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CALIFORNIA SOLAR INITIATIVE – LOW-INCOME SOLAR PROGRAM EVALUATION

Market Assessment Report

Prepared for
California Public Utilities Commission

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E Executive Summary

Navigant Consulting, Inc., (Navigant) conducted an evaluation of the Single-Family Affordable Solar Housing Program (SASH) and the Multifamily Affordable Solar Housing Program (MASH) for the Energy Division (ED) at the California Public Utilities Commission (CPUC). APPRISE, Inc., assisted in the development and deployment of surveys of program participants. Advent Consulting, Inc., provided support in the analysis of data from those surveys. This Market Assessment report (Market Report) is the second of a set of reports delivered as part of the current evaluation cycle of the SASH/MASH programs.

The California Solar Initiative (CSI) provides solar rebates to customers of the investor-owned utilities (IOUs) in California to increase the adoption of solar energy in California. The CSI includes components for low-income single-family homeowners and multifamily affordable housing:

» The Single-Family Affordable Solar Housing Program provides financial assistance for the installation of solar photovoltaic (PV) generating systems on qualifying affordable single-family housing. SASH is implemented statewide by GRID Alternatives, a nonprofit solar provider whose mission is to "empower communities in need by providing renewable energy and energy efficiency services, equipment and training."[1]

» The Multifamily Affordable Solar Housing Program provides financial assistance for the installation of PV systems on low-income multifamily housing. MASH is implemented by three Program Administrators—the California Center for Sustainable Energy (CCSE) in the service territory of San Diego Gas and Electric (SDG&E), Pacific Gas and Electric (PG&E), and Southern California Edison (SCE).

E.1 Research Objectives

The overarching goal of the Market Assessment is to identify opportunities to improve the SASH and MASH programs. In addition, the Market Report addresses the following research areas:

1. **SASH Market Size and Program Eligibility**: What is the size of the low-income market?
2. **Market Channels**: What are the channels/entry points into the low-income market?
3. **Market Drivers**: What are the market drivers for the installation of solar PV in low-income residential applications?
4. **Program Spillover**: What are the broader market effects caused by the low-income program?
5. **Job Creation (SASH)**: What jobs have been created?
6. **SASH Project Funding and Incentive Level**: Is the SASH program design effective given that most of the systems have been installed free of charge?
7. **MASH Project Financing and Incentive Level**: How are MASH projects financed?
8. **Comparative Assessment of Low-Income Solar Programs**: What are other low-income programs around the country doing other than offering incentives?
9. **Sustainability**: What does the low-income market need to be sustainable?

[1] Grid Alternatives. 2010. "Grid Alternatives: Mission, History, and Future." Available: http://www.gridalternatives.org/mission-history

E.2 Evaluation Methodology

The Market Assessment research and findings described in this report are based upon the following evaluation activities:

- Program databases and other program-related documents
- In-depth interviews with representatives of the following groups:
  - CPUC Staff
  - SASH and MASH Program Administrators
  - Market Actors
  - SASH and MASH Program Participants
  - SASH and MASH Non-Participants (including SASH Service Decliners)
- Surveys with participants of SASH and MASH

E.3 SASH Findings and Recommendations

This analysis focuses on the dynamics in the market in which GRID Alternatives operates the SASH program. By better understanding the market context, it is possible to assess more completely the effectiveness of GRID's strategies in addressing market needs to achieve programs goals. This section explores the unique aspects of the SASH market and assesses GRID's effectiveness in using the available resources to reach the target market and achieve the program's goals. Recommendations highlight opportunities for GRID to advance the market for PV amongst low-income single-family households.

1.1.1 SASH Findings

This section summarizes the main findings related to the SASH program.

OVERALL MARKET (SECTION 2.1)

- **GRID sits at the center of the market for low-income single-family solar in California.** GRID is at the center of nearly all interactions with the customer in the market for PV system development among single-family homeowners. GRID either interfaces directly with the customer or facilitates relationships with nearly all of the other market actors whose involvement contributes to a successful project.

- **The market for SASH is big enough to support the program.** The evaluation team estimates that the total market size for SASH is approximately 128,000 households. This indicates that a sufficient market exists to enable GRID to achieve its target of 6,000 installations, which represents a five percent market share of the 128,000 homes.

» **GRID has progressed in reaching out to one of the priority markets outlined by CPUC.** SASH program participants are more likely to primarily speak Spanish in their homes than the general population.

CHANNEL STRATEGY (SECTION 2.2)

» **GRID's channel strategy to date appropriately meets the program's need to build trust and protect brand equity.** GRID has restricted other organizations' ability to promote the product to potential homeowners by retaining control over the message, the quality of customer experience, and the risk associated with ensuring that homeowners meet the complex program requirements. By maintaining control over the channels of distribution, GRID reduces the risk that an outside partner might (even inadvertently) jeopardize the work done to develop trust and to ensure GRID achieves fairly low sales force costs as a percentage of total project costs.

» **SASH participants report first hearing about SASH through all of the channels that GRID uses.** More than one-third (34 percent) of SASH participants who responded to a survey report that they learned about SASH through a community organization, including Habitat for Humanity.

» **Some segments of the market respond better to certain channels.** Households in which English is the primary language respond better to direct communications, such as mailers or contact with GRID staff. Referrals from friends, relatives, and neighbors are nearly twice as effective in Spanish-speaking communities as in English-speaking ones.

» **Survey data also indicate that GRID clients are very satisfied with their experience with GRID and with SASH to date.** Nearly all (92 percent) indicate that they are very satisfied with GRID, and 90 percent report that they are very satisfied with the SASH program as a whole.

DRIVERS AND BARRIERS TO PARTICIPATION (SECTION 2.3)

» **Financial and environmental motivations drive the vast majority of homeowners' decisions to participate in SASH.** Over three-quarters of respondents (76 percent) indicate that the reduction in their electric or utility bills was the primary reason that they participated in SASH. In addition, another 17 percent of survey respondents indicated that helping the environment was their primary reason for participating in SASH. The role of neighbors and friends is a less significant factor in the decision to actually install solar than it is in introducing the SASH program to homeowners.

» **Cost remains the primary barrier to participating in SASH.** Over one-quarter of program participants indicated that the cost of the system created an initial barrier to participation in SASH, though their interactions with GRID resolved these concerns. Interviews with non-participants indicate that the cost of the system remained the most important barrier for them; many of these non-participants had not heard of SASH previously, however.

» **GRID is still in a period of building credibility with the low-income communities throughout the state.** Nearly one-quarter of the program participants surveyed indicated that they initially thought that the program was "too good to be true" or had doubts about the level of anticipated bill savings.

PAYING FOR THE SYSTEM (SECTION 2.4)

» **SASH incentives are covering more of the total system cost than the anticipated range indicated in CPUC 07-11-045.** For more than half of installed projects, the SASH incentive covers 90 to 100 percent of the system cost; for 86 percent of all installed projects, the SASH incentive covers more than 80 percent of the project cost.

» **GRID has successfully appealed to a diverse set of organizations to contribute to funding gaps for SASH projects.** The average project funding gap filled by an outside organization is approximately $2,600. A small number of participants have contributed their own financial resources to pay for their systems.

» **Nearly one-half of participants surveyed indicated willingness to allocate some portion of their bill savings to loan payments to help pay for their PV system.** This approach would require a lending partner that offered a product with a reasonable interest rate.

SPILLOVER (SECTION 2.5)

» **SASH has the potential to add between 12 and 22 full-time equivalent positions by the end of 2014.** This estimate includes between 10 and 18 Subcontractor Partnership Program (SPP) contractors and between two and four job trainees.

» **The SASH program's outreach on energy efficiency appears to have spurred a number of program participants to implement energy-efficient equipment or behaviors.** Almost 65 percent of participants who responded to a survey indicated that they had adopted some energy-efficient actions or behaviors as a result of SASH.

» **Knowledge about solar appears to have increased among SASH participants, while messages about the affordability of and benefits of PV are still penetrating the broader market.** Nearly half of participants report an increase in their level of knowledge about solar since participating in SASH.

1.1.2 SASH Recommendations

This section outlines the recommendations for the SASH program moving forward. Section 2.6 provides additional detail on these recommendations.

MARKET CHANNELS

» **GRID should continue to maintain tight control over its channels for the foreseeable future.** Developing the brand equity required to meet SASH's ambitious goals requires a dedicated and knowledgeable sales force that keeps the best interests of SASH and its participants in mind. The alternative structures allow for more much variation in messaging and customer experience than the current one does, creating the potential to erode GRID's brand equity and damage the long-term effectiveness of the SASH program.

» **Making a concerted effort to involve children in the households that GRID serves in its outreach efforts may create longer-term effects of the program.** GRID may consider exploring this aspect of its outreach further. Research from the energy efficiency evaluation community indicates that children retain knowledge gained about energy efficiency and continue to practice energy efficiency behaviors as long as six years after initially encountering the information.[2] SASH can realize similar effects by including children in the educational component of the outreach and possibly incorporating them into the installation of the project (in very low-risk ways).

» **Engaging previous program participants to provide testimonials to the program can leverage the important role of neighbors, friends, and family in recruiting participants to the program.** Where appropriate, GRID staff may attend community meetings organized by previous participants to answer any formal questions about the program. This is already ongoing at some level, but it warrants additional attention, especially in Spanish-speaking communities where friends, family, and neighbors are the primary source of initial information about the program.

PROJECT FINANCING

» **Finding a more sustainable alternative than fully funding projects through a combination of SASH incentives and GRID fundraising will enhance the program's long-term success.** Given the likely administrative burden associated with filling funding gaps on a per-project basis, significant potential exists for a broader financing approach to address these gaps and increase the rate of SASH project installations. At the same time, however, soliciting such personal contributions and securing a vehicle to enable them will increase the cost of the program and pose additional barriers to participation.

[2] Hanson, R. & Siegel, D.F. 1995. "The Enduring Effects of an Elementary School Energy Education Program." *Proceedings of the 1995 International Energy Program Evaluation Conference, pp. 493-504.* NEPEC.

» **GRID may consider developing a strategic partnership with one or a limited number of third-party financing providers.** These types of relationships would facilitate the process for developing financing agreements for SASH participants.

» **Power purchase agreements (PPAs) with third parties are likely not appropriate for SASH.** First, PPAs require third-party ownership, which is counter to SASH's exclusion as described above. The focus of the SASH program is participant ownership. Second, the transactional costs likely negate the limited financial returns. Third, it would be difficult to structure rules related to contract length, ownership "flip" schedules, among other issues, that are both fair for the PPA providers and discernable for the SASH participants.

» **Projecting monthly energy bill savings—especially with access to loans—could increase potential participants' ability and willingness to contribute financially to the cost of a system.** Understanding the financial benefits more clearly would likely increase the rate of SASH installations. At the same time, any resulting personal contributions would leverage GRID's fundraising efforts to reach a greater number of participants.

SPILLOVER

» **Continue to develop relationships with job training programs.** GRID's approach to providing job training program participants with the opportunity to participate on jobs as volunteers plays an important role in the participants' professional development.

EVALUATION

» **At some point in the future, it may be appropriate to revisit the effectiveness of SASH's channel strategy.** Reconsideration may occur after GRID has developed broader recognition and acceptance within the market. Additional investigation may also be warranted as more SPP contractors install systems and become more familiar with the requirements of SASH and the distinct needs of the low-income population. Neither of these scenarios are the case at this time, however.

» **Clearer definitions for the "source of gap funding amount" field in the database would create a more comprehensive picture of clients' contributions to their system cost.** Specifically, it would be useful to list the homeowner as the source when they apply for and use U.S. Department of Housing and Urban Development (HUD) loan funds to pay for a portion of the system. Although the capital initially comes from HUD, the homeowner commits to repaying it in the future.

» **A non-participant survey would provide a vehicle to better gauge the willingness to pay a portion of the gap amount funding through bill savings.** Current analysis is limited to data provided by program participants, many of whom have already seen reduced energy bills and understand the tangible effects of the net metering agreement. Non-participants have less knowledge about those mechanics, making it difficult to infer how they would make decisions.

» **Better tracking of job trainees and volunteers would provide the evaluation team with a better starting point for assessing the effectiveness of this aspect of SASH.** On-the-job training for solar installers and broader industry experience for a broader range of clean energy workers are important components of MASH's value proposition. Tracking contact information, their job training program, the number of times they provided SASH project installation assistance, and the identity of future employers will provide important information for future evaluation teams. This information will be useful for both SPP job trainees and those job trainees and volunteers that assist in SASH-led installations.

» **Collecting more information about energy efficiency upgrades completed during the client's engagement with GRID would facilitate better evaluation of the program's total benefits.** In the event that CPUC determines that energy efficiency is a higher priority and worthy of the resources necessary to track progress in this area, GRID may consider collecting additional information about how participants alter their energy use.

E.4 MASH Findings and Recommendations

This section focuses on the dynamics in the market in which the Program Administrators operate the MASH program. The key decision makers in this market represent business, non-profits, and other organizations; in contrast, individuals constitute the decision-making population in the SASH market. Thus, the dynamics in the market in which MASH interacts follow more closely the dynamics of other markets in which decision makers must consider the priorities of their investors (or funders) and the implications for the profitability (or sustainability) of their organization.

1.1.3 MASH Findings

This section summarizes the main findings relevant to the MASH program.

MARKET DESCRIPTION (SECTION 3.1)

» **Participation in the MASH market is dominated by a handful of large host customers, third-party system owners, and solar installers.** The top six host customers hold 48 percent of MASH projects, with the most prolific holding 52 projects. The top six third-party system owners are listed on 71 percent of projects, with the largest appearing on 103 projects (27 percent of the total). Finally, the top eight installers are listed on 78 percent of projects, with the largest appearing on 114 projects (30 percent of the total).

» **In many cases, several MASH projects may be required for multiple service points on a single property.** For completed projects, 27 individual projects were allocated to only 16 unique host customer locations, with one location comprising five projects.

» **Nonprofit affordable housing developers and solar integrators participate more frequently than other types of organizations.** Nonprofit affordable housing developers are the most common type of participating host customer; 31of these types of organizations hold 58 percent of reservations. Solar integrators hold the top spot for both system owners and installers. Six unique solar integrators are listed on 68 percent of projects as system owners, and eight unique solar integrators are listed as the installer on 53 (non-mutually exclusive) percent of projects.

MARKET CHANNELS (SECTION 3.2)

» **MASH has used an intensive distribution model in which many entities have the ability to distribute information about MASH and recruit participants for the program.** Whereas the SASH program retains control over the messaging and customer interaction, the MASH program enables a variety of market actors to perform the outreach and promote the program.

» **Contractors served as the primary distribution channel for MASH's Track 1 program.** The incentive available for MASH accrues directly to these entities in most cases, and the potential financial benefits for these entities drive their efforts to recruit participants.

DRIVERS AND BARRIERS (SECTION 3.3)

» **Across the board, the primary motivation for participating in MASH is the attractive financial benefit.** Some participants also cite environmental benefits, tenant bill savings, and alignment with organizational priorities.

» **Without previous experience in solar, potential host customers need support in learning about the issues related to negotiating PPAs.** Agencies that support the low-income multifamily segment and at least one participant indicate that owners of these types of buildings have a steep learning curve to overcome before they will agree to participate in a project. While many building owners understand the concept and benefits of solar power, they lack experience in negotiating a PPA. Ensuring that they secure a fair deal for their facility (and possibly their tenants) requires them to understand the risks and implications very well.

» **Data indicate that many of the organizations that have participated in MASH to date may be considered "early adopters."** Survey responses indicate that 65 percent of participants had considered solar prior to applying for MASH. Installers and PPA providers indicate that they developed projects first with organizations with which they had previous relationships. Given the myriad of other issues on their plate, it is possible that organizations that had not previously considered solar missed the window for participation because the program sold out so quickly.

» **Survey responses from MASH participants about virtual net metering (VNM) reveal inconsistencies about their understanding of VNM and the role that it played in their decision to complete their projects.** VNM itself was not usually cited as a barrier or a benefit, but interview and survey respondents did indicate their perceptions of the benefits of VNM and also discussed the challenges of VNM as currently designed. The most commonly cited reasons for not using VNM on MASH projects were the service delivery point issue, a lack of awareness or understanding of VNM, and having enough common area load to use the generation of a PV system (or having a roof too small to warrant allocating credits to tenant area load). The commonly cited positive attribute was the ability to pass on the direct benefits of solar to tenants. Respondents indicated that without VNM, potential solar adoption would have a much lower ceiling as roughly half of residential and commercial units are multi-tenant.

PROJECT FINANCING AND INCENTIVE LEVELS (SECTION 3.4)

» **Systems that have reached completion are larger than average projects in the program tracking database.** The median system capacity for active MASH projects is 37.7 kW_{AC}, with 69 percent falling between 10 and 75 kW. However, the capacities for completed projects have tended higher, with most falling between 50 and 75 kW.

» **MASH projects are both larger and less expensive on a per-capacity basis than comparable projects under the General Market CSI program.** On a cost-per-watt basis, MASH projects appear to be achieving an average cost $0.89/W lower than the residential-only segment, and up to $1.12/W lower than the entire General Market program. This may result directly from economies of scale associated with the MASH program's larger per-project system capacities, enabling system owners and installers to use bulk purchasing to influence equipment vendors.

» **The third-party ownership structure permeates MASH projects.** Two-thirds (68 percent) of surveyed MASH participants said they used PPAs to help finance their projects. Market actors related that the federal Investment Tax Credit and related Treasury Cash Grant remained strong financial drivers for projects, reinforcing the importance of third-party ownership for host customers with nonprofit status.

» **Incentives cover a smaller portion of overall project costs than in the SASH program.** For the majority (57 percent) of projects, incentives cover 40 to 49 percent of the calculated system cost, with a median of 43.5 percent of project costs covered.

» **The evaluation revealed mixed perceptions about the level of the MASH incentive.** More than half of participants surveyed indicated that their projects required the full amount of MASH incentive available. On the other hand, **i**nstallers and third-party financing firms provided anecdotal evidence that the incentive levels were very high.

SPILLOVER (SECTION 3.6)

» **Spillover effects of MASH appear to be less diverse than for SASH.** Spillover effects of MASH include some energy efficiency upgrades and some benefits for tenants. The broader market (i.e., nonparticipant population), however, reports low levels of awareness about MASH and their consideration of PV due to MASH.

1.1.4 MASH Recommendations

There are several potential paths forward for MASH. This section provides recommendations in two main categories. The first set of recommendations apply to MASH in its current state, as it continues to manage the process for projects that have already secured reservations. The second set of reservations address a situation in which CPUC considers extending or expanding MASH with some modifications.

AS THE PROGRAM CURRENTLY STANDS

» **Provide additional education to low-income multifamily property owners about the business aspects of PV project to further expand the market for PV among low-income multifamily facilities.** The PAs could provide education to low-income multifamily facility owners about the PPA terms and conditions, key decision criteria for selecting key partners (such as installers and financing partners), and additional resources available to assist with the development of PV projects. This would enable a broader group of organizations to gain access to the solar market, even in the absence of further incentives from MASH.

» **Provide additional outreach and education about VNM to system hosts.** Lowering the barriers to accessing VNM for system hosts would enable tenants to reap additional benefits from PV systems installed on their buildings. Regardless of whether or not CPUC decides to expand MASH, this additional information would provide additional opportunities for building owners to create these benefits for their tenants.

MODIFYING MASH

» **Establish a stable policy environment to provide a less risky environment in which businesses can invest.** To build on the momentum gained by MASH for the market for solar among low-income multifamily facilities, key market actors need a clear idea of the market opportunity going forward.

» **Increase the pricing differential between projects that benefit common area and tenant load.** CPUC may consider creating incentives for projects to decrease energy use and costs for affordable housing tenants.

» **For those projects with existing reservations that meet the ongoing requirements of the program at the time that they secured their reservation, keep incentive levels consistent with those set at the time of the reservation request.** These project owners, installers, and host customers met the requirements of the program at the time of enrollment, and they should be able to retain the benefits that were available under the program at the time of enrollment.

EVALUATION

» **Collect more information about energy efficiency upgrades prior to awarding the MASH rebate.** If CPUC views the energy efficiency benefits of MASH as high enough priorities, future evaluation teams will need additional information to effectively review progress in this area. The program may consider adding a field to the incentive request form to capture the types of energy efficiency upgrades implemented from the host customers before a rebate is paid and inputting this information into the program database. This could be as simple as a box that they check that indicates which energy efficiency upgrades the building owner made as a result of their participation in MASH.

» **Revisit the distribution of financial benefits among tenants, project hosts, and project owners.** Due to the limited number of projects completed at the time of this evaluation, a comprehensive assessment of the distribution of financial benefits from MASH was not possible. Future evaluations may consider the extent to which tenants, who the CPUC intended to benefit from the MASH program, actually receive financial benefits from the program.

» **Gather data about the PPA terms and conditions.** Future evaluation teams may inquire about the PPA terms and conditions to better understand the financing schemes, the bill impacts for tenants and project hosts, and the long-term financial benefits of the systems for tenants, project hosts, and project owners. MASH may need to require that program participants share this data as a precondition for participation in the program.

» **Investigate the "host customer" component of the MASH value chain in further depth.** Further exploring the types of market actors in the multifamily affordable housing community, their business models, and motivations will provide a more comprehensive picture of the factors that influence their decisions to participate. In addition, this information may provide a better understanding of how the program can reach a broader slice of the market.

1 Introduction

Navigant Consulting, Inc., (Navigant) is conducting an evaluation of the Single-Family Affordable Solar Housing Program (SASH) and the Multifamily Affordable Solar Housing Program (MASH) for the Energy Division (ED) at the California Public Utilities Commission (CPUC). APPRISE, Inc., assisted in the development and deployment of surveys of program participants. Advent Consulting, Inc., provided support in the analysis of data from those surveys. This Market Assessment report (Market Report) is the second of a set of reports to be delivered as part of the current evaluation cycle of the SASH/MASH programs. The overarching goal of the Market Assessment is to identify opportunities to improve the SASH and MASH programs. The Market Assessment focuses on the forces at work in these unique low-income sectors and seeks to determine the extent to which MASH and SASH are pulling the right levers in the market to achieve program goals.

This section provides an overview of the SASH and MASH programs, the research that the evaluation team conducted, and an overview of the organization of the Market Report.

1.2 Program Description

The California Solar Initiative (CSI) provides solar rebates to customers of the investor-owned utilities (IOUs) in California to increase the adoption of solar energy in California. The CSI includes components for low-income single-family homeowners and multifamily affordable housing:

- The Single Family Affordable Solar Housing Program, a component of the CSI, provides financial assistance for the installation of solar photovoltaic (PV) generating systems on qualifying affordable single-family housing. SASH is implemented statewide by GRID Alternatives, a nonprofit solar provider whose mission is to "empower communities in need by providing renewable energy and energy efficiency services, equipment and training."[3]

- The Multifamily Affordable Solar Housing Program, another component of the CSI, provides financial assistance for the installation of PV systems on low-income multifamily housing. MASH is implemented by three Program Administrators—the California Center for Sustainable Energy (CCSE) in the service territory of San Diego Gas and Electric (SDG&E), Pacific Gas and Electric (PG&E), and Southern California Edison (SCE).

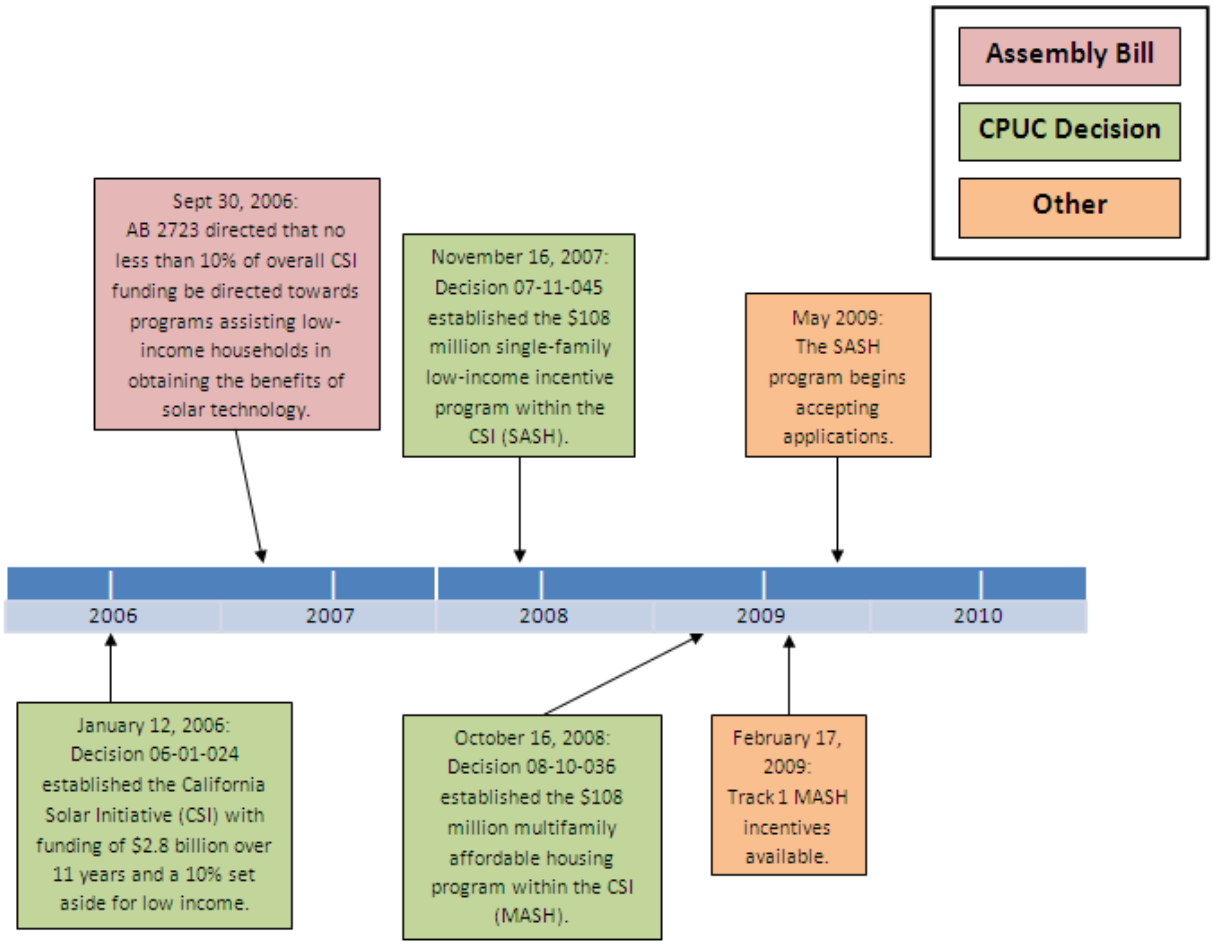
The CPUC established the CSI in early 2006 in Decision 06-01-024. Decision 06-01-024 included a provision to set aside a minimum of 10 percent of CSI program funds for projects installed by low-income residential customers and affordable housing projects. Later in 2006, the California Legislature codified this low-income funding requirement in Senate Bill (SB) 1 and Assembly Bill (AB) 2723. Subsequently, in Decision 06-12-033, the CPUC directed the PAs to conform the CSI program to the SB 1 and AB 2723 requirement that 10 percent of the CSI budget be reserved for the single-family and multifamily low-income residential solar incentive programs. On November 16, 2007, the CPUC established the $108.34 million SASH program. The administration of the SASH program was awarded

[3] Grid Alternatives. 2010. "Grid Alternatives: Mission, History, and Future." Available: http://www.gridalternatives.org/mission-history

to GRID Alternatives, and the program began accepting applications in May of 2009. On October 16, 2008, in Decision 08-10-036, the CPUC established the $108.34 million MASH program. Track 1 incentives were first available on February 17, 2009.

Figure 0-1 below summarizes the key milestones in the SASH and MASH development.

Figure 0-1. CSI Low Income Timeline



Source: CPUC D. 06-01-024, 07-11-045, 08-10-036, AB 2723, and interviews with MASH and SASH Program Administrators.

1.3 Research Objectives

In addition to the overarching goal to identify opportunities to improve the SASH and MASH programs, there are ten specific research areas the Market Report addresses. In some areas, research objectives were established for MASH and SASH separately. In other places, however, the research objectives were more general; in these cases, the research team attempted to identify areas in which the MASH and SASH markets are similar and different.

