting the cost components associated with installing a SWH system, and
- Section 5 discusses the topics that need to be researched further in order to determine the feasibility of a statewide SWH incentive program.

# 3

## Summary of Survey Results

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This section provides summary information for each set of surveys conducted. The surveys are meant to provide data and qualitative information to assess the current SWH market in California and to design an effective statewide program. All survey instruments are included in Appendices A–H.

### 3.1 Residential Survey Results

Residential surveys were conducted on two groups: homeowners who applied and participated in the program (participants); and those homeowners who attended a workshop on the program but elected not to participate (nonparticipants).

The Itron Computer Assisted Telephone Interviewing (CATI) Center interviewed 40 residential SWHPP applicants and 30 homeowners who had attended a CCSE workshop on SWH but had not applied to the program. Additionally, CCSE conducted a short online survey that was sent to workshop attendees and website users who provided contact information. CCSE received 37 responses, of which 11 said they had already contacted a contractor.

#### ***Program Participant Survey Respondents***

To better understand any connection between demographic features and participation in the SWHPP, participants were asked questions regarding home occupancy levels, household income level, and the number of years they had lived in their current home.

Itron’s CATI Center interviewed 40 residential SWHPP participants. The majority of the respondents to the survey had two people living in the household (55 percent). Only one participant had only one individual in the household. A little more than one-third (38 percent) of the surveyed participants lived in a household with three or more individuals. None of the participants lived in a household with more than six individuals. The majority (60 percent) of SWHPP participants had lived in their house for more than 10 years.

The participants were asked which income range defined their household income. Five of the survey participants refused to provide income information. Of the remaining 35 participants, over half stated their household income was more than \$100,000 per year.

### **Decision Factors**

Identifying the factors that most influenced a homeowner's decision to participate in the SWHPP is key in determining what factors may influence the decision of homeowners across the state to purchase SWH systems.

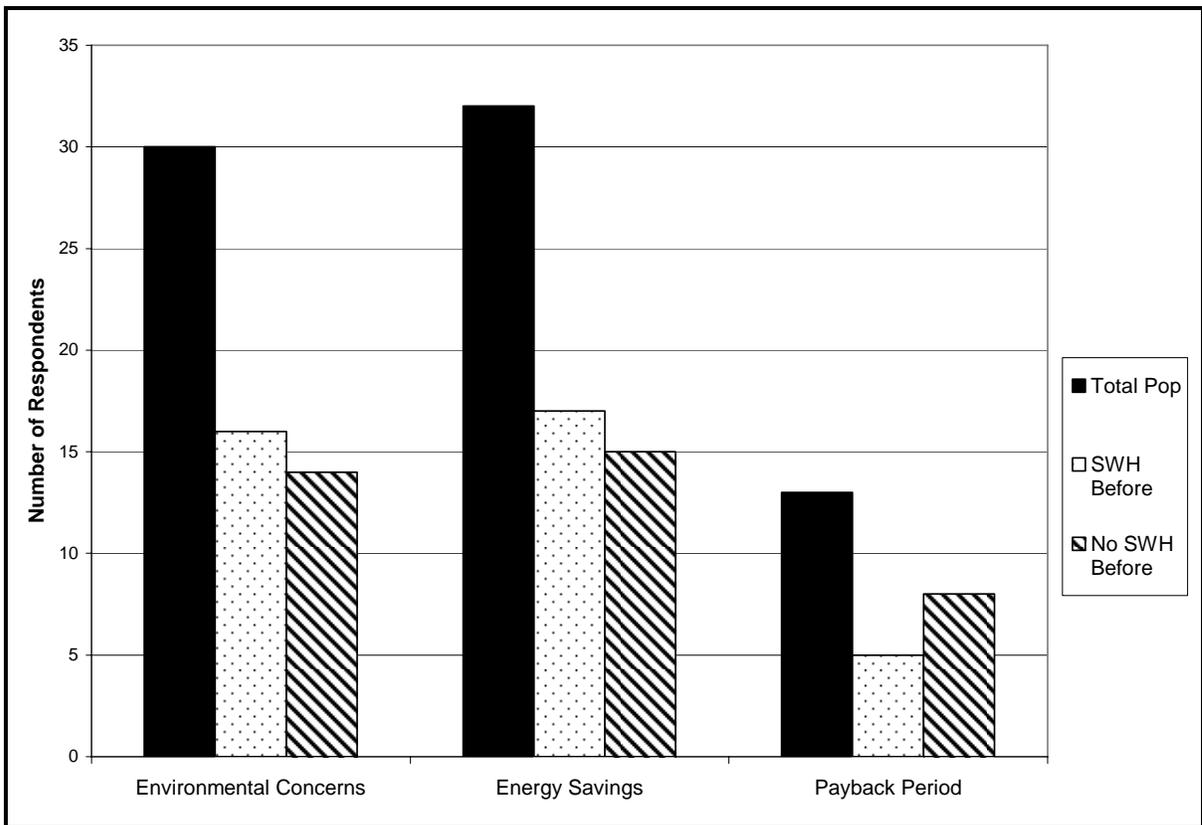
Prior experience with a product or technology can greatly influence a consumer's decision to purchase a product. Of the 40 residential participants surveyed, 19 had previously owned a SWH. The most common answer given for why they were replacing their old system was that the system leaked (33 percent). The remaining responses were split evenly between upgrading their old system, the old system having freeze damage, or the homeowner having moved to a different house. Two of the respondents to the CCSE online survey had previously owned a SWH. One of these respondents had lost their house in a fire near San Diego and was looking to install a SWH on their new home. The other respondent was looking to upgrade their SWH.

The influence of the availability of an incentive on the decision to purchase a SWH system was also examined. Thirty of the 40 survey respondents stated that they had considered installing a SWH before learning about the SWHPP, and just over half of those 30 had researched installing a system. Thirty-two of the 40 participants said they were very likely or somewhat likely to install the SWH, regardless of whether there was an incentive program. However, 14 of those 32 respondents replied that they would have installed their SWH at a later time. Eighteen of the respondents indicated they were hesitant to purchase a SWH because of the initial costs and four of the respondents were hesitant to purchase a SWH because they needed more information about the technology or the costs. Nineteen respondents indicated they would have installed their SWH at the same time; 10 of these 19 respondents had previously owned a SWH system. Overall, 21 of the respondents that were hesitant to buy a SWH system felt that their concerns were alleviated by SWHPP staff. Only one participant felt that he/she needed more information on how to find local installers and/or retailers.

The surveys also tried to identify the factor that most influenced a homeowner's decision to purchase a SWH system. Consequently, program participants were asked which factors influenced their decision to install a SWH and were able to choose more than one response. Figure 3-1 shows the three most important factors in the homeowner's decision to install a SWH system. The chart also compares those participants who previously had a SWH to those who did not. The total number of respondents is also shown. The most common

reason for deciding to install a SWH was the energy savings; however, environmental concerns were also very important. The payback period was more important to program applicants who did not previously have a SWH. While 32 of the 40 respondents claimed that energy savings influenced their decision to install a SWH, 23 respondents did not know whether there had been a decrease on their utility bill. The average reported savings by the 17 other respondents was 30 percent. Of the 17 respondents that reported savings, seven had natural gas backup water heaters and reported saving an average of 34 percent on their utility bill, and six had electric backup water heaters and reported saving an average of 28 percent on their utility bill.

**Figure 3-1: Major Influencing Factors in Purchasing a SWH System**



**Satisfaction with Contractor**

After deciding to purchase a SWH system, homeowners are then influenced by the efficiency of the installation process. Consequently, participants were queried as to the extent to which they were satisfied with the installation of their SWH systems. All respondents reported that they thought their contractor was knowledgeable about SWH. Thirty-five of the 40 participants felt their contractor was knowledgeable about the SWHPP. Eighty percent of the survey respondents were extremely satisfied with the contractors that they hired, and 95 percent were either mostly satisfied or extremely satisfied with the contractor. Thirty-seven

of the respondents reported that their contractor had encouraged him/her to contact them if they had any questions or problems with their system. Ten of the survey respondents stated that they had called their contractors to either check or fix the system. Two callbacks were done on recommendation by the CCSE post-installation inspector to fix minor violations. The most common call-backs were due to the water not getting hot or the water getting too hot. Nine of these 10 respondents reported that the contractor responded positively and in a timely manner to their concern. The other respondent did not answer the question.

### **Satisfaction with the SWHPP**

Program implementation can influence participation rates in an incentive programs. For example, positive marketing and favorable “word-of-mouth” conversations regarding a program can increase interest and participation. Program participants were asked about their satisfaction with the SWHPP process and if they had any recommendations for improving the program. Respondents were also asked about marketing materials they had seen and the usefulness of the workshop.

Twenty-five of the program participants first heard about the SWHPP through the contractor they selected to perform the installation. Six participants had seen either a television spot or a newspaper article that mentioned the CCSE SWHPP. Two more participants heard about the program when visiting the CCSE website. Three of the participants were in the solar business and therefore knew about the program through their work. One respondent heard about the program at a home show. Another respondent learned about the program through word-of-mouth. In general, those participants that had seen marketing materials for the program liked the marketing materials. Ten respondents commented that CCSE needs to do even more advertising for the program and recommended utility bill inserts, radio and television spots, and billboard advertisements.

Only four of the respondents had attended a SWHPP workshop. Two workshop attendees thought that the most valuable part of the workshop was the technical information presented. One workshop attendee appreciated the opportunity to speak with other homeowners interested in installing a SWH. One workshop attendee wished there had been more information during the workshop on how to compare different SWH systems and how to find local installers.

Program participants were asked if any part of the rebate process took longer than expected. Seven respondents reported problems and delays with obtaining a city or county permit. Three respondents did not like that they needed separate inspections by the city and by CCSE and recommended that the inspections be combined. Several respondents commented that it took too long to get the rebate and they thought that the process needed to be streamlined.

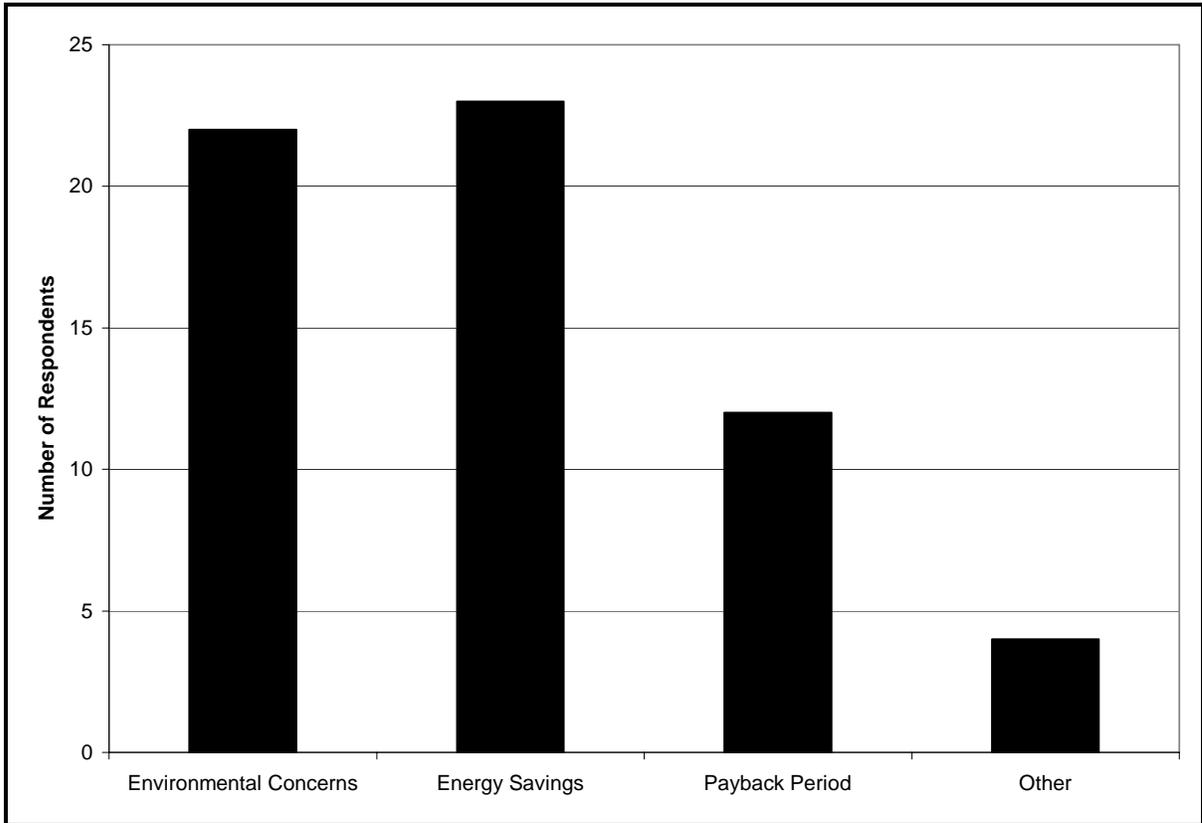
### ***Program Nonparticipant Survey Respondents***

The Itron CATI Center also interviewed 30 homeowners who had attended one of the CCSE Solar Water Heating Basics for Homeowners workshops but had not submitted an application to the program. Twenty-nine of the 30 respondents were SDG&E customers, while the other respondent owned a home elsewhere in California. The majority of the respondents had three or more people living in the household (46 percent). Five respondents (17 percent) had only one individual in the household. About 37 percent of the surveyed participants had two people living in their household. None of the participants lived in a household with more than five individuals. Forty percent of the respondents had lived in their house for six to 10 years and 23 percent of the respondents had lived in their house for more than 10 years. The other respondents had lived in their house for less than five years. Seven of the 30 respondents had previously participated in an energy efficiency incentive program, and three other respondents had received an incentive for installing a PV system. Just over 60 percent of the survey respondents had an annual household income of less than \$100,000.

### ***Reasons for Interest in SWH***

The surveys tried to identify the factors that might most influence a homeowner's decision to purchase a SWH system. Consequently, workshop attendees were asked why they were interested in installing a SWH and were able to choose more than one response. Figure 3-2 shows the three most important factors in the homeowner's interest in installing a SWH system. The two most important reasons for workshop attendees' interest in SWH were environmental concerns and energy savings. Other reasons included complementing their solar electric system, upgrading an old system, and having first-hand knowledge of how they work so that he/she can better inform clients.

**Figure 3-2: Reasons for Interest in Installing a SWH**



**Reasons Why They Have Not Yet Installed a SWH**

Workshop attendees were asked what the biggest factors were in causing them to wait to install a SWH and were able to choose more than one answer. Although 12 respondents were concerned about the initial cost, 21 of the respondents stated other reasons such as their roof does not have an optimal orientation, their roof is shaded, they are in the middle of a remodel, they are moving soon, or they are currently renting their home. Several commented that they would like to install the system themselves and so they are waiting to take a class on how to do it. One respondent mentioned that two separate contractors that were listed on the CCSE website would not install his/her system through the CCSE rebate program because there were too many requirements. A couple of other respondents replied that they would be installing a PV system in addition to or instead of the SWH.

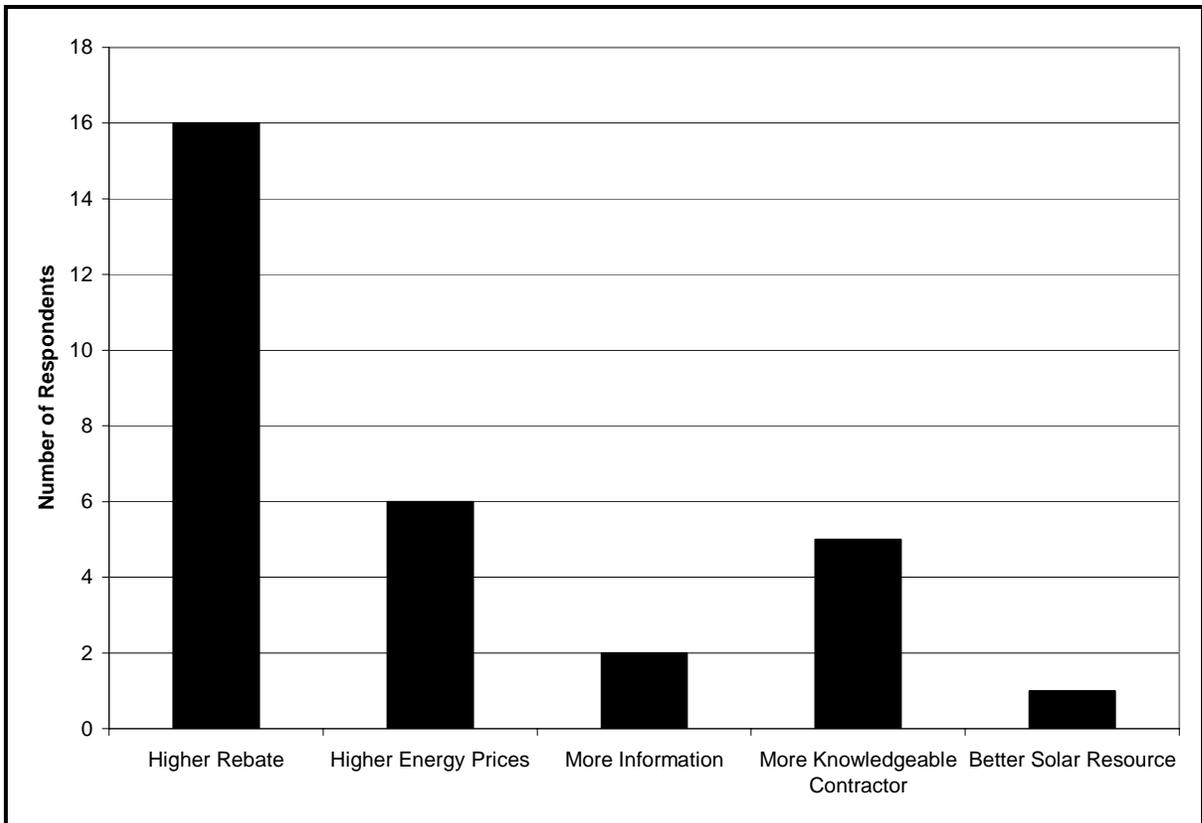
Responses to the CATI center survey were similar to those received in CCSE’s online survey.<sup>6</sup> In particular, nine of the 21 respondents that had not contacted a contractor said they would not install a SWH due to the initial cost, six reported that it was not feasible for them at that time, and one replied that he/she had just installed a tankless water heater. Other

<sup>6</sup> Note that respondents to the CCSE online survey may or may not have attended a CCSE workshop on solar water heating.

respondents did not answer the question. The CCSE online survey then asked if the homeowner planned to do any energy efficiency upgrades to their home and 20 of the respondents who had not contacted a SWH contractor planned to do upgrades. Two respondents planned to install a tankless water heater and seven respondents planned to install a PV system. Other responses included energy-efficient windows, energy-efficient appliances, low-flow faucets, more insulation, and a hot water recirculation system.

Workshop attendees were asked to choose the factor that would be most influential on their decision to install a SWH. The factors included a higher rebate, a low-interest loan, higher energy prices, a friend’s recommendation, more information, better solar resource, and a more knowledgeable contractor. Over 50 percent of the attendees said that they would be more likely to install a SWH if there was a higher rebate. Others would be more likely to install a SWH if energy prices were higher or if they could find a more knowledgeable contractor.

**Figure 3-3: The Most Influential Factors on Decision to Install a SWH**



**Satisfaction with CCSE Workshop and Marketing Materials**

The workshop attendees were asked about how they heard about the SWHPP and for their opinion on the CCSE workshop.

Over 50 percent of the workshop attendees found out about the workshop through the CCSE mailing list or through the CCSE website. Two respondents mentioned a flyer at a food cooperative in Ocean Beach. Two others heard about the workshop through word-of-mouth. When asked about what marketing materials the respondents had seen, 18 of the 30 said that they had not seen any marketing. The other 12 mentioned radio and television spots, newspaper articles, bill inserts, brochures, and the solar expo during the American Solar Energy Society conference held in San Diego in May 2008. In general, the respondents liked the marketing materials that they saw.