Table 0-1. Overview of Research Objectives

Topic Area	Research Questions	Location in the Report
SASH Market size and program eligibility (PUC 2852)	» What is the size of the low-income market? » Are there issues with PUC 2852? » Should the CPUC recommend to legislature that changes be made? » What is the SASH and MASH potential if eligibility is expanded or changed?	Section 2.1.2
Market channels	» What are the channels/ entry points into the low-income market? » Who is active at these entry points/in these channels? » To what extent do specific channels need to be supplemented by policy?	Section 2.2 (SASH) Section 3.2(MASH)
Market drivers	» What are the market drivers for the installation of solar PV in low-income residential applications? » What are the primary barriers to installing solar PV in low-income residential applications (beyond up-front cost)?	Section 2.3 (SASH) Section 3.3(MASH)
"Spillover"	» What are the broader market effects caused by the low-income program (e.g., job creation, installations, perception of solar among low-income residents)? » Is the LIEE seeing more participants come through SASH?	Section 2.5 (SASH) Section 3.5(MASH)
Job creation (SASH)	» What jobs have been created? » What is the staff training? » What is the size of the labor force? » What is the sustainability of that creation?	Section 2.5.1

Topic Area	Research Questions	Location in the Report
SASH Project Financing and Incentive Level	» Is the SASH program design effective given that most of the systems have been installed free of charge? » Under what conditions would they be willing to co-fund the installation? » What would an acceptable payback period be? » If any SASH participants had a copayment, how did they pay their portion? » Identify the various gap financing options used and assess whether the availability or unavailability of these program is creating issues for SASH. » Is the SASH incentive level distinction meaningful given that all systems have been installed free of charge?	Section 2.4
MASH Project Financing and Incentive Level	» How are MASH project financed? » Are different financing strategies being used for those projects that provide tenant benefits? » To what extent are PPAs being used? » Was the MASH incentive too high?	Section 3.3.3
Comparative assessment of low-income (solar) programs	» What are other low income programs around the country doing other than offering incentives?	Section 4
Sustainability	» What does the low-income market need to be sustainable? » Is this even a possibility?	Section 5
Other	» How to expand and improve the programs in the future.	Section 5

1.4 *Other SASH and MASH Evaluation Reports*

As seen in Figure 0-2, this Market Report is the second in a series of three reports in which Navigant is reporting the results of evaluations of the CSI low-income programs that it conducted for the Energy Division:

1. A draft Program Administrator Assessment was delivered to the CPUC in September of 2010 and provided information on the efficacy and effectiveness of SASH and MASH and provided recommendation for program modifications;[4] and

2. A SASH Impact and Cost Benefit Analysis will be delivered to the CPUC in the second quarter of 2011 and will quantify the energy impacts of the SASH program and assess the program's cost effectiveness; additional areas of investigation include customer bill impacts. An impact and cost-benefit analysis of the MASH program is not included because of the low number of projects expected to be completed by the end of 2010.

In addition to the three formal evaluation reports, the Navigant team is supporting the CPUC in the development of the SASH and MASH biennial reports due to the California Legislature in June 2011.

Figure 0-2. Overview of Evaluation Reports for MASH and SASH

[4] Navigant Consulting. Forthcoming. *CSI SASH and MASH Program Administrator Assessment Report.* Prepared for the Energy Division of the California Public Utilities Commission. (The remainder of this document will refer to this report as "the PA Assessment Report."

1.5 Evaluation Methodology

The Market Assessment research and findings described in this report are based upon the following evaluation activities:

- Program Databases and Other Program-Related Documents
- In-Depth Interviews with representatives of the following groups:
  - CPUC Staff
  - SASH and MASH Program Administrators (Appendix A)
  - Market Actors (Appendix B for SASH and Appendix C for MASH)
  - SASH Target Market: Participants, Non-Participants, and Service Decliners (Appendix D)
  - MASH Target Market: Participants and Non-Participants (Appendix E)
- Surveys with participants of SASH and MASH (Appendix F)

A full description of the Evaluation Methodology is provided in Appendix G.

1.6 Report Organization

Four sections follow this introduction:

- Section 2, the SASH Market Assessment, addresses the SASH Market Assessment research objectives.
- Section 3, the MASH Market Assessment, addresses the MASH Market Assessment research objectives.
- Section 4, the Comparison with Other Low-Income Solar Programs, provides an overview of programs from other parts of the United States that serve markets similar to those served by SASH and MASH.
- Section 5, the Recommendations, provides the recommendations for modifications to the SASH and MASH programs or to future low-income solar programs in California.

In addition, a series of appendices provide additional detail on the content of this report.

- Appendix A: Program Administrator Interview Guides
- Appendix B: SASH Market Actor Interview Guides
- Appendix C: MASH Market Actor Interview Guides
- Appendix D: SASH Target Market Interview Guides
- Appendix E: MASH Target Market Interview Guides
- Appendix F: Survey Guides for Program Participants
- Appendix G: Evaluation Methodology
- Appendix H: Sample Maps of Empowerment and Enterprise Zones

2 SASH Market Assessment

This section focuses on the dynamics in the market in which GRID Alternatives operates the SASH program. By better understanding the market context, the effectiveness of GRID's strategies in addressing market needs to achieve programs goals can be assessed more completely. The CSI low-income market is a business-to-consumer (or B2C) market, which means that GRID (the non-profit business) is marketing its offerings to a consumer market. The dynamics of B2C markets are much different than those in a business-to-business (B2B) market, such as the MASH market. This section explores the unique aspects of this B2C market and assesses GRID's effectiveness in using the available resources to reach the target market and achieve the program's goals.

GRID's offering to this consumer market is multi-faceted. First and foremost, GRID offers the ability for qualifying low-income homeowners to decrease their energy costs by receiving power from a PV system. Through the LIEE program, GRID can also offer energy efficiency retrofits to a subset of its clients. Beyond that, however, GRID offers a way for a participating low-income homeowner to be seen as a leader in her community through the installation of a state-of-the-art PV system and by engaging her neighbors in the installation of the PV system. This combination of products and community experience has proved to be a compelling package for GRID's customers to date.

This section is organized as follows.

- Section 2.1 provides a high-level overview of the market in which GRID operates the SASH program.
- Section 2.2 examines the channels by which the target market accesses the SASH program and discusses the advantages and disadvantages of alternative models of doing so.
- Section 2.3 discusses the reasons that the target market participates in SASH and the barriers to further expanding participation;
- Section 2.4 highlights the financial mechanisms that GRID and the target market use to pay for the systems and analyzes alternative approaches.
- Section 2.5 identifies benefits achieved by the program that are outside of the program's goals.
- Section 2.6 summarizes the key findings of the analysis conducted for this part of the report.

2.1 Market Description

This section lays the foundation for the remainder of the SASH section of this report by describing the structure of the market within which GRID operates the SASH program. This high-level overview of the market includes a description of the ways in which GRID interacts with the major market actors and provides brief descriptions of each of those market actors.

2.1.1 Market Structure

GRID is at the center of nearly all interactions with the customer in the market for PV system development among single-family homeowners in the low-income market. GRID either interfaces directly with the customer or facilitates relationships with other market actors whose involvement contributes to a successful project. Figure 2-1 depicts the relationships between GRID, the homeowner, and key market actors.[5]

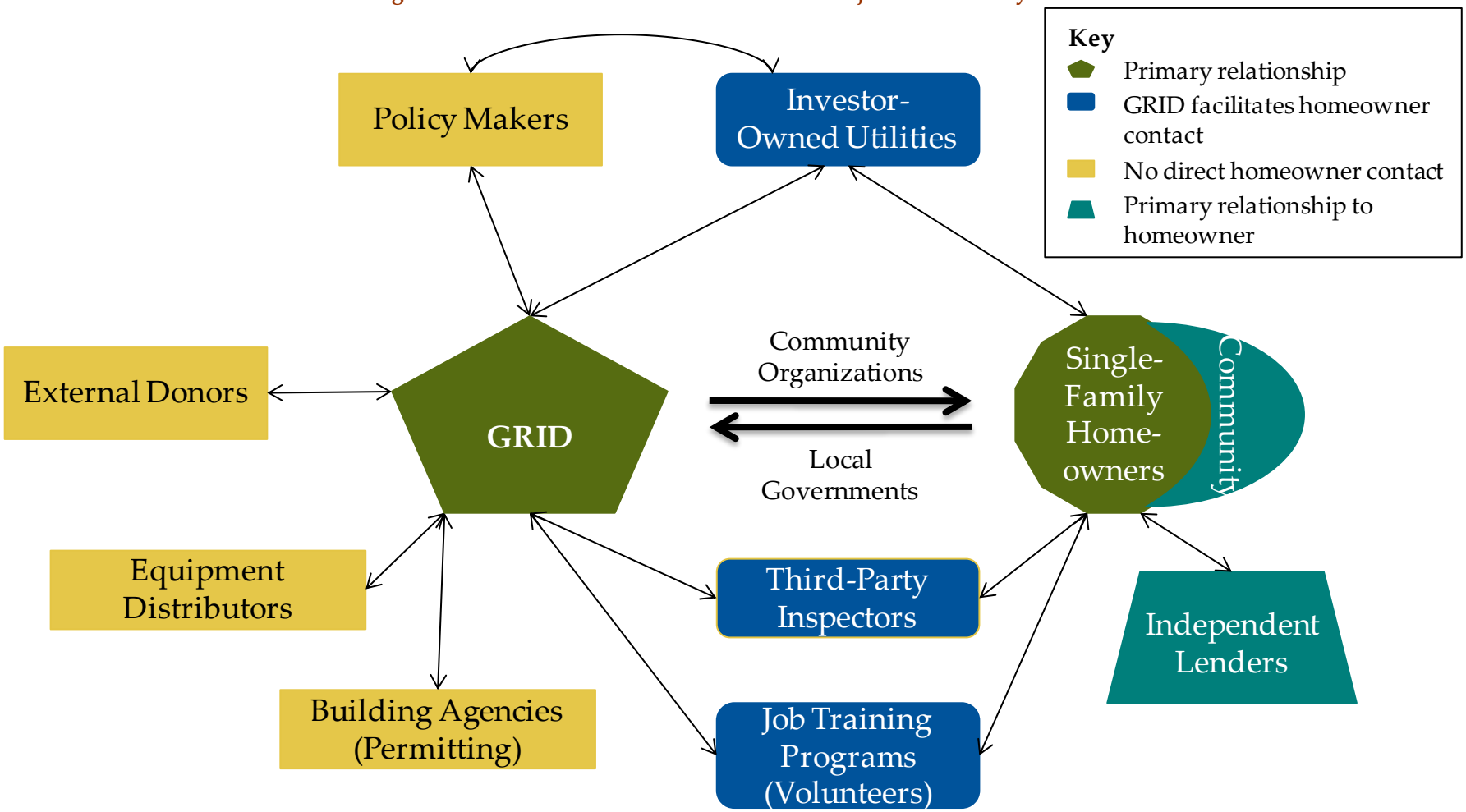
The market structure changes slightly depending on whether GRID or one of its Subcontractor Partnership Program (SPP) contractors installs the system. While the market actors remain largely the same, some of the interactions that are less significant to the homeowner shift from GRID to the SPP contractor. The main features of these two scenarios are as follows:

- ***For projects in which GRID installs the system***, market actors interface directly with GRID in almost every aspect of the program. GRID maintains control over messaging, quality of customer experience, and the organizations that interface with the customer. Figure 2-1 summarizes the interactions in the marketplace when GRID serves as the installer.

- ***For projects in which an SPP contractor installs the system***, GRID still serves as the primary "face" of the program to the homeowner. The SPP contractor, however, serves as a second point of contact for the homeowner, focused on installation-related issues. In addition, the SPP contractor assumes the responsibility for interacting with a subset of the market actors with which GRID interacts exclusively for GRID-installed system; that is, the customer remains removed from these interactions, as they would in a general market solar project. Figure 2-2 summarizes the interactions in the marketplace when GRID serves as the installer.

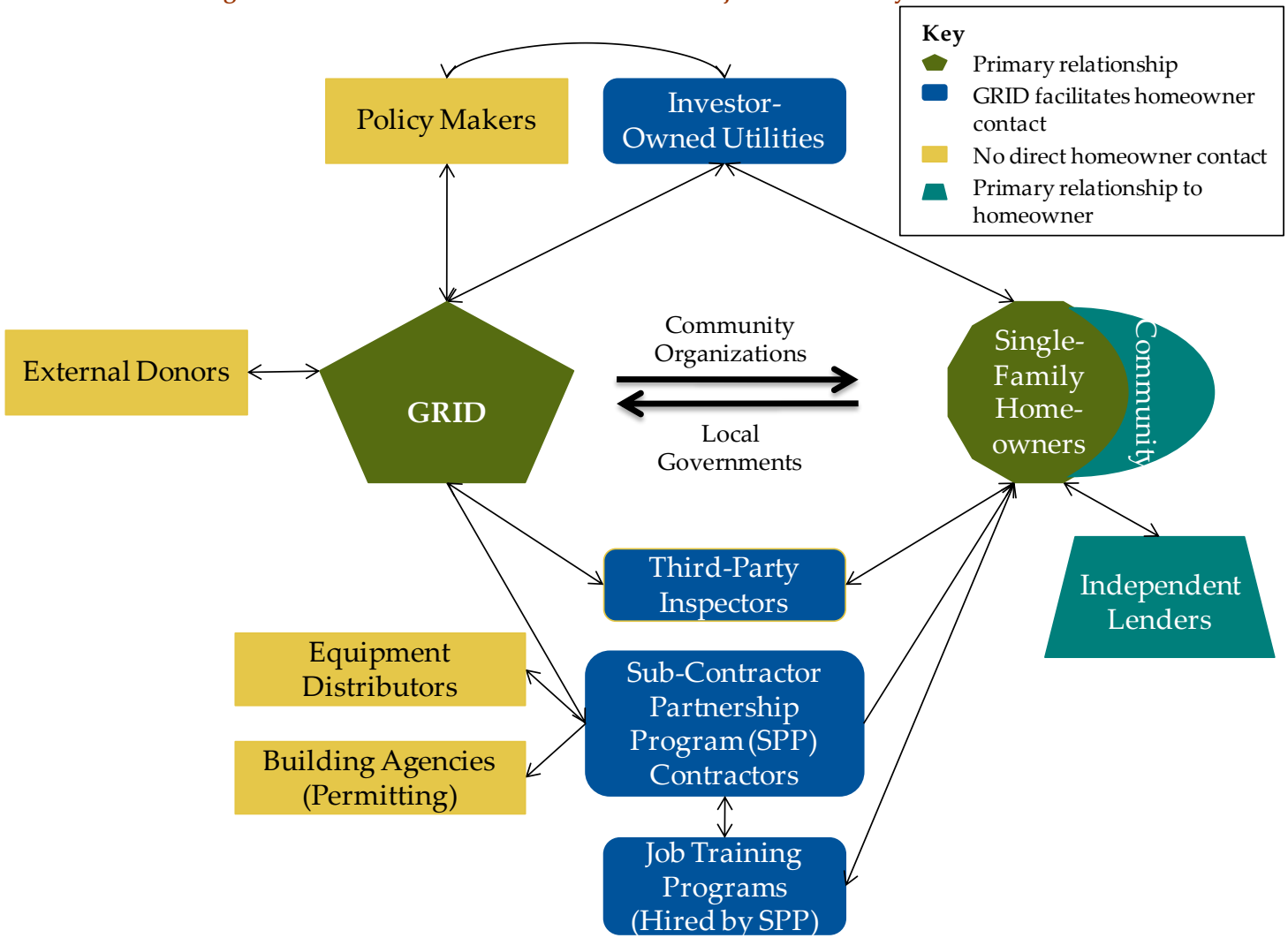
[5] Organizations and individuals that have a role in the adoption of PV by single-family homeowners in the low-income market comprise the population of "market actors." Market actors may play a role in the exchange of goods and services, in influencing eligible homeowners to participate, in creating or maintaining the market for the services, or otherwise enabling these homeowners to benefit from PV.

Figure 2-1. Overview of Market Structure for Projects Installed by GRID



Source: Navigant analysis 2011.

Figure 2-2. Overview of Market Structure for Projects Installed by SPP Contractors



Source: Navigant 2011.

A brief summary of the interaction between each market actor and GRID and the homeowner follows; the market actors are organized in alphabetical order.

BUILDING AGENCIES. Building agencies provide the permits for installing a PV system and complete (or administer) the local government's inspection of the completed project. As in the general solar market, the installer (whether it is GRID or the SPP) interfaces with the building agency, not the homeowner. The installer pays for the permit and ensures that the inspection is completed once the installation is complete.

COMMUNITY. Neighbors, friends, relatives, and coworkers can play an important role in the success of a SASH project. Over one-fifth (22 percent) of SASH participants initially learned about the program through one of these sources. In addition, community members may join SASH participants in providing in-kind assistance on the day of the system installation, including making a meal for the volunteer installers or helping to install the system. The effect of word-of-mouth in these communities can play an important role in the expansion of SASH going forward.

COMMUNITY ORGANIZATIONS AND LOCAL GOVERNMENTS. Community organizations and local governments currently serve as catalysts for homeowners' participation in SASH. GRID partners include Habitat for Humanity, the San Diego Housing Commission, and the Faith-Based Community Development Corporation, and a select group of municipalities, among others. To date, these organizations have helped SASH to recruit new participants by sending out letters about SASH directly to their members/participants and sharing information about SASH with their members/participants in one-on-one and group settings. To date, GRID has not compensated these partners for their assistance. Further discussion on the role of community organizations is included in section 2.2.

EQUIPMENT DISTRIBUTORS. In cases in which GRID installs the system, GRID secures the equipment from distributors. GRID typically works with one of three main suppliers for the modules, though GRID changes its vendors periodically to obtain better prices from other sources. GRID does not have any signed agreements with suppliers; instead, GRID provides projections to its suppliers about the expected volume, helping to secure discounted pricing. In a limited number of cases, GRID has obtained the equipment through donations.

In cases in which SPP contractors install the system, the SPP contractors procure materials themselves. Many have their own relationships with the suppliers; such arrangements may include serving as a dealer for a given supplier, operating as an independently-owned franchise of a vertically integrated manufacturer-distributor-installer, formal supply agreements, or established relationships in the field.

In either case, there is typically no interaction between the distributor and the homeowner. This is consistent with the situation in the broader solar market.

EXTERNAL DONORS. External donors often help to fill the funding gap. In cases where the SASH incentive does not provide for a fully subsidized system and the homeowner is not willing or able to provide the full amount of gap funding, GRID pursues funding from external donors. GRID may prepare an application for funding from these external donors or may negotiate a funding agreement with them. External funders range from private enterprises to local governments and private foundations. The external donors, in turn, provide some level of gap funding to one or

more projects to enable the project. In most cases, the homeowner does not interact with the external donor at all or may interact indirectly through GRID. GRID performs this role regardless of whether or not it installs the system. Section 2.4 includes additional discussion about GRID's use of external donors.

INDEPENDENT LENDERS. In cases in which SASH participants assist in providing the gap funding needed to pay for their system, independent lenders are one option for obtaining the necessary capital. To date, the homeowner has served as the primary conduit to these entities; GRID has not taken the lead in this area, preferring instead to work with external donors to secure the gap funding required. Independent lenders may include credit unions, banks, or other financial institutions. Per the ruling that instituted SASH, third-party providers of power purchase agreements (PPAs) may not participate in the SASH market.[6] Section 2.4 includes further discussion about the role of independent lenders in this market.

INVESTOR-OWNED UTILITIES. As outlined in the decision that established SASH,[7] the IOUs interact with both GRID and the customer. Fundamentally, the relationship with GRID is a contractual one in which the IOUs collectively fund GRID's operations as well as the incentives that it pays out. In addition, the operational component of the IOU-GRID relationship includes GRID's application to the IOUs for interconnection and net metering for the facilities that are installed through SASH. In the event that a program participant is eligible for low-income energy assistance, GRID also facilitates enrollment in the appropriate EE programs. After system installation, the homeowner continues to receive an account statement from the utility that details net energy usage, and the amount due to the utility or the amount owed to the homeowner, as appropriate.

JOB TRAINING PROGRAMS. Many job training programs in California have begun to offer solar installer courses in recent years.[8] Whether as a result of funding from the American Recovery and Reinvestment Act (ARRA) or through other internal initiatives, these programs produce workers with the basic skills necessary to install new PV systems. Many graduates lack the hands-on experience needed to secure stable employment, however. GRID uses the participants of these job training programs in two distinct ways:

- Volunteers on projects that GRID installs: GRID gives job trainees preference when selecting volunteers to help install a system. In some cases, job trainees may approach GRID and apply directly to the organization. In other cases, job training programs have established agreements with GRID to send a team of job trainees to install systems one or more times during a term.

- Paid staff for projects installed by SPP: GRID requires that each SPP use at least one graduate from a job training program on the team that installs each SASH project.

Through their participation in the installation of projects, these job trainees interact with the homeowners. This is a unique feature of SASH; ***though it may occur in the general solar market, it is not required***. Section 2.5 includes additional discussion about the job creation aspects of SASH.

[6] California Public Utilities Commission. November 2007. "Opinion Establishing Single-Family Low-Income Incentive Program within the California Solar Initiative. Decision 07-11-045.
[7] Ibid.
[8] SASH market actor interviews, 2010.

POLICY MAKERS. State legislators and regulatory agencies have established the regulatory framework under which the solar market operates. Relevant policies include the state's renewable portfolio standard (RPS), net metering laws, interconnection processes, the funding mechanism for SASH program, the parameters within which the SASH program operates, and the definition of low-income. CPUC also provides oversight for the overall operation of the investor-owned utilities (IOUs) and of GRID. As is the case in the general solar market, these policy makers do not interact directly with the homeowner or other market actors.

SUBCONTRACTOR PARTNERSHIP PROGRAM. The Subcontractor Partnership Program (SPP) enables external solar installation contractors to participate in SASH as installers. GRID has only recently begun subcontracting installations through the SPP but anticipates increasing the volume and percentage of projects installed through SPP. SPP contractors must submit to a review and approval process administered by GRID in order to be included in a list of pre-qualified bidders on projects that GRID chooses not to install. In this role, the SPP contractor does not need to interact with the homeowner to market its services; GRID is responsible for all up-front marketing and conducts value-added services like energy education and training on the use and maintenance of system, along with an energy efficiency audit. GRID is responsible for paying the SPP contractor based upon completion of certain milestones.

Once chosen for a job by GRID, the SPP contractor will interact with the homeowner as needed for the installation of the system. As detailed earlier in this section, the SPP contractor may also work with the equipment distributor to obtain the necessary equipment and with the building agencies to secure necessary permits and the local government's inspection. These aspects of the SPP contractor's role are consistent with those in the general solar market.

THIRD-PARTY INSPECTORS. GRID uses third-party inspectors for all installations to ensure high quality installations and to meet CPUC requirements. The third-party inspectors visit each site after the installer reports that the installation is complete, usually within three weeks of notification. GRID works with the California Center for Sustainable Energy (CCSE) in SDG&E territory and Burnham Energy in SCE and PG&E territories. For SPP-involved systems, GRID also provides funding for these third-party inspectors to apply methods that use additional rigor to maintain high standards of quality for all installations. GRID contracts directly with the third-party inspectors and funds the basic field verification inspection through the SASH administrative budget while funding the additional level of rigor for SPP projects through GRID.

2.1.2 Market Size and Eligibility under PUC 2852

This section provides a brief history of the evolution of eligibility requirements for SASH and then provides an estimate of the number of eligible residents in California. Four main criteria define a household's eligibility for SASH:

- The home receives electrical service from one of three IOUs (PG&E, SCE, or SDGE&E);
- The applicant must own the single-family residence and reside in it;

» The households annual income must be at or below 80 percent of the Area Mean Income (AMI);[9] and

» The home must fit within the definition of "affordable housing," as prescribed by P.U. Code 2852.[10]

The first three of these criteria are straightforward and have remained consistent throughout the life of the SASH program.

The requirements to meet the fourth criterion have changed twice during the course of the program and are the most difficult to interpret. Since the inception of SASH in November 2007, policy makers have evolved this definition in the following manner:

» Initially, P.U. Code 2852 defined eligible households as those with (1) incomes at or below 80% of area median income, and (2) a deed restriction requiring the resale of their house to another low-income household.[11] Under these criteria, there was concern that the pool of eligible homeowners was too small. The evaluation team's interviews with community housing organizations confirmed the perception that the deed restriction requirement presented a barrier to program participation. This requirement limited program outreach and recruiting because it required household buy-in before a program representative could determine whether the household met the eligibility criteria.

» In October 2009, AB1551 changed the deed restriction requirement in P.U. Code 2852 and allowed households to be subject only to a resale restriction or qualifying equity sharing agreement. The legislation, however, did not define the meaning of the term "resale restriction."

» In May 2010, CPUC clarified its interpretation of the resale restriction.[12] CPUC's clarification maintained consistency with the federal definition used by federal affordable housing programs, which define resale restrictions to include deed restrictions and "presumed resale restrictions," which apply if the house is located in an Empowerment or Enterprise Zone.

[9] This level varies by household size and by county. For example, in 2009, 80 percent of Oakland's AMI was $66,250 for a four-person household. In 2010, 80 percent of Riverside County's AMI was $52,000, for a four-person household. http://www.oaklandnet.com/government/hcd/policy/docs/IncomeLimits2009.pdf, http://www.kmtg.com/fck_uploads/2010%20Riverside%20County%20Redevelopment%20Agencies%20Worksheet.pdf

[10] California Public Utilities Commission. June 2010. *California Solar Initiative Program Handbook.* http://www.cpuc.ca.gov/NR/rdonlyres/14CD3F07-7B87-49AB-8505-D5F09403A833/0/CSIProgramHandbookJune2010v3_2.pdf (Accessed January 23, 2011)

[11] CPUC D. 07-11-045.

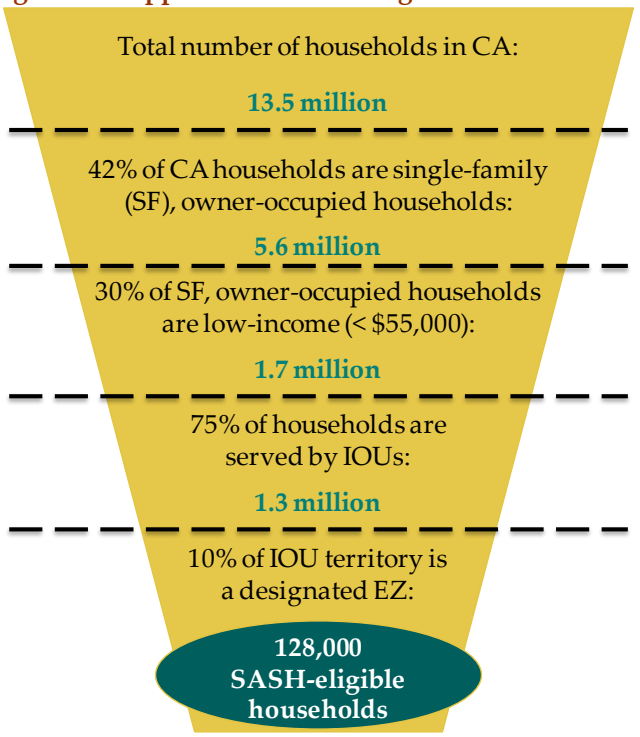
[12] GRID Alternatives. May 24, 2010. Memo Defining 'Resale Restriction' for SASH Program.

Empowerment Zones and Enterprise Zones are geographically targeted areas of economic development. There are four Empowerment Zones and 42 Enterprise Zones located throughout California.[13] The purpose of these zones is to encourage business investment and promote the creation of new jobs in blighted neighborhoods through special state and local incentives.[14] Tax incentives are provided to stimulate job creation and retention and business investment in buildings and equipment. The Federal government designates Empowerment Zones, while the state designates Enterprise Zones. While there is no list of households that are located within one of these zones, the federal Department of Housing and Urban Development (HUD) and the state provides address locators, which indicate whether a household falls into an Empowerment or Enterprise Zone.[15,16] Appendix H includes sample maps of these areas. With the revision of P.U. Code 2852 to include these zones as an eligibility condition, GRID Alternatives can use these maps and address locators to reach potential participants through door-to-door outreach as well as targeted marketing.

Census data from the 2009 American Community Survey was leveraged to estimate the pool of homeowners eligible for the SASH program. Of the approximately 13.5 million households in California, 5.6 million, or 42%, are single-family, owner-occupied homes.[17] Approximately 30% of those households have a household income of $55,000 or less, which is used as a general estimate of a qualifying income for SASH (at or below 80% of AMI); thus, there are 1.7 million, single-family, owner-occupied households with a household income less than $55,000. Another program requirement is that a household is located in an IOU service territory. The three IOUs serve approximately 10 million California residents, or 75% of California households.[18] Applying this ratio to the 1.7 million households gives 1.3 million single-family, owner-occupied low-income homes in an IOU service territory. Finally, if an estimated 10% of IOU service territory is designated an enterprise zone or an empowerment zone this yields approximately 128,000 households that are eligible for the SASH program.

[13] California Department of Housing and Community Development. 2010. Enterprise Zone Program, http://www.hcd.ca.gov/fa/cdbg/ez/EZoverview.html.
U.S. Department of Housing and Urban Development. 2010. California RC/EZ/EC Communities. Available: http://www.hud.gov/offices/cpd/economicdevelopment/programs/rc/tour/ca/.
[14] California Association of Enterprise Zones. 2007. "About Enterprise Zones." Available: http://www.caez.org/About-Enterprise-Zones/index.html.
[15] U.S. Department of Housing and Urban Development. 2010. Empowerment Zone Address Locator. Available: http://egis.hud.gov/ezrclocator/
[16] Enterprise Zone Maps and Street Ranges. Available: http://www.hcd.ca.gov/fa/cdbg/ez/enterprise/newmap.html
[17] U.S. Census Bureau. 2009. American Community Survey Public Micro-Use Data. Available: http://www.census.gov/acs/www/data_documentation/public_use_microdata_sample/
[18] U.S. Department of Energy, Energy Information Administration. 2009. EIA 861: Annual Electric Power Industry Report. Available: http://www.eia.doe.gov/cneaf/electricity/page/eia861.html

Figure 2-3. Approach to Estimating SASH Market Size



Source: Navigant analysis 2011.

2.1.3 Program Participants' Profile

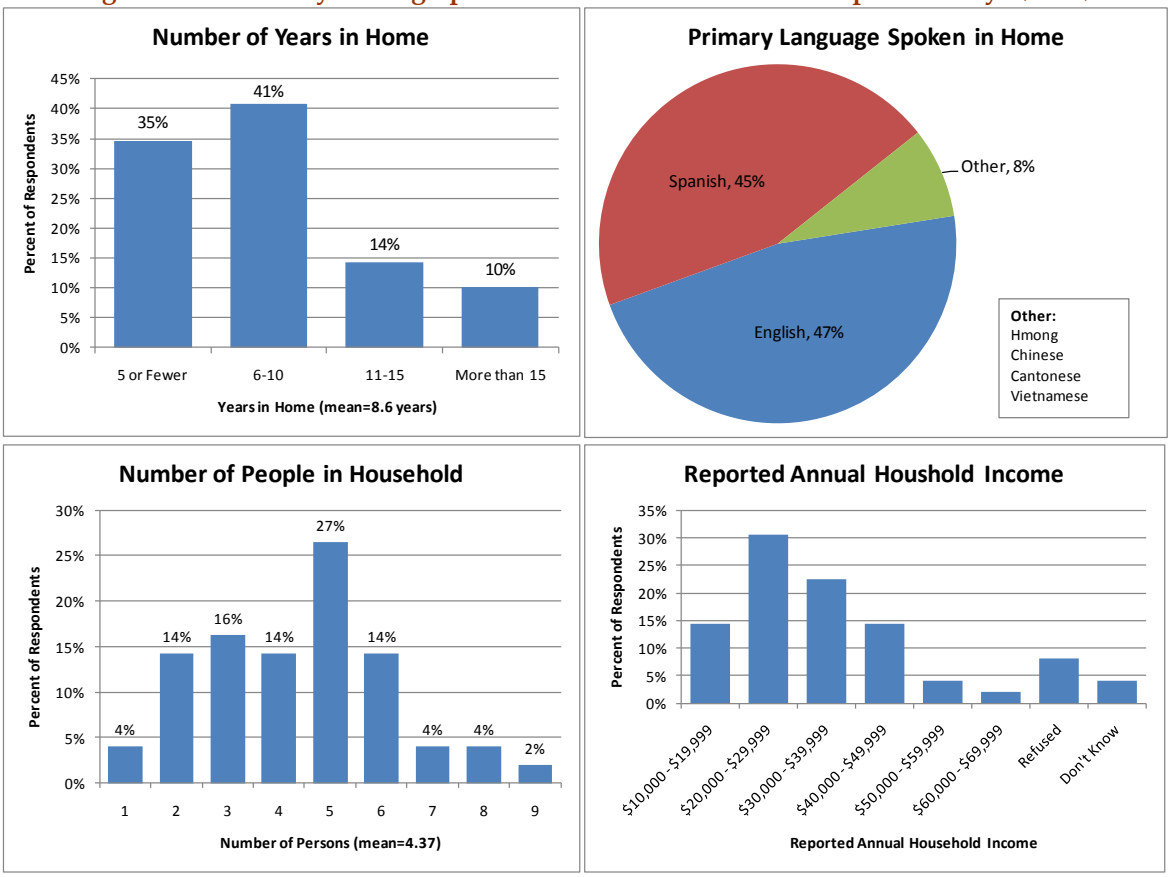
This section provides a snapshot of the diverse population that has participated in SASH to date. In order to consider the SASH program's ability to serve this market, the market must first be defined. Understanding the characteristics of a typical SASH program participant enables the evaluation team to assess the SASH program's ability to address the unique concerns of the target market. The evaluation team gathered SASH program participant information from both the participant phone surveys and the SASH program database.

The following two sets of summary graphics present representative findings from the participant phone surveys. The graphs in Figure 2-4 summarize the demographic characteristics of SASH participants, revealing GRID's progress toward one of the priorities that the CPUC outlined in its decision instituting SASH: "The outreach program should include a component geared to populations that are not proficient in English and persons with disabilities."[19] SASH program participants are more likely to primarily speak Spanish in their homes than the general population. Among survey respondents, 45 percent reported speaking primarily Spanish in their homes, compared to 28 percent for the state as a whole. In part, this may be due to a higher concentration of Spanish-speaking households in one of the populations eligible for SASH; Spanish-speaking households are 175 percent more likely to fall below the poverty line in California than English-speaking households in the state are.[20]

[19] CPUC D. 07-11-045.

[20] U.S. Census Bureau. 2010. *2005-2009 American Community Survey.* Available: http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=04000US06&-qr_name=ACS_2009_5YR_G00_S1603&-ds_name=ACS_2009_5YR_G00_

Figure 2-4. Summary Demographic Statistics from SASH Participant Surveys (n=49)



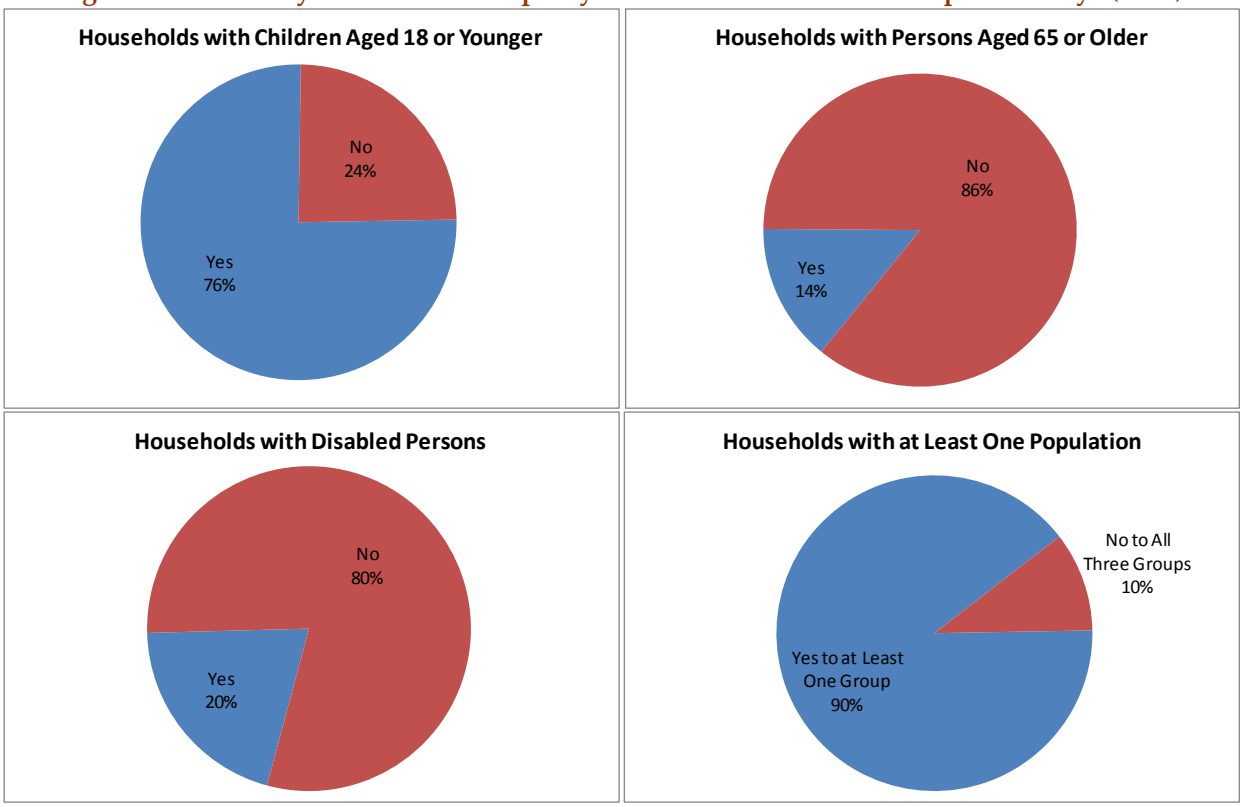
Source: Analysis of SASH Participant Survey 2010.

The latter two graphs in Figure 2-4 provide some insight into the income levels of SASH participants.[21] The above data do help reveal the overall difficulties likely faced by many SASH participant households, with the majority of annual incomes reported between $20,000 and $40,000, and an average of 4.4 persons per household.

[21] It is important to remember that SASH eligibility relies on calculations of a household's percentage of the Area Median Income (AMI), which considers both gross annual income level and number of persons in a household into a comparison against the average for a particular geographic area. AMI statistics, pulled from the GRID Program data, are presented later in this section.

Figure 2-5 summarizes the likelihood that SASH participant households include vulnerable populations: children aged 18 or younger, persons 65 or older, and disabled persons. As shown, a majority (76 percent) of respondents reported having at least one child in their household. Ninety percent of households include a member of at least one of the three vulnerable populations.

Figure 2-5. Summary Household Occupancy Statistics from SASH Participant Surveys (n=49)



Source: Analysis of SASH Participant Survey, 2010.

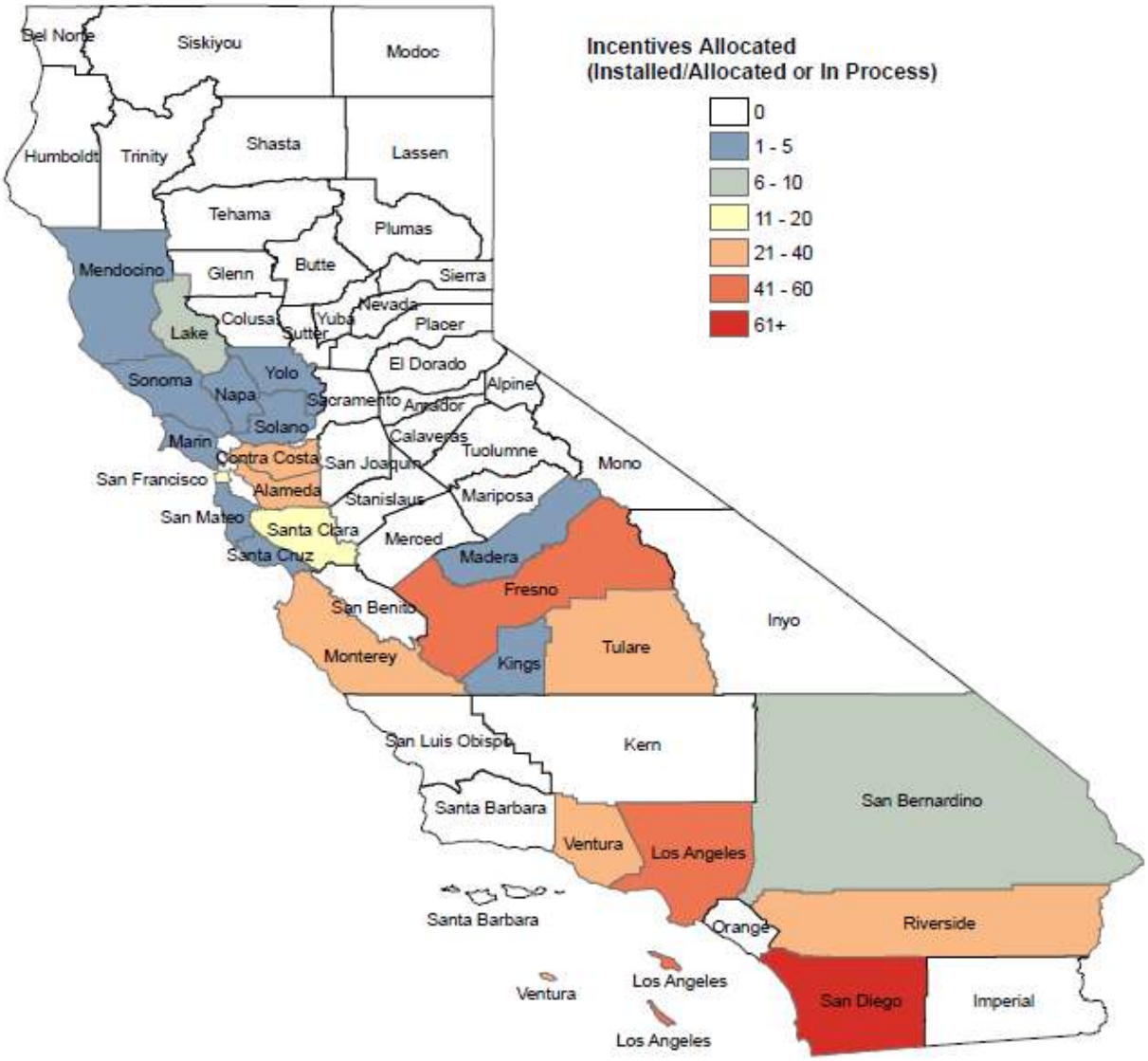
The role of children in the household will likely have important implications for the long-term effects of the SASH program. Research from the energy efficiency evaluation community indicates that children retain knowledge gained about energy efficiency and continue to practice energy efficiency behaviors as long as six years after initially encountering the information.[22] SASH can realize similar effects by including children in the educational component of the outreach and possibly incorporating them into the installation of the project (via age-appropriate tasks). To date, it appears that GRID has not focused on this aspect of its outreach, given that it is not a program priority. GRID may explore this aspect of its outreach further in the future to more intentionally engage the children that live in more than three-quarters of SASH participants' households may.

[22] Hanson, R. & Siegel, D.F. 1995. "The Enduring Effects of an Elementary School Energy Education Program." *Proceedings of the 1995 International Energy Program Evaluation Conference, pp. 493-504.* NEPEC.

2.1.4 Geographic Distribution

Turning to the SASH project records in GRID's program database, Figure 2-6 shows the distribution of projects by county. The projects on this map include those categorized as Installed/Completed as well as those categorized as In-Process that had recorded incentive allocations as of November 1, 2010. Eight counties (Alameda, Contra Costa, Fresno, Los Angeles, Monterey, San Diego, Tulare, and Ventura) account for 78 percent of the projects installed or completed to date. GRID has office locations in four of these eight counties – Alameda, Fresno, Los Angeles, and San Diego; this likely drives higher participation rates in the areas near GRID offices.

Figure 2-6. Distribution of SASH Projects (Installed/Complete or In Process with Incentives Reserved) by County through 10/31/10



Source: Analysis of GRID's Program Database, November 1, 2010.

2.1.5 Participation in and Eligibility for Utility Low-Income Electric Rate and Energy Efficiency Programs

According to GRID's records, a majority of program participants in each of the three utility territories were already paying CARE electric rates prior to involvement with the SASH program. As shown in Table 2-1(which includes both Installed/Completed and In-Process projects), at least 45 homeowners (or just fewer than 10 percent) have switched to CARE rates from regular residential rates over the course of their interaction with GRID. Missing entries for additional customers' original rate schedules, however, suggest that total could be as high as 85 homeowners (or 18 percent).

Table 2-1. Summary of SASH Participants' Electric Rate Changes

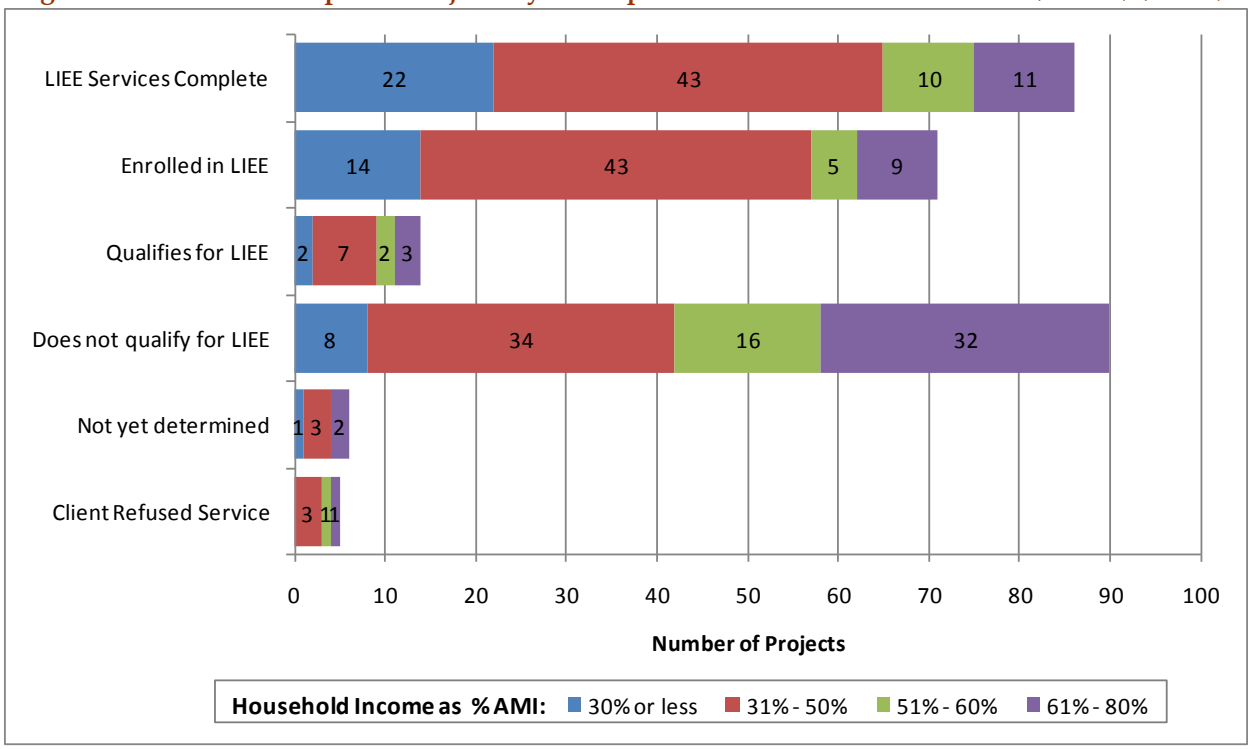
Utility	Low Income Rate Prior to SASH Participation	Retained Standard Rate	Switched from Standard Rate (E-1 or D) to Low Income Rate (E-1 CARE or D-CARE)	No Record for Original Rate; New Rate Recorded as Low Income Rate (E-1 CARE or D-CARE)	Total
PGE	212	32	28	2	274
SDG&E	55	7	2	1	65
SCE	67	3	15	37	122
Total	334	42	45	40	461

Source: Analysis of GRID's Program database, November 1, 2010.

GRID's data also indicate the status of participants' enrollment in the Low-Income Energy Efficiency (LIEE) program of their respective utility. Figure 2-7shows the number of projects installed or completed for each category of energy efficiency status designation.[23] Each bar also reveals the number of program participants at each qualifying income level by percentage of area median income (AMI). The majority of SASH system recipients either qualifies for or is enrolled in LIEE programs.

[23] Two projects were missing energy efficiency status data, while 13 were missing AMI%. (n=272).

Figure 2-7. Installed/Completed Projects by Participant EE Status and Income Level (%AMI) (n=272)



Source: GRID's Program Database, November 1, 2010.

There is some discrepancy in the income thresholds that dictate eligibility for CARE/LIEE, SASH, and the Family Electric Rate Assistance Program (FERA).[24] Whereas the CARE/LIEE and FERA income thresholds are set at the state level, the CSI income threshold is set at the county level. The CSI income threshold is based on the area median income (AMI), which the U.S. Department of Housing and Urban Development (HUD) establishes annually at the county level. AMI takes into account variations in the cost of living at the county level. FERA's income threshold is set at 125% of the CARE/LIEE income threshold for each household size.

The degree of difference in income threshold between SASH and CARE/LIEE and FERA varies by county and by household size.

- In smaller households (1-4 persons), SASH's thresholds are uniformly higher than those for CARE/LIEE and higher than those for FERA in about half of the counties that are served at least in part by PG&E, SCE, and SDG&E.

[24] In addition to the income threshold, LIEE has three additional eligibility screens:

- LIEE measures must be feasible (sufficient space and condition of home, cost effective to install);
- Home must be more than five years old and
- Home may not have received LIEE services in the past ten years.

Further, PG&E and SCE will deem a household ineligible if they cannot communicate with the client after three or four tries. SASH team continues to submit names that have contact issues up to three times, even after being deemed ineligible.

» For larger households (5-8 persons), there is a wider variation in the differences. In about half of the county-household size combinations in the eligible counties, SASH income limits are higher than those set by CARE/LIEE. In many counties, SASH's income thresholds drop off more quickly than FERA's as the household size increases; as a result, the share of counties in which the SASH income threshold is higher than the FERA thresholds drops from 31% in a five-person household to just 12% in an eight-person household.

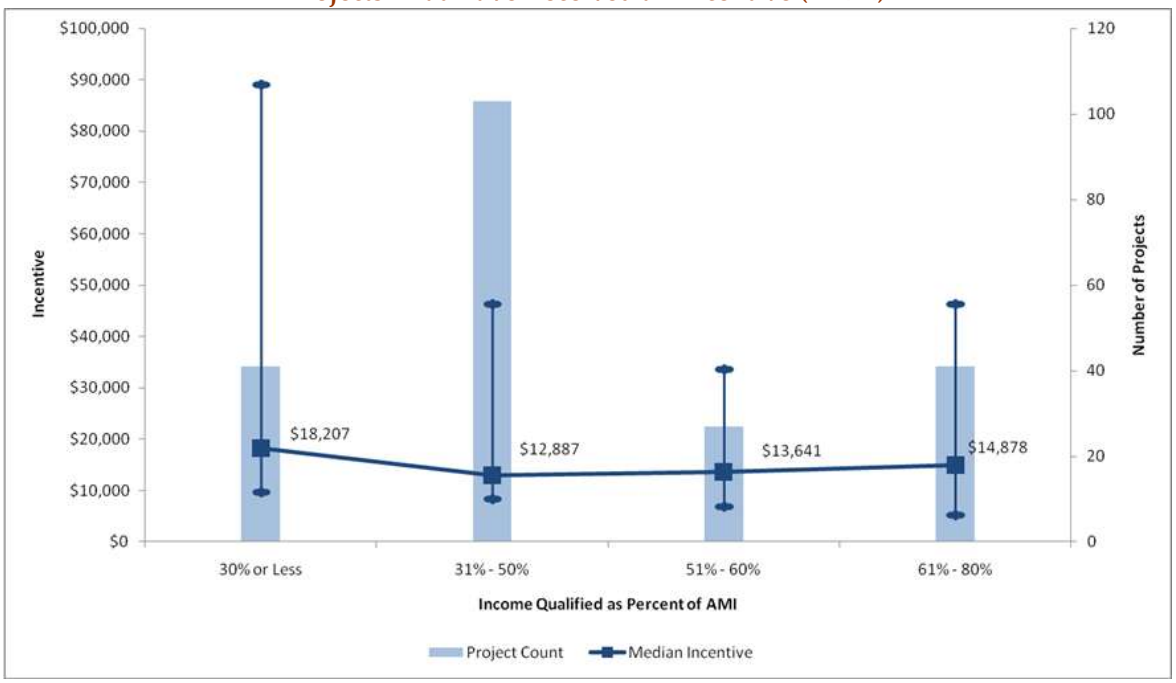
» In larger households (5-8 persons), the SASH threshold is often lower than those for CARE/LIEE and FERA are. This occurs in 41% of the counties for five-person households and 59% of the counties for eight-person households.

Overall, this means that a significant portion of SASH participants will not qualify for CARE/LIEE or FERA. The results presented in Figure 2-7 are consistent with that expectation.

2.1.6 Participant Income and Incentive Levels

For each AMI category, Figure 2-8 illustrates the distribution of installed projects and the average incentive dollar amount applied to cover system equipment and installation costs.[25] According to program rules, GRID uses a combination of a homeowner's CARE eligibility and tax liability to determine appropriate incentive categories and amounts. The error bars represent the minimum and maximum incentive dollar amount awarded in each income category.

Figure 2-8. Project Count and Incentive Statistics by Income AMI Category for Completed/Installed Projects That Have Received an Incentive (n=212)



Source: Analysis of GRID's Program Database, November 1, 2010.

[25] Of the 215 installed/completed projects with a record for "Incentive Received Date," three (3) were missing accurate information for either one or both Income Qualified as AMI% or Incentive Level.

As shown, nearly half (49 percent) of SASH participants with installed or completed systems fall in the 31- to 50-percent AMI range. However, these homeowners have received lower average incentives than those in higher categories. Homeowners in the lowest AMI category (30 percent or less) have received the highest average incentives. In part, this may be due to differences in the system sizes needed for households in each of these ranges.

An important conclusion from Figure 2-8 relates to the levels of incentives that homeowners with household income less than 50 percent AMI have received. Program rules specify that these homeowners are eligible to receive a fully subsidized 1 kW system, up to a total cost of $10,000; alternatively, they may choose to have a larger unit placed on their home under the usual incentive schedule.[26] Only 23 homeowners for whose systems incentives have already been awarded have chosen to receive a fully subsidized 1 kW system. Of those 23 homeowners, only six have received incentives through SASH that fully cover the cost of the system; i.e., these systems have installed costs under the $10,000 cap (averaging $8.72 per Watt total system cost). The remaining 17 homeowners have received systems that were not fully covered by the SASH subsidy; these systems had installed costs that averaged $10.01 per Watt. It is unclear what factors have driven this disparity, but it does appear to be an issue for GRID to address in the future.

2.2 *Market Channels*

This section focuses on the channels that GRID uses to distribute information about the SASH program to its target populations. Section 2.2.1 discusses the channel strategy that GRID has used to date and includes a description of the key market actors that interact with the program. Section 2.2.2 summarizes the channels through which SASH participants report initially learning about the program and highlights how two market segments respond differently than the market as a whole. Finally, section 2.2.3 includes analysis of alternative channel strategies that GRID could use to disseminate information about the program and conduct other tasks, highlighting the major advantages and disadvantages of each approach.

2.2.1 GRID's Channel Strategy to Date

GRID has taken a hands-on approach to distribution of its product and restricted other organizations' ability to promote the product to potential homeowners. The main benefit to this approach is that GRID retains control over the message, the quality of customer experience, and the risk associated with ensuring that homeowners meet the complex program requirements. In addition, the homeowners experience a more knowledgeable and dedicated sales force.

[26] California Public Utilities Commission. June 2010. *California Solar Initiative Program Handbook.* http://www.cpuc.ca.gov/NR/rdonlyres/14CD3F07-7B87-49AB-8505-D5F09403A833/0/CSIProgramHandbookJune2010v3_2.pdf (Accessed January 23, 2011)

GRID conducts initial research to identify residents who are likely to be eligible for SASH using information from cities, affordable housing developers, and public databases that include information about residents in Empowerment and Enterprise Zones. Then, GRID targets these likely-eligible residents directly. By spending the time up front to identify eligible residents, GRID reduces the amount of time required to "screen out" a large number of interested but ineligible residents.

GRID leverages relationships with strategic partners where possible but aims to retain control over the message, customer experience, and qualification process to the extent possible. GRID uses channels to distribute information about the program, but they play a minimal role in selling the product, closing the sale, or maintaining a long-term customer relationship on behalf of GRID. GRID's selection of channels enables GRID to address three main challenges: GRID's emerging connection to the neighborhoods, clients' lack of awareness of the technology and its benefits, and concerns about the broader implications of the system installation for either the homeowners association or the city inspectors. The channels that GRID uses to disseminate information about the program include the following:

» **Direct Mail** – GRID's brochures and mailers often serve as the first point of contact with a potential client. The brochures are glossy, in color, and translated into six different languages (all on one mailer) to grab the recipient's attention and to increase the likelihood that they will read and understand it. The brochure asks the clients to call GRID. GRID also works with cities and affordable housing developers to write a letter to introduce GRID. In some cases, cities and developers decline to provide GRID with specific names and addresses due to privacy concerns; in these cases, the partner organization will mail the letter directly.

» **Telephone Calls and Home Visits by GRID's Sales Force** – Only GRID staff are currently empowered to meet with potential clients to determine their interest in and eligibility for SASH incentives. GRID follows the targeted mailers with phone calls and door-to-door outreach. In some cases, GRID staff use the door-to-door outreach at the time of a new installation, leveraging their presence in the neighborhood to reach out to potential clients who may have a connection to the existing client; door hangers may be left in the event that no one answers the door.

» **Community Organizations** – Community organizations have provided lists of qualified homes and have helped with outreach. They have helped GRID to build trust with clients in their neighborhoods. Sometimes a city or a local Habitat for Humanity will send out a letter to introduce GRID and the SASH program. GRID attends community meetings in church basements, at community halls, and at homeowner association meetings. Sometimes, one client in the neighborhood will host a meeting in his/her home.

  Native American tribes have played a much more direct role in outreach. GRID has trained them on the types of documents needed, and the tribes conduct most of the direct outreach because it is more effective. GRID has one subcontractor on some of those projects who has been working with the tribes since program inception.

» **Social Networking –** GRID reports that the most effective outreach comes after GRID installs a system in a neighborhood and the neighbors talk to one another. Sometimes qualified homes, such as the Habitat for Humanity homes, are clustered in neighborhoods, providing a fertile ground for recruitment. This social networking stems from the clients' satisfaction with the service provided by GRID and successfully addresses the issue of trust in these communities.

» **General Advertising and Public Relations** – GRID occasionally uses traditional advertising methods and public relations efforts (e.g., news coverage of new installations) to create a broader awareness about the SASH program. For example, one of GRID's staff members received an award on *Good Morning America* for her work with low-income families. This type of general publicity builds awareness in the broader marketplace about the benefits of SASH and also builds awareness in the target community. The disadvantage of these types of efforts is that such stories often generate false leads for SASH; the interested parties do not meet the eligibility requirements, and SASH must still spend time and resources following up with them.