Workshop attendees were asked about their primary purpose in attending the workshop. Seven respondents replied that they intended to install a SWH on their home. Three replied that they wanted to learn about SWH for their job, and one elaborated that he/she remodels homes and wanted to be able to answer questions about SWH if the subject came up. Seventeen respondents said that they were there because they were interested in the technology, but did not necessarily intend to install a SWH at that time. Two other respondents said that they were investigating ways to reduce their energy bills. The last respondent said that he/she was there because he/she was interested in a position with CCSE. The attendees were also directly asked if they planned on installing a SWH on their home in the future, and 90 percent of them said that they did plan to install a SWH in the future. When asked when they would install their SWH, over 70 percent said that they planned to install a SWH within the next year.

Workshop attendees were asked what they liked most about the workshop, and 77 percent said they thought that the technical information was the most useful. Only one workshop attendee thought that there was too much technical information presented. Other respondents found the information about installation costs and rebates to be the most useful, while one respondent appreciated the opportunity to talk with other homeowners about installing a SWH. Suggestions for improving the workshop included providing a list of approved contractors, showing more pictures and discussing actual installations, and talking about using a tankless water heater as the backup system. A few were also interested in learning how to design and install their SWH themselves.

### **3.2 Contractor Survey Results**

Contractors play a critical role in the success of an installation-based incentive program. In addition, the successfulness of an incentive program depends on its ability to integrate seamlessly into the day-to-day operations of the commercial marketplace. Consequently, contractors were surveyed to determine their satisfaction with the SWHPP, how well it met their needs, what they liked or disliked, and changes they recommend CCSE consider to the program. The contractor surveys are reproduced in Appendices C–E .

Iron interviewed 24 contractors in two separate rounds. The first round of questions was completed in December 2007 and concentrated mainly on contractor satisfaction with the SWHPP; therefore, the sample group consisted of contractors who had attended a CCSE Installer workshop. The second round of interviews is currently in-process. For the second round, contractors statewide are being interviewed about their opinion on the SWHPP design and on their business models. The sample group for the second round is made up of 20 contractors who have attended a CCSE Installer workshop for either the SWHPP or the new Palo Alto program, and 10 contractors found on either the California Solar Energy Industries Association website or the Find Solar website<sup>7</sup>. Thirteen contractors were interviewed in the first round and 11 have been interviewed so far for the second round.

### **Customer Perceptions and Market Barriers**

Contractors represent the front line of an installation incentive program. As such, they tend to be “tuned-in” to how customers are viewing the market opportunity and have developed opinions regarding issues they believe constitute market barriers.

Contractors believe that one market barrier for SWH is that competition exists between PV and SWH. Most contractors indicated that they do not try to influence a customer’s decision to select a SWH system or a PV system because usually the homeowner has already made their decision prior to contacting the contractor. One contractor indicated that because PV is advertised more and because more homeowners throughout California are eligible for a PV rebate, PV is generally the first or only solar energy technology that comes to mind for most customers. This same contractor believes there is competition between PV and SWH in terms of a homeowner’s view of energy reduction potential, available roof space, and cost.

Most contractors feel that a SWH market will naturally develop with increased technology exposure from rebate programs, and most believed that the PV rebate program “jump-started” the PV industry. All of the surveyed SWH contractors who also install PV systems indicated that the rebate is a very important factor in making a PV sale.

A few contractors indicated that delays in rolling out a statewide program were slowing down the SWH market. These contractors speculate that the public has heard of a potential statewide SWH rebate program and is waiting to see if additional or higher incentives will be available before proceeding with installation. However, this is inconsistent with the fact that all contractors had reported an increase in SWH business from a year ago.

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<sup>7</sup> <http://findsolar.com>

### **SWH Installation Practices and Repair Experiences**

Contractors were asked questions about their SWHPP installation process in order to determine if the CCSE SWHPP requirements were in-line with current practices. Questions regarding contractor installation practices included the types of systems they installed most often, the use of rebuilt or refurbished parts, and the use of monitoring equipment. Contractors were also asked about the types of repairs they see most often and the type of systems and age of systems that most often need repair.

The majority of surveyed contractors reported installing only Solar Rating and Certification Corporation (SRCC) OG-300 certified systems<sup>8</sup>. Two contractors indicated that they sometimes install OG-300 systems but other times they preferred to design the system themselves. No respondents reported using rebuilt or refurbished parts in their installations; however, two contractors said they use rebuilt or refurbished parts for repairs. Only two of the interviewed contractors reported that they install monitoring equipment on at least some of their systems.

Contractors were also asked about their experience with service calls and repairs for SWH systems. Of the six contractors that also service SWH systems, the number one reason cited for a service call was a leak somewhere in the system. Contractors mentioned the most common locations for leaks occur at a junction, in the panel, or in a mechanical device such as a pump. Most contractors mentioned that these systems were installed over 20 years ago. Two contractors reported that they receive service calls for active systems more often than for passive systems due to the moving parts on an active system. Repairs for freeze-damaged systems were almost all caused by controller failure or failure to perform regular system maintenance. All respondents indicated that the number of freeze-damaged systems is decreasing due to increased owner awareness and manufacturer improvements in systems.

### **Permitting Experiences**

Contractors were asked about the length of time required to obtain permits and the ease or difficulty in obtaining permits. All contractors except one reported that all of the cities in which they install SWH systems required a permit. The cost of a SWH permit depends on the city and varied from \$100 to \$400. The average cost reported for a SWH permit was \$220. The time to acquire the permit ranged from immediately (i.e., could be obtained over the counter) to as long as four months, with an average of two weeks. The length of time depended on whether an inspection was required. Contractors reported that inspections were required most often for systems with higher roof loading. When compared to the permitting

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<sup>8</sup> OG-300 is a rating system developed by the SRCC which provides installation guidelines and an efficiency rating for an entire SWH system (as opposed to the OG-100 rating system which provides the efficiency rating for the collector portion of the SWH system only).

process for PV installations, half of the contractors reported that the permits for PV projects were easier to obtain, while the other half reported that they saw no difference in the process. Contractors who felt that PV permits were easier to obtain thought that this was because structural roof reinforcement is not needed for PV and because cities are generally more familiar with permitting PV systems. The cost of a PV permit also depended on the city but the contractors reported that PV permits could cost anywhere from \$100 to \$650. The average cost reported for a PV permit was \$275.

A couple of the interviewed contractors believed that local SWH permitting requirements, which take precedence over the state or rebate program requirements, discourage some contractors from installing systems in some geographical areas covered by the CCSE SWHPP. These contractors had encountered situations where a city permitting department required more certification or documentation than what has been required for installs in other locations. The additional requirements result in a large additional cost and discourage SWH installations within that city and this could be having an effect on SWHPP participation rates. One of the interviewed contractors stated that this particular local permitting agency is requiring additional certification such as that from Underwriter Laboratories, Inc. (UL). The contractor pointed out that very few SWH systems have UL certification. This contractor went on to say that he had planned to install 100 systems under the SWHPP; however, due to permitting requirements, the contractor will now only install five systems, all of which will be outside of this local permitting agency's jurisdiction.

### **Experience with Other Incentive Programs**

Contractors were asked about their experiences with other incentive programs they had participated in, for either SWH or PV, and were asked to comment on what they liked more or less about these other programs.

Three of 11 surveyed contractors had participated in SWH rebate programs in the early 1980s. These contractors liked the simplicity of the applications used in the 1980s, but felt that low quality work resulted due to the lack of equipment and contractor requirements.

The SWH contractors who also install PV systems reported participating in the CSI program. These contractors believed that the CSI program has increased their PV sales. About half of the PV installers also participate in the California Energy Commission (CEC)'s New Solar Homes Partnership (NSHP) program in addition to the CSI program. The contractors' two most common complaints of the PV incentive programs were the time it takes to complete the application and the time it takes for the program managers to approve the application. One contractor indicated that the PV program is constantly changing its application form which increases the time the contractor spends filling out the application. Contractors also did not like that different programs had different incentive calculation methods for the same

technology, and it was recommended that one calculation method be used for all rebate programs for the same technology.

### **Recommendations for the CCSE SWHPP**

This section discusses contractor survey responses regarding recommendations for a SWH rebate program. In some cases recommendations stem from a contractor's participation in other rebate programs if the contractor was unfamiliar with CCSE SWH rebate programs.

#### **Application Process**

Some contractors were discouraged from participating in the program because of the number of requirements and paperwork. Contractors mentioned that being discouraged by the time it took to fill out the application, the equipment requirements, and the liability insurance requirement. All of the contractors interviewed said that they fill out the incentive application for the customer. The contractors stated that the additional time associated with filling out the application ranges from eight to 30 hours per application, which many contractors felt was too long. Most of the contractors have full-time employees dedicated to filling out rebate applications.

In order to reduce the complexity of the residential application, contractors suggested switching to a fixed rebate amount per installation or to a tiered incentive approach, which would allow a fixed incentive for different solar fraction ranges. Another suggested that the SWH rebate application should be as consistent as possible with the PV rebate application so employees can be cross-trained.

#### **Eligibility Requirements**

Currently the SWH rebate programs require two separate inspections; one for the permit and another for the rebate. One contractor recommended that inspection reports be shared between CCSE and the city. Another recommendation was that inspectors could be trained to work jointly for the city and for CCSE in order to meet the requirements of both in a shorter time.

Additionally, all residential systems must be SRCC OG-300 certified systems. One contractor specifically did not like the OG-300 certification requirement because he felt that it was not always the best option for a site. This contractor suggested that an alternative way for a program to maintain quality installations could be to require continuing contractor education and more stringent contractor certification requirements. Some contractors thought that the program did not need all of these requirements in order to ensure quality installations.

### Outreach and Education

Most of the contractors thought that increased marketing would be useful; however, there were a couple that thought there were already sufficient educational materials readily available. Contractors mentioned that they thought utility bill inserts are a good method for advertising the SWHPP. One also suggested providing accurate historical natural gas price information within the utility bill inserts to help people to see the potential of SWH systems.

In terms of additional education material, all of the surveyed contractors indicated that they thought the CCSE estimate of \$6,500 for a SWH system installed within the program was too low. A few commented that for a batch system or for a family of two this estimate would be accurate. Some contractors reported that they believed a more accurate average estimated cost would be \$8,100 for a system before incentives and tax credits.

### **Overall Recommendations**

Although the majority of the contractors interviewed were not familiar with the CCSE SWHPP, they had recommendations from participation in PV and previous SWH rebate programs. Among the recommendations that contractors made for a SWH rebate program are the following:

- In general, streamline the application process.
- Simplify the calculation of the incentive amount for residential customers.
- Consider a simple two or three tiered qualification approach with fixed incentive levels at each tier.
- Increase the rebate amount in order to cover the cost of the added labor or hardware requirements required by participation in the program.
- Communicate accurate cost information and routine maintenance requirements on hardware.
- Increase targeted marketing efforts and visibility by the CCSE SWHPP.
- Attempt to establish relationships with city permitting offices and possibly offer educational sessions for permitting office staff.

### **3.3 Manufacturer & Distributor Survey Results**

Two SWH equipment manufacturers in California were interviewed by Itron. One company was well-established and had been in business since the late 1970s, while the other had been in business for less than one year. Due to the stark contrast in the two businesses, many of their responses regarding the impact of a statewide incentive program were very different. Both felt that the biggest market barrier in California was the lack of public knowledge about

the technology, but that AB 1470 will play an important role in creating a SWH market in California. The business models for these companies are discussed in Section 4.

### **3.4 Program Administrator Survey Results**

Program Administrators (PAs) within California and nationwide were surveyed in order to gather information on how other SWH incentive programs work, how they dealt with any problems they encountered, and how programs have changed to adapt to a changing market.

#### ***California Programs***

There are currently four other SWH incentive programs in California which are not administered by CCSE. Three of the four are offered by utilities and only provide incentives for SWH that are backed up with electricity. Itron spoke with the PAs of each of these programs.

The programs that were interviewed included:

- Redding Electric Utility (REU)
- Sacramento Municipal Utility District (SMUD)
- Santa Clara Sewer and Water
- Marin County

Two of the four programs offer a flat-rate incentive payment, while a third offers flat-rate incentive payments on a per-panel basis. The fourth program takes a unique approach and leases the SWH to customers. Most of the SWH incentive programs are part of larger renewable and energy efficiency programs and are funded by a general fund for solar technologies or renewable technologies. Natural gas is the primary fuel for domestic hot water in California; therefore, only a small percentage of customers are eligible for a SWH incentive offered by an electric utility that intends for the incentive to go towards displacing electricity.<sup>9</sup>

#### **Redding Electric Utility (REU)**

The REU SWH program provides an incentive on a per-collector basis with up to \$1,000 for the first collector, \$500 for the second collector, and \$250 for the third collector, not to exceed 50 percent of the cost of the system. The program is funded by a public benefits fund charge and is part of a larger incentive program. The system must be installed by a licensed contractor or may be self-installed. The system must be inspected by the building permit

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<sup>9</sup> Both SMUD and REU stated that only 10-20 percent of their customers have electric water heaters and would be eligible for the solar water heating incentive.

inspector and will not receive payment until the system passes inspection. SWH systems installed under the program contribute to meeting REU's renewable portfolio standard (RPS) goal. Over 70 percent of the systems that have received an incentive from REU were installed in 2002. REU does not require systems to be OG-300 certified.

### **Sacramento Municipal Utility District (SMUD)**

SMUD currently offers a flat-rate incentive program of \$1,500 per system for residential customers. However, SMUD is in the process of altering the SWH incentive program and will soon offer a three-tiered incentive program with the incentive amount dependent on the estimated energy savings provided by the system. The change in the program design is to ensure that the rebate level reflects the amount of energy savings provided by the SWH system, with systems that achieve greater energy savings receiving a higher rebate. SMUD has been receiving 15-20 applications per month but has seen a recent slowing in applications in the last year, which the PA believes may be due to the slowdown in the economy. SMUD inspects 100 percent of the systems prior to payment and requires that the systems be installed by a contractor with a solar contractor license (C-46). SWH systems installed under the program contribute to meeting SMUD's RPS goal.

### **Santa Clara Water and Sewer**

The Santa Clara Water and Sewer Leasing Program began in 1977 in response to the energy crisis. Solar pool heating and solar domestic hot water heating systems were offered to residential and multifamily units through a lease program. Though the program still exists, only 20 domestic solar hot water systems have been installed to date, and the last system was installed sometime in the 1980s. Almost all of the systems installed are still operational. Currently, the lease program is not actively marketed as the PA believes it is more cost-effective for homeowners to purchase the systems themselves so that they can receive the tax rebates.

### **Marin County**

Marin County provides a flat-rate incentive payment of \$300 per system, for both residential and commercial customers. Unlike SMUD and REU<sup>10</sup> who only offer incentives for customers with an electric backup water heater, Marin County offers incentives for both natural gas and electric backup water heaters. To date, only eight SWH systems have been installed under this program. Marin County began its solar technology program primarily in response to a decreased incentive from the CEC for PV systems. SWH is an element within the larger solar technologies program which also provides incentives for PV systems and

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<sup>10</sup> Both SMUD and REU are electric utilities. Offering incentives to customers who use natural gas to fuel the backup water heaters would be cross-subsidization between the different fuels and would cost the electric customers to subsidize the natural gas customers who are purchasing natural gas from a different company.

solar pool heating systems. The program received \$55,000 in June 2005, \$50,000 of which was set aside for incentives. The program was fully subscribed as there were 100 PV systems installed under the program and the incentive was \$500 per system. Recently, Marin County received an additional \$25,000 for funding more PV, SWH, and solar pool heating systems.

### ***Programs Outside California***

Iron also conducted interviews with five PAs outside California who administer SWH incentive programs. The five programs surveyed were:

- Lakeland Electric Utility (Lakeland Electric); Florida
- Arizona Public Services (APS); Arizona
- Hawaii Electric Company (HECO); Hawaii
- Eugene Water and Electric Board (EWEB); Oregon
- National Grid; Massachusetts, Rhode Island, New Hampshire and New York

#### **Lakeland Electric Utility (Lakeland Electric)**

Lakeland Electric's SWH program began in 1997. The program does not provide an incentive payment to customers for SWH systems; instead, the utility purchases the SWH system and installs the system on the customer's roof. In return, the utility customer obtains fixed rates for the portion of energy offset by the SWH for the duration of the time that they are a customer of Lakeland Electric. The energy offset by the SWH is calculated by metering and recording the sum of the BTUs produced each month and converting the value into the total monthly kWh that were displaced. The customer is then charged a flat rate on a per kWh basis. The funding for the program ended in 2002 and was part of a grant from the U.S. Department of Energy (DOE).

Lakeland Electric recently received more funding to restart this program in 2009 and install up to 10,000 SWH systems.

#### **Arizona Public Services (APS)**

The SWH program at APS began in 2002 and was a flat-rate incentive payment for residential customers. During the five-year incentive program, a total of 258 systems were installed, however, less than 10 systems were installed during the first two program years. APS expects that for the new program, the first year will see participation in the thousands.

In 2007, the Arizona Corporation Commission adopted a Renewable Energy Standard requiring each investor-owned utility to procure at least 15 percent of its energy portfolio from renewable resources; 30 percent of that 15 percent must come from distributed generation. The mandate includes SWH as a renewable resource. The program began in

February 2008 and has been expanded to include commercial customers. Large commercial and industrial customers receive incentives based on a custom design system. The collector must be OG-100 certified, and the participant may choose to either receive 45 cents/kWh based on the first year energy savings estimate or may choose to participate in the performance-based incentive program either for 10, 15, or 20 years, depending on the agreement between APS and the participant. The APS program requires all customers to pay a minimum of 15 percent of the system cost.

**Hawaii Electric Company (HECO)**

HECO's SWH program has been in existence since 1996 and to date has paid out on over 40,000 installations. One of the main reasons cited for its success is the state tax credit of 35 percent, which is additional to the 30 percent federal tax credit. Residential SWH participants must meet at least 90 percent of their hot water use with the SWH. In the HECO SWH program, the contractor receives the incentive payment and is responsible for completing the application. All contractors must be licensed, insured, and bonded, and must agree to follow the policies and procedures of the SWH incentive program. HECO requires SRCC OG-300 certification. In addition, HECO offers a fast-track application process, which allows for the incentive payment to be paid prior to final approval for contractors that have proven that they are successful. A successful contractor passes the inspection on either the first or second try and completes at least 12 installations in a year.

**Eugene Water and Electric Board (EWEB)**

EWEB began its SWH program in the 1980s and created the Bright Way to Heat Water SWH incentive program. In 1990 EWEB added a no-interest loan option in addition to the rebate. In 2002, EWEB sold the rights of the Bright Way to Heat Water program to the Bonneville Power Administration (BPA) who provides the program to other utilities that are BPA customers. The cash incentive is based on the estimated energy savings provided by Oregon's Department of Energy, and the incentive amount has not changed since the program was introduced in the 1980s. In 1990 the no-interest loan option was added to the program, and for a few years the program saw an increased participation rate. However, the program has reported that participation rates have decreased lately because the incentive and loan amounts have not changed while the price of a SWH has almost doubled.

In order to qualify for EWEB's rebate and/or zero-interest loan program, the customer must choose one of four qualified contractors to install the system. Self-installations are allowed as long as one of the qualified contractors oversees the work. Qualified contractors attend additional training and receive a Solar Specialist License. The qualified contractors are also required to attend training with the Oregon Department of Energy. One hundred percent of the systems are inspected prior to final payment.

**National Grid**

National Grid is unique compared to the other PAs that were surveyed. Its program is the only one that allows only natural gas as the backup tank fuel as it is a natural gas utility. In addition, National Grid covers multiple states, including New Hampshire, New York, Massachusetts, and Rhode Island. National Grid is mandated to participate in a program that funds new technologies. The SWH incentive program being offered by National Grid started in August 2007. Residential customers receive an upfront payment of 15 percent of the total cost up to \$1,500. Commercial and industrial customers may either receive payment based on estimated therm savings, capped at \$3 per therm, or they may receive a payment for 50 percent of the cost of the system, up to \$100,000.