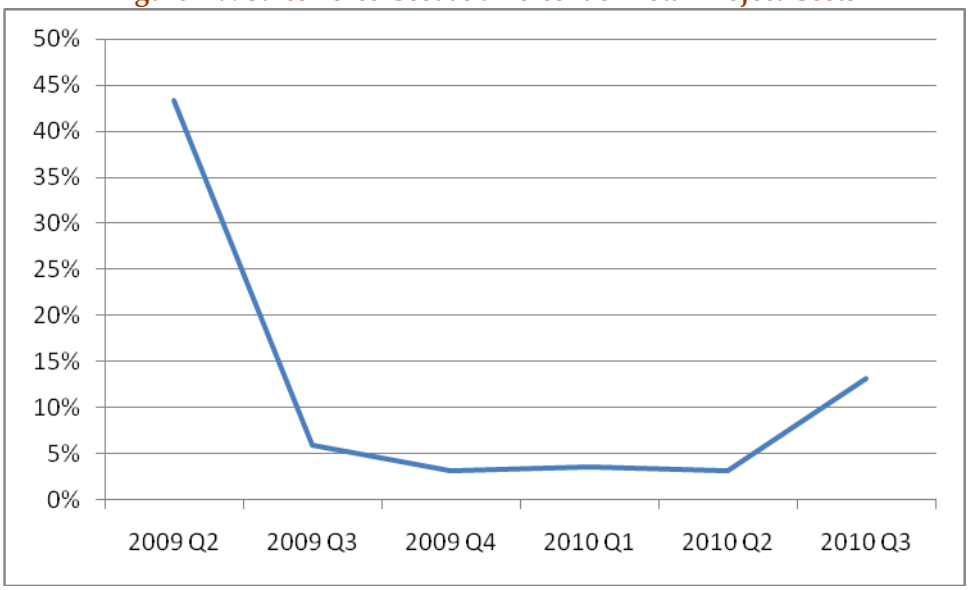
By maintaining control over the distribution channel, GRID seeks to address a major hurdle to successful distribution of PV systems among the target population: trust. Developing trust within the neighborhoods and with the clients is a critical part of the project development process. In some cases, the low-income population has been taken advantage of, and the community is wary of outsiders. GRID's *Outreach Manual* provides a very detailed approach to working with clients, ensuring that the Outreach Coordinators take the steps necessary to make the clients feel comfortable. Any breach of trust with an individual homeowner puts at risk the projects in development in the entire neighborhood.

By maintaining control over the channels of distribution, GRID reduces the risk that an outside partner might (even inadvertently) jeopardize the work done to develop trust and to ensure GRID achieves fairly low sales force costs as a percent of total project costs. This is a traditional metric applied to marketing departments and can be used to indicate the effectiveness of sales staff.[27] The cost of the time that GRID staff have billed to marketing and outreach is the best proxy for sales force costs. Total project costs were considered for all projects with a status of Installed or Complete; the figures for these categories of projects are considerably more accurate than those projects in earlier stages of development. This analysis attempts to match sales force costs with actual installations, realizing that many projects are not "sold" and installed in the same quarter.[28]

As expected, the sales force costs as a percent of total project costs have decreased significantly since the program began. Initial startup costs skewed the ratio in the early part of the program, but the ratio became more reasonable once project installations began. The spike in the third quarter of 2010 is likely a result of the methodology used to calculate this metric; the database did not include all installations from that quarter at the time that the data was provided to the evaluation team, resulting in the allocation of project costs across fewer quarters than normal.

[27] Kotler, P. and K.L. Keller. 2006. *Marketing Management Twelfth Edition.* Pearson Prentice Hall: New Jersey.
[28] The PA Assessment Report includes a full description of the approach used to allocate these costs in the Program Statistics section.

Figure 2-9. Sales Force Cost as a Percent of Total Project Costs



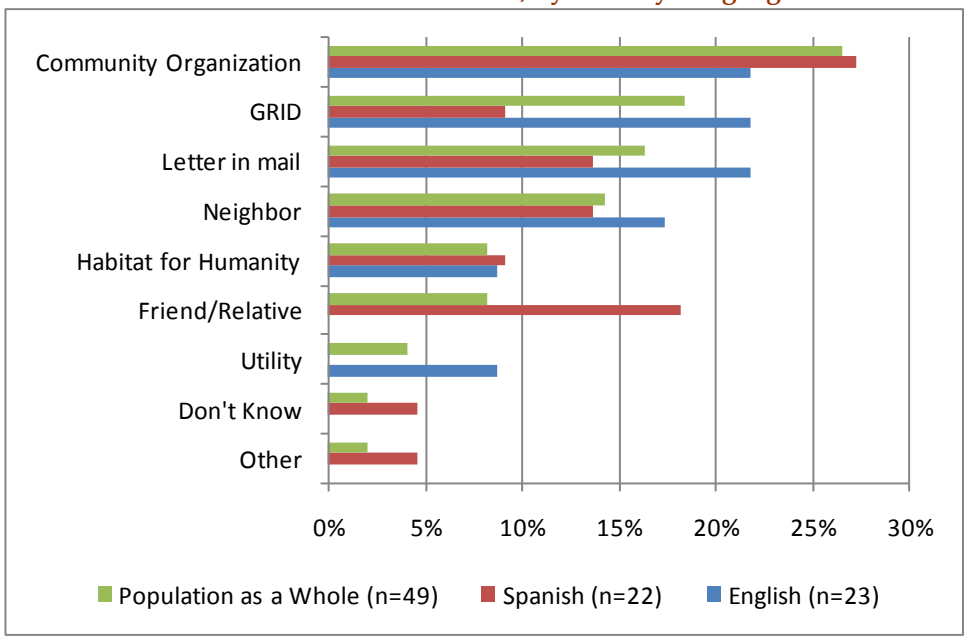
Source: Analysis of GRID Quarterly Reports (Sales Force Cost) and GRID Database (Total Project Costs).

2.2.2 Customer-Reported Channels to SASH

SASH participants report first hearing about SASH through all of the channels that GRID uses. Some channels are cited more frequently than others, and some segments of the population report encountering SASH for the first time through some channels more frequently than others do. This section is based on analysis of the results of a survey conducted with SASH program participants as part of this evaluation. Figure 2-9 identifies the first source from which survey participants report initially learning about the SASH program. The chart breaks down the results into three main populations:

- The population as a whole – all respondents to the survey;
- Spanish – households reporting that Spanish is the primary language spoken in the home; and
- English – households reporting that English is the primary language spoken in the home.

Figure 2-10. Initial Source of Information about GRID, by Primary Language Used in the Home (n=49)



Source: Analysis of SASH Participant Survey, 2010.
Note: The four survey respondents that indicated that they primarily speak a language other than English or Spanish in the home were excluded from the category breakdown. The small sample size distorted the apparent importance of the categories. Two of them indicated that GRID was their initial source of information about SASH, and two of them indicated that a community organization was. These responses are included in the "Population as a Whole" data.

As seen in Figure 2-10, more than one-third (34 percent) of SASH participants who responded to a survey report that they learned about SASH through a community organization, including Habitat for Humanity. These community organizations already serve as trusted partners in the participants' lives, and it is possible that their referral to GRID incites action on the part of homeowners more frequently than other channels for this reason. This finding held true across households with a range of primary languages in the home.

Survey participants identified GRID as their first source of information about SASH second most frequently (19 percent of the time). This response was more common among households in which English is the primary language (22 percent) than in households in which Spanish is the primary language (9 percent). It is unclear why this is the case, but several possibilities exist:

- GRID staff target English-speaking households more heavily;
- Households in which English is not the primary language may not be connected to GRID's network to the same extent that English-speaking households are;
- Other channels may be more important to households in which English is not the primary language, leading to better recall of the other channels.

Regardless of the reason, GRID's sales force does appear to initiate nearly one-fifth of the contacts.

Figure 2-10 highlights two other interesting findings:

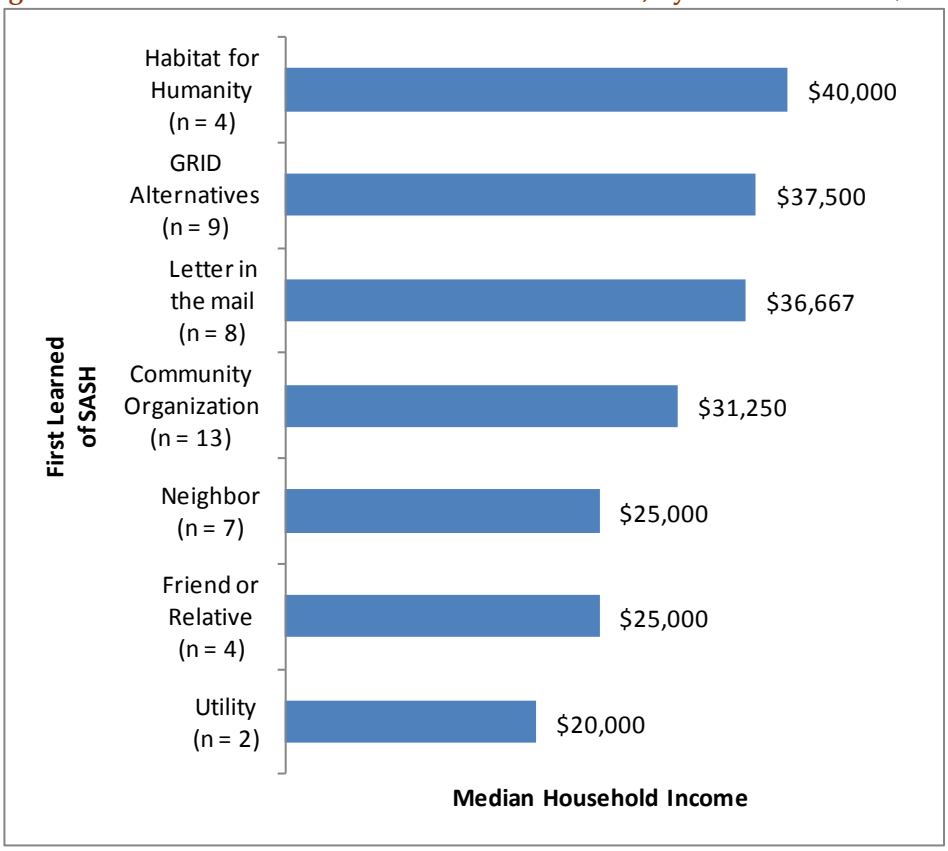
» Households in which English is the primary language respond better to direct mail and utility-driven efforts (e.g., bill stuffers) to communicate information about SASH. This may indicate that the direct mailings should consider targeting mailings more carefully based on the language spoken in the home. This approach would require that key resources (e.g., community organizations or publicly available databases) indicate which language is the primary language in each home.

» Referrals from friends, relatives, and neighbors are most effective in Spanish-speaking communities. Among the primarily Spanish-speaking households, 18 percent report that a friend or relative introduced the SASH program to them and another 14 percent indicate that it was a neighbor. Comparatively, no households in which English is the primary language report first hearing about SASH through friends and relatives and only 17 percent report hearing about SASH through a neighbor. This is an important cultural consideration and should be used to enhance market penetration among primarily Spanish-speaking households.

As shown in Figure 2-11, the data also suggest differences in the participants' responses to different sources of information about SASH based on annual household income. Households with the lowest levels of income are more likely to recall hearing about SASH from a source that they trust – a community organization, or a friend, relative, or neighbor. On the other hand, high incomes are associated with initial introduction to SASH from a relatively less known quantity – GRID itself or through a letter in the mail.

This information indicates that GRID will have more success with the lowest-income communities when it gains the trust of those communities or closely allies with an organization (or individual) that the community already trusts. This aligns with GRID's approach to maintain consistent messaging and customer experiences while building trust with its clientele by maintaining close control over the channels used to reach its customers. It is also consistent with GRID's approach to leverage community organizations' relationships with low-income homeowners to acquaint the target market with GRID's offerings.

Figure 2-11. Initial Source of Information about SASH, by Annual Income (n=47)



Source: Analysis of SASH Participant Surveys, 2010.

2.2.3 Analysis of Alternative Channel Strategy Options

During the interviews conducted as part of this evaluation, some stakeholders suggested that GRID should consider alternative channel strategies. Specifically, a representative of one of the community organizations interviewed indicated that GRID should pay community organizations a referral fee for introducing clients to GRID. In addition, a contractor suggested that GRID allow contractors to conduct the business development efforts (including initial outreach, education about the program, and determine who installs the systems).

Table 2-2 examines the advantages and disadvantages of GRID's current channel strategy and three alternative structures to assess the extent to which any changes to the current strategy would benefit the program.[29]

[29] This channel strategy analytical framework adapted from Kotler, P. and K.L. Keller. 2006. *Marketing Management Twelfth Edition.* Pearson Prentice Hall: New Jersey.

Table 2-2. Overview of Benefits and Risks to a Selection of Outreach Channel Strategies

Channel Strategy	Brief Description	Benefits	Risks
Exclusive Distribution	GRID serves as sole organization that can conduct specific outreach on program eligibility and approve applications; strategic partners participate in outreach efforts, mostly behind the scenes (uncompensated)	» **Ensures consistent messaging, quality of customer interaction, and qualification of eligible customers** » Sales force is most dedicated and knowledgeable about the program compared with other options presented » **Maintain low costs of sales due to few unqualified referrals** » Stream of applicants more closely matches GRID staff's bandwidth for managing projects	» **Direct link between contractors and the affordable housing market may delay contractor understanding of market needs and challenges** » Some strategic partners may not be willing to conduct outreach without compensation, resulting in a smaller pool of applicants in some areas
Selective Distribution	GRID and a select group of other strategic partners (e.g., community organizations), who are compensated, conduct specific outreach on program eligibility; only GRID can approve project	» **Can leverage existing networks of community organizations, reaching a greater number of end users** » Acknowledges that community organizations may have budget constraints and creates financial incentives for prioritizing efforts to promote GRID	» **Increases cost of distribution by adding new cost category and additional training** » **Reduces GRID staff's exposure to the market, reducing the ability to adjust the program to meet shifting market needs** » Potential for inconsistent messaging, variation in quality of customer interaction » The financial compensation will create a perverse incentive to push ineligible households through, creating conflict between community organizations and disappointed households » Risk that every future request of the strategic partners will require a financial incentive

Channel Strategy	Brief Description	Benefits	Risks
Selective Distribution	GRID and a select group of other compensated strategic partners (e.g., community organizations) conduct specific outreach on program eligibility and approve applications	» **Can leverage existing networks of community organizations, reaching a greater number of end users** » Acknowledges that community organizations may have budget constraints and creates financial incentives for prioritizing efforts to promote GRID	» **GRID assumes risk for partners' diligence in qualifying new participants** » **Creates a major change to the current model, requiring significant time and effort to reallocate resources, develop and execute appropriate training, and manage additional sales force.** » Increases cost of distribution by adding new cost category and additional training » Reduces GRID staff's exposure to the market, reducing the ability to adjust the program to meet shifting market needs » Potential for inconsistent messaging, variation in quality of customer interaction » The financial compensation will create a perverse incentive to push ineligible households through, creating conflict between community organizations and disappointed households. » Risk that every future request of the strategic partners will require a financial incentive

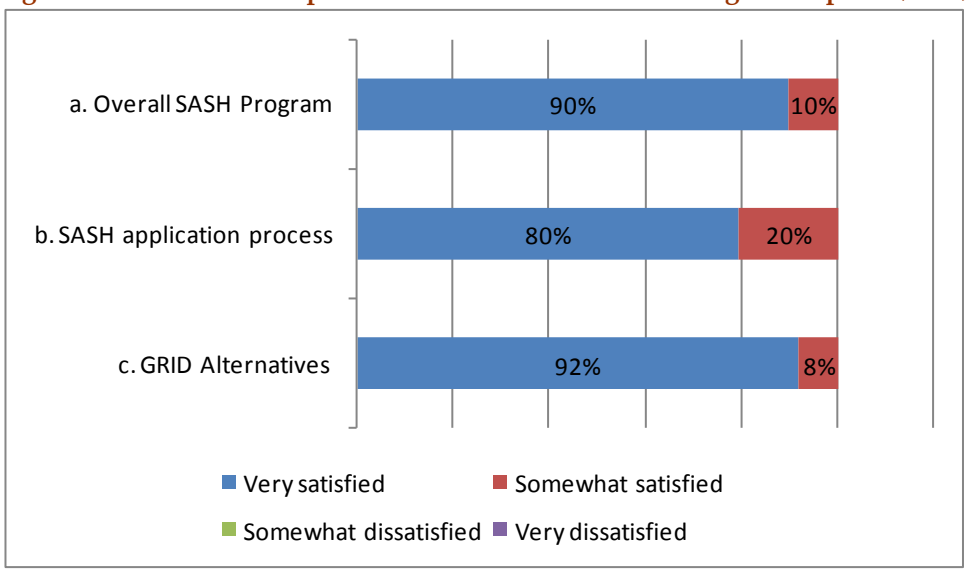
Channel Strategy	Brief Description	Benefits	Risks
Intensive Distribution	GRID and a wide range of other compensated organizations (e.g., contractors) conduct specific outreach on program eligibility and approve applications	» Provide financial incentive for contractors to engage with the low-income community earlier in the project development cycle » **Reach a broader target market more quickly**	» **GRID assumes risk for partners' diligence in qualifying new participants** » **Creates a major change to the current model, requiring significant time and effort to reallocate resources, develop and execute appropriate training, and manage additional sales force.** » Potential for inconsistent messaging, significant variation in quality of customer interaction due to differences in goals between GRID and contractors » The financial compensation will create a perverse incentive to push ineligible households through, creating conflict between community organizations and disappointed households » Increases cost of distribution by adding new cost category and additional training » Reduces GRID staff's exposure to the market, reducing the ability to adjust the program to meet shifting market needs

Source: Navigant analysis, 2011.

GRID's channel strategy to date is consistent with its integrated implementation approach and its efforts to build trust with the communities that it serves through SASH. As highlighted in section 2.2.1, this strategy has enabled GRID to keep sales force costs relatively low. As outlined in section 2.2.2, this approach has also resulted in client interest through a variety of sources providing initial introductions.

Survey data also indicate that GRID clients are very satisfied with their experience with GRID to date. As shown in Figure 2-12, 92 percent indicate that they are very satisfied with GRID, and 90 percent report that they are very satisfied with the SASH program as a whole. None of the respondents scored GRID lower than somewhat satisfied in any of the categories related to the channel strategy.

Figure 2-12. SASH Participant Satisfaction with Various Program Aspects (n=49)



Source: Analysis of SASH participant survey, 2010.

The benefit-risk analysis summarized in Table 2-2 indicates that the current channel strategy is still appropriate at this point in the program implementation. Developing the brand equity required to meet SASH's ambitious goals requires a dedicated and knowledgeable sales force that keeps the best interests of SASH and its participants in mind. The alternative structures allow for more much variation in messaging and customer experience than the current one does, creating the potential to erode GRID's brand equity and damage the long-term effectiveness of the SASH program.

At some point in the future, it may be appropriate to revisit the effectiveness of SASH's channel strategy. Reconsideration may occur after GRID has developed broader recognition and acceptance within the market. Additional investigation may also be warranted as more SPP contractors install systems and become more familiar with the requirements of SASH and the distinct needs of the low-income population. Neither of these scenarios are the case at this time, however.

2.3 *Drivers and Barriers to Participation in SASH*

To date, participants in SASH report a fairly consistent set of drivers and barriers to participate in SASH. Section 2.3.1 will first outline the reasons that homeowners participate in the SASH program. Then, section 2.3.2 will summarize the barriers to participation. This section is based on the results of a survey conducted with SASH participants as part of this evaluation; the survey guide is available in Appendix F.

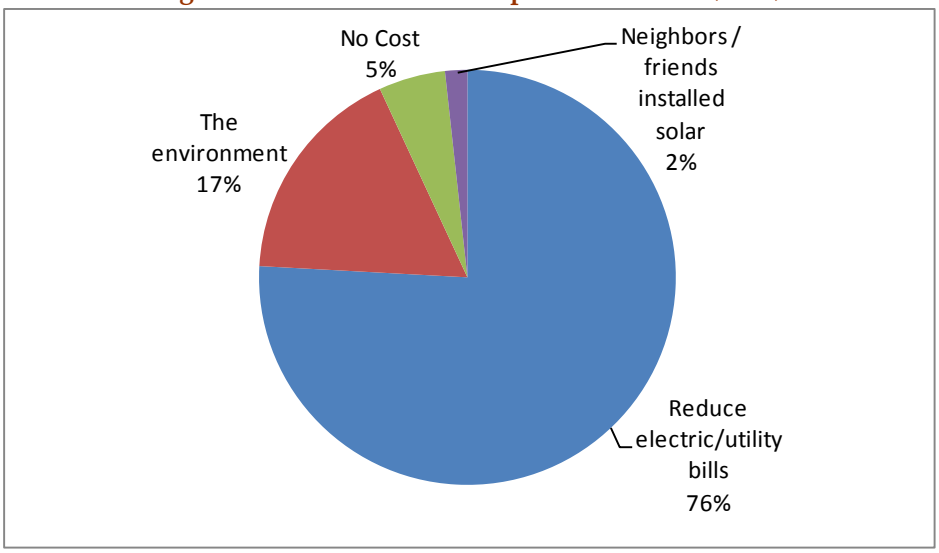
2.3.1 Drivers to Participation

The main reason that homeowners participate in the SASH program is financial. As seen in Figure 2-13, over three-quarters of respondents (76 percent) indicate that the reduction in their electric or utility bills was the primary reason that they participated in SASH. This was consistent with more open-ended answers provided by other participants in in-depth interviews.

In addition, another 17 percent of survey respondents indicated that helping the environment was their primary reason for participating in SASH. Participants who responded to in-depth interview questions cited this reason more frequently, and several of those who did mention the environment had previously tried to install solar on their homes; those previous attempts were unsuccessful because the price was too high for the homeowner. Anecdotal evidence from the in-depth interviews indicates that homeowners whose primary driver is the environment are also more likely than those citing the reductions in electric bills to report having completed a variety of energy efficiency retrofits as well.

The role of neighbors and friends is a less significant factor in the decision to actually install solar than it is in introducing the SASH program to homeowners. As discussed in section 2.2, friends, relatives, and neighbors are the most common channels for homeowners to initially learn about SASH. As the homeowners learn more about the program and about the benefits of solar, however, the role of the community becomes less important than the financial motivations.

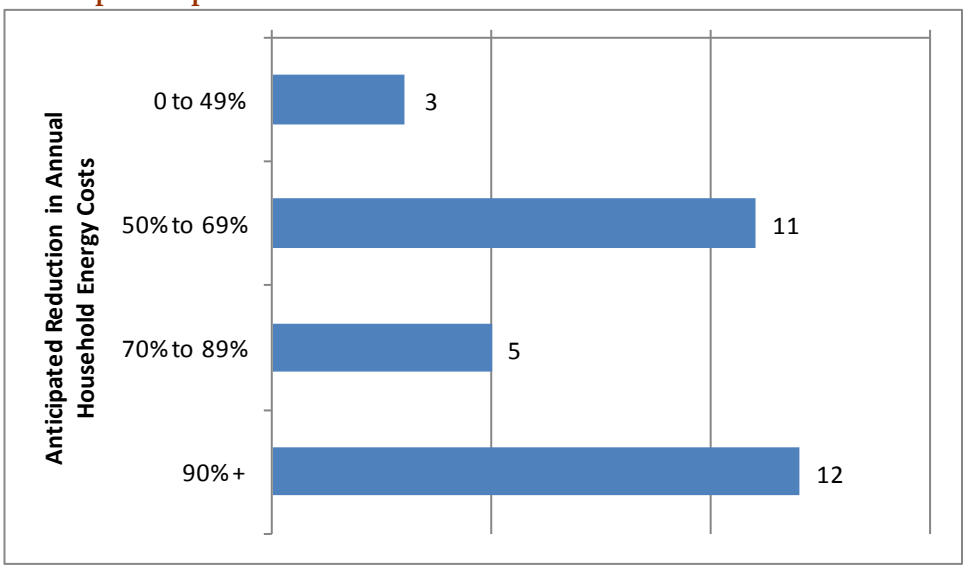
Figure 2-13. Drivers to Participation in SASH (n=58)



Source: Analysis of SASH Participant Survey, 2010.

Considering the anticipated electric cost savings that survey respondents expect makes the financial motivator even more compelling. When asked how much they believe that they will save in annual electric costs following the installation of their PV system, nearly all respondents indicate that they will save at least 50 percent. The evaluation team developed this estimate based on two questions in the survey that asked respondents to report (1) their annual electric costs before the PV system and (2) their expected annual electric costs after the PV system.

Figure 2-14. Participant-Reported Reduction in Annual Household Electric Costs Due to SASH (n=31)



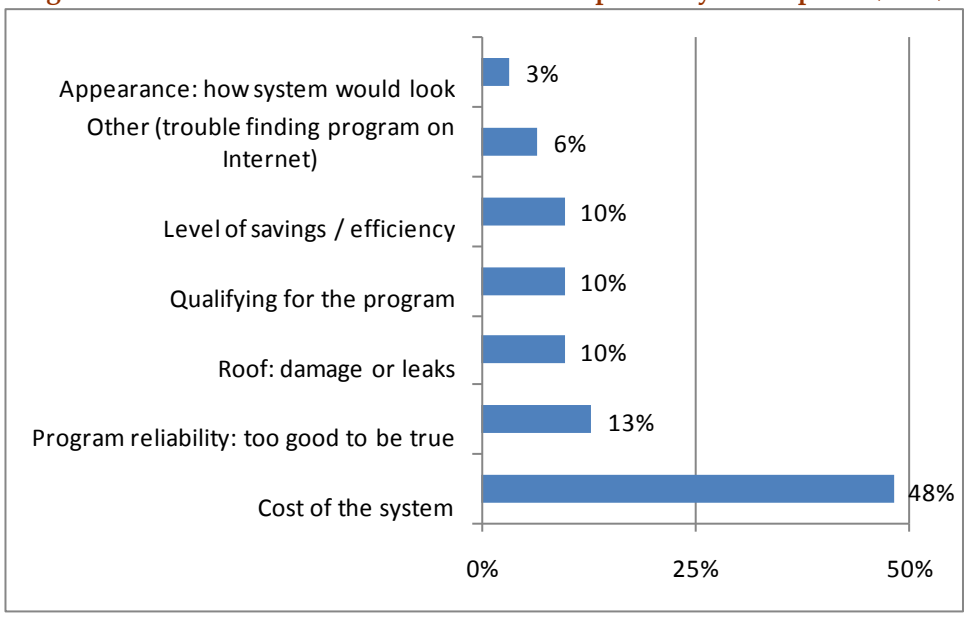
Source: Analysis of SASH Participant Survey, 2010.

2.3.2 Barriers to Participation

On the other side of the equation lay the barriers to participation in SASH. More than half (55 percent) of survey respondents indicated that they had some concerns about participating in SASH when they first learned about it. This rate was fairly consistent, regardless of the source of the initial introduction to SASH. The initial concerns that the survey respondents indicate align closely with the issues that GRID staff have indicated that they frequently address in the field, as specified in the PA Assessment Report. This section outlines the issues raised by the 55 percent of survey respondents who indicated that they did have some initial concerns about the SASH program.

As seen in Figure 2-15, the main concern that participants initially have about SASH is about the cost of the system. Despite this initial concern, all of the respondents to this question decided to participate in the SASH program. As discussed further in Section 2.4, GRID has used a variety of strategies to overcome this barrier to participation.

Figure 2-15. Initial Concerns about SASH as Reported by Participants (n=31)



Source: Analysis of SASH participant surveys, 2010.

Two of the concerns voiced by participants' relate to their initial perception of the credibility of the SASH program. Of the participants who indicated that they did have initial concerns about the program:

- 13 percent indicated that they thought the program was too good to be true.
- An additional 10 percent had concerns about the level of electric bill savings that they would realize after installing the system.

As with the concerns about cost, GRID deployed successful techniques to build trust with these homeowners and convince them to participate in the program. These responses indicate that GRID is still in a period of building credibility with the low-income communities throughout the state and underpin the need for GRID to retain the ability to maintain control of its ability to do so.

The survey respondents indicated that they had fewer concerns about technical issues than the financial, credibility, and administrative issues. Ten percent of respondents needed reassurance that the system would not damage their roof or cause leaks, and an additional three percent indicated that they had concerns about the aesthetics.

It is not clear how frequently these barriers actually prevent homeowners from participating in the program.[30] In-depth interviews with non-participants indicate that the cost of the system remained the most significant barrier. One interview respondent indicated that the resistance from a homeowners association prevented eight homeowners in their association from participating; the homeowners association was mainly concerned about the potential damage that the systems would cause to the roofs

[30] The survey conducted for this evaluation did not include non-participants due to cost limitations and practicality considerations.

and the associated costs. As GRID develops better approaches for contacting eligible low-income households, future evaluations may consider dedicating more resources to surveying non-participants to better understand the issues in the broader population.

2.4 *Project Financing and Incentive Levels*

This section provides an overview of the financial structure for SASH projects. It includes a discussion of incentive levels and the source and amount of financing required to cover any gap between project cost and the prescribed incentive. Data sources include interviews and surveys with program administrators, participants and nonparticipants, as well as project statistics from the SASH program database as of November 1, 2010.[31] In most cases, the analysis in this section focuses on projects completed through September 30, 2010, to facilitate quarterly comparisons.

2.4.1 Installed Project Costs

The evaluation team assessed the per-Watt cost of installed SASH projects and compared them to the per-Watt costs of projects in CSI's general market programs to determine the competitiveness of the prices received by GRID for installed systems.