**Overall Summary of Other Incentive Programs**

Table 3-1 and Table 3-2 provide an overall summary of the incentive programs that were interviewed for comparison with the CCSE SWHPP. Incentive structures of the different SWH incentive programs are shown in Table 3-1. The incentive structures have been defined as a fixed amount or as performance-based. A fixed incentive is one that remains the same regardless of the type of SWH installed. A performance-based incentive is one that is calculated as some function of total project cost or as a function of estimated system performance. The incentive offered by CCSE seems to be on a par with incentives offered by other programs; however, the other programs are mainly serving electric customers who will see a faster payback period.

**Table 3-1: Incentive Structure of Residential SWH Incentive Programs**

<b>Program Name</b>	<b>Incentive Structure</b>	<b>Incentive Calculation Method</b>	<b>Maximum Incentive Allowed</b>	<b>Typical Incentive Amount</b>	<b>Loan Availability</b>
Lakeland Electric	Lease Program	n/a	n/a	n/a	n/a
Arizona Public Services (APS) (2008 program)	Performance Based*	\$0.75 per kWh of estimated first-year savings	50% of total system cost	\$1,200 - \$2,600	None
Hawaii Electric Company (HECO)	Fixed	\$1,000	\$1,000	\$1,000	0 – 2 % interest for low-income participants only
Eugene Water and Energy Board (EWEB)	Fixed	\$600	\$600	\$600	Zero-interest
National Grid	Percentage of Cost	15% of project cost	\$1,500	\$900 - \$1,350	None

**Table 3-1: Incentive Structure of Residential SWH Incentive Programs, continued**

<b>Program Name</b>	<b>Incentive Structure</b>	<b>Incentive Calculation Method</b>	<b>Maximum Incentive Allowed</b>	<b>Typical Incentive Amount</b>	<b>Loan Availability</b>
Sacramento Municipal Utility District (SMUD)	Fixed <sup>†</sup>	\$1,500	\$1,500	\$1,500	7.5% interest
Santa Clara	Lease Program	n/a	n/a	n/a	n/a
<b>CCSE SWHPP (SDG&amp;E customers)</b>	<b>Performance Based*</b>	<b>Function of the SRCC rating and the Solar Orientation Factor</b>	<b>\$1,500</b>	<b>\$800 - \$1,500</b>	<b>Zero-interest‡</b>
Marin County	Fixed	\$300	\$300	\$300	None
Redding Electric Utility (REU)	Fixed amount per collector	First collector: \$1,000 Second collector: \$500 Third collector: \$250	50% of total system cost	\$1,000 - \$1,500	None

\* Performance Based applies to both estimated and metered energy savings and is measured on a per kWh basis.

<sup>†</sup> The SMUD program is changing its incentive structure to a three-tiered incentive.

<sup>‡</sup> SDG&E recently extended their On-Bill Financing program to include projects with a 10 year payback period.

Table 3-2 presents general information about when the program started, what sectors are eligible, what types of customers (e.g., electric or natural gas) are eligible, how many projects have been installed, whether or not inspections are required, any unique characteristics of the program, and whether or not the program is collecting metered data from the installed systems. Very few programs provide incentives to natural gas displacing projects, as most PAs are electric utilities. Almost all programs require that 100 percent of the projects be inspected before receiving their rebate. The leasing programs meter their projects in order to bill the customer each month, but otherwise the majority of programs did not require metering on residential systems.

**Table 3-2: Summary of Other SWH Incentive Programs**

<b>Program Name</b>	<b>Sectors</b>	<b>Backup Tank Fuel</b>	<b>Year Started</b>	<b>To-Date Installations</b>	<b>Inspection</b>	<b>Unique Characteristics</b>	<b>Performance Monitoring</b>
Lakeland Electric	Residential	Electric	1997	60 residential	100%	Utility owns, customer pays for electricity	Meters BTUs produced and records on a monthly interval
APS	Residential	Electric	2002-2007	258	Available for audit		
APS	Residential, Commercial, Industrial	Electric and Natural Gas	2008	None yet, expected to be in the thousands	Available for audit	Mandated program	For the performance-based incentive the BTUs produced are recorded monthly
Hawaii Electric Co.	Residential and some Commercial	Electric	1996	42,500 residential and commercial systems (about 39,000 are residential systems)	100%	State tax credit of 35%; Fast track for contractors that have proven record	Do not meter.
EWEB (Bright Way to Heat Water)	Residential and Commercial	Electric	1990 (sold ownership rights to BPA in 2002)	At least 1,030	100%	Zero-interest loan up to \$4,000 with a cash back incentive paid to contractor who passes on discount to customer	Do not meter.

**Table 3-2: Summary of Other SWH Incentive Programs, continued**

<b>Program Name</b>	<b>Sectors</b>	<b>Backup Tank Fuel</b>	<b>Year Started</b>	<b>To-Date Installations</b>	<b>Inspection</b>	<b>Unique Characteristics</b>	<b>Performance Monitoring</b>
National Grid	Residential and Commercial	Electric and Natural Gas	August 2007	30 residential; 6 commercial	20% actual inspection; photo required for 100% prior to payment	Natural gas only, multi-state program	Do meter for commercial and a few residential systems.
SMUD	Residential and Commercial	Electric	2005 <sup>11</sup>	over 200 residential	100% by program administrator	Requires contractors have C-46 license; solar contractor	Do not meter
Santa Clara	Residential and Multifamily	Electric	1977	20	n/a	Lease program; Last installation was in the 1980s; Not actively marketed	Do not meter
CCSE SWHPP	Residential, Commercial, Industrial	Electric, Natural Gas, Propane	July 2007	36	100% by program administrator	Evaluation including market research is being conducted in order to develop a statewide incentive program	Metering 15-minute interval data for a sample of the systems
Marin County	Residential and Commercial	Electric and Natural Gas	June 2005	8	100 % by building inspector	Funds natural gas and electric backup water heaters	Do not meter
Redding Electric Utility	Residential only at this point	Electric	January 2002	29	100 % by building inspector	Does not require SRCC certified systems. Does not require freeze protection	Do not meter

<sup>11</sup> The current version of the program has been in place since 2005. However, SMUD has offered a SWH incentive program since the 1980s.

### 3.5 Market Actor Survey Results

Itron talked with four market actors and asked questions about market barriers in California, incentive program designs that work well, and expected technology improvements within the next 10 years. Respondents included representatives from the SRCC, DOE, CalSEIA, and the Hawaii Solar Energy Industries Association (HISEIA). Respondents were asked questions about current market barriers, designing a SWH incentive program, and recommendations for implementing a statewide incentive program in California.

#### **Market Barriers**

Several market barriers were mentioned during the interviews with the market actors. These included:

- Lack of public knowledge about SWH.
- The existence of state incentives for PV and energy efficiency, but not for SWH.
- Traditional water heaters are reliable and inexpensive and are not often replaced.
- Eight-five percent of homeowners in California have natural gas water heaters and natural gas is still relatively inexpensive.
- Builders are reluctant to include SWH on new homes or pre-plumb homes for SWH because they do not understand the technology and do not want call-backs.

There was overall consensus that one of the biggest market barriers is lack of public knowledge about SWH. Respondents felt that SWH has been ignored in California and that California does not recognize the value of SWH, particularly compared to other renewable technologies. In particular, it was stated that this difference in recognized value was demonstrated by the existence of state incentives for PV systems and energy efficiency measures, but the lack of a statewide incentive for SWH. One respondent added that many people interested in renewable energy find the concept of spinning their electricity meter backwards very appealing and are therefore inclined to purchase a PV system instead of a SWH system.

Another market barrier is the fact that water heaters are reliable and inexpensive and so they do not need to be replaced very often. One survey respondent commented that other market players believe tankless water heaters are as good as or better than SWH; however, he argues that a SWH is better than a tankless water heater because tankless water heaters still run on fossil fuels. Additionally, natural gas is still relatively cheap. A strong argument in favor of SWH is that natural gas should be used for an end use (such as creating electricity) that is not easily achievable by or as affordable as some other method. One respondent commented that if California wants to reduce fossil fuel use, SWH is the low-hanging fruit. Solar electric,

SWH, and energy efficiency should be carried out together, and the combination should be designed to optimize cost-effectiveness.

Builders are reluctant to include SWH systems in new homes because they do not want call-backs if the system needs repair. They are also concerned about aesthetics.

### ***Incentive Program Design***

All respondents felt that an incentive program was necessary for stimulating the SWH market in California. Several pointed out that incentive programs often make the difference between significant sales and little to no sales.

### ***Incentive Structure***

The incentive structure needs to be well designed. An incentive that is too high could result in poor technology and poor installations being done in order to make a quick buck. However, if the incentive is too low, nothing will happen. There was agreement that the incentive should be based on the energy production of the SWH system; however, there should be a maximum incentive amount, and some felt that there should also be a minimum performance standard. One respondent thought that the current CCSE SWHPP incentive was too low. Additionally, the incentive structure needs to be designed in order to meet the state's goals. It needs to be decided if the program will encourage a high quantity of low efficiency (and less expensive) systems or a lower quantity of high efficiency (and more expensive) systems.

Performance-based metering makes sense for commercial or industrial systems because the additional cost for metering is minimal compared to the system costs. However, this does not make as much sense for residential systems where costs need to be kept low.

Respondents were at odds when asked if repair or replacement of SWH systems should be eligible for an incentive. An argument in favor of this was that the program should want the energy savings to persist. One respondent added that only certain repairs should be eligible and that the incentive should be designed so as not to encourage homeowners to replace the entire system when, for example, only a new pump is needed. The respondent against providing an incentive for repair thought that the warranty should cover it and after that it would be the homeowner's responsibility and in the homeowner's interest to keep the system running.

All respondents felt that new construction should be eligible for an incentive; however, they did not feel that it should be mandatory for new homes to include a SWH. Some thought that new homes should be pre-plumbed for SWH, although one respondent commented that he

had not seen an increase in SWH installations for pre-plumbed homes and he did not feel that this had much value.

All respondents agreed that a SWH incentive ideally would result in a decrease in installation costs as the contractors became more efficient. All commented that the equipment costs were more dependent on the cost of raw materials and the cost of energy rather than the presence of an incentive program. Respondents believed that the problems that occurred in the 1980s, where installations were of poor quality and SWH system prices increased, were due to the lack of quality control.

Another method of alleviating the cost barrier would be to develop a statewide carbon credit market for which SWH systems would be eligible. Currently the carbon credit market is not well developed and would not result in any substantial cost benefits for SWH.

### **Equipment Requirements**

Respondents agreed that equipment should be certified OG-300 for residential systems and OG-100 for commercial systems. One commented that residential installs should not require field engineering and should be “cookie cutter” systems in order to standardize the industry and ensure quality work. Another respondent added that systems need to be designed to work reliably in the climate where it’s installed, and requirements should err on the side of caution. One respondent felt that the minimum production level requirement should be consistent with the Federal Energy Star requirement, i.e., that the SWH should meet 50 percent of the energy needs for heating water.

### **Contractor Requirements**

Currently California state law allows contractors with a plumbers license, a specialized solar contractor license, or an HVAC license (when included as part of a larger project) to install SWH. The respondents agreed that an incentive program should not require anything more than a state contractor license, but that North American Board of Certified Energy Practitioners (NABCEP) certification or other certification should be encouraged. More requirements are going to increase costs, and costs need to be kept as low as possible.

### **Model SWH Incentive Programs**

All but one survey respondent stated that HECO has the model SWH incentive program. The other respondent replied that there are no model programs in the U.S. and pointed to Europe, where development of a SWH market also resulted in a market for solar thermal heating and cooling. Other programs that were mentioned were the Lakeland Electric and the EWEB programs. Itron interviewed the PAs of these programs; the results were discussed in Section 3.4 and will be analyzed in more detail in Section 4.

### ***Technology Improvements over the Next 10 Years***

A wide range of responses were received when the interviewees were asked what technology improvements they expected to see in the next 10 years. One respondent was unsure if any improvements would be seen because there is currently no market for SWH in the U.S. The other respondents mentioned the use of less expensive materials for the collector, finding suitable piping material that is less expensive than copper, more “plug and play” systems, aesthetic improvements, and the design integration of solar thermal systems with solar electric systems.

# 4

## Analysis of Survey Results

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This section analyzes the survey results as a whole and discusses SWH installation and equipment costs, the business models of SWH manufacturing companies, the business models of SWH installation companies, and the design of other utility incentive programs.

### 4.1 Cost Components

This section discusses data from the CCSE program tracking database and the confidential cost surveys of the contractors. The cost data are summarized over all contractors and over all system types. The individual cost components are compared against the total cost to identify which costs have the largest impact on total cost.

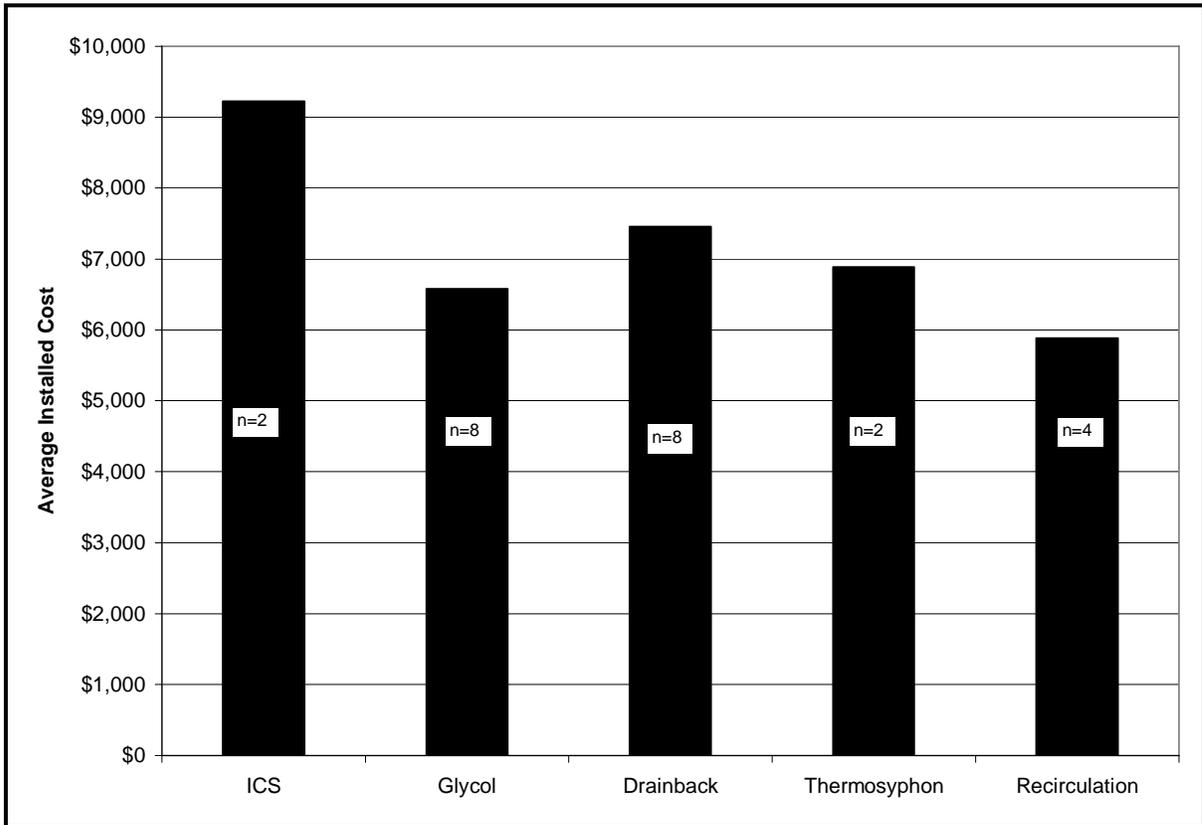
#### ***Sources of Data***

The first source of data is the CCSE's SWHPP tracking database, which includes the OG-300 numbers of the systems for which applications have been received. It also tracks the stage of the rebate process that the project has reached. Itron merged the CCSE tracking database with SRCC data to develop summary statistics, such as monthly and cumulative number of participants, technology characterization, and size. In addition to the cost data from the applications submitted as part of the CCSE SWHPP, Itron conducted phone interviews with 11 contractors and mailed out a confidential cost survey to 100 contractors. Itron did not receive enough confidential cost surveys in order to do an in-depth analysis of equipment and installation costs at this time, therefore results from the confidential cost surveys will be presented in the Interim Evaluation Report to be completed in September 2008.

#### ***Summary of Cost Data***

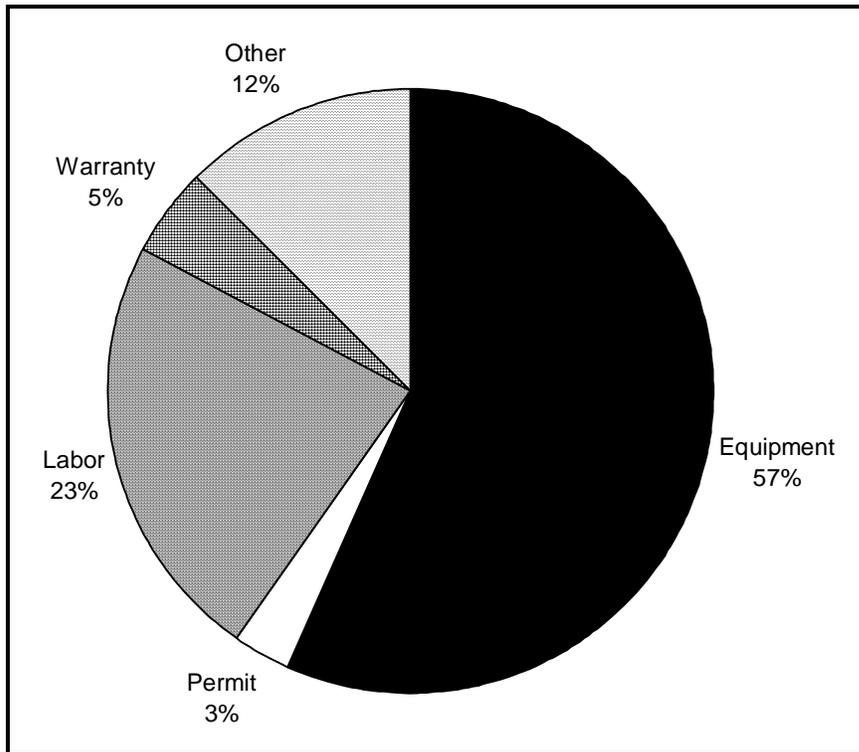
Figure 4-1 shows the average cost by system type for residential retrofit projects that applied for incentives through the SWHPP. The average installed cost for projects that had submitted applications to the SWHPP was about \$7,000. Recirculation systems were the least expensive, with an average cost of around \$5,900. ICS systems were the most expensive, with an average cost of roughly \$9,200. However, there were very few ICS systems installed and of those installed, one project had multiple collectors which inflated the average price of the ICS systems.

**Figure 4-1: Average Installed Cost by System Type for Residential Retrofit Projects**



The average reported permit cost for a residential retrofit project was about \$200. The average labor cost over all residential system types was about \$1,500 and the average collector cost over all residential systems was about \$2,100. Figure 4-2 shows the percentage that each cost contributes to the total installed cost of a SWH system. Equipment costs, including the collector, tank, and balance of system components, account for 57 percent of the total costs. Labor accounts for 23 percent, the warranty accounts for 5 percent, and the permit currently accounts for 3 percent of the total cost. The “Other” category served as a catch-all for any costs that could not be accounted for in the defined groups, and accounts for twelve percent of the total cost. Some contractors included the cost of finding new customers in the “Other” category. According to contractor cost surveys and discussion with one of the market actors, the cost of acquiring a customer can be up to \$1,000 which is part of the cost passed on to the customer. The average incentive amount received by residential retrofit projects is roughly \$1,200, approximately 17 percent of the overall cost.

**Figure 4-2: Breakdown of Costs for a Residential Retrofit Project**



The cost of a SWH permit depends on the city but the reported range was from \$100 to \$400 and the average cost reported for a SWH permit was \$220. The cost of a PV permit also depended on the city, but the reported range is from \$100 to \$650 and the average cost reported for a PV permit is \$275. Even though the average costs are about the same, if compared as a percentage of total system cost the SWH permit is substantially more expensive.

The majority of contractors indicated that they do not expect to see the equipment costs decrease in the future because the cost of copper and other materials used in the collector plates is increasing.