SASH PROJECT AVERAGE COSTS

The evaluation team used the installation and equipment cost estimates in GRID's database to evaluate the per-Watt$_{AC}$ cost for SASH projects installed through the third quarter of 2010. As shown in Table 2-3 and Figure 2-16, the average cost of a project completed through SASH has decreased from $7.80/W in the second quarter of 2009, to an overall average of $7.18/W through the third quarter of 2010. Note that these figures include only equipment and installation costs and exclude the allocation of GRID's program administrator costs.

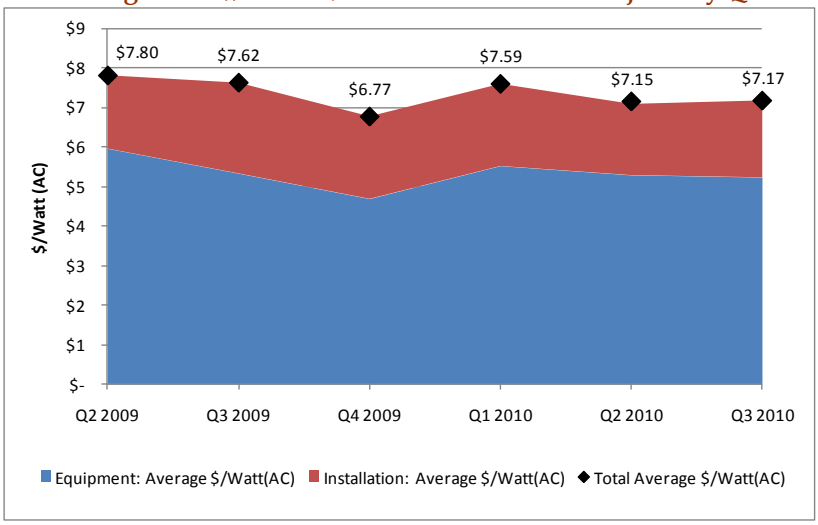
Table 2-3. Average Cost ($/W$_{AC}$) for Installed SASH Projects

Quarter	Equipment Costs	Installation Costs	Total Installed Costs	Installations Completed	kW (AC) Installed	Avg. $/Project	Equip. Avg. $/Watt	Install Avg. $/Watt	Total Avg. $/Watt
Q4 2008	$0	$0	$0	0	0.000				
Q1 2009	$0	$0	$0	0	0.000				
Q2 2009	$38,174	$11,890	$50,064	3	6.415	$16,688	$5.95	$1.85	$7.80
Q3 2009	$237,180	$102,170	$339,350	24	44.554	$14,140	$5.32	$2.29	$7.62
Q4 2009	$572,093	$254,801	$826,893	51	122.197	$16,214	$4.68	$2.09	$6.77
Q1 2010	$722,645	$272,334	$994,979	56	131.109	$17,767	$5.51	$2.08	$7.59
Q2 2010	$1,139,750	$388,898	$1,528,648	78	215.870	$19,598	$5.28	$1.80	$7.15
Q3 2010	$1,025,185	$381,182	$1,406,367	71	196.182	$19,808	$5.23	$1.94	$7.17
Total	$3,735,025	$1,411,276	**$5,146,301**	**283**	716.327	**$18,185**	**$5.21**	**$1.97**	**$7.18**

Source: Analysis of GRID's Program database, November 1, 2010.

[31] See Appendices A, D, and F for the interview and survey guides.

Figure 2-16. Average Cost ($/Watt$_{AC}$) for Installed SASH Projects by Quarter (n=283)



Source: Analysis of GRID's Program database, November 1, 2010.

Equipment costs have generally decreased since the program's launch. In the fourth quarter of 2009, equipment costs showed a notable, sharp decline and increased volatility. Installation costs have fluctuated less significantly. Per-Watt installation costs decreased notably in the second quarter of 2010, the same quarter in which GRID began subcontracting installations. It is too early in the SPP, however, to evaluate whether overall project costs will decrease under the SPP, as GRID administrative costs associated with the subcontractor program must also be considered.

Comparison to CSI General Market Costs

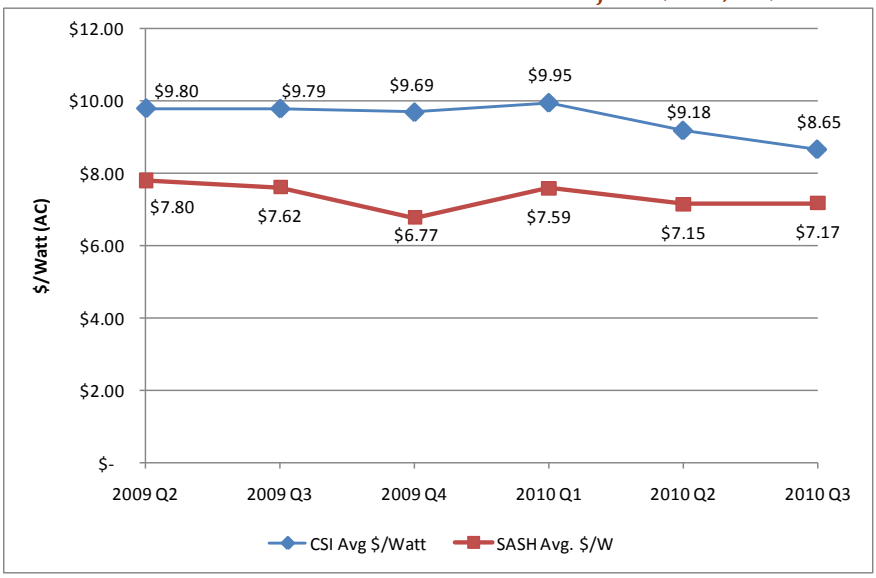
Using publicly available CSI statistics from the California Solar Statistics website,[32] the evaluation team compared SASH project installed cost statistics to those of CSI's general market program. Figure 2-17 shows the average installed cost for general market CSI projects between the second quarter of 2009 and the third quarter of 2010 for projects similar to those installed under the SASH program.[33] Compared to the totals in Figure 2-17, the SASH program's costs appear to be substantially lower than the general market program. This may be partly attributable to GRID's relatively strong reliance on volunteer labor, which reduces the installation labor component of project costs, which typically accounts for 13 to 15 percent of overall project costs.[34]

[32] Go Solar California. 2010. "California Solar Statistics: Cost by Quarter."Available: http://www.californiasolarstatistics.ca.gov/reports/quarterly_cost_per_watt/.

[33] For consistency with SASH's program profile, the analysis of the general market program database included residential projects with capacity of 10kW or less, and a design factor of at least 95 percent.

[34] Personal communication with Paula Mints, Navigant. January 28, 2011.

Figure 2-17. Average Installed Cost for CSI General Market Projects with Characteristics Similar to SASH Projects (n=10,313)

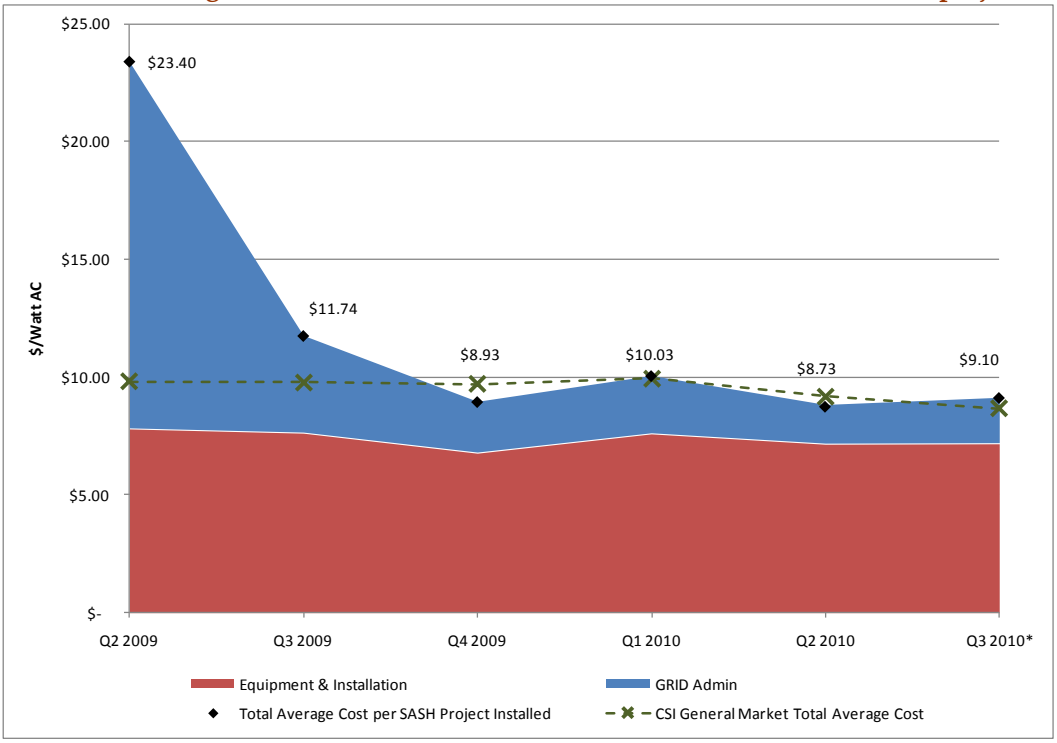


Source: Analysis of California Solar Statistics database, December 30, 2010.
Note: For consistency with SASH's program profile, the analysis of the general market program database included residential projects with capacity of 10kW or less, and a design factor of at least 95 percent.

When GRID's costs for administering the SASH program are allocated to projects installed in each quarter, the average cost per Watt for SASH projects increases by roughly $2.29 over the program's lifetime, as described in the PA Assessment Report. Figure 2-18 shows this inclusive average per-Watt cost for SASH projects as compared to the general market CSI per-Watt costs over the same period. When program administrator costs are incorporated into the summary, the SASH program appears to be relatively in-line with the cost experienced by the CSI program in general.[35]

[35] The California Solar Statistics database does not identify if program administrator costs are incorporated into reported project costs. Navigant assumed any such costs were excluded and that Total Cost is based on a combination of Equipment and Installation (Labor) expenses. In addition to GRID administrative expenses, SASH projects would also accumulate costs associated with each of the investor-owned utilities' administrative requirements for the program (e.g., processing interconnections and incentives).

Figure 2-18. Comparison of Average Installed Total Costs per Project: SASH (including Administrative Costs) versus General Market CSI (similar projects)



Sources: Analysis of the California Solar Statistics database, December 30, 2010, and of GRID's Program database, November 1, 2010.

2.4.2 Incentive Levels

GRID determines the appropriate level of incentive for SASH projects using two primary inputs:

» System size: SASH uses the Expected Performance Based Buy-down Method (EPBB). Based on this calculation, GRID calculates the system capacity and incentive.

» Household income: Households with income at or below 50 percent AMI qualify for a fully subsidized 1-kilowatt (kW) system, with a subsidy not to exceed $10,000.[36] Households with income greater than 50 percent AMI but less than 80 percent AMI qualify for incentives based on federal income tax liability and CARE eligibility, as shown in Table 2-4.[37]

[36] CPUC D. 07-11-045.
[37] CPUC. 2010. "CSI Single-Family Solar Affordable Homes (SASH) Program." Available: http://www.cpuc.ca.gov/PUC/energy/Solar/sash.htm

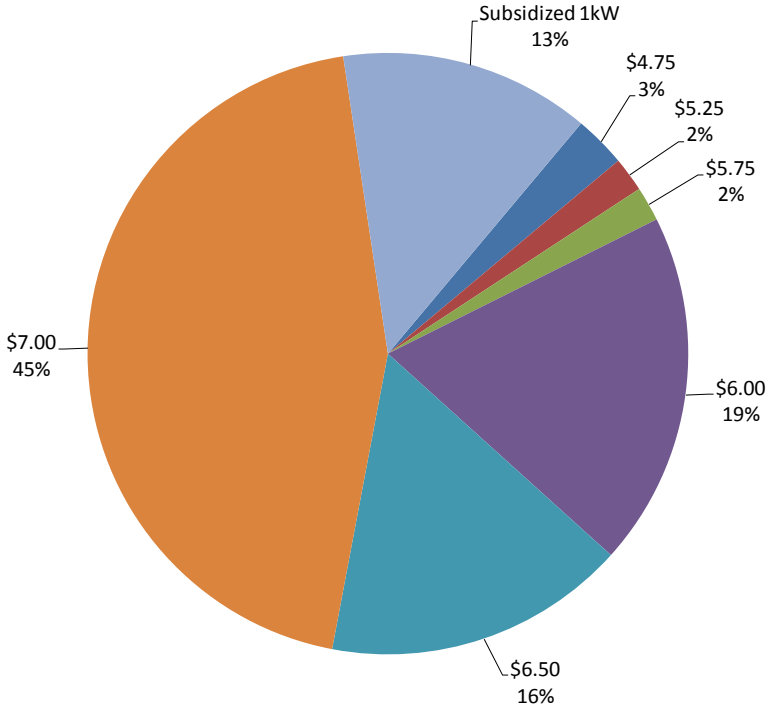
Table 2-4. SASH Incentive Levels ($/Watt)

Federal Income Tax Liability	CARE Eligible	Not CARE Eligible
$0	$7.00	$5.75
$1-$1,000	$6.50	$5.25
$1,000+	$6.00	$4.75

Source: CPUC SASH website, http://www.cpuc.ca.gov/PUC/energy/Solar/sash.htm

The distribution of incentive levels applied to the 215 installed projects for which incentives had been received through the third quarter of 2010 is shown in Figure 2-19. Eighty percent of projects qualified for incentives at the CARE-eligible-household levels, including 45 percent that received the $7.00/W rate. An additional 13 percent received 1kW systems that were fully subsidized through SASH funds.[38]

Figure 2-19. SASH Incentives ($/W) Provided to Installed Projects for Which Incentive Payments Have Been Received (n=215)

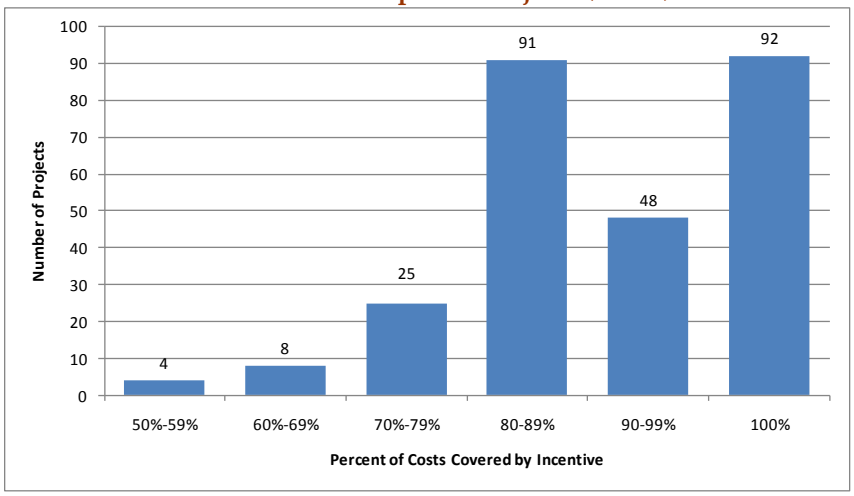


Source: Analysis of GRID's Program database, November 1, 2010.

In many cases, the incentive levels determined by GRID are insufficient to cover calculated system costs for program participants, creating a funding gap. Figure 2-20 shows the percent of system costs covered by SASH incentives for installed projects. For more than half of installed projects, the SASH incentive covers 90 to 100 percent of the system cost; for 86 percent of all installed projects, the SASH incentive covers more than 80 percent of the project cost.

[38] For the 29 installed/completed, fully subsidized projects for which incentives had been received, the average calculated incentive amount was $8.86/W.

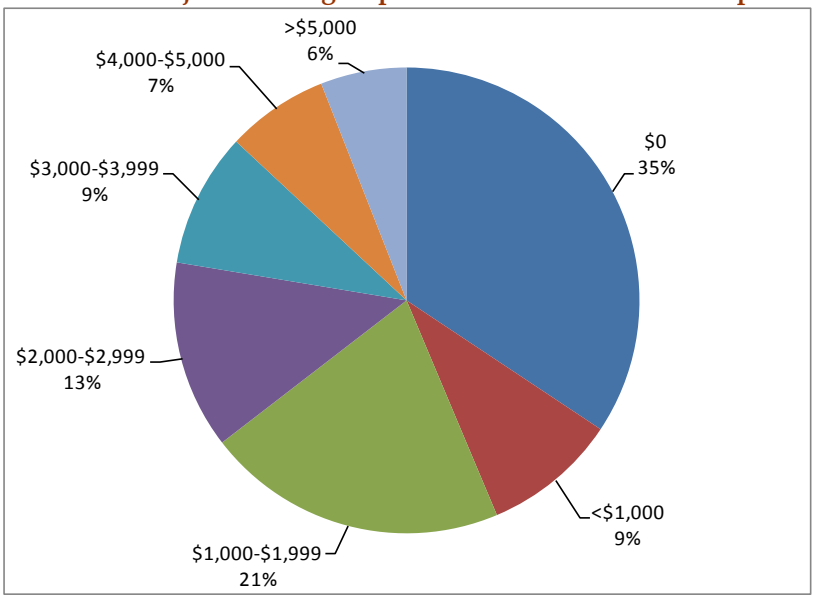
Figure 2-20. Percent of System Costs Covered by SASH Incentive for Installed/Completed Projects (n=268)



Source: Analysis of GRID's Program database, November 1, 2010.

Recognizing that overall system sizes and costs can vary considerably, it is important to consider the associated dollar value of the gap. The pie chart in Figure 2-21 shows the distribution of installed and completed projects by funding gap amount. Generally speaking, about one-third of installed projects had no funding gap, while nearly one-third had a gap of less than $2,000.

Figure 2-21. Distribution of Project Funding Gap Amounts for Installed/Completed Projects (n=268)



Source: Analysis of GRID's Program database, November 1, 2010.

The preceding analysis reveals the degree to which SASH incentives appear to cover a greater percentage of installed system costs than CPUC had anticipated. According to the SASH decision, the CPUC designed the incentive rates in Table 2-4 to cover 50 to 75 percent of total system costs, assuming installed costs averaged $9.00/W.[39] Excluding GRID administrative costs, the total installed cost for completed SASH projects has averaged only $7.18/W, creating the appearance that SASH incentives cover a greater percentage of project costs. However, as presented in the PA Assessment Report, allocating GRID's administration costs to installed projects raises this average system cost to $9.47/W. In a sense, any reduced installation costs from GRID's use of inexpensive or volunteer labor provides an additional subsidy to SASH system recipients. To the degree that GRID allocates system design, permitting, and other project-specific work to its program administration expenses (rather than project-specific installation costs), additional inconsistencies may exist in comparing SASH system costs to the general market program.

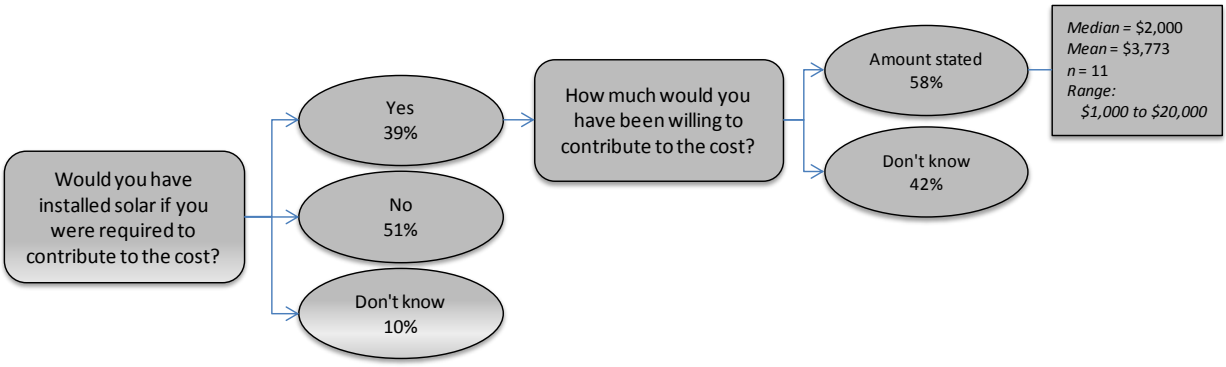
Unfortunately, publicly available CSI general market program data lists only total system costs (e.g., the sum of equipment and installation costs). Determining the degree to which GRID's lower average installation costs create this disparity would require such data for the general market program. Any attempt to compare per-project program administrator costs between SASH and the general market programs would require additional in-depth analysis that is beyond the scope of this report.

2.4.3 Participant Willingness to Pay

Throughout the data collection process, the evaluation team focused on the potential for increased homeowner contributions to SASH system costs. The results of participant telephone surveys indicate that a portion of participants would have willingly contributed to the cost of their SASH systems, either directly or through a loan. When the possibility of expected energy savings were factored into paying back such a loan, participant willingness to contribute borrowed money increased significantly.

Figure 2-22 summarizes the proportion of respondents who stated they would have still installed solar if they were required to contribute financially to the system's cost.

Figure 2-22. Participant Willingness to Contribute to System Costs (n=49)



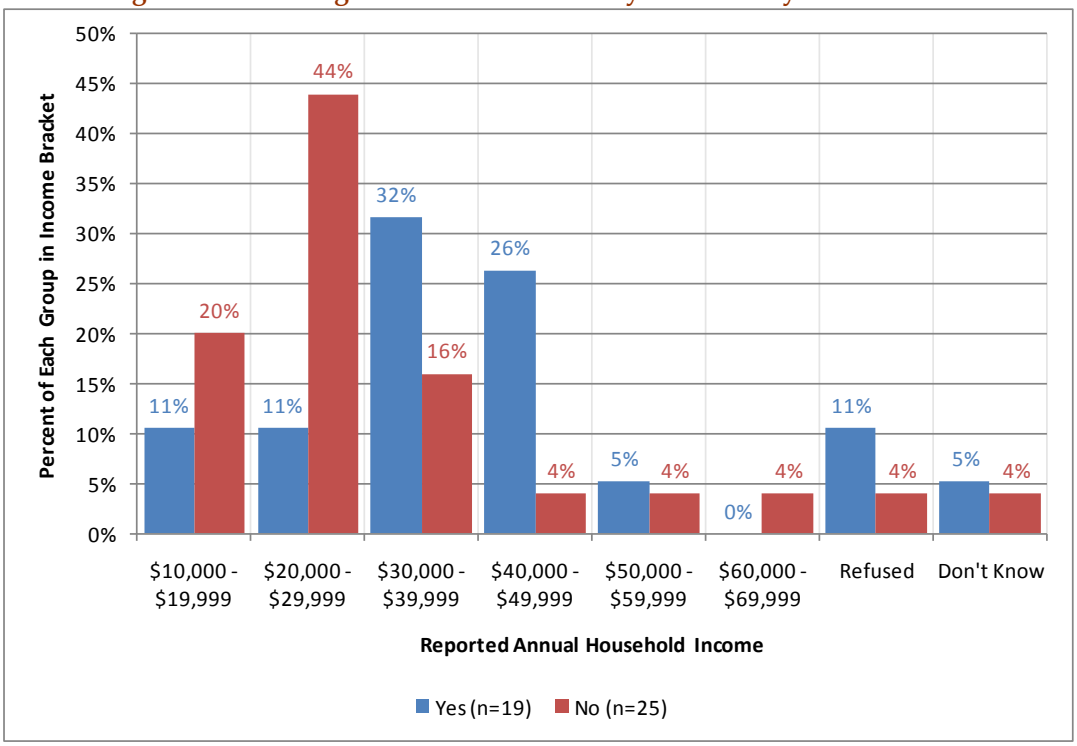
Source: Analysis of SASH participant surveys, 2010.

[39] CPUC SASH decision. http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/75400.htm

Of the 39 percent of respondents who would have contributed, 58 percent provided a dollar value for that potential contribution. The median value provided was $2,000, from a range of $1,000 to $20,000. Based on these responses, it could be estimated that 23 percent of SASH participants would have willingly contributed at least $1,000 toward the installation of a subsidized solar PV system. Recall from Figure 2-21 that nine percent of the funding gaps for installed SASH projects were less than $1,000, with an additional 21 percent falling between $1,000 and $1,999.

For these respondents, Figure 2-23 illustrates the distribution of participants in each category by self-reported annual household income. For example, 44 percent of those who said they would not contribute reported their income as between $20,000 and just under $30,000. The majority (58 percent) of respondents who said they would have contributed to the system's cost reported an annual household income between $30,000 and $50,000. For those who would not have contributed to the system, the majority (64 percent) reported an annual household income between $10,000 and $30,000, revealing an expected relationship between income level and willingness to contribute.

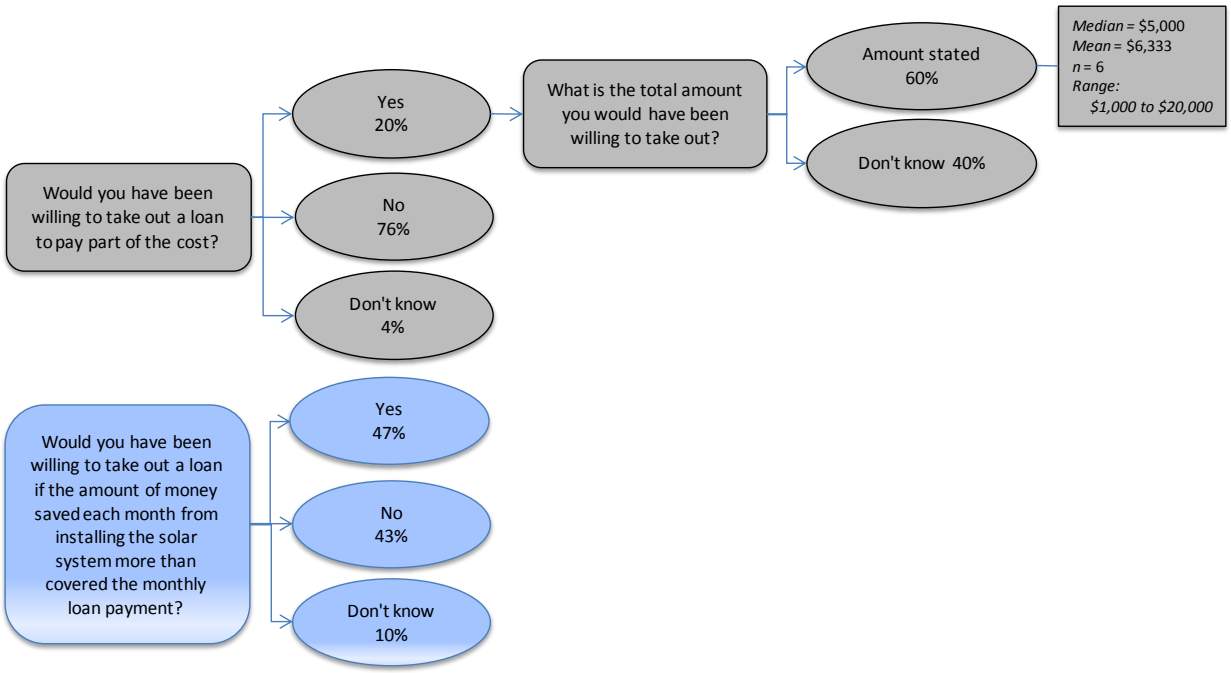
Figure 2-23. Willingness to Contribute to System Cost by Income Level



Source: Analysis of SASH participant surveys, 2010.

Respondents were subsequently asked if they would have been willing to borrow money to contribute to the system cost. As shown in Figure 2-24, only 20 percent of respondents would have been willing to borrow money. The dollar values provided for those who reported a willingness to borrow ranged from $1,000 to $20,000, with a median of $5,000. All respondents were then asked a follow-up question proposing that a portion of the money saved on their electric bills could cover their monthly loan payments. In this scenario (shown in blue in Figure 2-24), the proportion of respondents willing to borrow money rose to 47 percent.

Figure 2-24. Participant Willingness to Borrow Money to Contribute to System Costs (n=49)



Source: Analysis of SASH participant surveys, 2010.

It is important to note that the survey respondents are SASH participants *who had already begun to realize those monthly savings* expressed interest in using energy bill savings to repay such a loan. Convincing potential participants of these savings before they witness those savings may pose greater challenges; perhaps previous program participants could provide testimonials or speak to the magnitude of the cost savings. Nonetheless, the receptivity of nearly half of respondents to allocating a portion of the PV system's financial benefits to a loan that would enable them to contribute to the system's cost is noteworthy. Assuming a lending partner offered a product that would enable such a trade-off, framing the energy bill savings as a source of creditworthiness could encourage more applicants to contribute financially to a SASH system.