## 4.2 Business Models/Adaptation in the Market

Interviews with contractors throughout California, manufacturers of SWH equipment located in California, and PAs nationwide provide the basis for the business model discussion in this section. Itron staff surveyed 24 contractors, nine PAs, and two manufacturers regarding their approach to the SWH industry. Survey instruments are included in the Appendices.

### ***Contractor Business Models***

Itron interviewed 24 contractors in two separate rounds. The first round of questions was completed in December 2007 and concentrated mainly on contractor satisfaction with the SWHPP; therefore, the sample group consisted of contractors who had attended a CCSE Installer workshop. The second round of interviews is currently in-process. For the second round, contractors statewide are being interviewed about their opinion on the SWHPP design and on their business models. The sample group for the second round is made up of 20 contractors who have attended a CCSE Installer workshop for either the SWHPP or the new Palo Alto program, and 10 contractors found on either the CalSEIA website or the Find Solar website<sup>12</sup>. Thirteen contractors were interviewed in the first round and 11 have been interviewed so far for the second round. In both rounds, contractors were asked questions about what they consider to be their primary business, the number of employees they have, how they market their business, and the number of SWH installations they carry out in a year. The second round questions asked more specifically about business practices such as where they look to hire employees, how they train new employees, and how many experienced employees they have.

### ***Business Characteristics***

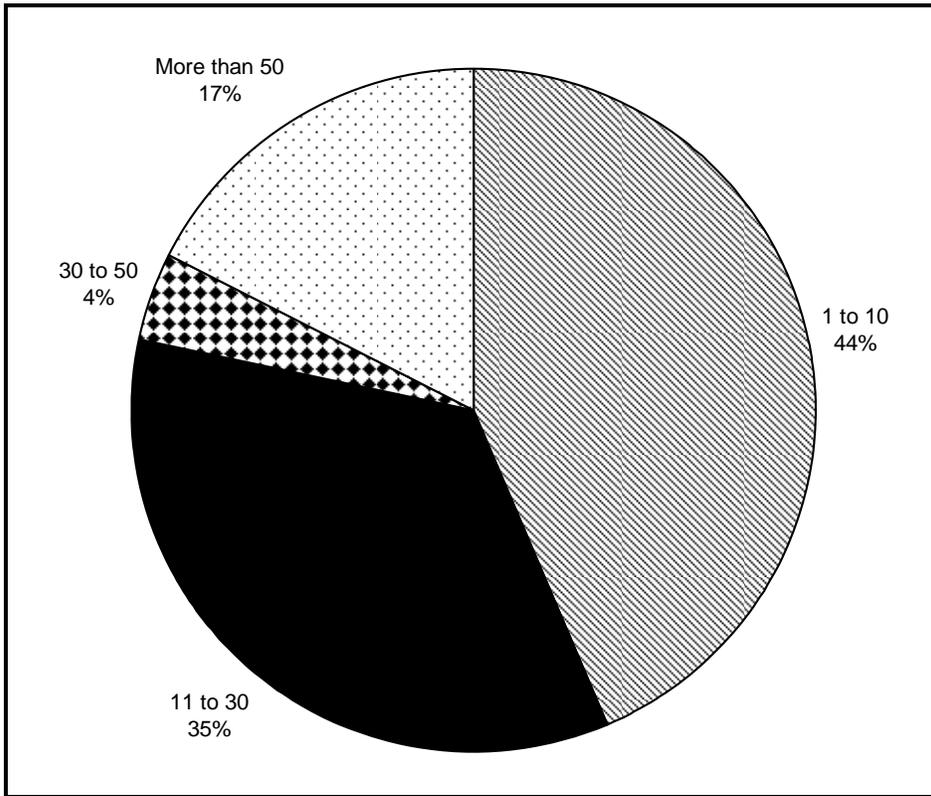
Eleven of the 23 interviewed contractors stated that their primary business was installing PV systems. Many of the contractors also install SWH for pools. One company reported that its main business was repairing SWH systems. Only one contractor indicated that the majority of SWH installations were in the commercial sector.

Figure 4-3 shows the distribution of the number of employees per company that participated in both the current survey and the previous survey. The predominant business type is a business with less than 10 employees; however, there is also a relatively large group of businesses with more than 50 employees (17 percent of all survey respondents). All except one contractor commented that they are currently actively expanding their business.

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<sup>12</sup> <http://findsolar.com>

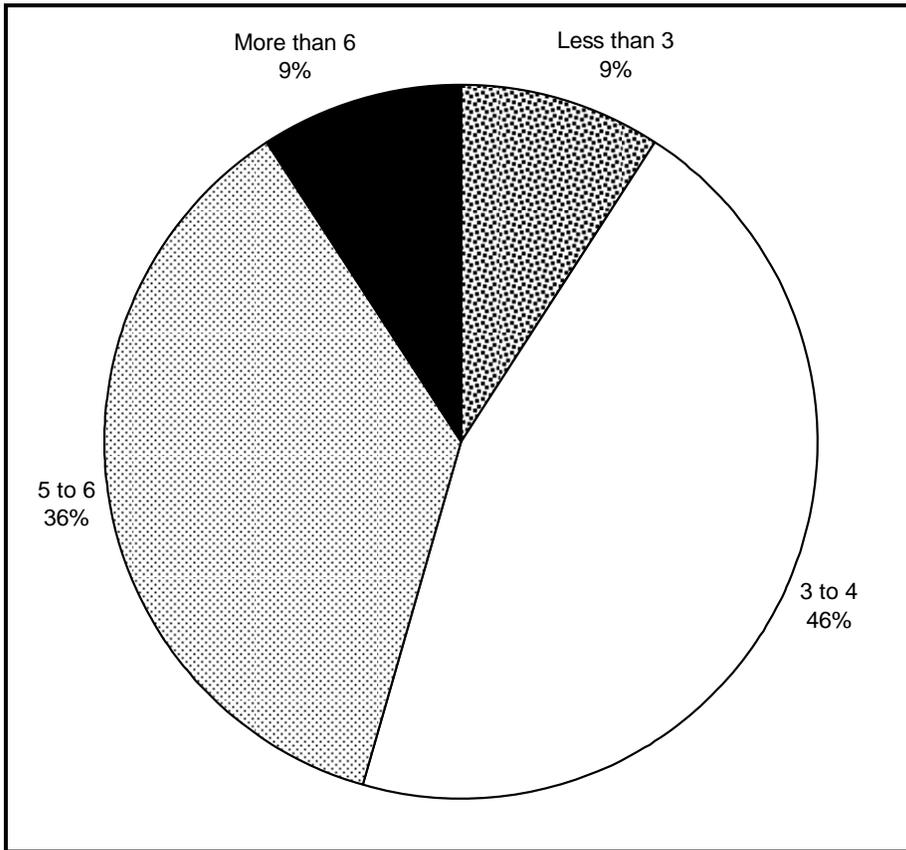
**Figure 4-3: The Distribution of the Number of Employees per Business Interviewed**



Three of the 11 interviewed contractors did not have any dedicated sales staff; however, those three contractors stated that all staff are in essence sales staff as their goal is to finalize the sale of the system. The majority of the contractors surveyed had one to two sales staff, with one respondent claiming to have over six sales staff employees. Of interest is that the larger companies, in terms of number of employees, did not necessarily have more sales employees. Combined with survey results from the first round of surveys, over 60 percent of the contractors had either one or two sales staff. Many of the respondents indicated the sales staff work on at least partial commission. One contractor whose sales staff do not receive commission indicated that, in their experience, paying sales staff commission can lead to over-sizing of the system.

Figure 4-4 shows the distribution of experienced installers per business. The number of experienced SWH installers was from two to eight employees. About 46 percent of companies interviewed reported that they had three to four experienced installers. Contractors surveyed in Round 2 reported having a C-46 license (solar contractor's license) or an active B license (general building license).

**Figure 4-4: The Distribution of the Number of Experienced Employees per Company Interviewed**



Of the contractors that responded to the survey question regarding the annual number of SWH installations, contractors that employed a larger staff saw a reduction in the number of installations per employee. This implies that a larger staff does not necessarily mean a larger number of SWH installations. The lowest annual SWH installation rate per employee was 0.2 and the highest was 2.67 SWH installations per employee per year.<sup>13</sup> The same pattern is mirrored in the PV installations; however, the annual number of installations per employee is greater for PV than for SWH, with a minimum of 2.77 PV installations per employee per year and a maximum of 12.5 PV installations. With SWH and PV combined, the lowest per employee number of installations was 1.67 while the highest value was 13.75. However, those companies with fewer employees were generally concentrating on only one technology, while companies with a greater number of employees were capable of installing numerous kinds of technologies, usually consisting of some combination of PV, SWH, and pool SWH.

<sup>13</sup> Note that the total number of employees also includes administrative and other staff who are not installing systems, and so this rate does not reflect the number of systems being installed per year by the number of installers working at the company. Instead, this is the number of systems installed per year per total number of employees.

### **Hiring and Training New Employees**

Many of the contractors reported that they use the internet to find new employees, whether they hire through the company website or through job search and job posting sites. All of the contractors reported that new employees are trained on the job. A couple of contractors also indicated that they are required to attend a manufacturer training course.

### **Marketing Practices**

Very few of the contractors reported that they do not do any marketing for SWH or PV. The other respondents reported using marketing channels such as home, trade, or energy shows; magazines; direct mail; word-of-mouth; the company website; and the Yellow Pages. The most commonly reported marketing tools were the company website and word-of-mouth. Most of the contractors interviewed do not market to any specific segment of the population or market a specific type of SWH system.

The number of direct customer contacts has increased during the last year for over half of the contractors interviewed during the second round. None of the contractors reported selling fewer SWH systems now than they did a year ago. All of the contractors familiar with the San Diego market felt that interest in SWH has increased due to rising gas prices and increased public awareness. Contractors mentioned CCSE SWHPP advertisements as contributing to this increase in awareness.

### **Unique Business Models**

One contractor mentioned that there are companies that focus only on initiating the sale and the initial site visit, but they do not install the SWH. These companies will size the system and provide the customer with a cost estimate and then sell the installation job to the lowest bidding contractor. In this scenario, the company installing the system is fully liable for the finished product, and some companies are not comfortable accepting liability for another company's system design. However, building this type of relationship between companies has the potential to reduce installation costs.

### **Best Practices**

Given the limited sample size and the variety of business characteristics of the contractors who were interviewed, it is difficult at this time to distinguish which business practices to consider best practices. Businesses having the most success with the SWHPP are those who can easily comply with the city permitting requirements; however, improvements are needed in the permitting process. Practices taken from the PV and wind industry that could be applicable to the SWH industry and could decrease costs include:

- Installation of cookie-cutter systems
- Implementation of plug-and-play technologies
- Increased training of installers
- Optimized design/install logistics
- Buying and/or selling in bulk

Installing cookie-cutter systems or plug-and-play systems can reduce system design and installation time. Increased training of installers will decrease system design and installation time and will result in higher quality installations with few call-backs for repairs. Optimized design and install logistics will also save installation time. Buying in bulk can reduce equipment costs, and selling systems to community cooperatives or similar groups could result also result in lower equipment and installation costs.

### **Manufacturer/Distributor Business Models**

In addition to interviewing the contractors, Itron staff also contacted two manufacturers of SWH equipment that are located in California. One company was well-established and had been in business since the late 1970s while the other had been in business for less than one year. Due to the stark contrast in the two businesses, many of their responses regarding the impact of a statewide incentive program were very different.

### **Equipment**

The first company mainly manufactures collectors but also manufactures other equipment such as differential controllers and racking hardware. The second company manufactures a low-cost SWH system which is sold as a kit and they hope to sell the kit in a “big box” store as a do-it-yourself project. Both companies had their equipment certified by SRCC. Both companies also reported that the biggest influence on system cost were raw material costs and energy costs; however, the respondent from the newly established company reported that their manufacturing costs would decrease by 25 percent if they sold 1,000 systems per year and by 50 percent if they sold 10,000 systems per year. Both companies market their systems by working with installers, and both offer formal training sessions for installers throughout the year.

### **Impact of a Statewide Incentive Program on Business**

The respondent from the well-established company believed that a statewide incentive program would have an insignificant effect on their business. Currently, California accounts for less than 1 percent of their sales. A statewide incentive program is unlikely to affect their manufacturing costs.

The respondent from the newly established company believed that a statewide incentive program would greatly increase their sales, and added that they wanted to focus on the California market. The respondent commented that their system would contribute greatly to meeting the goals of a statewide incentive program due to its low cost, and was confident his company could meet the potential increase in demand if a statewide incentive program was established.

### ***Program Administrator Business Models***

Of the nine program administrators surveyed, five have programs which only provide an upfront incentive, two have a metered and performance-based incentive component, and two took an alternative approach wherein the customer does not own the system and does not receive an incentive payment directly.

The programs which have been in place the longest have shown adaptation over time by changing the program design based on changes in the market or changes in legislation and regulation. In addition, some programs have unique approaches due to circumstances which have only occurred in their region. However, there are also general commonalities which seem to be a result of historical experience in the SWH industry. With the exception of Redding Electric Utility, all PAs that were surveyed require that the system have SRCC OG-300 certification and all require installation by a licensed contractor and/or final inspection by either the PA or a building inspector.

The HECO SWH program is one of the older SWH incentive programs and is the program that has issued the most incentive payments. The program has evolved over time in terms of process but also in basic design elements. One of the more unique process elements of the HECO SWH program is the two different approaches to approving applications. When a contractor makes a sale or is just about to make a sale, the contractor calls HECO to obtain an authorization number. The authorization number acts as a means to reserve the funds for that system. During the standard approval process, the contractor completes the application, and the customer signs the agreement and then schedules an inspection once installation is complete. After the system has passed inspection, the payment is received. If a contractor has a proven record, they may use the fast track process which allows payment prior to final inspection. This approval process is only available if the contractor passes the first two inspections and completes a minimum of four installations per quarter. Allowing a fast track

to a subset of contractors speeds up the approval process and helps streamline applications. In addition, this may alleviate any cash-flow issues that contractors may face while awaiting incentive payments for several systems at a time.

In addition to introducing a fast track approval process, HECO also introduced some changes with respect to permit requirements. Starting in 1999, Hawaii began to see a construction boom which resulted in a slowdown in acquiring permits from the county. To adapt to this change in the market, the fast track approval process was amended to only require proof that the participant had applied for a permit in order to be eligible.

In addition to process evolution, HECO has also created new programs to spur the adoption of solar water heating systems. Last year, HECO introduced the Solar Savers pilot program which is designed to encourage greater participation by low-income customers as well as renters. The Solar Savers program does not require an upfront payment by the customer and instead allows the customer to pay monthly.

The EWEB program also evolved over time, primarily due to negative experiences related to earlier programs where systems were installed incorrectly or not at all. This is true for SMUD as well. Both EWEB and SMUD have developed close relationships with contractors and have a more extensive process for qualifying contractors to participate in their programs. Both utilities require that the contractor be licensed and, specifically, have a solar contractor license. In addition, both utilities inspect 100 percent of the participating systems prior to payment.

In terms of business models, the Lakeland Electric SWH program is very unique, as the utility is the owner of the system, rather than the customer, and there is no direct incentive payment to the customer. According to the PA, one benefit of the utility owning the system is that the installation of SWH does not decrease the load served by the utility, which helps maintain the customer base and revenues. Lakeland Electric installed 60 SWH systems from 1997 to 2002. The customer continues to pay for the energy produced by the SWH system, but at a fixed price that does not increase over time (unlike the remainder of the electricity bill). The utility now has funding to install up to 10,000 SWH beginning in 2009.

### **General Lessons Learned**

The common elements from the interviews of the various program administrators include the following:

- Inspections are important; however, the percentage of systems being inspected per contractor can be reduced if the contractor has a good track record
- Building and maintaining strong relationships with contractors is necessary for program success
- Equipment and contractor certification provides increased confidence in SWH systems
- Business models of program administrators need to be adaptive
- Home shows seem to be the most successful marketing tool

The foundation of a successful incentive program is requiring certified equipment and properly licensed installers. Many negative experiences for SWH incentive programs in the past were caused by installation of inappropriate equipment by inexperienced contractors. Creating equipment and contractor requirements will ensure quality installations. However, the requirements cannot be too burdensome and the incentive amount must account for the additional requirements. A good relationship with the local contractors and willingness to adapt the program requirements in response to their concerns are key to achieving this balance.

### **4.3 Overall Recommendations**

This section presents recommendations for addressing market barriers in California and designing a statewide incentive program. Recommendations are made for addressing market barriers, designing an incentive structure, contractor requirements, and system requirements.

#### **Addressing Market Barriers**

In the interviews conducted with PA, contractors, market actors, manufacturers, program participants, and CCSE workshop attendees, the following market barriers were considered to be the most important:

- Lack of knowledge about the technology
- Competition between PV systems, energy efficiency, and SWH
- Initial installation cost
- Building permits can be difficult and expensive to obtain

There was consensus among the survey respondents that a statewide incentive program is key in developing a sustainable SWH market in California. A statewide incentive program would address many of the market barriers. A statewide marketing campaign would increase public knowledge of the technology and having a utility-backed incentive would add legitimacy to the technology. The presence of a rebate would also reduce competition with PV systems and energy efficiency measures which already have incentives available. A statewide incentive program would decrease the initial installation cost. With an increase in SWH system installations, permits would be requested more often and as the city employees become more experienced in dealing with these types of permits the process will become more streamlined and perhaps more uniform between different cities.

### ***Incentive Structure***

The incentive structure design will be the key to a successful program which “jump-starts” the SWH market. The rebate structure should be designed to meet the state’s goals. It needs to be decided if the program will encourage a high quantity of low efficiency (and less expensive) systems or a lower quantity of high efficiency (and more expensive) systems.

It was recommended by almost all survey respondents that the rebate amount be based on the energy that will be produced by the system. This method may help encourage customers and contractors to adopt SWH systems that provide the greatest return in terms of natural gas or electricity displacement; however, there also needs to be a cap incentive so that systems are not oversized. The CCSE incentive amount is calculated using a function of the system’s solar fraction. Contractors have commented that this method is too complicated for a residential application. An alternative is to use a tiered incentive structure, which provides the same incentive amount for all systems which fall within a defined solar fraction range. Additionally, many of the survey respondents thought that the rebate amount needs to be higher than that currently offered by CCSE.

Offering a no-interest or low-interest loan to both residential and commercial customers may encourage those who are worried about the initial cost to install the SWH sooner rather than later. One survey respondent thought that homeowners do not generally take the initiative to find funding for installing a SWH system. Although the workshop attendees did not report that a low-interest loan would be the number one factor in changing their decision, programs that also offer no-interest or low-interest loans have seen that a high percentage of program participants will also take advantage of the loan.

The majority of survey respondents felt that incentives should be provided for replacement or repair of systems only under certain conditions. The program should encourage homeowners with existing SWH systems to repair them when it is cheaper than replacing the entire system. However, the program should not provide an incentive for repairs which are still

under warranty. It should be required that a contractor visit the home to determine what is wrong with the system and the cost to repair it.

### ***Contractor Requirements***

Survey respondents believed that there should be no requirements for contractors other than what was required by state law; however, other certifications such as the NABCEP should be strongly encouraged. Survey respondents also believed that it was necessary to require the contractors to attend a workshop on the program requirements before allowing them to participate in the rebate program.

When implementing a statewide program, it may be useful to include a “fast-track” process similar to that used by HECO. A fast-track approval process makes it possible for the contractor to receive the incentive prior to meeting all of the application requirements (such as obtaining a permit) and would only be available to contractors who met certain criteria. For example, contractors eligible for the fast-track approval process under the HECO program have to install a certain number of systems per quarter and must have a proven track record of quality installations. The fast-track process may help alleviate any cash flow issues the contractors may face upon waiting to receive incentive payments from numerous projects at once. Another suggestion for streamlining the application process is to reduce the number of projects that require inspections for contractors who meet the eligibility requirements for the fast-track process.

### ***Equipment Requirements***

The foundation of a successful incentive program is requiring certified equipment and freeze-protection requirements for different climate zones. Many negative experiences for SWH incentive programs in the past were caused by installation of inappropriate equipment by inexperienced contractors. Respondents agreed that equipment should be certified OG-300 for residential systems and OG-100 for commercial systems. One commented that residential installs should be “cookie cutter” systems in order to standardize the industry and ensure quality work. Another respondent added that an appropriate system for that climate zone should be installed, and program requirements should err on the side of caution when it comes to preventing freezing or overheating of systems. One respondent recommended that the program require a minimum production level requirement which is consistent with the Federal Energy Star requirement (i.e., the SWH is required to provide 50 percent of the energy needs for heating water).

# 5

## Further Evaluation Work

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This white paper has presented preliminary findings of the SWHPP evaluation work. Information gaps exist in a number of areas due to the somewhat limited number of completed applications at the time of the white papers. An Interim Evaluation Report will be completed in September 2008 that will present a more complete analysis of all of the survey results including a more in-depth look at the cost components of SWH and an analysis of the cost-effectiveness of SWH. Additionally, the Interim Evaluation Report will address concerns or issues that may be voiced at the CPUC workshop to be held on August 26, 2008. This section discusses the topics that need to be researched further in order to determine the feasibility of a statewide SWH incentive program. As such, it summarizes the work that will be completed and included in the Interim Evaluation Report. A more detailed discussion of future evaluation work is contained in the CCSE SWHPP Evaluation Plan, which was revised in July 2008 to expand the market research statewide. The Evaluation Plan is available upon request.

### 5.1 Additional Survey Work Needed

For this white paper, Itron completed interviews with CCSE SWHPP applicants (residential only), SWHPP workshop attendees who have not installed a SWH, PAs of other SWH incentive programs throughout the United States, and market actors throughout the United States. The market actor group included respondents from DOE, CalSEIA, HISEIA, and SRCC.

However, Itron is also in the process of interviewing manufacturers of SWH equipment in California, distributors of SWH equipment in California, and contractors throughout California who install SWH. Additionally, Itron mailed out confidential cost surveys to 100 contractors, which asked basic questions about their business and then asked for their average equipment, labor, and overhead costs.<sup>14</sup> Results from those surveys will be included in the Interim Evaluation Report and will contribute additional perspective to the evaluation of the impact of incentives on prices, demand, and cost-effectiveness.

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<sup>14</sup> Preliminary results of these surveys were presented in Sections 3 and 4.

For the Interim Evaluation Report, Itron will also interview several other groups including homeowners throughout California who do not own a SWH (referred to as the residential nonparticipant group), homeowners throughout California who do own a SWH, commercial businesses statewide who have a SWH, and commercial businesses statewide who have considered installing a SWH (referred to as the commercial nonparticipant group). The residential nonparticipant sample will come from the three Investor Owned Utilities in California (SDG&E, Southern California Gas (SoCalGas), and PG&E) in order to compare any differences in market barriers between the service territories of the three potential program administrators for the statewide incentive program.

Table 5-1 presents the current status of the surveys that will be completed for the Interim Evaluation Report due in September 2008.

**Table 5-1: Summary of Surveys to be Completed for the Interim Evaluation Report**

Survey Group	Survey Sample Size	Status
SWHPP Participants (Round 1)	40	Complete
Residential Nonparticipants		
- SDG&E (Round 1)	70	To begin in August
- CCSE SWHPP workshop attendees	30	Complete
- SoCalGas	100	To begin in August
- PG&E	200	To begin in August
CA Residential NG Customers with SWH (outside of SDG&E)	25	To begin in August
CA Commercial NG Customers with SWH (outside of SDG&E)	20	To begin in August
Commercial Nonparticipants		
- SDG&E	10	To begin in August
- Rest of CA	20	To begin in August
Contractors		
- San Diego area (SWHPP)	20	In-process
- Rest of CA	10	In-process
Contractor Cost Survey	100	Mailed Out
Manufacturers	5	In-process
Distributors		
- San Diego area	5	In-process
- Rest of CA	10	In-process
CA SWH PAs	4	Complete
Nationwide SWH PAs	5	Complete
Market Actors	5	Complete

## 5.2 Additional Analysis Needed

Once all of the surveys have been completed, the analysis of market barriers, business models, and equipment and installation costs can be finalized.

### **Market Barriers**

The discussion of market barriers in this white paper is based on interviews with industry representatives and will not be a well-rounded discussion until survey results from the target market (homeowners) are received. A random sample of 400 homeowners in California (100 within SDG&E territory, 100 within SoCalGas territory, and 200 within PG&E territory) will be surveyed to find out how many of them are familiar with SWH. Those homeowners familiar with the technology will be asked what factors could influence their purchase of a SWH. Additionally, 25 homeowners throughout California who have installed a SWH will be interviewed for insight into their decision-making process and to find the key factors that influenced their decision.

Similarly, commercial businesses throughout California with and without SWH will be interviewed. Businesses with SWH will be asked about their system's payback period and other factors that would have played a role in their decision. Businesses that have considered installing a SWH, but have not done it yet will be asked what factors are preventing them from moving forward with the project.

This discussion will be followed by recommendations on how to address the market barriers in California.

### **Cost Analysis**

Cost has been identified as a market barrier by the industry. Therefore, Itron requested system installation cost information from the PAs who were interviewed and also mailed out confidential cost surveys to 100 contractors in California. Incentive program data will be compared to contractor data for those who do not participate in an incentive program in order to determine if incentive programs have an effect on SWH costs. The analysis will also look for incentive program designs or contractor business practices that may result in lower installation costs. Contractor data will help identify cost components that have the most potential to improve the cost-effectiveness of SWH.

Using the collected cost data, a cost-effectiveness analysis will be performed. The measure of cost-effectiveness that should be used is still undecided. The Standard Practices Manual<sup>15</sup> methodology is currently the standard measure for energy efficiency cost-effectiveness. An alternative method would be to use a simplified leveled cost of energy model.

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<sup>15</sup> California Standard Practices Manual: Economic Analysis of Demand-Side Programs and Projects.

### **5.3 Comments from the CPUC Workshop on August 26, 2008**

The intent of the CPUC workshop in August is to determine if the evaluation of the SWHPP is headed in the right direction and if there are any other issues that should be researched. The Interim Evaluation Report will address concerns and issues that are presented during the CPUC workshop, to the extent possible. Those issues that need more extensive research will be addressed in the Final Evaluation Report to be completed in 2009.

# Appendix A

## Residential Survey—Participants

**PARTICIPANT SURVEY  
ROUND 1  
CCSE SWH PILOT PROGRAM  
PROGRAM YEAR 2007**

**INTRODUCTION AND FINDING CORRECT RESPONDENT**

**Q1** Hello, this is <INTERVIEWER NAME> calling from Itron on behalf of California Center for Sustainable Energy. This is not a sales call. May I please speak with &PROGRAM\_CONTACT? [IF NEEDED]: my understanding is that &PROGRAM\_CONTACT is responsible for making energy-related decisions at your home at &SERV\_ADDR – may I please speak with him/her?

<b>1</b>	No, this person no longer works/lives here	Q1B
<b>2</b>	No, this person is not available right now	Q1B
<b>4</b>	Yes	Q1C
<b>77</b>	No, Other reason (specify)	Q1B
<b>88</b>	Refused	Q1B
<b>99</b>	Don't know	Q1B

**Q1B** [IF &PROGRAM\_CONTACT WILL NOT EVER BE AVAILABLE]  
May I please speak with the person most knowledgeable about the recent installation of a solar water heating system at this address? [IF NEEDED] We're calling to do a follow-up survey about your participation in the CCSE Solar Water Heating Pilot Program. The purpose of the survey is to assess how well the program met your needs and to make improvements to better meet those needs in the future.  
[IF NEEDED] This is a very important fact-finding survey among customers that have recently participated in the pilot program sponsored by the California Public Utilities Commission. CCSE is administering this pilot program to determine whether a statewide program would benefit California. We are NOT interested in selling anything, and responses will not be connected with you in any way. CCSE wants to understand how program participants think about and manage their energy needs.

<b>77</b>	There is no one here with information on that address/wrong address	T&T
<b>1</b>	Address correct/Continue Q1B until you find appropriate contact person	Q1C

**Q1C** [IF &PROGRAM\_CONTACT IS AVAILABLE]  
 Hello Mr/Mrs &PROGRAM\_CONTACT, this is <INTERVIEWER NAME> calling from Itron on behalf of the California Center for Sustainable Energy. Our records show that you participated in the CCSE Solar Water Heating Pilot Program, involving an installation of a solar water heater for &SERV\_ADDR on &INST\_DATE. Is this correct?  
 [IF NEEDED] We're calling to do a follow-up survey about your participation in the CCSE Solar Water Heating Pilot Program. The purpose of the survey is to assess how well the program met your needs and to make improvements to better meet those needs in the future.  
 [IF NEEDED] This is a very important fact-finding survey among customers that have recently participated in a pilot program sponsored by the California Public Utilities Commission. CCSE is administering this pilot program to determine whether a statewide program would benefit California. We are NOT interested in selling anything, and responses will not be connected with you in any way. CCSE wants to understand how program participants think about and manage their energy needs.

1	Yes, we participated in the program, and address is correct	Q2
2	There is no one here with information on that address/wrong address	T&T
3	Do not recall participating in the program	T&T

Before we get started, let me just ask you a few questions to see if you qualify for our survey:

**Q2** Do you recall participating in the Solar Water Heating program from CCSE on or around &SURV\_DATE?

1	Yes	G1
2	No	Q2B
88	Refused	Q2B
99	Don't know	Q2B

**Q2B** It sounds like someone else at your location may be more familiar with your firm's participation in this energy management program? IF YES: Can you tell me who that person might be?

1	Yes, it was probably [NEW CONTACT NAME]	Q1B
77	No	T&T
88	Refused	T&T
99	Don't know	T&T

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**GENERAL**

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**G2** How long have you been at your current residence (where the SWH is installed)?

1	< 1 year	G3
2	1-2 years	G3
3	3-5 years	G3

4	6-10 years	G3
5	> 10 years	G3
88	Refused	G3
99	Don't know	G3

**G3** Do you own the system or is it a third-party-owned system?

1	Own	G5
2	Third-Party	G5
77	OTHER (Specify)	G5
88	Refused	T&T
99	Don't know	T&T

**G4** Did you have a SWH prior to this installation?

1	Yes	G4A
2	No	G5
88	Refused	G5
99	Don't know	G5

**G4A** If so, why are you replacing it?

1	Freeze damage	G5
2	Leaks	G5
3	Upgrading	G5
77	Other (Specify)	G5
88	Refused	G5
99	Don't know	G5

**G5** Have you applied for rebates through other CCSE or state energy efficiency programs?

1	Yes	G5A
2	No	G6
88	Refused	G6
99	Don't know	G6

**G5A** What type of equipment was that rebate for?

1	lighting	G6
2	appliances (specify type)	G6
3	heating/cooling	G6
77	OTHER (Specify)	G6
88	Refused	G6
99	Don't know	G6

**G6** How did you first hear about the Solar Water Heating Pilot program?

1	Chosen Solar Water Heating Company	G7
2	Different Solar Water Heating Company	G7
3	CCSE Print Advertisement (which one?)	G7

4	Television (CCSE SWH commercial, news stories, KPBS special, Rod Luck, Sustain San Diego special?)	G7
5	Newspaper Article (which one?)	G7
6	Radio (KPBS, Clear Channel, Sign on San Diego?)	G7
7	Internet (which website? KPBS, Sustain San Diego, CCSE, craigslist, San Miguel Fire District?)	G7
77	OTHER (Specify)	G7
88	Refused	G8
99	Don't know	G8

**G7** What type of marketing have you seen for the Solar Water Heating Pilot program? (select all applicable)

1	CCSE Print Advertisement (which one?)	G7A
2	Television (CCSE SWH commercial, news stories, KPBS special, Rod Luck, Sustain San Diego special?)	G7A
3	Newspaper Article (which one?)	G7A
4	Radio (KPBS, Clear Channel, Sign on San Diego?)	G7A
5	Internet (which website? KPBS, Sustain San Diego, CCSE, craigslist, San Miguel Fire District?)	G7A
66	NONE	G8
77	OTHER (Specify)	G7A
88	Refused	G8
99	Don't know	G8

**G7A** What did you think of the marketing materials?

1	liked them (specify any positive comments here)	G8
2	did not like them (specify any negative comments here)	G8
77	OTHER (Specify)	G8
88	Refused	G8
99	Don't know	G8

**G8** What made you decide to install a solar water heater? (circle all that apply)

1	Environmental concerns	G9
2	Energy savings	G9
3	Money - Payback Period	G9
4	Money - Internal Rate of Return (IRR)	G9
5	Money - Net Present Value (NPV)	G9
77	OTHER (Specify)	G9
88	Refused	G9
99	Don't know	G9

**G9** Has installing a SWH increased the value of your home?

1	Yes, by an amount equal to what was paid for the SWH	G10
2	Yes, by X percent <i>more</i> than what was paid for the SWH (Specify the percent)	G10
4	No	G10

<b>88</b>	Refused	G10
<b>99</b>	Don't know	G10

**G10** Had you been considering installing a SWH before you heard about the program?

<b>1</b>	Yes	G11
<b>2</b>	No	G12
<b>88</b>	Refused	G12
<b>99</b>	Don't know	G12

**G11** Had you researched the costs of a SWH before you knew about the program?

<b>1</b>	Yes	G11A
<b>2</b>	No	G12
<b>88</b>	Refused	G12
<b>99</b>	Don't know	G12

**G11A** Were the actual costs consistent with your researched costs?

<b>1</b>	Yes	G12
<b>2</b>	No	G12
<b>88</b>	Refused	G12
<b>99</b>	Don't know	G12

**G12** Without the program, how likely would you have been to install the SWH?

<b>1</b>	Not at all likely	G12A
<b>2</b>	Not very likely	G12A
<b>3</b>	Somewhat likely	G12A
<b>4</b>	Very likely	G13
<b>88</b>	Refused	G12A
<b>99</b>	Don't know	G12A

**G12A** What concerns were causing you to hesitate in your decision to install a SWH?

<b>1</b>	Initial cost	G12B
<b>2</b>	Aesthetics	G12B
<b>3</b>	Lack of information	G12B
<b>4</b>	Reliability concerns	G12B
<b>5</b>	Contractor knowledge/experience	G12B
<b>77</b>	OTHER (Specify)	G12B
<b>88</b>	Refused	G13
<b>99</b>	Don't know	G13

**G12B** How were your concerns addressed?

<b>1</b>	Received more information from the CCSE SWH program	G13
<b>2</b>	Received more information from a contractor	G13

3	Received more information from a different source (Specify)	G13
77	OTHER (Specify)	G13
88	Refused	G13
99	Don't know	G13

**G13** Without a financial incentive from the Pilot Program, would you have installed the SWH at the same time?

1	Same time	F10
2	Later	G13A
3	Earlier	G13A
88	Refused	F10
99	Don't know	F10

**G13A** How many months/years later (or earlier) and why?

77	OTHER (Specify)	F10
88	Refused	F10
99	Don't know	F10

**F10** Did you receive financial assistance from a source other than CCSE?

1	Yes	F10A
2	No	F11
88	Refused	F11
99	Don't know	F11

**F10A** From whom?

77	OTHER (Specify)	F10B
88	Refused	F10B
99	Don't know	F10B

**F10B** How much assistance?

77	OTHER (Specify)	F11
88	Refused	F11
99	Don't know	F11

**F11** How much has your electricity / natural gas / propane bill per month decreased since installing a SWH (as % of total bill)?

1	NONE	I12
77	OTHER (Specify)	I12
88	Refused	I12
99	Don't know	I12

**I12** Did you attend a CCSE SWH workshop?

1	Yes	I12B
2	No	C1
88	Refused	I12B
99	Don't know	I12B

**I12B** What was most helpful in the workshop?

1	information on rebates and other funding options	I12C
2	technical information	I12C
3	information on contractors/vendors	I12C
4	talking with other people interested in installing a SWH	I12C
77	OTHER (Specify)	I12C
88	Refused	I12C
99	Don't know	I12C

**I12C** Were there any topics you wish they had covered in more detail?

77	OTHER (Specify)	I13
88	Refused	I13
99	Don't know	I13

**I13** Where else did you look for information?

77	OTHER (Specify)	I14
88	Refused	I14
99	Don't know	I14

**I14** Was there anything you wish there had been more information about?

77	OTHER (Specify)	C1
88	Refused	C1
99	Don't know	C1

**CONTRACTOR CHARACTERISTICS**

**C1** Did the contractor seem knowledgeable about the SWHs?

1	Yes	C2
2	No	C2
88	Refused	C2
99	Don't know	C2

**C2** Did the contractor seem knowledgeable about the CCSE SWH program?

1	Yes	C3
2	No	C3
88	Refused	C3
99	Don't know	C3

**C3** Did the contractor encourage you to contact them when/if maintenance is needed?

1	Yes	C4
2	No	C4
88	Refused	C4

99	Don't know	C4
----	------------	----

**C4** Have you contacted the contractor to come back to fix or check anything?

1	Yes	C5A
2	No	C6
88	Refused	C6
99	Don't know	C6

**C5A** What was the problem?

77	OTHER (Specify)	C5B
88	Refused	C6
99	Don't know	C6

**C5B** Did the contractor respond positively and in a timely fashion?

1	Yes	C6
2	No	C6
88	Refused	C6
99	Don't know	C6

**C6** On a scale of 1 to 5 with 5 being the most satisfied and 1 being the least, how satisfied were you with the contractor you hired?

1	Dissatisfied	C7
2	Moderately dissatisfied	C7
3	Neutral	C7
4	Moderately satisfied	C7
5	Very satisfied	C7
88	Refused	C7
99	Don't know	C7

**C7** What did you like/dislike about them?

77	OTHER (Specify)	B1
88	Refused	B1
99	Don't know	B1

**BACKUP TANK CHARACTERISTICS**

The next few questions are about your backup hot water tank system.

**B1** What type of backup hot water system do you have?

1	Tank (Not Energy Star)	B1A
2	Tank (Energy Star)	B1A
3	Tankless	B2
4	None	RW1
5	Other (Specify)	B2

88	Refused	B2
99	Don't know	B2

**B1A** What size is the backup tank? (in gallons)

77	OTHER (Specify)	B2
88	Refused	B2
99	Don't know	B2

**B2** What type of backup hot water system do you have?

1	Electric	B3
2	Natural Gas	B3
3	Propane	B3
4	Other (Specify)	B3
88	Refused	B3
99	Don't know	B3

**B3** What is the temperature setting on your backup hot water system?

1	Temperature (Specify - should be from 120 - 140 Fahrenheit)	RW1
2	Range (Specify - warm, very warm, hot)	RW1
88	Refused	RW1
99	Don't know	RW1

### HOT WATER USAGE PROFILE

The next questions are about when and how hot water is used in your household.