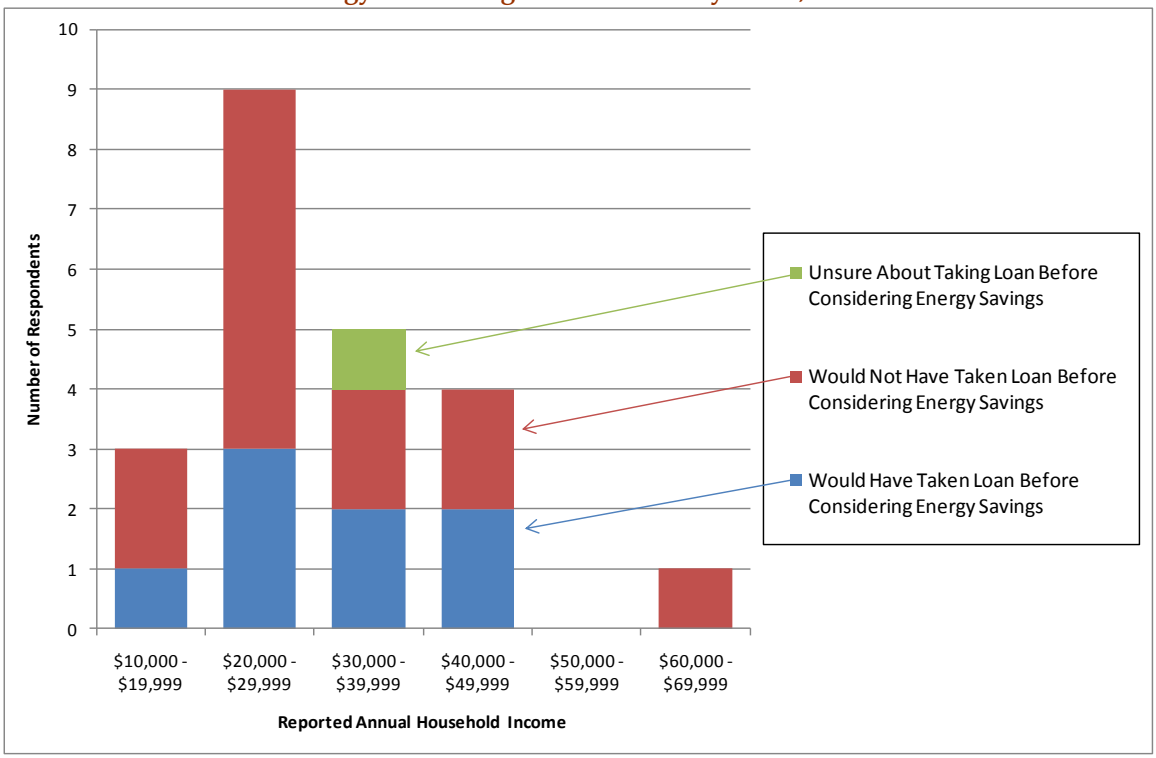
Figure 2-25 again illustrates the income distribution of the two categories of respondents for the above question about applying cost savings to loan repayment. As shown, for the participants who reported a willingness to have taken out a loan under such circumstances, 39% reported an annual household income between $20,000 and $29,999. Compared to the income distributions of those who were willing to contribute to system costs without a loan (Figure 2-23), the distribution of affirmative respondents in Figure 2-25 shows a substantial shift toward lower income brackets.

Figure 2-25. Willingness to Borrow Money to Contribute to System Cost by Income Level

Source: Analysis of SASH participant surveys, 2010.

Figure 2-26 further illustrates the effect of framing energy bill savings as a potential means of loan repayment, with responses again distributed by income level. Those in blue would have considered taking out a loan before the use of energy bill savings was specifically mentioned. The individuals shown in red or green were those who subsequently decided they would be willing to take out a loan once repayment with energy bill savings was mentioned. For all income brackets, the approach more than doubled the number of respondents who said they would be willing to take out a loan.

Figure 2-26. Summary of Affirmative Changes in Willingness to Contribute if Energy Bill Savings Cover Loan Payments, n=22



Source: Analysis of SASH participant surveys, 2010.

To qualify participants' perceptions of these expected savings, the survey asked respondents to characterize their expected annual energy costs both before and after the installation of their systems. The average reported annual cost of respondents' energy bills before installing the solar system was $1,178, while the average expected annual cost one year after the system's installation was $263, revealing an average expected annual average of $915 (about 74 percent). While this number provides some context for participants' willingness to have contributed to system costs, the forthcoming Impact Analysis Report will provide a more rigorous assessment of projected participant energy bill savings.

Nonparticipant Willingness to Pay

To provide some balance to the willingness-to-pay perceptions of those who had already received SASH systems, the evaluation team also interviewed a group (n=11) of nonparticipants recruited through affordable housing agencies that had helped to promote the SASH program. When asked how much of their own money they would be willing to contribute to the cost of a subsidized system with a reminder that it would reduce their monthly energy bills, five of the interviewees offered specific amounts. The responses ranged from the general ("maybe up to $4,000" and "maybe one half of the full cost of the system") to more specific amounts ("$5,000"), including some based on monthly energy bill savings ("$50 per month" or "between $80 and $100 per month"). When asked to consider if such a contribution could be made in monthly installments, six interviewees offered estimates of their current monthly electric bills, ranging from $50 to $250 per month.

This "reality check" with those who have not yet participated in the program suggests that projecting monthly energy bill savings—especially with access to loans—could increase potential participants' ability and willingness to contribute financially to the cost of a system. Such personal contributions would likely serve to increase the rate of SASH installations while leveraging GRID's fundraising efforts to reach a greater number of participants.

At the same time, however, soliciting such personal contributions and securing a vehicle to enable them will increase the cost of the program and pose additional barriers to participation. GRID will likely continue to serve as the focal point of the client relationship, continuing to provide the turnkey project development services. As a result, it is likely that GRID will be responsible for walking the client through the process of working with the third-party financier, filling out the paperwork, and collecting relevant documentation. In addition, securing a customer contribution will create a significant barrier to participation for many homeowners; GRID will need to work through these issues with the homeowner and work harder to demonstrate the soundness of the decision to participate in GRID. Together, all of these activities would further delay the sales cycle and could add significant cost to the installations in terms of the Outreach Coordinators' time.

HOMEOWNER ABILITY TO CONTRIBUTE

When considered relative to a household's annual gross income, the gap between SASH incentives and project cost can be significant. The following analysis draws from the funding gaps and annual household gross incomes recorded in the SASH program database for installed or completed projects. As seen in Table 2-5:

- Just over one-fifth of the projects have gaps greater than zero but less than five percent of the client's annual household gross income; this is equivalent to a typical low-income household's[40] annual expenditures on apparel and services or its expenditure on electric utilities (estimated at 3.3 percent of average annual expenditures).[41]

- An additional five percent of those projects have gaps between five and 10 percent of the client's annual household gross income; in the absence of SASH, a typical low-income household spends this amount annually on health care.[42]

- For 13 percent of the completed or installed projects, the gap amount was between 10 and 25 percent of the household's gross annual income; a typical low-income household spends the same fraction of their annual income on food.[43]

[40] In this case, a "typical" low-income household is intended to reflect a household income of $46,100, which is the income level calculated by the U.S. Department of Labor in the Consume Expenditure Survey to reflect the income level of the third quintile of U.S. households. Source: U.S. Department of Labor: Bureau of Labor Statistics. 2010. "Consumer Expenditure Survey, 2009." Available: http://www.bls.gov/cex/#tables

[41] U.S. Department of Labor: Bureau of Labor Statistics. 2010. "Consumer Expenditure Survey, 2009." Available: http://www.bls.gov/cex/#tables

[42] *Ibid.*

[43] *Ibid.*

» For another three percent of these projects, the gap amount was more than one-quarter of the household's annual gross income.

Table 2-5. Gap Amount as Percent of Client's Household Income and Comparison to Existing Annual Expenditures

Gap Amount as % of Annual Gross Income	% of Completed / Installed Projects	Comparable Expenditure for Household Earning $46,000
≤ 0%	32.8%	N/A
0%-4%	22.4%	Apparel and Services
5%-9%	23.9%	Healthcare
10%-24%	13.1%	Food
25%-49%	2.2%	Housing
50%-99%	0.4%	No single category represents more than 50% of gross income
No Gross Income Reported	5.2%	N/A

Note: In this case, a "typical" low-income household is intended to reflect a household income of $46,100, which is the income level calculated by the U.S. Department of Labor in the Consumer Expenditure Survey to reflect the income level of the third quintile of U.S. households.
Source for Completed/Installed Projects: GRID's program database, November 1, 2010.
Source for Comparable Expenditures: U.S. Department of Labor: Bureau of Labor Statistics. 2010. "Consumer Expenditure Survey, 2009." Available: http://www.bls.gov/cex/#tables

The information about gap amount relative to household income indicates provides further insight into a homeowner's decision to make a financial contribution to a PV system provided through SASH. In most cases, the gap amount competes for funding with basic necessities. Carving out the money to make a one-time payment is unlikely. Thus, some type of financing is likely required.

Assuming some homeowners would apply projected energy bill savings toward loans used to contribute to SASH system costs, those contributions' values can be estimated using the survey responses presented in the previous section. Table 2-6 provides the estimated initial principal amount of loans that could be available to participants based on combinations of average monthly energy bill savings and the portion of those savings participants are willing to set aside for monthly loan repayments. The estimates use a simple present value calculation assuming an eight-percent interest rate, compounded monthly, for a one-, three-, and five-year loan period.

Table 2-6. Estimated Loan Amounts Available to SASH Homeowners Based on Varying Contributions from Energy Bill Savings

Average Energy Bill Savings					
Per Month	**$50**	**$75**	**$100**	**$150**	**$200**
Portion of Monthly Energy Savings Contributed to Repaying Loan					
100% of Bill Savings Contributed	$50	$75	$100	$150	$200
75% of Bill Savings Contributed	$38	$56	$75	$113	$150
66% of Bill Savings Contributed	$33	$50	$67	$100	$133
50% of Bill Savings Contributed	$25	$38	$50	$75	$100
Annual Contribution to Repaying Loan with Interest (monthly payment x 12)					
100% of Bill Savings Contributed	$600	$900	$1,200	$1,800	$2,400
75% of Bill Savings Contributed	$450	$675	$900	$1,350	$1,800
66% of Bill Savings Contributed	$400	$600	$800	$1,201	$1,601
50% of Bill Savings Contributed	$300	$450	$600	$900	$1,200
Loan Amount Based on One-Year Repayment at 8% Interest, Compounded Monthly					
100% of Bill Savings Contributed	$575	$862	$1,150	$1,724	$2,299
75% of Bill Savings Contributed	$431	$647	$862	$1,293	$1,724
66% of Bill Savings Contributed	$383	$575	$767	$1,150	$1,534
50% of Bill Savings Contributed	$287	$431	$575	$862	$1,150
Loan Amount Based on Three-Year Repayment at 8% Interest, Compounded Monthly					
100% of Bill Savings Contributed	$1,596	$2,393	$3,191	$4,787	$6,382
75% of Bill Savings Contributed	$1,197	$1,795	$2,393	$3,590	$4,787
66% of Bill Savings Contributed	$1,064	$1,596	$2,129	$3,193	$4,257
50% of Bill Savings Contributed	$798	$1,197	$1,596	$2,393	$3,191
Loan Amount Based on Five-Year Repayment at 8% Interest, Compounded Monthly					
100% of Bill Savings Contributed	$2,466	$3,699	$4,932	$7,398	$9,864
75% of Bill Savings Contributed	$1,849	$2,774	$3,699	$5,548	$7,398
66% of Bill Savings Contributed	$1,645	$2,467	$3,290	$4,934	$6,579
50% of Bill Savings Contributed	$1,233	$1,849	$2,466	$3,699	$4,932

Source: Navigant analysis, 2011.

Note: (1) This analysis assumes that electricity rates remain constant. In reality, electricity prices will likely rise, as will the dollar value of the bill savings. In that event, it is possible that the homeowner could contribute additional funds to the loan payment each month. That scenario is not presented here. (2) Homeowners need to set aside some of their monthly bill savings to pay to replace the inverter after the warranty expires; this analysis did not set aside that amount.

According to participant survey responses, 20 percent of respondents would have been willing to borrow money without having explicitly considered applying their energy bill savings to their monthly payments. The size of loans suggested by those respondents ranged from $1,000 to $20,000, with a median of $5,000. Based on the above table, a $1,000 loan could be accessible to a homeowner willing to

contribute as little as $33 per month over a three-year period, still leaving an average of one-third of their monthly energy bill savings for some of the other important uses discussed above.

A non-participant survey would provide a vehicle to better gauge the willingness to pay a portion of the gap amount funding through bill savings. Structuring the interview guide using an appropriate willingness-to-pay methodology (e.g., contingent valuation) would provide the data needed to quantitatively analyze the amount of funding gap that homeowners who are new to SASH would willingly contribute. Future evaluation teams should consider including such analysis in their evaluation plans although this was not part of the scope for this year's evaluation; as such, the evaluation team did not conduct non-participant surveys for this evaluation cycle.

2.4.4 Sources of Funding to Fund Gap Amount

To date, GRID has used two primary types of funding to fill the gap amount: homeowner contributions and fundraising from public and private sources. In most cases where funding gaps existed, GRID has addressed the shortfall on a project-by-project basis. This section describes some of the circumstances under which GRID has used each of these funding sources and then discusses alternative strategies for funding the gap amount going forward.

HOMEOWNER CONTRIBUTIONS

For significant funding gaps (e.g., $1,000 or more), GRID asks the homeowner to contribute to the system cost. It appears that homeowners have contributed to the gap amount in relatively few cases to date; however, GRID's treatment in the SASH program data of homeowners who used municipal loans to help pay for systems may distort this analysis. For example, one interviewed participant used a home rehabilitation loan from his local housing commission to help pay for part of his SASH system in addition to completing other repairs to his property (e.g., painted eaves, fixed gutters, etc.). The program data lists the gap funding provider for this project as the housing commission that provided the loan rather than the homeowner himself. Moving forward, GRID should consider refining the categories used to enter this information in the database.

Only two projects explicitly listed "Homeowner" as the gap funding provider. The first homeowner provided a nominal $134 to cover his funding gap. The other participant had qualified for a fully-incentivized system, but desired a larger system than the one GRID had designed. He used money from his retirement savings (a 401(k) plan) to contribute the additional amount[44] in order to afford the larger capacity system.[45]

[44] The homeowner reported having contributed $4,000; GRID records showed $3,050.

[45] Neither participant was listed as eligible for LIEE rates. Participant 1 fell just below the 80 percent AMI eligibility level, while Participant 2 fell in the 31-50 percent AMI range.

If each project for which the database lists a housing commission or municipal entity as the gap funding provider indicated that a homeowner used a municipal loan to contribute to a SASH system, the total number of homeowner-financed funding gaps would not exceed 23 projects. This represents only 7 percent of completed or installed SASH projects.

GRID Fundraising

In cities in which GRID has a grant, it can use general fundraising to help homeowners afford systems with relatively small funding gaps (e.g., $100). For larger gaps (e.g., $1,000 or more) to which the homeowner cannot or will not contribute, GRID may attempt to raise funds from other organizations (e.g., local city government, other non-profits, or private companies).

GRID has successfully appealed to a diverse set of organizations to contribute to funding gaps for SASH projects. Thirteen organizations have contributed gap funding for 37 installed or completed projects with another seven projects in process. The average project funding gap filled by an outside organization is approximately $2,600; however, this excludes several records in the SASH database that had incomplete or missing data related to gap funding amounts.

During interviews, GRID staff reported that the project-by-project approach to fundraising had worked relatively well, but the ongoing economic downturn creates doubts as to its sustainability. Given the likely administrative burden associated with filling funding gaps on a per-project basis, significant potential exists for some broader financing approach to address these gaps and increase the rate of SASH project installations.

Other Potential Financing Mechanisms

According to the CPUC decision establishing SASH, the program was designed to take advantage of low-interest lending from local governments,[46] but the economic downturn has reduced local government budgets and the availability of such loans. According to a contact with one such loan provider, much of this funding derives from property taxes, and the decline in lending has resulted largely from the devaluation of the housing market associated with the recessions.[47] Furthermore, the popular Property Assessed Clean Energy (PACE) financing mechanism, through which homeowners can repay municipally-funded loans through increased property taxes, continues to languish. Fannie Mae and Freddie Mac's opposition to the priority given to the lien on the solar system over government-held mortgages has halted deployment of the mechanism throughout most of the country.[48] Furthermore, PACE, as currently written, requires a loan minimum of $5,000, which is higher than most gap funding needs.

GRID has also reported that requiring homeowners to take out a loan to contribute to the cost of their system would create additional barriers to solar adoption by low-income households. Specifically, GRID cites a general unwillingness or inability among homeowners to take out loans stemming from several reasons: inability to qualify, high interest rates, or minimum loan amounts that exceed their SASH funding gap. However, nearly half of the actual program participants surveyed suggested they would

[46] CPUC D. 07-11-045

[47] Interview with SASH Affordable Housing Agency Market Actor. 2010.

[48] Freddie Mac. May 5, 2010. *Industry Letter regarding First Lien Mortgages and Energy Efficient Loans.* Available: http://www.freddiemac.com/sell/guide/bulletins/pdf/iltr050510.pdf

have been willing to borrow money to contribute to their system once they considered the possibility of using energy bill savings to help repay the loan, although the surveys did not seek to qualify the loan terms participants might be willing to accept. Section 2.4.3 presents additional details on these findings.

The availability of consumer credit changed significantly between the time that CPUC adopted D. 07-11-045 in November 2007 and the end of this first evaluation period in late 2010.[49] In the 12 months leading up to D.07-11-045, non-revolving consumer credit increased by 4.6 percent, as seen in Figure 2-27; the market for consumer credit in November 2007 was at a then all-time high.[50] Just one month later, the economy officially began to enter the recession,[51] but non-revolving consumer lending would continue to grow until July 2008.[52] During the two years following the peak in July 2008, the amount of non-revolving consumer credit decreased by 1.9 percent. The amount of credit available decreased as lenders tightened their lending standards while consumers hesitated to take on new debt while facing uncertain economic situations, including high unemployment and decreasing home values.[53] Home equity lines of credit were harder to obtain.[54]

[49] Federal Reserve Board of the United States. January 7, 2011. *Federal Reserve Statistical Release: Consumer Credit (G.19).* Available: http://www.federalreserve.gov/releases/g19/hist/cc_hist_sa.txt

[50] Federal Reserve Board of the United States. January 7, 2011. *Federal Reserve Statistical Release: Consumer Credit (G.19).* Available: http://www.federalreserve.gov/releases/g19/hist/cc_hist_sa.txt

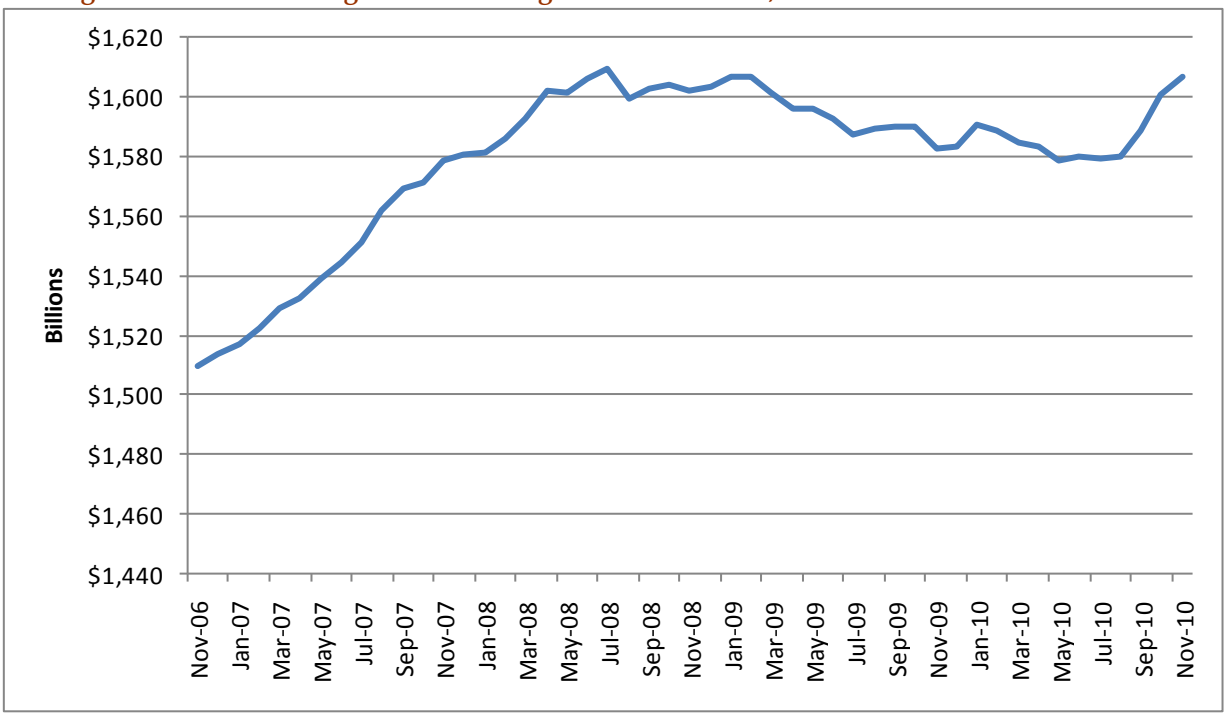
[51] Hancock, D. and W. Passmore. 2011. *Did the Federal Reserve's MBS Purchase Program Lower Mortgage Rates?* Finance and Economics Discussion Series: Division of Research and Statistics and Monetary Affairs. Federal Reserve Board. Available: http://www.federalreserve.gov/pubs/feds/2011/201101/201101pap.pdf

[52] Federal Reserve Board of the United States. January 7, 2011. *Federal Reserve Statistical Release: Consumer Credit (G.19).* Available: http://www.federalreserve.gov/releases/g19/hist/cc_hist_sa.txt

[53] Gutierrez, C. September 8, 2009. "Consumer Credit Plummets." *Forbes.* Available: http://www.forbes.com/2009/09/08/consumer-credit-loan-markets-economy-banking.html

[54] Stout, H. March 26, 2010. "Renovations Make a Comeback." *New York Times.* Available: http://www.nytimes.com/2010/03/28/realestate/28Cov.html?_r=1&pagewanted=1

Figure 2-27. Outstanding Non-Revolving Consumer Credit, November 2006-November 2010



Source: Federal Reserve Statistical Release, Consumer Credit, January 7, 2011.

During the protracted decline in consumer credit, it is unlikely that homeowners eligible to participate in SASH would have had the access to adequate amounts of credit to self-fund their gap amounts. Lending standards were very strict during this time, as banks sought to protect the capital they had by taking more risk-averse positions. Requiring SASH participants to secure a loan to fund the gap amount would have likely resulted in a significant decline in program participation. This would have created an additional barrier to program participation during a time that GRID was striving to achieve an aggressive milestone of 1,000 projects completed by the end of 2010.

After two years during which consumer credit was both generally decreasing and volatile, the amount of non-revolving consumer credit outstanding increased for three straight months between August and October 2010, as seen in Figure 2-27. This is a positive sign for the availability of the type of credit that SASH participants would need to secure to contribute to any gaps between SASH incentives and the total system cost. At the same time, some studies indicate that Americans have experienced a fundamental change in the way they view debt.[55] This may indicate that Americans will be less willing to take on debt in the future, preferring instead to save money and invest when the capital is available. At this time, it is too early to tell.

Given the declining availability of municipal loan funding and the uncertainty in the market for consumer finance, the CPUC needs to consider additional options to address project financing gaps. In the CPUC SASH Decision, staff proposes that the responsibility falls to the Program Manager (i.e., GRID Alternatives) "to identify new private sector financing providers and packages." The following text briefly outlines two potential options that the CPUC and GRID might explore for the SASH program.

Home Equity Line of Credit. It is common for individuals to rely on home equity to finance PV systems, where the house is used as collateral. However, given the current credit market conditions and the low-income status of the homeowners, this may present a particular challenge.

Third-Party Financing Agent. GRID may consider developing a strategic partnership with one or a limited number of third-party financing providers. These types of relationships would facilitate the process for developing financing agreements for SASH participants. GRID could work with these partners to develop standard application templates that make sense for low-income homeowners and that still meet the third party's requirements. Building trust with a limited number of strategic partners would align with GRID's broader approach to building trust in the marketplace. In addition, this approach would help to overcome homeowners' initial resistance to making a financial contribution. GRID would need to take precautions to ensure that the partner or partners met strict ethical criteria as well as providing a strong financial base.

Power Purchase Agreements (PPA). The SASH program currently excludes third-party owners from receiving incentives in the interest of protecting low-income and senior populations from predatory lending.[56] However, the decision supporting this exclusion also mentions the possibility of revisiting this funding mechanism once CPUC has "further experience with solar incentives to low-income homeowners or more information concerning third-party ownership arrangements for low-income homeowners."[57]

Although MASH program participants have successfully implemented PPAs, there are three key reasons why they are not appropriate for SASH. First, PPAs require third-party ownership, which contradicts SASH's exclusion as described in the previous paragraph; the focus of the SASH program is participant ownership. Second, it is unlikely that GRID would successfully secure a willing PPA provider given the limited financial opportunity; the transaction costs would likely negate the limited financial returns for

[55] Newport, F. April 27, 2009. "In U.S., 32 percent Say Spending Less is Their "New Normal."" Gallup. Available: http://www.gallup.com/poll/118003/Say-Spending-Less-New-Normal.aspx
[56] CPUC. D. 07-11-045.
[57] CPUC. D. 07-11-045.

the PPA provider. Third, it would be difficult to structure rules related to contract length, ownership "flip" schedules, and other terms that are both fair for the PPA providers and discernable for the SASH participants.

Emerging Alternatives. Several established private companies, non-profits and unique organizations specialize in offering financing arrangements such as micro financing, peer-to-peer lending and peer-to-peer donation that may be ideal for addressing the barriers faced by homeowners who cannot afford the high upfront costs of solar.

- *Peer-to-Peer Lending/Micro Financing*: After incentives, nearly one-third of SASH participants are left with a gap funding requirement of less than $2,000. Peer-to-peer lending services are ideal suited for loans of this size. Services such as www.kiva.org or www.prosper.com allow individuals (or groups of individuals) to provide loans to other individuals.

- *Peer-to-Peer Donation*: Approximately 9 percent of participants require less than $1,000. Peer-to-peer donations may be particularly well suited for loans in this amount. Services such as www.kickstarter.com or direct solicitation such as GRID's holiday email as for individual donors.

2.5 Spillover

For the purposes of this report, "spillover" describes the benefits of SASH that go beyond the stated goals of the program. As stated in the CPUC decision instituting SASH, the primary goal of SASH is as follows: "to provide existing low-income single family homes with access to photovoltaic (PV) systems to decrease electricity usage and bills without increasing monthly household expenses."[58] Earlier sections of this report provided an overview of the program's progress in this area, and the upcoming Program Impact Evaluation Report will analyze the program's effectiveness with a more substantial level of rigor.

At the time of this evaluation, some spillover benefits of the SASH program remain qualitative. These qualitative benefits, combined with the quantitative benefits outlined in the rest of this section, make a compelling case for the benefits of the program to society more broadly. If GRID or the CPUC would like to measure these benefits in the next evaluation, GRID needs to provide additional documentation. The qualitative benefits include the following:

- **Job creation by GRID:** GRID reports that 70 paid staff members support the SASH program. It is not clear if these are full-time equivalents or simply the number of individuals supporting the program.

[58] California Public Utilities Commission. November 2007. "Opinion Establishing Single-Family Low-Income Incentive Program within the California Solar Initiative. Decision 07-11-045.

» **Additional panels installed:** Anecdotal evidence indicates that two SASH participants installed more panels on their homes than the number paid for by SASH. These homeowners wanted larger systems than SASH incentives covered, and they arranged to pay for these panels on their own. They indicate that this would not have happened without their participation in the SASH program.

» **Hands-on job training opportunities for solar installation job trainees:** Solar job trainees receive hands-on training through SASH in two ways. First, SPP contractors hire at least one per SASH installation to fulfill a program requirement. In addition, GRID has relationships with several solar installer job training programs that provide students with the opportunity to volunteer to assist with SASH-led installations; GRID retains 20 percent of its volunteer slots for job trainees. These opportunities prepare job trainees for their future careers with on-the-ground training, which should provide employers with enhanced confidence in their ability to perform the work in a full-time position.

» **Workforce development for a broader group of clean energy workers:** Workers in the clean energy space gain a different perspective about the solar industry by volunteering to help with SASH installations. Such workers may hold or may eventually hold positions as consultants, policy makers, solar developers, system engineers, investors, or other positions that benefit from understanding the logistics and dynamics of a solar project installation.

» **Broad consumer education:** Volunteers that assist in GRID-installed projects participate in orientation and training. They learn about the basics of solar and about the mechanics of a solar installation. Not all of these volunteers will participate in the clean energy economy as workers. This type of education reaches a broader group than either of the two discussed in previous bullet points.

The rest of this section highlights the more quantifiable benefits of SASH that extend beyond the formally stated program goal. Section 2.5.1 discusses job creation created by the Subcontractor Partnership Program. Section 2.5.2 considers the energy efficiency actions taken by participants of SASH as a result of their program involvement. Section 2.5.3 explores the extent to which program participants and non-participants have developed a better understanding of solar as a result of GRID's activities.

2.5.1 Job Creation from the Subcontractor Partnership Program

While not an explicit goal of the SASH program, the CPUC's SASH Decision recognizes the program's potential to provide solar installation training and career development opportunities for low-income Californians.[59] For GRID Alternatives, this workforce development effort has manifested as the Subcontractor Partnership Program (SPP), which launched in late 2009.