**RW1** How many people are in your household?

77	OTHER (Specify)	RW2
88	Refused	RW2
99	Don't know	RW2

**RW2** What is the average number of showers/baths taken per day?

77	OTHER (Specify)	RW3
88	Refused	RW3
99	Don't know	RW3

**RW3** What is the average shower length (minutes)?

77	OTHER (Specify)	RW4
88	Refused	RW4
99	Don't know	RW4

**RW4** Do you have a low flow showerhead? (For more than one bathroom please record the number of low flow and non-low flow)

1	Yes (Specify number)	RW5
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2	No (Specify number)	RW5
77	OTHER (Specify)	RW5
88	Refused	RW5
99	Don't know	RW5

**RW5** What are the typical times of day each shower is taken? (Count for each person)

1	morning (Specify number)	RW6
2	afternoon (Specify number)	RW6
3	evening (Specify number)	RW6
4	night (Specify number)	RW6
88	Refused	RW6
99	Don't know	RW6

**RW6** What type of washing machine do you have (front or top loader?)

1	top loader (not EnergyStar)	RW7
2	top loader (EnergyStar)	RW7
3	front loader	RW7
77	NONE	RW7
88	Refused	RW7
99	Don't know	RW7

**RW7** How many loads of laundry are done per week?

1	OTHER (Specify)	RW8
88	Refused	RW8
99	Don't know	RW8

**RW8** How many loads are done at each temperature?

1	Cold (Specify number)	RW9
2	Warm (Specify number)	RW9
3	Hot (Specify number)	RW9
88	Refused	RW9
99	Don't know	RW9

**RW9** What typical day of the week do you do laundry?

1	weekday	RW10
2	weekend	RW10
88	Refused	RW10
99	Don't know	RW10

**RW10** What typical time of the day do you do laundry?

1	morning	RW11
2	afternoon	RW11
3	evening	RW11
4	night	RW11

<b>88</b>	Refused	RW11
<b>99</b>	Don't know	RW11

**RW11** Do you have a dishwasher?

<b>1</b>	Yes, EnergyStar	RW12
<b>2</b>	Yes, not EnergyStar	RW12
<b>3</b>	No	RW12
<b>77</b>	NONE	RW12
<b>88</b>	Refused	RW12
<b>99</b>	Don't know	RW12

**RW12** How many days a week do you wash dishes? (for those with a dishwasher fill in both responses 1 and 2)

<b>1</b>	By hand (Specify)	RW13
<b>2</b>	In dishwasher (Specify)	RW13
<b>88</b>	Refused	RW13
<b>99</b>	Don't know	RW13

**RW13** What time of day do you typically wash dishes?

<b>1</b>	morning	RW14
<b>2</b>	afternoon	RW14
<b>3</b>	evening	RW14
<b>4</b>	night	RW14
<b>88</b>	Refused	RW14
<b>99</b>	Don't know	RW14

**RW14** Has your water use pattern changed since installing a SWH?

<b>1</b>	Yes	RW14A
<b>2</b>	No	P1
<b>77</b>	NONE	P1
<b>88</b>	Refused	P1
<b>99</b>	Don't know	P1

**RW14A** How?

<b>1</b>	Other (Specify which activities used to be done differently)	A1
<b>77</b>	NONE	A1
<b>88</b>	Refused	A1
<b>99</b>	Don't know	A1

**APPLICATION PROCESS**

**A1** Were there any steps in the application process that took longer than expected?

<b>1</b>	Yes	A1B
<b>2</b>	No	A2
<b>88</b>	Refused	A2

99	Don't know	A2
----	------------	----

**A1B** What step was this?

77	OTHER (Specify)	A2
88	Refused	A2
99	Don't know	A2

**A2** What were the biggest hurdles in installing your solar water heater and going through the rebate process?

1	NONE	A3
77	OTHER (Specify)	A3
88	Refused	A3
99	Don't know	A3

**A3** Do you have any other comments or recommendations on improving the program?

1	Yes (Specify)	P1
88	Refused	P1
99	Don't know	P1

**SWH PERFORMANCE**

The next questions are about the performance of your solar water heater.

**P1** Have there been any problems with the solar water heater after it was installed and operating?

1	Yes	P1B
2	No	P2
88	Refused	P2
99	Don't know	P2

**P1B** What were the problems?

77	OTHER (Specify)	P1C
88	Refused	P1C
99	Don't know	P1C

**P1C** How were they fixed?

77	OTHER (Specify)	P2
88	Refused	P2
99	Don't know	P2

**P2** Have there been any issues with the freeze protection design?

1	Yes	P2B
2	No	P3
88	Refused	P3
99	Don't know	P3

**P2B** What were the problems and how were they fixed?

<b>77</b>	OTHER (Specify)	P3
<b>88</b>	Refused	P3
<b>99</b>	Don't know	P3

**P3** Have there been any issues with the backup hot water system?

<b>1</b>	Yes (Specify)	P4
<b>2</b>	No	P4
<b>88</b>	Refused	P4
<b>99</b>	Don't know	P4

**P4** Is your system being metered and is the data being collected by CCSE, the installer, or someone else?

<b>1</b>	Yes (Specify)	P5
<b>2</b>	No	P6
<b>88</b>	Refused	P6
<b>99</b>	Don't know	P6

**P5** Were there any problems associated with the metering equipment?

<b>1</b>	Yes (Specify)	P6
<b>2</b>	No	P6
<b>88</b>	Refused	P6
<b>99</b>	Don't know	P6

**P6** What is the warranty on your system?

<b>77</b>	OTHER (Specify)	P7
<b>88</b>	Refused	P7
<b>99</b>	Don't know	P7

**P7** What do you do with the system while you are on vacation in order to prevent overheating?

<b>1</b>	Nothing	P8
<b>2</b>	Turn it off without draining	P8
<b>3</b>	Turn it off and drain	P8
<b>4</b>	Other (Specify)	P8
<b>88</b>	Refused	P8
<b>99</b>	Don't know	P8

**P8** On a scale of 1 to 5 with 5 being the most satisfied and 1 being the least, how satisfied are you with your solar water heating system?

<b>1</b>	Very dissatisfied	P9
<b>2</b>	Moderately dissatisfied	P9
<b>3</b>	Neutral	P9
<b>4</b>	Moderately satisfied	P9

5	Very satisfied	P9
88	Refused	P9
99	Don't know	P9

**P9** Why do you say that?

77	OTHER (Specify)	T&T
88	Refused	T&T
99	Don't know	T&T

**G1** What is your annual household income?

1	< \$50,000	G2
2	\$50,000 - \$75,000	G2
3	\$75,000 - \$100,000	G2
4	\$100,000 - \$150,000	G2
5	> \$150,000	G2
88	Refused	G2
99	Don't know	G2

On behalf of the California Public Utilities Commission, the California Solar Initiative, and the California Center for Sustainable Energy we thank you for your time and thoughtful input on this important effort.  
Have a nice day. Goodbye.

**T&T**

# Appendix B

## Residential Survey—Nonparticipants Workshop Group

**NON-PARTICIPANT SURVEY  
ROUND 1  
CCSE SWH PILOT PROGRAM  
PROGRAM YEAR 2007**

**INTRODUCTION AND FINDING CORRECT RESPONDENT**

Hello, this is <INTERVIEWER NAME> calling from Itron on behalf of California Center for Sustainable Energy. This is not a sales call. May I please speak with &PROGRAM\_CONTACT? [IF NEEDED]: my understanding is that &PROGRAM\_CONTACT is responsible for making energy-related decisions for your firm at &SERV\_ADDR – may I please speak with him/her?

**Q1**

<b>1</b>	No, this person no longer works/lives here	Q1B
<b>2</b>	No, this person is not available right now	Q1B
<b>4</b>	Yes	Q1C
<b>77</b>	No, Other reason (specify)	Q1B
<b>88</b>	Refused	Q1B
<b>99</b>	Don't know	Q1B

[IF &PROGRAM\_CONTACT WILL NOT EVER BE AVAILABLE]

**Q1B**

May I please speak with the person responsible for making energy-related decisions at this address?

[IF NEEDED] We're calling to do a survey about the CCSE Solar Water Heating Pilot Program. The purpose of the survey is to assess how the program can be improved in order to increase the number of participants.

[IF NEEDED] This is a very important fact-finding survey among CCSE customers that have not participated in a pilot program sponsored by the California Public Utilities Commission. CCSE is administering this pilot program to determine whether a statewide program would benefit California. We are NOT interested in selling anything, and responses will not be connected with you in any way. CCSE wants to understand how customers think about and manage their energy needs.

<b>77</b>	There is no one here with information on that address/wrong address	T&T
<b>1</b>	Address correct/Continue Q1B until you find appropriate contact person	Q1C

**Q1C** [IF &PROGRAM\_CONTACT IS AVAILABLE]  
 Hello Mr/Mrs &PROGRAM\_CONTACT, this is <INTERVIEWER NAME> calling from Itron on behalf of the California Center for Sustainable Energy. Are you familiar with the CCSE Solar water heater pilot program?  
 [IF NEEDED] We're calling to do a survey about the CCSE Solar Water Heating Pilot Program. The purpose of the survey is to assess how the program can be improved in order to increase the number of participants.  
 [IF NEEDED] This is a very important fact-finding survey among CCSE customers that have not participated in a pilot program sponsored by the California Public Utilities Commission. CCSE is administering this pilot program to determine whether a statewide program would benefit California. We are NOT interested in selling anything, and responses will not be connected with you in any way. CCSE wants to understand how customers think about and manage their energy needs.

1	Yes, and I had considered participating in the program	G1
2	Yes, but I had not considered participating in the program	G1
3	No, but I am familiar with solar water heater technology	G1
4	No, and I am not familiar with solar water heater technology	G1
99	Don't know	T&T

---

**GENERAL**

---

**G2** How long have you been at your current residence (where the SWH would be installed)?

1	< 1 year	G3
2	1-2 years	G3
3	3-5 years	G3
4	6-10 years	G3
5	> 10 years	G3
88	Refused	G3
99	Don't know	G3

**G3** Have you applied for rebates through other CCSE or state energy efficiency programs?

1	Yes	G4
2	No	M1
88	Refused	M1
99	Don't know	M1

**G4** What type of equipment was that rebate for?

1	lighting	M1
---	----------	----

2	appliances (specify type)	M1
3	heating/cooling	M1
77	OTHER (Specify)	M1
88	Refused	M1
99	Don't know	M1

**From here:**

If Answer to Q1C was 1 or 2 then ask M1

If Answer to Q1C was 3 then skip to D1

If Answer to Q1C was 4 then skip to W1

How did you first hear about the Solar Water Heating Pilot program?

**M1**

1	Chosen Solar Water Heating Company	M2
2	Different Solar Water Heating Company	M2
3	CCSE Print Advertisement (which one?)	M2
4	Television (CCSE SWH commercial, news stories, KPBS special, Rod Luck, Sustain San Diego special?)	M2
5	Newspaper Article (which one?)	M2
6	Radio (KPBS, Clear Channel, Sign on San Diego?)	M2
7	Internet (which website? KPBS, Sustain San Diego, CCSE, craigslist, San Miguel Fire District?)	M2
77	OTHER (Specify)	M2
88	Refused	D1
99	Don't know	D1

What type of marketing have you seen for the Solar Water Heating Pilot program? (select all applicable)

**M2**

1	CCSE Print Advertisement (which one?)	M2A
2	Television (CCSE SWH commercial, news stories, KPBS special, Rod Luck, Sustain San Diego special?)	M2A
3	Newspaper Article (which one?)	M2A
4	Radio (KPBS, Clear Channel, Sign on San Diego?)	M2A
5	Internet (which website? KPBS, Sustain San Diego, CCSE, craigslist, San Miguel Fire District?)	M2A
66	NONE	D1
77	OTHER (Specify)	M2A
88	Refused	D1
99	Don't know	D1

**M2A**

What did you think of the marketing materials?

1	liked them (specify any positive comments here)	D1
2	did not like them (specify any negative comments here)	D1
77	OTHER (Specify)	D1
88	Refused	D1
99	Don't know	D1

**D1** Have you ever considered installing a SWH?

1	Yes	D1B
2	No	D3
88	Refused	D3
99	Don't know	D3

**D1B** What made you consider installing a solar water heater?

1	Environmental concerns	D1C
2	Energy savings	D1C
3	Money - Payback Period	D1C
4	Money - Internal Rate of Return (IRR)	D1C
5	Money - Net Present Value (NPV)	D1C
77	OTHER (Specify)	D1C
88	Refused	D1C
99	Don't know	D1C

**D1C** Had you researched the costs of a SWH?

1	Yes	D1D
2	No	D1D
88	Refused	D1D
99	Don't know	D1D

**D1D** What concerns are causing you to hesitate in your decision to install a SWH? (rank in the order of most importance)

1	Initial cost	D2
2	Aesthetics	D2
3	Lack of information	D2
4	Reliability concerns	D2
5	Contractor knowledge/experience	D2
77	OTHER (Specify)	D2
88	Refused	D2
99	Don't know	D2

**D2** Would you install a SWH in the future?

1	YES	D2A
2	NO	D2A
88	Refused	D3
99	Don't know	D3

**D2A** Why?

77	OTHER (Specify)	D3
88	Refused	D3
99	Don't know	D3

**D3** Would you install a SWH in the future if: (circle all answers, try to gauge which would be the most influential)

1	there was a higher rebate	B1
2	there was a low interest loan available through the program	B1
3	energy prices increase	B1
4	a friend recommended it to you	B1
5	there was more readily available information	B1
6	your residence had a better solar resource (trees or other factors may be shading their roof)	B1
7	better/more knowledgeable or experienced contractor	B1
77	OTHER (Specify)	B1
88	Refused	B1
99	Don't know	B1

**WATER HEATER CHARACTERISTICS**

The next few questions are about your water heater.

**B1** What type of water heater do you have?

1	Tank (Not Energy Star)	B1A
2	Tank (Energy Star)	B1A
3	Tankless	B2
4	None	RW1
5	Other (Specify)	B2
88	Refused	RW1
99	Don't know	B2

**B1A** What size is the tank? (in gallons)

77	OTHER (Specify)	B2
88	Refused	B2
99	Don't know	B2

**B2** What type of hot water heater do you have?

1	Electric	B3
2	Natural Gas	B3
3	Propane	B3
4	Other (Specify)	B3
88	Refused	B3
99	Don't know	B3

**B3** What is the temperature setting on your water heater?

1	Temperature (Specify - should be from 120 - 140 Fahrenheit)	RW1
2	Range (Specify - warm, very warm, hot)	RW1
88	Refused	RW1
99	Don't know	RW1

**HOT WATER USAGE PROFILE**

The next questions are about when and how hot water is used in your household.

**RW1** How many people are in your household?

<b>77</b>	OTHER (Specify)	RW2
<b>88</b>	Refused	RW2
<b>99</b>	Don't know	RW2

**RW2** What is the average number of showers/baths taken per day?

<b>77</b>	OTHER (Specify)	RW3
<b>88</b>	Refused	RW3
<b>99</b>	Don't know	RW3

**RW3** What is the average shower length (minutes)?

<b>77</b>	OTHER (Specify)	RW4
<b>88</b>	Refused	RW4
<b>99</b>	Don't know	RW4

**RW4** Do you have a low flow showerhead? (For more than one bathroom please record the number of low flow and non-low flow)

<b>1</b>	Yes (Specify number)	RW5
<b>2</b>	No (Specify number)	RW5
<b>77</b>	OTHER (Specify)	RW5
<b>88</b>	Refused	RW5
<b>99</b>	Don't know	RW5

**RW5** What are the typical times of day each shower is taken? (Count for each person)

<b>1</b>	morning (Specify number)	RW6
<b>2</b>	afternoon (Specify number)	RW6
<b>3</b>	evening (Specify number)	RW6
<b>4</b>	night (Specify number)	RW6
<b>88</b>	Refused	RW6
<b>99</b>	Don't know	RW6

**RW6** What type of washing machine do you have (front or top loader?)

<b>1</b>	top loader (not EnergyStar)	RW7
<b>2</b>	top loader (EnergyStar)	RW7
<b>3</b>	front loader	RW7
<b>77</b>	NONE	RW7
<b>88</b>	Refused	RW7
<b>99</b>	Don't know	RW7

**RW7** How many loads of laundry are done per week?

1	OTHER (Specify)	RW8
88	Refused	RW8
99	Don't know	RW8

**RW8** How many loads are done at each temperature?

1	Cold (Specify number)	RW9
2	Warm (Specify number)	RW9
3	Hot (Specify number)	RW9
88	Refused	RW9
99	Don't know	RW9

**RW9** What typical day of the week do you do laundry?

1	weekday	RW10
2	weekend	RW10
88	Refused	RW10
99	Don't know	RW10

**RW10** What typical time of the day do you do laundry?

1	morning	RW11
2	afternoon	RW11
3	evening	RW11
4	night	RW11
88	Refused	RW11
99	Don't know	RW11

**RW11** Do you have a dishwasher?

1	Yes, EnergyStar	RW12
2	Yes, not EnergyStar	RW12
3	No	RW12
77	NONE	RW12
88	Refused	RW12
99	Don't know	RW12

**RW12** How many days a week do you wash dishes? (for those with a dishwasher fill in both responses 1 and 2)

1	By hand (Specify)	RW13
2	In dishwasher (Specify)	RW13
88	Refused	RW13
99	Don't know	RW13

**RW13** What time of day do you typically wash dishes?

1	morning	T&T
2	afternoon	T&T
3	evening	T&T
4	night	T&T

<b>88</b>	Refused	T&T
<b>99</b>	Don't know	T&T

**G1**      What is your annual household income?

<b>1</b>	< \$50,000	G2
<b>2</b>	\$50,000 - \$75,000	G2
<b>3</b>	\$75,000 - \$100,000	G2
<b>4</b>	\$100,000 - \$150,000	G2
<b>5</b>	> \$150,000	G2
<b>88</b>	Refused	G2
<b>99</b>	Don't know	G2

**T&T**      On behalf of the California Public Utilities Commission, the California Solar Initiative, and the California Center for Sustainable Energy we thank you for your time and thoughtful input on this important effort. Have a nice day. Goodbye.

# Appendix C

## Round 1 Contractor Survey

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Hello, my name is \_\_\_\_\_ and I'm assisting the California Center For Sustainable Energy (former the San Diego Regional Energy Office) in evaluating their Solar Water Heating Pilot Program. We identified your business as one that had attended a Contractor and Installer Orientation and Training workshop for the pilot program and I'd like to ask you some questions about your impressions of the program. All of your answers will be kept confidential. Do you have about 40 minutes to talk with me?

[If not, reschedule an appointment] \_\_\_\_\_

I'D FIRST LIKE TO ASK YOU SOME BACKGROUND QUESTIONS.

1. What is your primary business?

How many employees are there?

2. Do you sell and install solar water heating systems?

3. Are there other types of equipment that you sell? [check to see if they sell PV systems]

[if they sell PV] Do you push PV or SWH more? Why? If PV, how many systems do you sell per year?

4. Before the SWH Pilot started, how many SWH systems did you typically sell/install in a year? Residential \_\_\_\_\_ Commercial \_\_\_\_\_

Has that number been fairly constant each year or does it fluctuate a lot? [if fluctuates, why?]

5. How do you market SWH systems?  
[Probe] Advertisements, radio, newspaper, websites, home shows, energy fair, word of mouth?
6. Do you have a sales staff?
7. How long does it typically take from the initial customer contact to a signed contract for a SWH system? [the goal here is to determine time that elapses from initial contact to closing the sale]
8. About what percentage of direct customer contacts results in a sale? Has that changed since participating in the SWH pilot program?
9. How do you size a system for any given customer?  
[Probe] Rules of thumb, some form of calculation? Is it different for residential vs. commercial?
10. How do you estimate the savings a customer might get from installing a SWH system?  
[Probe] simple calc, software, average estimate? Residential vs. commercial?
11. Do you take shading into account when recommending and sizing a SWH system?  
[if yes] Possible future shading as well?  
Do you use any shading analysis tools?
12. What influences a customer's decision to install a SWH system? By building type:  
Commercial? Residential? New Construction?  
[Probe] Gas / Electric prices, climate change, acquire latest technology, replacement of old equipment?

13. What concerns do potential customers have and ask you about when they are considering SWH? What is the number 1 question they have?  
[Probe] Reliability, warranties / guarantees, life expectancy, cosmetics, cost/payback,
14. Is there an out-of pocket cost or payback period threshold above which residential customers seem to balk at installing SWH?
15. How important is having a warranty for the system to the customer?

THESE NEXT SEVERAL QUESTIONS ARE ABOUT THE SWH PILOT PROGRAM

16. About how many applications have you submitted to the program to date?
17. What are the aspects of the CCSE SWH Pilot Program that you like?
18. Are there any aspects of the CCSE SWH Pilot Program that you do not like?  
[Probe] Requirements: Pull a permit, freeze protection, anti-scald valve, SRCC certification of parts & systems, QC
19. Have you had any customers who had a system installed but opted not to participate in the program?  
  
If so, what is/are the reason(s) for not participating (desire not to permit, freeze protection requirements, etc.)?
20. Have you seen or heard on the radio or newspaper any marketing for or information about the SWH Pilot Program?
21. Do you believe that the SWH Pilot Program has been successful in attracting new business for you?  
  
[Probe] Why or why not?

22. Have you participated in any other SWH incentive programs in the past?
- [If yes] What was your experience was with those?
- [Probe if they were installing systems in the 1980's when the SWHs had all the reliability problems]
23. Do you think people are still afraid to install a SWH because of the problems in '80s?
- [If yes] What is your marketing strategy for those people?
24. Do you think that some form of additional system financing is needed and would attract more people and businesses to the SWH program? [talking about loans here]
25. Do you feel that interest in SWH is increasing in the San Diego region? If so, to what do you attribute this increase in interest?
26. What recommendations do you have for improving or modifying the current SWH Pilot Program?
- a. Specifically, what can be done to the SWH Program to increase your participation?
  - b. What might be done to stimulate interest in solar water heating systems more generally, either within the SWH Pilot Program or otherwise?
- [Probe] Incentive levels, outreach & marketing, customer education, contractor training? And why?
- Residential?                      Commercial?

THANK THEM FOR THEIR TIME AND CONCLUDE THE INTERVIEW.

# Appendix D

## Round 2 Contractor Survey—Previously Surveyed

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This survey is only for firms that have been previously surveyed in Round 1 interviews, and are active in the SWHPP.

Hello, my name is \_\_\_\_\_ and I'm assisting the California Center For Sustainable Energy in evaluating their Solar Water Heating Pilot Program. We identified your business as one that had attended a Contractor and Installer Orientation and Training workshop for the pilot program and I'd like to ask you some questions about your business and your impressions of the program. All of your answers will be kept confidential. Do you have about 40 minutes to talk with me?

[If not, reschedule an appointment] \_\_\_\_\_

a. Do you install SWH systems in the San Diego area?

### I'D FIRST LIKE TO ASK YOU SOME BACKGROUND QUESTIONS:

1. Has your primary business changed in the last six months?
2. In addition to solar water heaters, do you also sell/install radiant heating? absorption chillers? Pool solar water heaters? Instantaneous (tankless/on-demand) water heaters? PV systems? Geothermal heat pumps?
3. Employee questions:
  - a. How many (full-time/part-time?) employees work at your business?
  - b. How many of your employees are experienced (more than one year) in solar water heating?
  - c. How many of your employees have less than one year of working in solar water heating?
  - d. How many of your employees are experienced in PV (more than one year)?
  - e. How many have less than one year of experience in that field?
  - f. Where do you look to hire new employees?
  - g. How many sales staff do you have? Do they work on commission?
  - h. Is your company licensed by the California Contractors State Licensing Board? What kind of licenses do you have? (PROBE: C46-solar, B-general building contractor, C36-plumbing, C10-electrical, C61, etc...)

- i. What type of training do your employees go through? (manufacturer training? Community college programs? On-the job training? CalSEIA? Other?)
  - j. How long does it take for you to train a new employee? At what point do you consider a new employee to be “trained”?
4. Do you plan to expand your business? If no, why not? If yes, in what way will you expand your business (new services, new market sectors, etc.) If yes, what do you need in order to expand (training? Marketing?)
5. Do you market SWH? If yes , Have you changed how you market SWH systems in the last six months?  
  
[If yes] What have you changed? Have you noticed a difference?
  - a. Do you market to any specific segments of the population or market to a specific area? Do you market only certain types of SWH systems?
  - b. [If also sell PV] Do you market PV? Do you market PV the same way? If not how do you market PV and why do you market it differently?
6. Has the number of direct customer contacts increased since July 2007 (start of SWHPP)?
7. About what percentage of direct customer contacts results in a sale? Has that changed since July 2007 (start of SWHPP)?
8. How many SWH systems do you typically sell/install in a year?  
Total: \_\_\_\_\_
  - a. By technology type (talking about drainback vs. ICS, etc. here)
  - b. By back-up water heater type (electric, natural gas, propane)?
  - c. By manufacturer (please list with number)?
  - d. By sector:Residential \_\_\_\_\_Commercial \_\_\_\_\_
9. How many SWH systems did you typically sell/install in a year prior to the beginning of the SWH Pilot Program (July 2007)?  
Total: \_\_\_\_\_  
  
Has that number been fairly constant each year or does it fluctuate a lot? [ if fluctuates, why?]

10. Would you be able to provide a 10-year labor warranty and if yes, what would be the additional cost? (estimate is fine)

QUESTIONS FOR CONTRACTORS THAT ALSO SELL PV:

11. How many PV systems do you install each year? Do you influence a customer's choice of whether to buy a PV or SWH system? Does the decision to influence a customer's choice depend on the type of fuel used for the water heater (electric vs. natural gas)?
12. Have you participated in any PV incentive programs (such as Emerging Renewables Program, SGIP, or NSHP, CSI)?
  - a. If yes, which ones (list)? How long did you participate in the program(s)?
  - b. Do you think the PV incentive program(s) helped or hurt your sales (of PV and of SWH)? In what ways if any?
  - c. What did you like/dislike about the PV incentive program(s)?
  - d. Were there additional costs/time associated with participation in the PV incentive program(s)?
  - e. If yes, please list amount \$ or labor hours and description. As your company gained experience, did the amount of additional costs/time decrease?
13. How do you handle the rebate for PV? (and why?)
  - a. Does someone at your company fill out the application or does the customer do this?
  - b. How do you pass the rebate on to your customer? (send them a check later? Or decrease up-front cost?)

[If your company fills out the application **AND** receives the incentive payments]:

- i. How long does it take to fill out the application?
- ii. What is the average length of time between installation and receipt of incentive payment?
- iii. What is the maximum length of time you have experienced?
- iv. Has the timing of incentive payments impacted your business?
- v. If incentive payments took longer to be paid (due to an increase in demand for the incentive payment from a statewide program) would this be an issue for your business?

EQUIPMENT QUESTIONS:

14. How many SWH systems do you repair or replace in a year? What percentage of your business is repairs? What percentage of the repair calls are due to freeze damage?

- a. What types of systems are generally damaged? What types of systems generally are freeze damaged? (drainback, ICS, etc; open-loop or closed-loop)?
  - b. What generally causes the freeze damage? (controller failed? Glycol needed to be changed?)
  - c. Are these systems generally 10 miles or more from the coast?
  - d. What is the average age of SWH systems in need of repair? With freeze damage?
15. (Not Active) Are you aware of the equipment requirements of the SWH Pilot Program?
- a. Do you use similar equipment in the systems you install (pumps, collectors, etc.)?
16. (Active only) Have you had any problems with the availability of CCSE SWHPP required equipment? (valves, pumps, collectors, etc)
17. Do you ever install systems that are not SRCC certified?
- a. If yes, do these systems satisfy other certification requirements, for example: Europe (Solar Keymark)?
  - b. Are any sales delayed because the equipment is not yet SRCC certified?  
[do not say this] (wait on OG-100 certification is 9-24 months.)
    1. Is the delay due to OG100 certification?
    2. Is the delay due to OG300 certification of new system configurations or substitutions?
  - c. Do you use rebuilt or refurbished parts on the SWHs that you install?
18. (Active only) Is there additional or different equipment you now install due to the CCSE incentive program requirements that you were not installing before? If yes, what? Are there additional costs with the new or different equipment?
19. Do you install active open loop systems?
- a. [IF YES] Do you install these systems in climate zone 7?
  - b. [IF YES] Would you be able to meet a 5-year equipment and labor warranty (CCSE Pilot Program requirement for climate zone 7 installations) ? Why or why not? [Probe for their opinion on the requirement]

20. Do you install monitoring equipment on the systems you install? Why or why not? (this can reduce maintenance calls if customer can diagnose and/or fix problems over the phone)  
IF YES – Do you collect interval data from any sites? if yes - would you be willing to share the data with us? (would only require customer zip code and system characteristics)

QUESTIONS FOR INACTIVE OR NON-PARTICIPATING CONTRACTORS:

21. [ONLY ASK IF THEY SAID WERE FAMILIAR WITH THE SWHPP AT BEGINNING OF SURVEY] In the last six months, have you noticed any changes to the SWHPP that you like? Do not like?
22. [IF SERVICE TERRITORY INCLUDES SAN DIEGO] Have you had any customers in the San Diego area who had a system installed but opted not to participate in the program?

If so, what is/are the reason(s) for not participating (desire not to permit, freeze protection requirements, etc.)?

If so, did the customer request not to participate in the program or did you suggest that the customer not participate?

GO TO QUESTION 32.

QUESTIONS FOR (NEW) ACTIVE CONTRACTORS PARTICIPATING IN SWHPP:

23. In the last six months, have you found any additional aspects of the CCSE program that you like? That you don't like?
24. Are there additional costs you incur from filling out the paperwork required for the CCSE rebate? If yes, please elaborate on amount of labor/costs and if these costs are passed on to the customer.
25. In the last six months, have you had any customers in the San Diego area who have had a system installed but opted not to participate in the program?

If so, what is/are the reason(s) for not participating (desire not to permit, freeze protection requirements, etc.)?

If so, did the customer request not to participate in the program or did you suggest that the customer not participate?

26. Have you received leads from CCSE? If yes, how many of these have resulted in a sale? How many of the sales also participated in the program?
27. In the last six months, do you believe that the SWH Pilot Program has been successful in attracting new business for you?  
  
[Probe] Why or why not?  
What CCSE efforts have been most successful in attracting new business for you?
28. How do you handle the incentive payment (and why)?
  - a. Does someone at your company fill out the application or does the customer do this?
  - b. How do you pass the rebate on to your customer? (send them a check later? Or decrease up-front cost?) Why do you use this method?
  - c. How long does it take to fill out the application?
  - d. If you provide the discount upfront, how do you reconcile any differences in the actual incentive paid (reimburse the customer or take the loss?)?
29. [If your company fills out the application AND receives the incentive payments for SWH installations]:
  - a. What is the average length of time between installation and receipt of incentive payment?
  - b. What is the maximum length of time you have experienced?
  - c. Has the timing of incentive payments impacted your business?
  - d. If incentive payments took longer to be paid (due to an increase in demand for the incentive payment from a statewide program) would this be an issue for your business?
30. Have your business practices changed since participating in the Pilot Program? If yes, how? (always OG-300 systems? always pulling permits? All employees attending training?)
31. Has CCSE been responsive to questions and concerns regarding the rebate program?
  - a. Are there any questions or concerns you have posed or would like to pose to CCSE regarding the SWH Pilot Program?

GO TO QUESTION 32.

QUESTIONS FOR BOTH ACTIVE AND INACTIVE CONTRACTORS

32. Questions about building permit(s)
  - a. In which cities have you installed SWH (and PV if applicable) systems?
  - b. Do they all require permits?
  - c. For the cities that require permits, what is the average cost of a SWH permit? PV permit?
  - d. What is the average amount of time it took for you to receive the permit after you submitted the paperwork for a system with roof loading of less than 5 lbs./sq. ft.? For a system with roof loading over 5 lbs./sq.ft.?
  - e. Have you noticed a change in the approval time for permits associated with SWH (and PV if applicable)?
  - f. (IF DON'T ALSO DO PV, GO TO g) Have you found that SWH or PV were easier to get a permit for? If yes, why do you think it was easier or harder?
  - g. Have you found that certain types of SWH systems were easier to get a permit for than others? If yes, why do think some types of systems were easier or harder?
  
33. Is three months sufficient time to obtain permits and install a SWH system?  
[If not] How long should be given for installation of the SWH?
  
34. When asked, CCSE has been letting people know that the average installed cost of a SWH system for applications in the program is \$6,500. Has this affected customer's reactions to your quoted price? Do you think this quote appropriately represents the market cost?

MARKET

35. Have you seen or heard on the radio or newspaper any marketing for or information about the SWH Pilot Program? If so, which one?
  
36. In the last six months, do you feel that interest in SWH is increasing in the San Diego region? If so, to what do you attribute this increase in interest?
  
37. Technology changes quickly, how do you stay on top of and make decisions to integrate new technologies into your designs and installs? Can you provide examples? What key factors determine if you integrate a new technology and make it a standard practice?

38. What technological advances do you foresee in the SWH marketplace over the next 10 years (i.e valves, distribution pipes, metering, collectors, pumps, tanks etc)? Do you expect any of these to significantly reduce costs?
39. Do you see any competition between PV, SWH, tankless water heaters, demand response, and/or energy efficiency in terms of homeowner's views of energy reduction and available cost and space?
  - a. If yes, do you feel it is possible to integrate SWH systems with energy efficiency, demand response or PV technologies effectively?
  - b. If yes there is competition, what role would incentive programs play in rectifying this situation? Contractors? Government?
40. [If sell PV systems AND participated in a PV rebate program] what aspects of the PV program do you like which should be applied to the SWH Pilot Program?
41. Do you have any recommendations for the Pilot Program or for a future SWH incentive program?
  - a. What might be done to stimulate interest in solar water heating systems more generally, either within the SWH Pilot Program or otherwise?  
  
[Probe] Incentive levels, outreach & marketing, customer education, contractor training? And why?

## REQUESTS

42. As part of our evaluation activities, CalSEIA will be sending out confidential cost surveys, where you will have the option of including your contact information or mailing it back anonymously. Completing the survey will contribute to our evaluation of the cost-effectiveness of SWH and will help us make recommendations to the CPUC about how policy can change to reduce costs and to encourage the SWH market. Please return the survey by August 1.
43. (If install in the commercial sector-question#8d)): As part of our evaluation activities, we will be interviewing companies that have installed SWH systems AND are thinking about installing SWH within and outside of the SWHPP. This will also assist in determining the feasibility of a 10-year statewide incentive program. This information will be kept confidential and will only be used for purposes of contacting the customers to conduct the survey. Would it be possible to get a list with contact information of your commercial customers that bought or were thinking of buying solar water heating systems – pool or hot water) within the last year so that we could conduct these surveys?

44. (If install in the residential sector-question#8d): As part of our evaluation activities, we will be interviewing residential customers that have installed SWH systems outside of an incentive program. This will also assist in determining the feasibility of a 10-year statewide incentive program. This information will be kept confidential and will only be used for purposes of contacting the customers to conduct the survey. Would it be possible to get a list of the residential customers who purchased and installed SWH systems outside of a rebate program within the last year?

THANK THEM FOR THEIR TIME AND CONCLUDE THE INTERVIEW.

# Appendix E

## Round 2 Contractor Survey—Not Previously Surveyed

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Hello, my name is \_\_\_\_\_ and I'm assisting the California Center For Sustainable Energy in evaluating their Solar Water Heating Pilot Program. All of your answers will be kept confidential. Do you have about 40 minutes to talk with me?

[If not, reschedule an appointment] \_\_\_\_\_

a. Are you familiar with the CCSE SWHPP?

[If they are not familiar with the program – The CCSE pilot program gives incentives to residential and commercial, retrofit and new construction SWH projects. Residential incentives vary depending on the SRCC kWh or therms savings rating, with a maximum incentive of \$1,500. Commercial and industrial system incentives are \$15/sq ft for open-loop systems and \$20/sq ft for closed loop systems, with a maximum incentive of \$75,000. The Pilot program is the predecessor to a potential \$250 million statewide program.]

b. Do you install SWH systems in the San Diego area?

c. Have you been to a CCSE SWH workshop?

I'D FIRST LIKE TO ASK YOU SOME BACKGROUND QUESTIONS.

1. What is your primary business? (PV, pool SWH, SWH, plumbing, etc.)
2. Do you sell and install solar water heating systems?
3. In addition to solar water heaters, do you also sell/install radiant heating? Absorption chillers? Pool solar water heaters? Instantaneous (tankless/on-demand) water heaters? PV systems? Geothermal heat pumps?
4. Employee questions:
  - a. How many employees are there?
  - b. How many of your employees are experienced (more than one year) in solar water heating?
  - c. How many of your employees have less than one year of working in solar water heating
  - d. How many of your employees are experienced in PV (more than one year)?

- e. How many have less than one experience in that field?
  - f. Where do you look to hire new employees?
  - g. How many sales staff do you have? Do they work on commission?
  - h. Is your company licensed by the California Contractors State Licensing Board? What kind of licenses do you have? (PROBE: C46-solar, B-general building contractor, C36-plumbing, C10-electrical, C61, etc...)
  - i. What type of training do your employees go through? (manufacturer training? Community college programs? On-the-job training? CalSEIA? Other?)
  - j. How long does it take you to train a new employee? At what point to you consider a new employee to be “trained”?
5. Do you plan to expand your business? If no, why not? If yes, in what way will you expand your business (new services, new market sectors, etc.) If yes, what do you need in order to expand (training? Marketing?)
6. Do you market SWH? How?  
[Probe] Advertisements, radio, newspaper, websites, home shows, energy fair, word of mouth?
- a. Do you market to any specific segments of the population or market to a specific area? Do you market only certain types of SWH systems?
  - b. [If also sell PV] Do you market PV? Do you market PV the same way? If not how do you market PV and why do you market it differently?
7. Has the number of direct customer contacts increased since July 2007 (start of SWHPP)?
8. About what percentage of direct customer contacts results in a sale? Has that changed since July 2007 (start of SWHPP)?
9. How many SWH systems do you typically sell/install in a year?  
Total: \_\_\_\_\_
- a. By technology type (talking about drainback vs. ICS, etc. here)
  - b. By back-up water heater type (electric, natural gas, propane)?
  - c. By manufacturer (please list with number)?
  - d. By sector: Residential \_\_\_\_\_ Commercial \_\_\_\_\_
10. How many SWH systems did you typically sell/install in a year prior to the beginning of the SWH Pilot Program (July 2007)?  
Total: \_\_\_\_\_

Has that number been fairly constant each year or does it fluctuate a lot? [if fluctuates, why?]

11. Have you participated in any SWH incentive programs (other than the SWHPP)? (such as Emerging Renewable Buydown Program, SGIP, or NSHP (CSI))
  - a. If yes, which ones (list)? How long did you participate in each program?
  - b. Do you think the SWH incentive programs help or hurt your sales? In what ways if any?
  - c. What did you like/dislike about the program(s)?
  - d. Was there additional costs/time associated with participation in the SWH incentive programs?
  - e. If yes, please list amount \$ or labor hours and description. As your company gained experience with the application process for the SWH incentive program, did the amount of additional costs/time decrease?
12. How long does it typically take from the initial customer contact to a signed contract for a SWH system? [the goal here is to determine time that elapses from initial contact to closing the sale]
13. Would you be able to provide a 10-year labor warranty and if yes, what would be the additional cost? (estimate is fine)

**QUESTIONS FOR CONTRACTORS THAT ALSO SELL PV:**

14. How many PV systems do you install each year? Do you influence a customer's choice of whether to buy a PV or SWH system? Does your decision to influence depend on the fuel used for the water heater (electric vs. natural gas)?
15. Have you participated in any PV incentive programs (such as the Emerging Renewable Program, SGIP, CSI or NSHP)?
  - a. If yes, which ones [list]? How long did you participate in the program(s)?
  - b. Do you think the PV incentive program helped or hurt your sales? In what ways if any?
  - c. What did you like/dislike about the PV incentive program?
  - d. Was there additional costs/time associated with participation in the PV incentive program(s)?
  - e. If yes, please list amount \$ or labor hours and description? As your company gained experience, did the amount of additional costs/time decrease?
16. How do you handle the rebate for PV? (and why?)
  - a. Does someone at your company fill out the application or does the customer do this?

- b. How do you pass the rebate on to your customer? (send them a check later? Or decrease up-front cost?)
17. [If your company fills out the application **AND** receives the incentive payments]:
  - a. How long does it take to fill out the application?
  - b. What is the average length of time between installation and receipt of incentive payment?
  - c. What is the maximum length of time you have experienced?
  - d. Has the timing of incentive payments affected your business?
  - e. If incentive payments took longer to be paid (due to an increase in demand for the incentive payment from a statewide program) would this be an issue for your business?

#### EQUIPMENT QUESTIONS

18. How do you size a system for any given customer?

[Probe] Rules of thumb, some form of calculation? Is it different for residential vs. commercial?
19. How do you estimate the savings a customer might get from installing a SWH system?

[Probe] SRCC OG300 estimated performance, simple calc, software, average estimate? Residential vs. commercial?
20. Do you take shading into account when recommending and sizing a SWH system?

[if yes] Possible future shading as well?

Do you use any shading analysis tools (Pathfinder, SolMetric SunEye)?
21. How many SWH systems do you repair or replace in a year? What percentage of your business are repairs? What percentage of the repair calls are due to freeze damage?
  - a. What types of systems are generally damaged? What types of systems generally are freeze damaged? (drainback, ICS, etc; open-loop or closed-loop)?