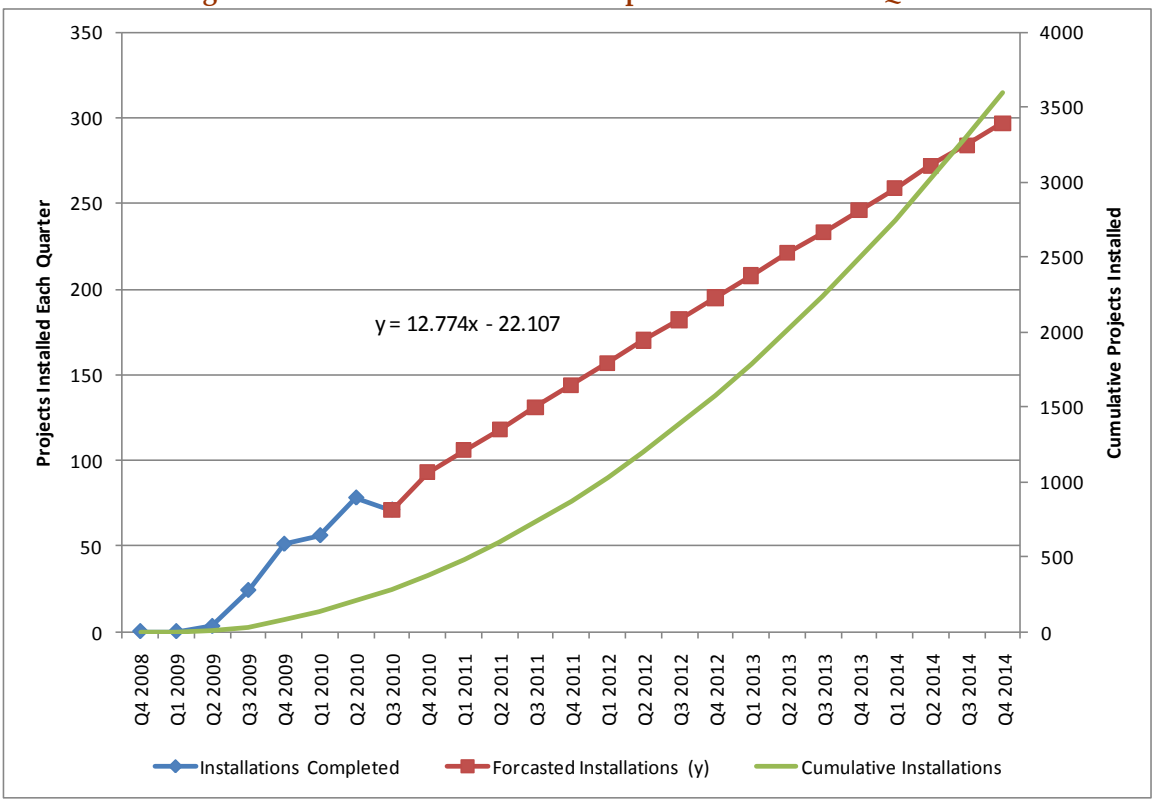
GRID developed the SPP to provide additional resources to increase SASH project installation rates beyond what can be completed solely through volunteers. By leveraging the skills of experienced solar contractors, the SPP can also provide higher levels of expertise for more technically complex projects.

[59] CPUC. D. 07-11-045.

Finally, by including a requirement that each SASH installation performed by a partner subcontractor include a solar job trainee, the SPP can help achieve this secondary solar job training objective.

The evaluation team has attempted to quantify the SPP's potential job creation and solar training effects. This analysis draws upon the existing forecast of future SASH installations prepared for the PA Assessment Report. The analysis uses the to-date rates of quarterly installations and average per-project costs to forecast cumulative system installations and budgetary requirements for GRID to achieve various SASH program installation goals. Figure 2-28 shows the forecast for GRID's quarterly installations through the end of 2014, assuming growth follows a linear trend based on GRID's to-date progress and the incorporation of the additional resources provided by the SPP.

Figure 2-28. SASH Installations Completed/Forecast Each Quarter



Source: Analysis of GRID's Program database, November 1, 2010.

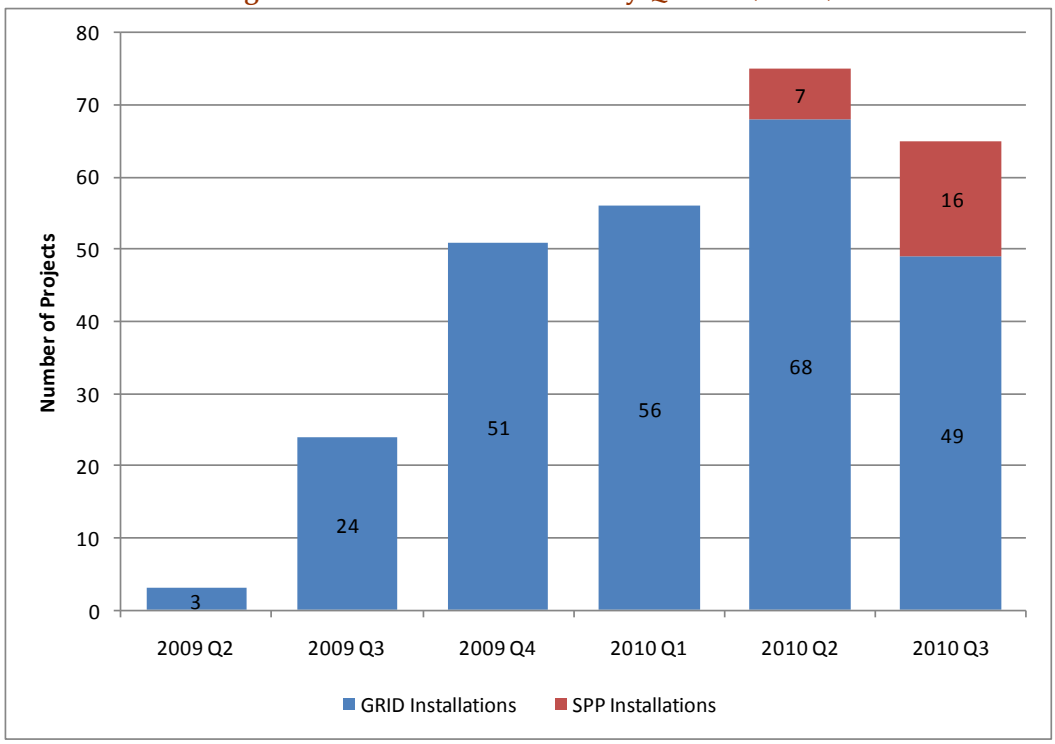
These forecasts do not account for inflation, fluctuating equipment costs, or any programmatic changes that might require a shift in resources, incentives, or per-project efforts by GRID.

GRID has only recently begun subcontracting installations through the SPP, but anticipates increasing the volume and percentage of projects installed through third-parties. Figure 2-29 summarizes GRID and SPP project installations by quarter[60]. While the SPPs only installed 25 percent of projects in Q3 2010, GRID has designated 60 percent of projects categorized as "In Process" (those approved for the program,

[60] Nine of the 283 projects in the database with Installation Dates during or before Q3 2010 had Status records other than Installed or Complete and were left out of the following figures (n=274).

but not yet installed) as subcontractor installations. Of those, more than 75 percent (246 projects) have already been assigned to a specific SPP contractor.

Figure 2-29. SASH Installations by Quarter (n=274)



Source: Analysis of GRID's Program database, November 1, 2010.

Using an assumption that 50 to 60 percent of future SASH installations would be completed by SPP subcontractors, the evaluation team modeled the potential additional work the SASH program will create for SPP contractors (a 33 percent scenario provides a low-range estimate), as presented in Table 2-7. Based on discussions with a residential solar installation company, Navigant projected the number of work hours associated with the SASH installations forecasted for each quarter through 2014 under each of these three SPP scenarios.[61] Navigant further assumed that of the hours worked on each SASH installation, solar job trainee staff would be responsible for at most 20 percent of the work.

The last six columns of Table 2-7 project the number of full-time equivalent (FTE) employment opportunities that will exist each quarter for both regular staff and job trainees under each of the three scenarios. Full-time equivalent (FTE) estimates illustrate the number of jobs that a program would create if the forecasted work allocated to a single individual. In reality, the program distributes this work among numerous firms and their staff. The quarterly estimates assume each FTE employee works 2,000 hours per year, or 500 hours each quarter (e.g., 40 hours/week x 50 weeks/year).

[61] The solar installation company estimated that a one- to three-kW, single-family, residential solar installation would require, on average, four staff each working two full, eight-hour days (64 work hours per project). This assumes that GRID maintains responsibility for recruitment and education of the customers, completing and processing the rebate application, and securing gap funding, while the contractor schedules the installation, secures equipment (though there is an option for GRID to fill this role) and permits, and installs the equipment.

Table 2-7. Potential SPP Contractor FTE Jobs Created from Forecasted SASH Installations

Quarter	Forecast Installs	Installations by SPP Contractors			Total Hours Worked (4 FTEs x 2 days x 8 hours/day)			Staff FTEs per Quarter (80% of hours worked)			Trainee FTEs per Quarter (20% of hours worked)		
		33%	50%	60%	33%	50%	60%	33%	50%	60%	33%	50%	60%
Q1 2010	56	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Q2 2010	75	7	7	7	448	448	448	0.7	0.7	0.7	0.2	0.2	0.2
Q3 2010	65	16	16	16	1024	1024	1024	1.6	1.6	1.6	0.4	0.4	0.4
Q4 2010	93	31	47	56	1984	3008	3584	3.2	4.8	5.7	0.8	1.2	1.4
Q1 2011	106	35	53	64	2240	3392	4096	3.6	5.4	6.6	0.9	1.4	1.6
Q2 2011	118	39	59	71	2496	3776	4544	4.0	6.0	7.3	1.0	1.5	1.8
Q3 2011	131	43	66	79	2752	4224	5056	4.4	6.8	8.1	1.1	1.7	2.0
Q4 2011	144	48	72	86	3072	4608	5504	4.9	7.4	8.8	1.2	1.8	2.2
Q1 2012	157	52	79	94	3328	5056	6016	5.3	8.1	9.6	1.3	2.0	2.4
Q2 2012	170	56	85	102	3584	5440	6528	5.7	8.7	10.4	1.4	2.2	2.6
Q3 2012	182	60	91	109	3840	5824	6976	6.1	9.3	11.2	1.5	2.3	2.8
Q4 2012	195	64	98	117	4096	6272	7488	6.6	10.0	12.0	1.6	2.5	3.0
Q1 2013	208	69	104	125	4416	6656	8000	7.1	10.6	12.8	1.8	2.7	3.2
Q2 2013	221	73	111	133	4672	7104	8512	7.5	11.4	13.6	1.9	2.8	3.4
Q3 2013	233	77	117	140	4928	7488	8960	7.9	12.0	14.3	2.0	3.0	3.6
Q4 2013	246	81	123	148	5184	7872	9472	8.3	12.6	15.2	2.1	3.1	3.8
Q1 2014	259	85	130	155	5440	8320	9920	8.7	13.3	15.9	2.2	3.3	4.0
Q2 2014	272	90	136	163	5760	8704	10432	9.2	13.9	16.7	2.3	3.5	4.2
Q3 2014	284	94	142	170	6016	9088	10880	9.6	14.5	17.4	2.4	3.6	4.4
Q4 2014	297	98	149	178	6272	9536	11392	10.0	15.3	18.2	2.5	3.8	4.6
Through 2014	3,456	1,118	1,685	2,013	71,552	107,840	128,832						

Source: Navigant analysis, 2011.

Notes:

(1) FTE stands for Full-time Equivalent employment. It represents the equivalent number of jobs created if a single employee performed all work involved. In reality, this added work is distributed among various firms and their staff.

(2) Q1-Q3 2010 based on actual SPP installations per GRID records.

(3) Total Hours Worked assumes four installation staff working two 8-hour days per installation.

(4) FTEs/Quarter numbers assume 500 work hours per quarter, with full-time staff working 80% and trainees working 20% of hours on each installation.

Table 2-8 summarizes the annual FTE estimates for both regular staff and solar trainees assuming that SPPs install 60 percent of future SASH projects. As shown, the SPP program will have created a total of 21 FTE employment opportunities through the end of 2014.

Table 2-8. Annual FTE Totals for 60% SPP Installations

Year	Annual Staff FTEs	Annual Trainee FTEs	Annual FTE Total
2011	7.68	1.92	9.60
2012	10.80	2.70	13.50
2013	13.98	3.49	17.47
2014	17.05	4.26	21.31

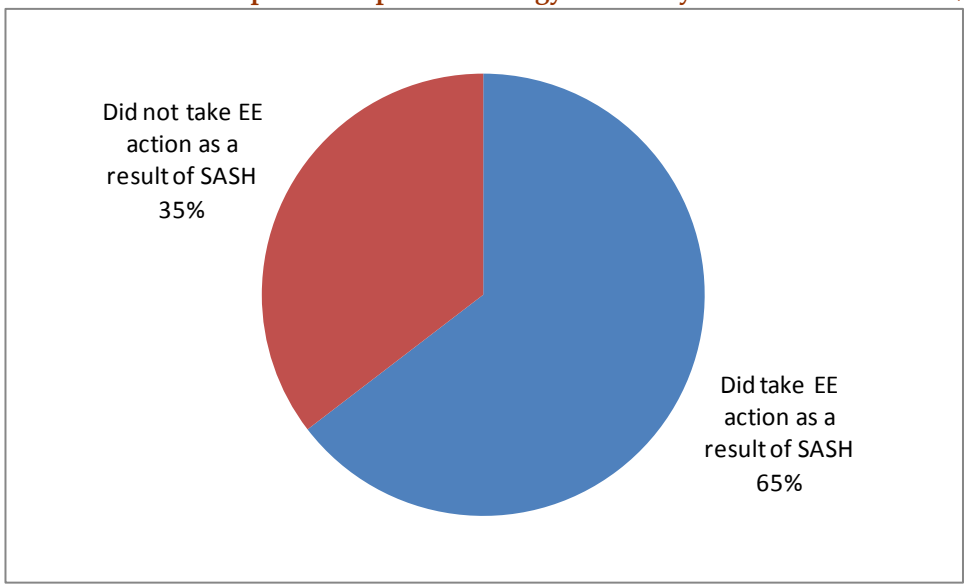
Source: Navigant analysis, 2011.

The preceding analysis does not attempt to quantify the full job creation impact of the entire SASH program. Rather, it considers only those employment opportunities created by the SPP. While projects installed by GRID staff also draw upon solar job trainee and workforce development programs, their heavy reliance on volunteer staff make FTE modeling more difficult. A broader assessment of program-wide workforce impacts would need to consider SASH-related activities among other market actors, including the CPUC, GRID Alternatives, the investor owned utilities, and equipment manufacturers and distributors.

2.5.2 Energy Efficiency Changes Caused by SASH

The SASH program's outreach on energy efficiency appears to have spurred a number of program participants to implement energy efficient equipment or behaviors. Almost 65 percent of participants who responded to a survey indicated that they had adopted some energy efficient actions or behaviors as a result of SASH. The vast majority of participants surveyed (84 percent) had not participated in LIEE. Thus, it is likely that the energy efficient changes resulted from GRID's outreach or the energy audit, which a GRID staff person conducts.

Figure 2-30. SASH Participants Adoption of Energy Efficiency as a Result of SASH (n=48)



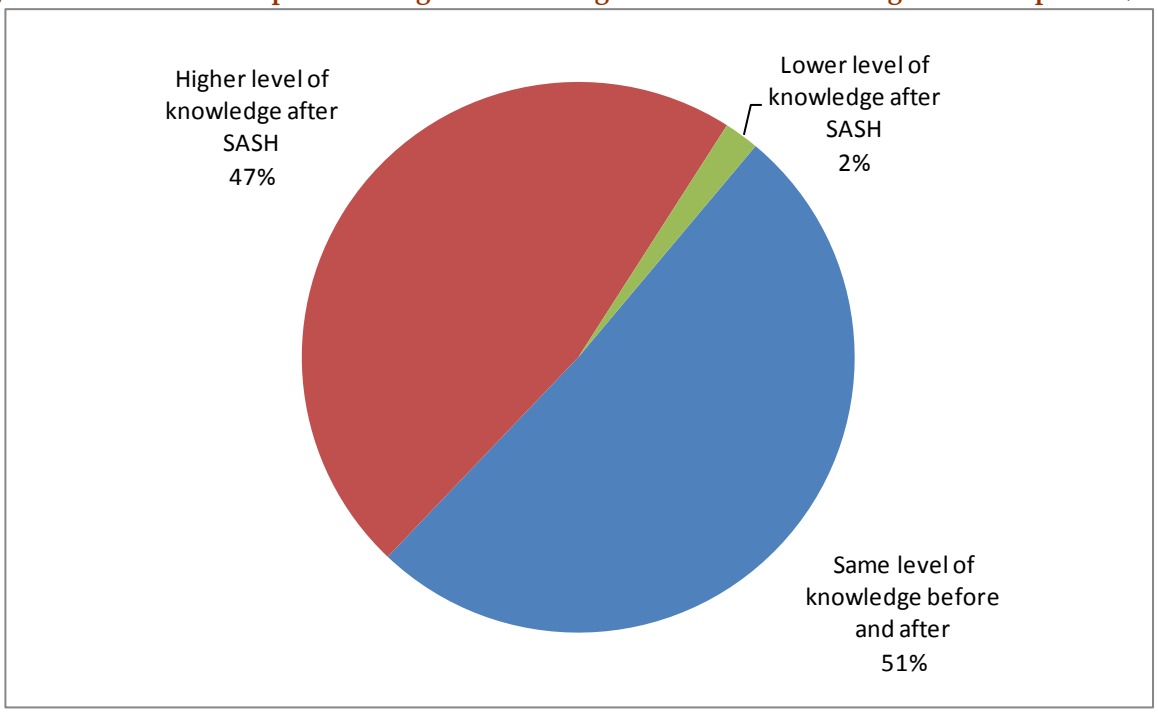
Source: Analysis of SASH participant survey, 2010.

GRID does not track energy efficiency improvements made by program participants, nor does GRID conduct surveys to assess changes in energy efficient behaviors. Given that program goals focus on renewable energy capacity installed and bill savings, GRID has focused its efforts on tracking other variables related more directly to the attainment of those goals. In the event that CPUC determines that energy efficiency is a higher priority and worthy of the resources necessary to track progress in this area, GRID may consider collecting additional information about how participants alter their energy use. For example, the outreach coordinator might conduct an inventory of the energy efficiency measures installed at the time of the visit for reviewing the client's electric bill in the first month after system installation. Again, this approach would add cost to the program in terms of staff time, database alteration, additional data entry, and other administrative task. This approach would enable the next evaluation team to focus additional resources on this issue while using a strong, data-driven approach.

2.5.3 Low-Income Market Awareness of and Knowledge about Solar

It appears that SASH has had a positive effect on participants' perception of their knowledge about solar. As seen in Figure 2-31, nearly half of those surveyed (47 percent) indicated that their knowledge increased by one step (either from Not at all to Somewhat or from Somewhat to Very Knowledgeable) after their involvement in SASH. In the absence of an objective test that assesses potential participants' baseline level of knowledge about SASH, the self-reported information is the best information available.

Figure 2-31. SASH Participants' Change in Knowledge about Solar After Program Participation (n=49)



Source: Analysis of SASH participant surveys, 2010.
Note: These data are self-reported assessments of the survey respondents' perception of their knowledge about solar; an objective test was not conducted.

SASH's marketing and outreach efforts aim to incite awareness in the low-income community that solar can be affordable even for low-income earners. In-depth interviews with nonparticipants indicate that this message is still penetrating the low-income community. Of 11 nonparticipants interviewed,[62] five report that they believed that solar has become more affordable for low-income earners over the past year; three respondents indicated that they do not believe that, and three respondents did not know. None of the respondents indicated that the information about the affordability of solar for low-income earners came from explicitly from GRID, however.

[62] It is important to note that the nonparticipants that responded to the in-depth interview questions were self-selected; the evaluation team did not use a random sample due to the difficulty in identifying households eligible for SASH. Instead, the nonparticipants that responded had received a request from a community organization with which they were familiar. The 11 individuals who responded made the effort to participate in the interview.

2.6 *Key Findings*

This section summarizes the main findings discussed in the SASH section of this report. Section 5 includes a discussion of the recommendations connected to these findings.

2.6.1 Overall Market

» **GRID sits at the center of the market for low-income single-family solar in California.** GRID is at the center of nearly all interactions with the customer in the market for PV system development among single-family homeowners. GRID either interfaces directly with the customer or facilitates relationships with nearly all of the other market actors whose involvement contributes to a successful project.

» **The market for SASH is big enough to support the program.** The evaluation team estimates that the total market size for SASH is approximately 128,000 households. This indicates that a sufficient market exists to enable GRID to achieve its target of 6,000 installations, which represents a five percent market share of the 128,000 homes.

» **GRID has progressed in reaching out to one of the priority markets outlined by CPUC.** In its decision instituting SASH, CPUC indicated, "The outreach program should include a component geared to populations that are not proficient in English and persons with disabilities."[63] SASH program participants are more likely to primarily speak Spanish in their homes than the general population. Among survey respondents, 45 percent reported speaking primarily Spanish in their homes, compared to 28 percent for the state as a whole.

2.6.2 Channel Strategy

» **GRID's channel strategy to date appropriately meets the program's need to build trust and protect brand equity.** GRID has taken a hands-on approach to distribution of its product and restricted other organizations' ability to promote the product to potential homeowners. The main benefit to this approach is that GRID retains control over the message, the quality of customer experience, and the risk associated with ensuring that homeowners meet the complex program requirements. By maintaining control over the channels of distribution, GRID reduces the risk that an outside partner might (even inadvertently) jeopardize the work done to develop trust and to ensure GRID achieves fairly low sales force costs as a percentage of total project costs. Alternative structures allow for much more variation in messaging and customer experience than the current one does, creating the potential to erode GRID's brand equity and damage the long-term effectiveness of the SASH program.

[63] California Public Utilities Commission. November 2007. "Opinion Establishing Single-Family Low-Income Incentive Program within the California Solar Initiative." Decision 07-11-045.

» **SASH participants report first hearing about SASH through all of the channels that GRID uses.** More than one-third (34 percent) of SASH participants who responded to a survey report that they learned about SASH through a community organization, including Habitat for Humanity. Survey participants identified GRID as their first source of information about SASH second most frequently (19 percent of the time). This response was more common among households in which English is the primary language (22 percent) than in households in which Spanish is the primary language (9 percent).

» **Some segments of the market respond better to certain channels.** Households in which English is the primary language respond better to direct communications, such as mailers and contact with GRID staff. Referrals from friends, relatives, and neighbors are nearly twice as effective in Spanish-speaking households as in English-speaking ones.

» **Survey data also indicate that GRID clients are very satisfied with their experience with GRID and with SASH to date.** Nearly all (92 percent) indicate that they are very satisfied with GRID, and 90 percent report that they are very satisfied with the SASH program as a whole. None of the respondents scored GRID lower than somewhat satisfied in any of the categories related to the channel strategy.

2.6.3 Drivers and Barriers to Participation

» **Financial and environmental motivations drive the vast majority of homeowners' decisions to participate in SASH.** Over three-quarters of respondents (76 percent) indicate that the reduction in their electric or utility bills was the primary reason that they participated in SASH. In addition, another 17 percent of survey respondents indicated that helping the environment was their primary reason for participating in SASH. The role of neighbors and friends is a less significant factor in the decision to actually install solar than it is in introducing the SASH program to homeowners.

» **Cost remains the primary barrier to participating in SASH.** Over one-quarter of program participants indicated that the cost of the system created an initial barrier to participation in SASH, though their interactions with GRID resolved these concerns. Interviews with non-participants indicate that the cost of the system remained the most important barrier for them; many of these non-participants had not heard of SASH previously, however.

» **GRID is still in a period of building credibility with the low-income communities throughout the state.** Nearly one-quarter of the program participants surveyed indicated that they initially thought that the program was "too good to be true" or had doubts about the level of anticipated bill savings.

2.6.4 Paying for the System

» **SASH incentives are covering more of the total system cost than the anticipated range indicated in CPUC 07-11-045.** According to the SASH decision, CPUC designed the incentive rates for SASH to cover 50 to 75 percent of total system costs, assuming installed costs averaged $9.00/W.[64] For more than half of installed projects, the SASH incentive covers 90 to 100 percent of the system cost; for 86 percent of all installed projects, the SASH incentive covers more than 80 percent of the project cost.

» **GRID has successfully appealed to a diverse set of organizations to contribute to funding gaps for SASH projects.** The average project funding gap filled by an outside organization is approximately $2,600. A small number of participants have contributed their own financial resources to pay for their systems.

» **Nearly one-half of participants surveyed indicated willingness to allocate some portion of their bill savings to loan payments to help pay for their PV system.** Framing the energy bill savings as a source of creditworthiness could encourage more applicants to contribute financially to a SASH system. This approach would require a lending partner that offered a product with a reasonable interest rate. If a household that realizes electric bill savings of $100/month is willing to contribute 50 percent of that savings to a monthly loan payment, they could afford to take out a three-year loan of $1,596, assuming eight percent interest.

2.6.5 Spillover

» **SASH has the potential to add between 12 and 22 full-time equivalent positions by the end of 2014.** This estimate includes between 10 and 18 SPP contractors and between two and four job trainees. This analysis considers only those employment opportunities created by the SPP. While projects installed by GRID staff also draw upon solar job trainee and workforce development programs, their heavy reliance on volunteer staff make FTE modeling more difficult. A broader assessment of program-wide workforce impacts would need to consider SASH-related activities among other market actors, including the CPUC, GRID Alternatives, the investor-owned utilities, and equipment manufacturers and distributors.

» **The SASH program's outreach on energy efficiency appears to have spurred a number of program participants to implement energy-efficient equipment or behaviors.** Almost 65 percent of participants who responded to a survey indicated that they had adopted some energy-efficient actions or behaviors as a result of SASH. The vast majority of participants surveyed (84 percent) had not participated in LIEE. Thus, it is likely that the energy-efficient changes resulted from GRID's outreach or the energy audit, which a GRID staff person conducts.

[64] CPUC SASH decision. http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/75400.htm

» **Knowledge about solar appears to have increased among SASH participants, while messages about the affordability of and benefits of PV are still penetrating the broader market.** SASH's marketing and outreach efforts aim to incite awareness in the low-income community that solar can be affordable even for low-income earners. Nearly half of participants report an increase in their level of knowledge about solar since participating in SASH. Conversely, over half of nonparticipants who responded to interview questions indicate that they either did not believe that solar had become more affordable to low-income households or that they did not know.

3 MASH Market Assessment

This section focuses on the dynamics in the market in which the Program Administrators operate the MASH program. As another example of a business-to-business (B2B) market, the market for solar on low-income multifamily buildings has a structure similar to the General Market CSI program. The key decision makers in this market represent business, non-profits, and other organizations; in contrast, individuals constitute the decision making population in the SASH market. Thus, the dynamics in the market in which MASH interacts follow more closely the dynamics of other markets in which decision makers must consider the priorities of their investors (or funders) and the implications for the profitability (or sustainability) of their organization. This section will explore the unique aspects of the B2B market.

MASH provides financial assistance for the installation of solar PV generating systems on low-income multifamily housing. Three program administrators (PAs) implement the program: PG&E, SCE, and CCSE in the service territory of SDG&E. The program's goals are the following:[65]

- Stimulate the adoption of solar power in the affordable housing sector.
- Improve energy utilization and overall quality of affordable housing through the application of solar and energy efficiency technologies.
- Decrease electricity use and costs without increasing monthly household expenses for affordable housing building occupants.
- Increase awareness and appreciation of the benefits of solar among affordable housing occupants and developers.

MASH provides rebates for PV installation based on the EPBB, a one-time lump-sum payment, after verification of system installation. In this downstream market intervention strategy, the PAs provide rebates to either the multifamily property owner or a third-party PV system owner (e.g., in the case of third-party financing) to lower the overall installed cost.

Multifamily buildings in PG&E, SCE, and SDG&E service territories that meet the definition of low-income affordable housing established in P.U. Code 2852 are eligible for program incentives. The code states that the housing must fall into one of the follow categories:

- A multifamily residential complex financed with low-income housing tax credits, tax-exempt mortgage revenue bonds, general obligation bonds, or local, state, or federal loans or grants, and for which either of the following applies:

[65] California Public Utilities Commission. October 16, 2008. "Decision Establishing Multifamily Affordable Solar Housing Program within the California Solar Initiative." Decision 08-10-036.

- The rents of the occupants do not exceed those prescribed by deed restrictions or regulatory agreements.

- The affordable units have been or will be initially sold at an affordable housing cost to a lower income household and are subject to a resale restriction or equity-sharing agreement.

- A multifamily residential complex in which at least 20 percent of the total housing units are sold or rented to lower income households and either of the following applies:

  - The rental housing units targeted for lower income households are subject to a deed restriction or affordability covenant with a public entity or nonprofit housing provider that ensures that the units will be available at an affordable rent for a period of at least 30 years.

  - The housing units have been or will be initially sold at an affordable cost to a lower income household, and those units are subject to a resale restriction or equity-sharing agreement.

This section will discuss the key aspects of the market in which the MASH program operates. Section 3.1 describes the structure of the market and describes the key market actors. Section 3.2 discusses the channels that the PAs use to market and implement the program. Section 3.3 outlines the drivers for and barriers to participation in this market from the perspective of host customers, third-party financiers, installers, and organizations that support the low-income multifamily housing industry.
Section 3.3.3 describes the strategies that host customers have used to finance their system and includes a discussion about the effects of incentives in the market to date and analyzes the effect of different incentive levels on project economics. Section 3.5 provides an overview of some of the differences between Track 1 and Track 2. Section 3.6 highlights some of the spillover effects of the program. Finally, section 3.7 summarizes the key findings from this section of the report.