- b. What generally causes the freeze damage? (controller failed? Glycol needed to be changed?)
  - c. Are these systems generally 10 miles or more from the coast?
  - d. What is the average age of SWH systems in need of repair? With freeze damage?
22. Are you aware of the equipment requirements of the SWH Pilot Program?
- a. Do you use similar equipment in the systems you install (pumps, collectors, etc.)?
23. (Active only) Have you had any problems with the availability of CCSE SWHPP required equipment? (valves, pumps, collectors, etc)
24. Do you ever install systems that are not SRCC certified?
- a. If yes, do these systems satisfy other certification requirements, for example: Europe (Solar Keymark)?
  - b. Are any sales delayed because the equipment is not yet SRCC certified?  
[do not say this] (wait on OG-100 certification is 9-24 months.)
    - 1. Is the delay due to OG100 certification?
    - 2. Is the delay due to OG300 certification of new system configurations or substitutions?
  - c. Do you use rebuilt or refurbished parts on the SWH that you install?
25. (Active Only) Is there additional or different equipment you now install due to the CCSE incentive program requirements that you were not installing before? If yes, what? Are there additional costs with the new or different equipment?
26. Do you install active open loop systems?
- a. [IF YES] Do you install these systems in climate zone 7?
  - b. [IF YES] Would you be able to meet a 5-year equipment and labor warranty (CCSE Pilot Program requirement for climate zone 7 installations) ? Why or why not? [Probe for their opinion on the requirement]
27. Do you install monitoring equipment on the systems you install? Why or why not? (this can reduce maintenance calls if customer can diagnose and/or fix problems over the phone)
- IF YES – Do you collect interval data from any sites? If yes - would you be willing to share the data with us? (would only require customer zip code and system characteristics)

QUESTIONS FOR INACTIVE OR NON-PARTICIPATING CONTRACTORS:

28. [If attended a workshop] The program records indicate that you or someone with your firm attended a CCSE workshop
- a. Have you submitted the Contractor Participation Application to participate in the SWH Pilot Program? [If not] Do you plan to complete the application?
  - b. [If yes, completed application, ask:] Our records show that you have not submitted any applications; would you tell me why you have not submitted any applications?
29. [ONLY ASK IF THEY SAID WERE FAMILIAR WITH THE SWHPP AT BEGINNING OF SURVEY] What are the aspects of the CCSE SWH Pilot Program that you like? Are there any aspects of the CCSE SWH Pilot Program that you do not like or that have discouraged your participation in the Pilot Program?
30. [IF SERVICE TERRITORY INCLUDES SAN DIEGO] Have you had any customers in the San Diego area that had a system installed but opted not to participate in the program?

If so, what is/are the reason(s) for not participating (desire not to permit, freeze protection requirements, etc.)?

If so, did the customer request not to participate in the program or did you suggest that the customer not participate?

GO TO QUESTION 42.

QUESTIONS FOR (NEW) ACTIVE CONTRACTORS PARTICIPATING IN SWHPP:

31. What are the aspects of the CCSE SWH Pilot Program that you like? Are there any aspects of the CCSE SWH Pilot Program that you do not like?
- [Probe] Requirements: Pull a permit, freeze protection, SRCC certification of parts & systems, QC, length of time to install the SWHs
32. Are there additional costs you incur from filling out the paperwork required for the CCSE rebate? If yes, please elaborate on amount of labor/costs and are the costs passed on to the customer?

33. Have you had any customers in the San Diego area that had a system installed but opted not to participate in the program?

If so, what is/are the reason(s) for not participating (desire not to permit, freeze protection requirements, etc.)?

If so, did the customer request not to participate in the program or did you suggest that the customer not participate?

34. Have you received leads from CCSE? If yes, how many of these have resulted in a sale? How many of the sales also participated in the program?

35. Do you believe that the SWH Pilot Program has been successful in attracting new business for you?

[Probe] Why or why not?

36. Do you think that some form of additional system financing is needed and would attract more people and businesses to the SWHPP?

37. How do you handle the incentive payment? (and why?)

- a. Does someone at your company fill out the application or does the customer do this?
- b. How do you pass the rebate on to your customer? (send them a check later? Or decrease up-front cost?)
- c. How long does it take to fill out the application?
- d. If you provide the discount upfront, how do you reconcile any differences in the actual incentive paid (reimburse the customer or take the loss?)?

38. [If company fills out the application AND receives the incentive payments for SWH installations]:

- a. What is the average length of time between installation and receipt of incentive payment?
- b. What is the maximum length of time you have experienced?
- c. Has the timing of incentive payments affected your business?
- d. If incentive payments took longer to be paid (due to an increase in demand for the incentive payment from a statewide program) would this be an issue for your business?

39. Have your business practices changed since participating in the Pilot Program? If yes, how? (always OG-300 systems? always pulling permits? All employees attending training?)
40. Has CCSE been responsive to questions and concerns regarding the rebate program?
  - a. Are there any questions or concerns you have posed or would like to pose to CCSE regarding the SWH Pilot Program?

GO TO QUESTION 42.

QUESTIONS FOR BOTH ACTIVE AND INACTIVE CONTRACTORS

41. Questions about building permit(s)
  - a. In which cities have you installed SWH (and PV if applicable) systems?
  - b. Do they all require permits?
  - c. For the cities that require permits, what is the average cost of a SWH permit? PV permit?
  - d. What is the average amount of time it took for you to receive the permit after you submitted the paperwork for a system with roof loading of less than 5 lbs./sq. ft.? For a system with roof loading over 5 lbs./sq.ft.
  - e. Have you noticed a change in the approval time for permits associated with SWH (and PV if applicable) ?
  - f. (IF DON'T ALSO DO PV, GO TO g) Have you found that SWH or PV were easier to get a permit for? If yes, why do you think it was easier or harder?
  - g. Have you found that certain types of SWH systems were easier to get a permit for than others? If yes, why do think some types of systems were easier or harder?
42. Is three months sufficient time to obtain permits and install a SWH system? [If not] How long should be given for installation of the SWH?
43. When asked, CCSE has been letting people know that the average installed cost of a SWH system for applications in the program is \$6,500. Do you think this quote appropriately represents the market cost? [If heard of SWHPP] Has this affected customers' reactions to your quoted price?

## MARKET

44. Have you seen or heard on the radio or newspaper any marketing for or information about the SWH Pilot Program? If so, which one?
45. (If know about San Diego area) Do you feel that interest in SWH is increasing in the San Diego region? If so, to what do you attribute this increase in interest?
46. Technology changes quickly, how do you stay on top of and make decisions to integrate new technologies into your designs and installs? Can you provide examples? What key factors determine if you integrate a new technology and make it a standard practice?
- 47.
48. What technological advances do you foresee in the SWH marketplace over the next 10 years (i.e. valves, distribution pipes, metering, collectors, pumps, tanks, etc.)? Do you expect any of these to significantly reduce costs?
49. Do you see any competition between PV, SWH, tankless water heater, demand response and/or energy efficiency in terms of homeowner's views of energy reduction and available cost and space?
  - a. If yes, do you feel it is possible to integrate SWH systems with energy efficiency, demand response or PV technologies effectively?
  - b. If yes there is competition, what role would incentive programs play in rectifying this situation? Contractors? Government?
50. [If sell PV systems AND participated in a PV rebate program] what aspects of the PV program do you like which should be applied to the SWH Pilot Program?
51. Do you have any recommendations for the Pilot Program or for a future SWH incentive program?
  - a. What might be done to stimulate interest in solar water heating systems more generally, either within the SWH Pilot Program or otherwise?

[Probe] Incentive levels, outreach & marketing, customer education, contractor training? And why?

## REQUESTS

52. As part of our evaluation activities, CalSEIA will be sending out confidential cost surveys, where you will have the option of including your contact information or mailing it back anonymously. Completing the survey will contribute to our evaluation of the cost-effectiveness of SWH and will help us

make recommendations to the CPUC about how policy can change to reduce costs and to encourage the SWH market. Please return the survey by August 1.

53. (If install in the commercial sector-question#9d)): As part of our evaluation activities, we will be interviewing companies that have installed SWH systems AND are thinking about installing SWH within and outside of the SWHPP. This will also assist in determining the feasibility of a 10-year statewide incentive program. This information will be kept confidential and will only be used for purposes of contacting the customers to conduct the survey. Would it be possible to get a list with contact information of your commercial customers that bought or were thinking of buying solar water heating systems – pool or hot water) within the last year so that we could conduct these surveys?
  
54. (If install in the residential sector-question#9d)): As part of our evaluation activities, we will be interviewing residential customers that have installed SWH systems outside of an incentive program. This will also assist in determining the feasibility of a 10-year statewide incentive program. This information will be kept confidential and will only be used for purposes of contacting the customers to conduct the survey. Would it be possible to get a list of the residential customers who purchased and installed SWH systems outside of a rebate program within the last year?

THANK THEM FOR THEIR TIME AND CONCLUDE THE INTERVIEW.

# Appendix F

## Manufacturer/Distributor Survey

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Hello, my name is \_\_\_\_\_ and I'm assisting the California Center For Sustainable Energy in evaluating their Solar Water Heating Pilot Program. I'd like to ask you some questions about your impressions of the SWH market in California. All of your answers will be kept confidential. Do you have about 40 minutes to talk with me?

[If not, reschedule an appointment] \_\_\_\_\_

1. What is your primary business? (primarily manuf? Distributor? Also install systems?)
  - a. How long have you been in business?
  - b. How many employees are there?
  
2. What types of solar water heating equipment does your company manufacture/sell?
  
3. Do you make/sell any SWH systems that are not SRCC certified?  
  
IF YES
  - a. Has the system been submitted for SRCC certification?
  
  - b. Have any sales been delayed because the customer is waiting for the system to be SRCC certified?
  
4. Do you sell the systems as an OG300 kit? Do you know what the OG300 approved substitutions are for that system?

5. Do you sell other types of equipment? [check to see if they make/sell PV systems as well as other equipment associated with SWH like radiant flooring, abs. chillers, pumps, pipes, metering equipment, etc.]

[if they make/sell PV] Do you push PV, SWH or Pool Heating the most (if they do solar pool heating)t? Why? If PV, how many systems do you sell per year?

[if they make/sell metering equipment] What type of metering equipment do you sell? (flow, temp, data acquisition capability, etc.)

6. What type of warranties do you offer?

7. How do you market SWH systems?

[Probe] Advertisements, radio, newspaper, websites, home shows, energy fair, word of mouth?

8. Do you offer training for installers for the systems that you distribute/manufacture?

IF YES

- a. How often do you hold the training?
- b. What is the average attendance at the training? Has attendance been increasing or decreasing? Why? Where are the trainings held?
- c. In the training, do you review SRCC standards and certification? Do you review the Uniform Solar Energy Code?

9. How many SWH systems do you typically manufacture/distribute in a year?

How many of those systems are installed in CA?

Has that number been fairly constant each year or does it fluctuate a lot? [ if fluctuates, why?]

10. Have you seen a change in any of your costs and if yes, which costs and why?  
[Probe to find out ways they decrease manufacturing costs]
11. What portion of your business holds the greatest potential for cost reductions?
12. What do you believe are the biggest recent breakthroughs in SWH technology and why?
13. What improvements to SWH technology would you like to see over the next 10 years?
14. Are you familiar with the SWH Pilot Program in San Diego?
  - a. If yes, do you believe the pilot has increased/decreased business for you?
  - b. If yes, what do you like/dislike about the pilot?
15. (If familiar with San Diego) Do you feel that interest in SWH is increasing in the San Diego region? Outside of the San Diego region? If so, to what do you attribute this increase in interest?
16. Are there any SWH components that may be limited in supply if a statewide program increased demand?
17. What do you believe the biggest market barriers are currently for SWH in California? Are there different market barriers to sales in northern versus southern CA (if selling statewide)?
18. Do you think that some form of additional system financing is needed and would attract more people and businesses to the SWH program? [talking about loans here] What type of financing would be most beneficial to the growth of the SWH industry in CA?

19. How will your business outlook change if there is a statewide incentive program in California?
20. Do you believe that incentive programs have an effect on equipment or installation costs? Do you think wholesale prices have increased or decreased since the CCSE SWHPP began?
21. Do you anticipate installed prices system prices to change if there is a statewide incentive program? Do you anticipate wholesale prices to change if there is a statewide incentive program?
22. Do you have any advice or concerns for a statewide incentive program?

THANK THEM FOR THEIR TIME AND CONCLUDE THE INTERVIEW.

# ***Appendix G***

## **Other Programs Survey**

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### Section 1.1 Process questions (how the program works)

1. Could you provide a brief description of how your SWH Incentive Program works? Eligibility criteria? (pool solar water heaters, size, sectors included, etc)
2. How is the incentive amount calculated and what is the maximum incentive for each sector (ask for residential/commercial/industrial)?
3. Do you offer incentives for repairing or retrofitting old systems? If so, how much is the incentive?
4. Does your program offer higher incentives to a) low-income housing, b) non-profits, c) equipment manufactured in-state?
5. When did this program begin (month & year)?
6. What is the annual administrative budget of the program? Incentive budget? How is it funded?
7. Is there a different process for the different sectors?  
(residential/commercial/industrial)
8. Who fills out and submits the application?
9. On average, how long does it take to approve an application?

10. Who receives the incentive payment? (Is the incentive a one-time payment or a production incentive payment?)
  - a. When is it paid?
  
11. [non-CA program only, skip to (a) for CA]  
Does your state have an RPS?
  - a. [IF YES or if CA program]  
Do SWH systems contribute towards meeting the RPS goal ? Is it automatic or does the utility need to purchase the rights from the owner of the system?
  
12. Is there a requirement for how long the system must be in place?
  - a. [If yes] What is the requirement?
  
13. Are there any program requirements for the situation in which the home is sold to a new owner?
  
14. Does the program require the participant to obtain a building permit from the city?  
  
Are there any other required permits?  
  
Do you know how much the permits cost and how long it takes to obtain the permit?
  - a. [If yes] How much does the building permit cost?
    - i. What is the amount compared to PV (if known)?
  - b. [If yes] How long do they normally take to get?
    - i. How does this compare to PV (if known)?

### Section 1.2: Program Results

15. What type of marketing and outreach has been done to get the word out about the program? (pamphlets, mail inserts, radio or TV ads, workshops, etc.)
  - a. Was the outreach successful? How was the success measured?
  - b. Which forms of media were most successful – how determined which worked better?

16. What is the total number to date, and annual totals since program inception per building sector of solar hot water system:
- a. applications received?
  - b. Payouts (both # and \$ amount for each sector)?
17. Do you think the presence of a SWH incentive program has affected the installation cost or equipment costs of SWHs in the area?
- a. [If yes] How?
  - b. [If yes] How do you know the change in price can be attributed to the program?
18. Have you conducted an evaluation of the program? Did you have measurable objectives?
- a. [If yes] Can you send us the evaluation report?

Section 1.3: Program Design

19. [non-CA programs only] In your state is SWH considered an energy efficiency measure?
20. Before this program started, was there a pilot program or other SWH incentive?
- a. [If yes] How long did the pilot program run before the program was expanded?
    - i. How many systems were installed in the pilot program? Specific types? Specific sectors?
  - b. [If yes] What was the process for deciding to expand the pilot program? (lessons learned, what research was valuable to make the decision to expand the program) Did certain criteria need to be met? What were the criteria?
  - c. [If yes] Were any requirements of the program changed when it was expanded?

- d. [If no] How did you determine the requirements for the program?
  - i. What was the policy driver for this program (legislatively mandated? Customer-decision (Publicly-owned utilities)?
  - ii. Prior to starting the program, were other SWH programs researched? What other program(s) were researched to determine criteria?
  - iii. Did you conduct stakeholder input sessions?

## Section 2: Technical requirements of solar hot water system

- 21. How do you size the systems?
- 22. Is there a minimum solar fraction or other minimum threshold for system performance for program eligibility?
- 23. What fuel sources are acceptable as backup water heaters (gas/electric/propane/both/other)?
- 24. Does the system have to be new? Probe: the entire system including the backup tank and all plumbing?
  - a. What about retrofitting a new collector to an existing set-up, are any incentives given for that?
  - b. Are there other age related requirements for other existing system parts or supporting structure of system? Probe: In some cases programs have indicated that if installed on a roof the roof must have a remaining useful life of 15 years.
- 25. Is the solar hot water collector required to be SRCC certified (OG-100)? What about the entire system (OG-300)?
  - a. Are SolarMark (European equivalent of SRCC) certified systems acceptable?
- 26. Is freeze protection required?
  - a. [If yes] What is required? (e.g. Closed loop glycol? Drainback with controls? Specific freeze tolerance?)

27. Are there any valve requirements beyond what is required by local building code?
- a. [If yes] What are they? ASSE standard number (if known)?
28. Does the program require that systems be installed by a licensed contractor? or can a homeowner, for example, install the system?
- a. [If yes for licensed contractor] What are requirements for the contractor? (do they require installers to attend a workshop/training?)
29. Are systems required to be inspected by the program administrator prior to payout?
- a. [If yes] What percentage of total installations are inspected?
30. Do you monitor the performance of any of the completed projects in the program?
- a. [If yes] What data points are being monitored? (metering the temperatures and flow in order to calculate the heat provided to the backup tank by the SWH, or (bare bones) metering hot water flow out of back-up tank)
  - b. [If yes] At what time interval is the data being collected?
  - c. [If yes] How is data transferred? (via internet to remote website, direct meter read)
  - d. [If yes] Currently what percentage of the installations are monitored? (break out by commercial/residential/industrial)
    - iv. Are you willing to share this performance data with the CCSE?  
Explain: The CCSE program is hoping to go statewide and this data could be valuable in adjusting the current program requirements, and determining the performance and cost-effectiveness of projects. The data would not be used for any other purpose and only system data would be needed (no data needed regarding the applicant, other than what sector and the zip code).
      1. [If yes] Who would be the contact for the data?
31. Do you collect system cost and labor cost data?
- a. [If yes] Would you be willing to share a summary of that data with us? (summarize by zip code, system type, residential only, electric vs. NG)

Section 3: Program success

32. What are the goals of the program? Do you feel the program has achieved the goals?
33. How successful do you feel this program is? What criteria do you use to measure your program's success?
34. What are the most effective aspects of the program? Least effective?
35. How do you think participants (customers) feel about the program? What feedback have you gotten regarding what aspects of the program work and what does not work?
36. How do you think participating contractors feel about the program? What feedback have you gotten regarding what aspects of the program work and what does not work?
37. What would you change about the program, if anything?
38. What do you think makes your program unique from other SWH incentive programs? (program requirements, implementation, anything goes here)
39. Do you have any advice for creating a statewide solar water heating incentive program?
40. Is there anything else you would like to share with us, which we have not covered?

# ***Appendix H***

## **Market Actor Survey**

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1. What do you feel are the market barriers to SWH? [probe for opinions on residential versus commercial, competition with PV and energy efficiency]
2. Do you believe that an incentive program is needed to stimulate the growth of the SWH market?
3. How should the incentive structure be designed? [Fixed rate? Tiered? Performance based?]
4. Should there be a minimum efficiency requirement for incentive eligibility?
5. Should repair or replacement of system components on an older SWH system be eligible for financial incentives from SWH programs? Should there be different requirements for existing vs. new?
6. What types of system requirements should there be regarding freeze protection, valves, roof-life, minimum production, system maintenance?
7. Is there value in requiring certification of equipment? What type of certification should be required?
8. Is there value in requiring certification for contractors? What type of certification should be required?
9. What types of businesses should be doing the installations? solar contractors, plumbing contractors?

10. Is a high degree of penetration into the new construction market required before there will be enough public acceptance to sustain a replace/retrofit market?
11. Where is the technology headed in the next 10 years?
12. Historically, which SWH incentive programs do you feel have been most effective in transforming the market? Why?
13. Do you feel that SWH incentive programs affect installation and/or equipment costs of SWHs? If so, how? Do you know of any research that supports this?
14. Do you know of any carbon credit markets for which SWH is eligible? If yes, is the value of the credits enough to have much impact in improving cost-effectiveness?
15. Do you have any comments, advice or suggestions for the development of the SWH market in California where the majority of water heaters are currently fueled by natural gas?