3.1 Market Description

This section provides a high-level overview of the market with which the MASH program interacts. Understanding the types of interactions among market actors and the profile of typical program participants provides a foundation for examining the remaining research objectives covered in the MASH Market Assessment. Section 3.1.1 identifies where the MASH program administrators fit with the rest of the supply chain. Section 3.1.2 provides additional detail about the characteristics of the main categories of market actors (host customers, system owners, and installers, respectively) and highlights the trends in their participation in the program.

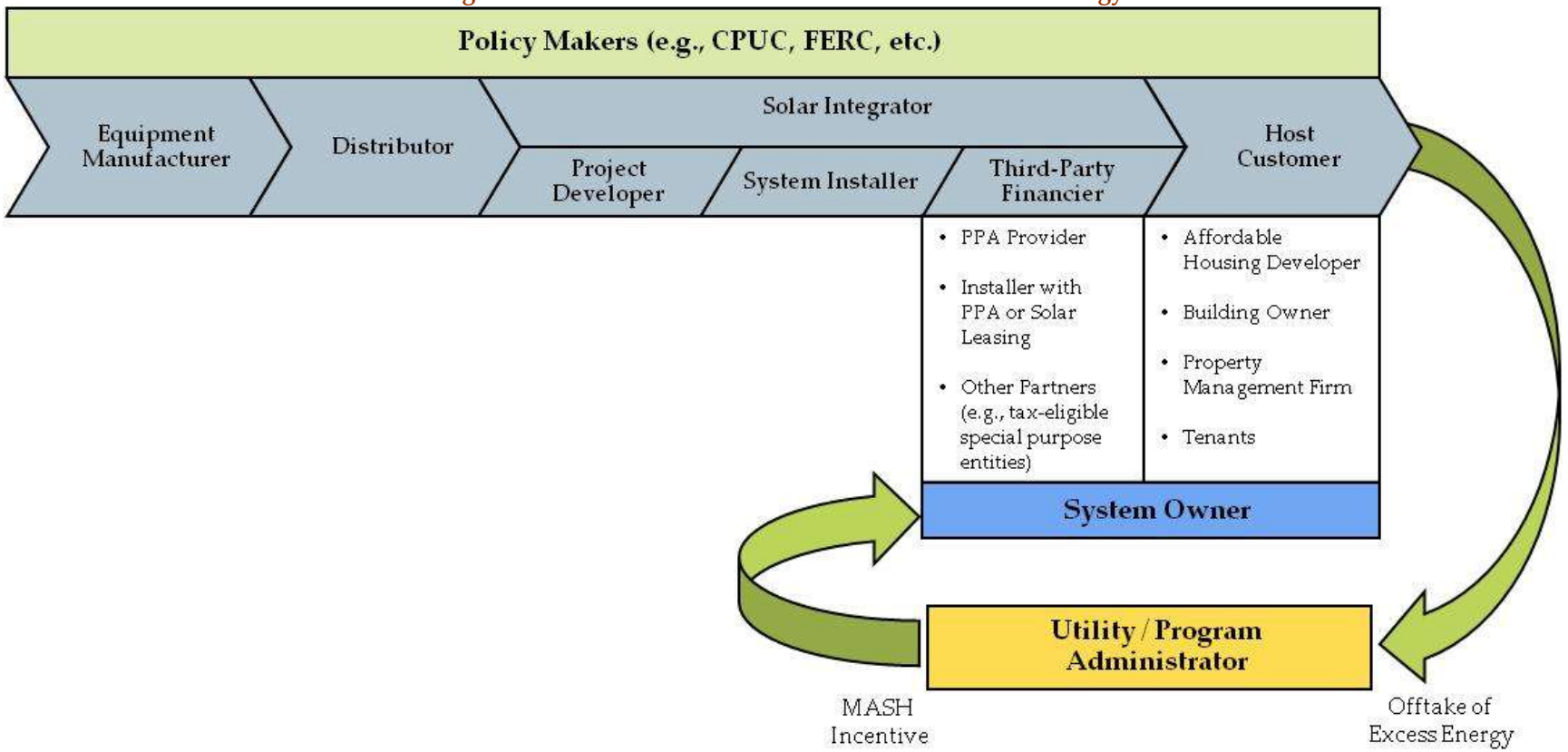
Much of the analysis in this section relies on the data maintained in Power Clerk by the program administrators. The analysis uses data exported for CCSE and SCE on November 12, 2010, and acquired from PG&E on November 17, 2010.

3.1.1 Market Structure

The MASH program design provides market actors a great deal of flexibility in establishing the specific project approaches, financing arrangements, and relationships that will create viable solar installations for the affordable multi-family housing market. For a given project, the program administrator (PA) works primarily and most directly with a single project applicant, usually from one of three primary market actor categories: host customers, system owners, and installers. For many projects, a single party may be listed in the Power Clerk data for more than one of these roles. For example, a host customer that finances its own project will also list itself as the system owner; a vertically integrated solar company that markets itself as a "solar integrator" may appear as both the installer and the system owner (indicating a third-party ownership financing arrangement). In other cases, a project may involve three separate entities for each role.

Figure 3-1 depicts the primary relationships between the PAs and the key MASH market actors. A brief summary of the interactions between market actors follows; the market actors are organized in alphabetical order.

Figure 3-1. MASH Market Structure and Intervention Strategy



Source: Navigant analysis, 2011.

EQUIPMENT MANUFACTURERS AND DISTRIBUTORS. MASH program participants benefit from California's well-established and competitive solar industry. Host customers can solicit bids from a wide range of experienced project developers, installers, integrators, and third-party financing firms that have diverse approaches to equipment procurement and supplier relationships. These arrangements may include serving as a dealer for a given supplier, operating as an independently-owned franchise of a vertically integrated manufacturer-distributor-installer, formal supply agreements, or established relationships in the field. As with the broader solar market, most host customers rely on these solar industry players to deal with the complexities of equipment selection and to provide competitive equipment pricing rather than approaching suppliers themselves.[66]

HOST CUSTOMERS. The MASH program's host customers own the qualifying affordable housing properties on which incentivized systems are installed. Also referred to in this report as "program participants," these organizations include affordable housing developers (both nonprofit and for-profit entities), general-market housing developers that own some affordable housing properties, municipal housing authorities, property management firms, and independent property owners.[67] Independent of the type of host customer, these program participants interact to varying degrees with the PAs. Some take a primary role in applying for incentives, interacting with program staff, and providing requested information, while others rely on their chosen financing or system installation partners to handle the day-to-day requirements for moving a project forward.

Whether or not the host customer directly receives the MASH incentive payment or requests the PA to redirect it to a parent company, solar financing firm, or other third-party system owner, the host customer and its installer must still interact with its respective utility (the same party as the PA, except in the case of SDG&E, which contracts MASH administration to CCSE) for approvals and billing arrangements related to any interconnection, net metering, and virtual net metering requirements. The host customer also represents the channel through which MASH program benefits pass on to affordable housing tenants.

INVESTOR-OWNED UTILITIES (IOUS) AND PROGRAM ADMINISTRATORS (PAS). The CPUC holds each of the three investor-owned utilities (PG&E, SCE, and SDG&E) independently responsible for implementing the MASH program in its service territory. Both PG&E and SCE administer the program internally, while the California Center for Sustainable Energy (CCSE), a San Diego-based nonprofit organization, implements the program in SDG&E's service territory. Each PA handles all aspects of MASH program marketing, application processing, project review and approval, progress monitoring, and final incentive disposition.

In addition, the IOUs must handle any interconnection requests, net metering, and virtual net metering arrangements provided for MASH projects, and must accept any excess energy generated by the system in a given month. After system installation, the account holder continues to receive an account statement from the utility that details net energy usage, and the amount due to the utility or the amount owed to the customer or system owner, as appropriate.

[66] Market Actor Interviews

[67] Navigant categorized host customers based on a combination of Power Clerk data and information available on each organization's website.

SOLAR COMPANIES. As indicated in Figure 3-1, California's diverse solar market has given rise to a variety of solar business models. Some companies offer services across the solar value chain – from equipment procurement to system design and installation, and even project financing. Other firms focus their activities in one or a few of these areas. The following provides a brief overview of the most common combinations of market functions and approaches.

- **PROJECT DEVELOPERS.** Some firms develop renewable energy projects (i.e., secure property rights, equipment orders, interconnection agreements, etc.) independent of any in-house construction or installation capabilities. Often this approach is used with the intention of securing a PPA and/or selling all or part of the potential project "package" to an investor interested in owning the assets. In the case of solar, this approach most commonly occurs for large utility-scale projects. For the system sizes typical of the MASH program, the project development function falls primarily to the third-party system owners and firms offering installation services (e.g., solar integrators and solar installers).

- **SOLAR INTEGRATORS.** The term "solar integrator" is a nebulous term used by many solar companies. In most cases, such firms position this integration as providing "complete solutions" that include system design, installation services, and financing services (though they may subcontract a portion of these functions to a third-party partner). In this analysis, the term refers to a company that directly offers customers some form of project financing assistance in combination with project development and/or installation services.

  For MASH projects listing a solar integrator as the system owner, a review of the associated project installers provides some notable insights. In particular, two solar integrators list themselves as installer for all but one of the projects for which their firm is also owner (n=156 projects). The other four solar integrators exclusively list third-party solar installers or contractors as the system installer for their projects (n=98 projects), revealing the degree to which solar integrators may or may not self-perform system installations.

- **SOLAR INSTALLERS.** Many solar companies generally limit the scope of their activity to the actual design and construction of the PV system, having been contracted by a host customer or third-party system owner. Some installers may only provide construction services for a solar integrator that has already developed a project and designed a system. For this analysis, the term is used to differentiate "solar installers" not directly providing system ownership or third-party financing solutions from "solar integrators" who offer such fully integrated services.

- **OTHER INSTALLATION CONTRACTORS.** In addition to solar installers that focus primarily on constructing solar PV systems, other firms offer solar installation services as a supplement to other areas of expertise such as general contracting, electrical contracting, or energy consulting.

POLICY MAKERS. State legislators and regulatory agencies have established the regulatory framework under which the solar market operates. Relevant policies include the state's renewable portfolio standard (RPS), net metering laws, interconnection processes, the funding mechanism for MASH program, the parameters within which the MASH program operates, and the definition of low-income. CPUC also provides oversight for the overall operation of the investor-owned utilities (IOUs) and their internal and contracted program administration staff.

THIRD-PARTY OWNERSHIP AND FINANCING PROVIDERS. More so than general market customers who wish to install PV, MASH participants tend to have significant constraints on their ability to provide the upfront capital typically required for a PV system. The solar market, however, has developed alternative financing mechanisms in the form of solar PPAs and solar leases that enable host customers to reap the benefits of onsite PV without having to actually own the system. In these cases, a project developer or solar integrator will retain ownership of a system installed on the host customer's property (sometimes leasing the space for the system from the customer) in exchange for a contractual agreement from the customer to purchase the system's output for a pre-determined price and length of time.

Other third-party ownership models include arrangements for system ownership by a host customer's parent company or affiliate, sometimes a special purpose entity established specifically for that purpose. More than 75 percent of MASH projects in the Power Clerk database listed a system owner that was other than the host customer, while 68 percent of surveyed program participants reported utilizing a PPA to finance their systems. In most of these cases, the system owner or PPA provider likely played a lead role in interacting with the PA throughout the application and project development process.

3.1.2 Overview of Program Participation

This section provides additional insight into the level and scope of MASH program involvement among different types of organizations in each of the three market actor categories tracked by program data (i.e., host customer, system owner, and installer). These findings help illustrate the types of relationships and roles that have developed among these market actors in response to the MASH program. In most cases, the following analysis focuses on the aggregate status of active Track 1 projects (excluding those that have been cancelled or withdrawn) through early November 2010.

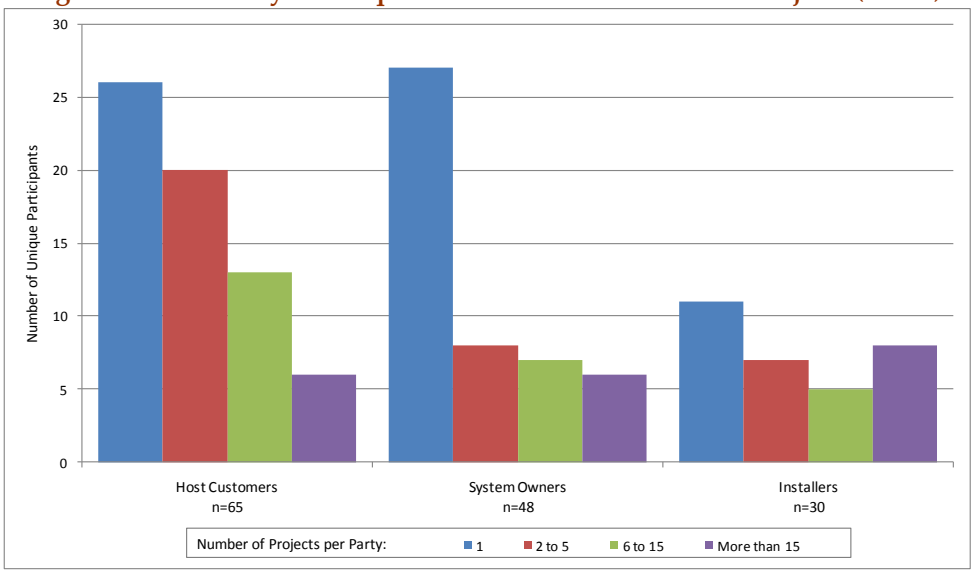
Table 3-1. Summary of MASH Projects by Status and Program Administrator

Status	CCSE	PG&E	SCE	Total
Cancelled/Withdrawn	3	16	25	**44**
Reservation Requested	0	2	27	**29**
Reservation Reserved	4	16	27	**47**
Proof of Project Milestones Submitted	0	40	17	**57**
Reservation Confirmed	22	81	56	**159**
Incentive Claim Request Submitted	1	9	2	**12**
Project Completed and Incentive Paid	3	17	7	**27**
Total	**33**	**181**	**161**	**375**

Source: Analysis of PowerClerk Database, November 2010.

As shown above in Table 3-1 , the program data includes 375 Track 1 projects. With the 44 cancelled or withdrawn projects excluded, the total number of active (including completed) projects stood at 331 at the point of evaluation. In an effort to understand more about those participating in the MASH program, the evaluation team analyzed the composition of unique host customers, system owners and installers listed for these projects. Figure 3-2 presents a snapshot of the number and involvement of program participants in each of these categories. For the 375 MASH projects, there are only 65 unique host customers, 48 unique system owners, and 30 unique installers participating across the state.

Figure 3-2. Summary of Unique Parties Involved in MASH Projects (n=375)



Source: Analysis of PowerClerk Database, November 2010.

Table 3-2 provides additional details to help characterize these program participants. As shown, 26 of the 65 unique host customers have only a single MASH project, accounting for seven percent of the total projects. Conversely, the six largest host customers account for 156 projects (42 percent of the total projects).

Table 3-2. Details of Unique Party Participation in All MASH Projects (n=375)

Participant Category	Unique Parties	Number of Projects per Party				Range of Projects per Party		
		1	2 to 5	6 to 15	More than 15	Min	Max	Median
Host Customers	65	26	20	13	6	1	52	3
% of projects		7%	18%	34%	42%			
System Owners	48	27	8	7	6	1	103	1
% of projects		7%	6%	16%	71%			
Installers	30	11	7	5	8	1	114	4
% of projects		3%	5%	14%	78%			

Source: Analysis of PowerClerk Database, November 2010.

An even greater disparity exists among system owners. While 27 system owners have a single project, only six unique organizations are listed as system owner for more than two-thirds of MASH projects (265 of the 375 projects). The largest single system owner is listed for 103 projects (27 percent of the total projects).

These statistics suggest the degree to which large affordable housing organizations, third-party financiers, and solar integrators are involved in the MASH program. While many of these participants have secured reservations for numerous sites, individual projects often require multiple MASH projects to accommodate separate buildings at a single project site. This is illustrated in Table 3-3, which provides summary statistics for the 27 projects for projects that have already reached completed status (meaning they have received their MASH incentive payments). As shown, only 11 unique hosts and 16 individual sites exist for these 27 projects.

Table 3-3. Summary Statistics for Completed Projects

Completed Projects	
Total Applications	27
Unique Host Locations	16
Max Applications per Project	5
Average Applications per Project	1.69
Unique Host Customers	11
Applications with Direct Ownership	11
Applications with Third Party Ownership	16

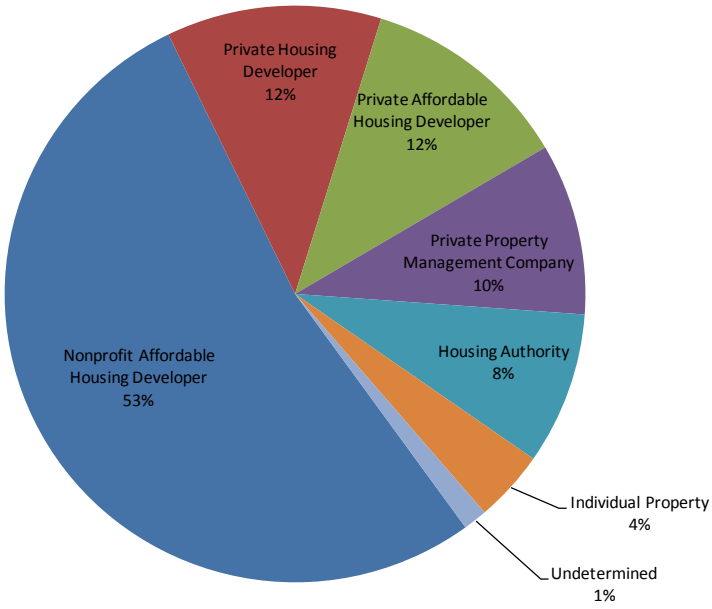
Source: Analysis of PowerClerk Database, November 2010.

The following sections provide additional analysis and insight into the participation of each of the three key market actor categories.

HOST CUSTOMERS

There are 65 unique parties listed as host customers for MASH projects. As shown in Figure 3-3, the majority (53 percent) of MASH projects are held by host customers identified on their websites as nonprofit affordable housing developers or community development corporations. Private housing developers hold an additional 24 percent of projects, with an even split between those working primarily in the affordable housing market and those for whom affordable housing is only one of several targeted real estate sectors.

Figure 3-3. Share of All MASH Projects by Host Customer Type (n=375)



Source: Analysis of PowerClerk Database, November 2010.

Table 3-4 provides additional details about the number and average level of MASH participation for each of the host customer categories. Again, nonprofit affordable housing developers represent the highest levels of participation on the basis of unique parties (n=31) and overall projects (n=198), including one organization with that holds 52 MASH projects.

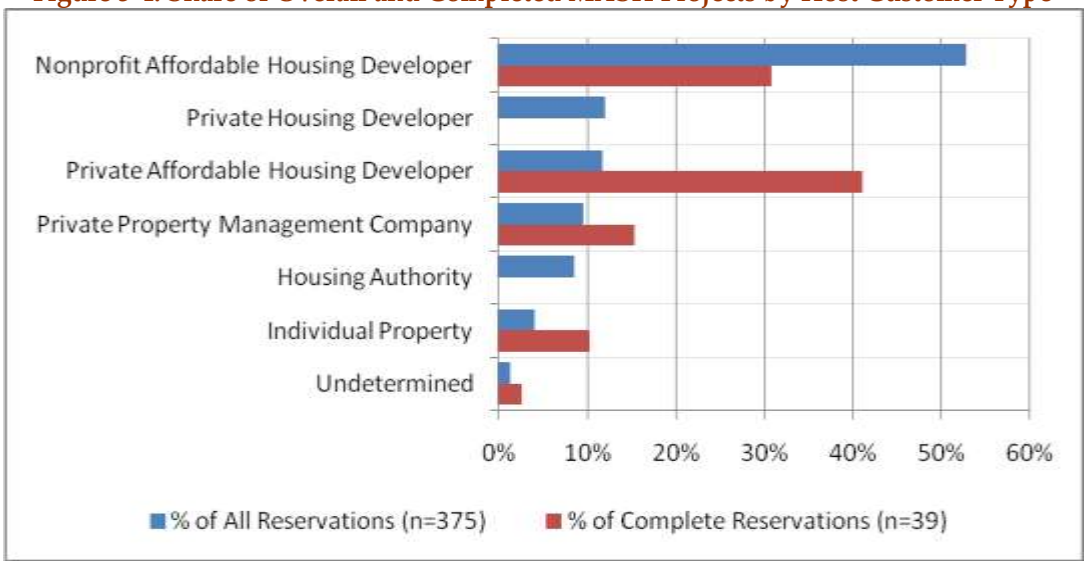
Table 3-4. Details of Unique Host Customer Participation in MASH Projects (n=375)

Host Customer Type	Projects	Unique Parties	Projects per Party		
			Mean	Median	Max
Nonprofit Affordable Housing Developer	198	31	6.4	2.0	52
Private Housing Developer	45	8	5.6	5.5	13
Private Affordable Housing Developer	44	7	7.0	5.0	16
Private Property Management Company	36	4	9.0	8.0	17
Housing Authority	32	3	10.7	12.0	19
Individual Property Owner	15	10	1.5	1.0	4
Undetermined	5	2	2.5	2.5	4
Total	**375**	**65**	**5.8**	**3.0**	**52.0**

Source: Analysis of PowerClerk Database, November 2010.

While nonprofit developers hold the majority of MASH projects, their projects have not necessarily moved forward as quickly as those of other host customer types. Figure 3-4 compares each host customer type's share of overall projects with its share of projects for installed and completed projects (including those for which incentive claims have been filed but not paid). As shown, nonprofit affordable housing developers represent only 31 percent of completed projects, but more than half of overall projects. The evaluation team credits this discrepancy to the completion of several MASH projects by a pair of private affordable housing developers (one being responsible for 14 of the 16 completed projects in that category), which hold a smaller relative share of the overall projects.

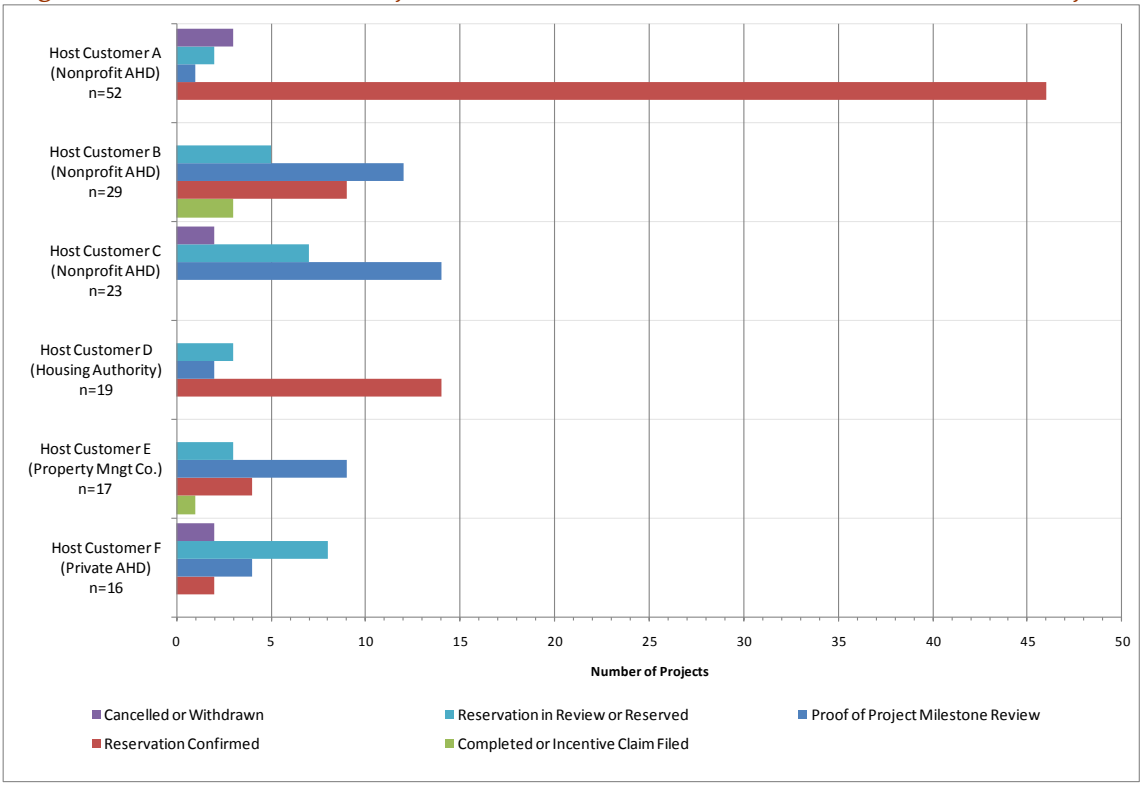
Figure 3-4. Share of Overall and Completed MASH Projects by Host Customer Type



Source: Analysis of PowerClerk Database, November 2010.

For the six host customers that each hold more than 15 MASH projects, Figure 3-5 shows the number of projects in each project status category. While only four projects among the 156 attributed to these customers have been completed, most are moving forward based on the submission of proof of project milestones. With most of these projects' projects initiated in the third and fourth quarters of 2009, applicants generally have until the first or second quarters of 2011 to complete projects and submit incentive claims (barring any extensions). Illustrating the degree to which apparent partnerships have evolved among market actors, most of the projects for three of these six large host customers list one of only four large solar integrators as the system owner (likely indicating a PPA financing arrangement).

Figure 3-5. Status of MASH Projects for Host Customers with More Than 15 MASH Projects

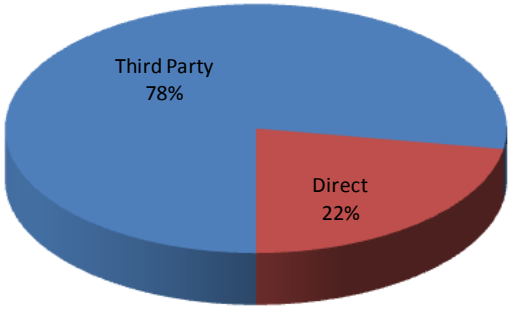


Source: Analysis of PowerClerk Database, November 2010.

SYSTEM OWNERS

As suggested in the previous section, third-party system owners and financing arrangements plays a significant role in developing MASH projects and securing incentives. Figure 3-6 illustrates the approximate division of ownership structures for active MASH projects based on differences in last name between the host customer and system owner listed for each project. More than three-fourths of MASH projects involve a third-party system owner, while the remainder lists the host customer (or its parent/holding company) as the system owner. This topic is discussed further in section 3.3.3 on Project Financing and Incentive Levels.

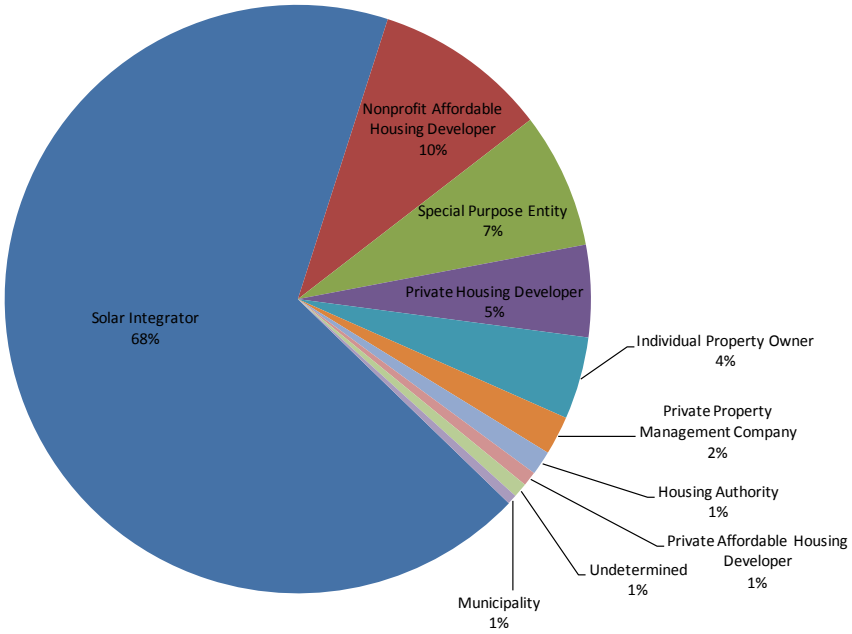
Figure 3-6. Ownership Structure for Active MASH Projects (n=331)



Source: Analysis of PowerClerk Database, November 2010.

Based on an online assessment of the organizations listed as system owners for each of the 375 existing MASH projects (including those canceled or withdrawn), the majority of third-party owners appear to be self-described "solar integrators" that offer project development, installation, and financing services (primarily PPAs). As shown in Figure 3-7, 68 percent of all projects list a solar integrator as the system owner.

Figure 3-7. Share of All MASH Projects by System Owner Type (n=375)



Source: Analysis of PowerClerk Database, November 2010.

The detailed summary of unique system owners' involvement in the MASH program in Table 3-5 reveals that only six unique solar integrator firms are listed as owners for those 254 MASH projects. The other major category of third-party system owners comprises three "special purpose entities" that appear affiliated with, but not part of, their associated host customers. Based on market actor interviews, some may have been established specifically to take title of MASH systems for specific host customers.

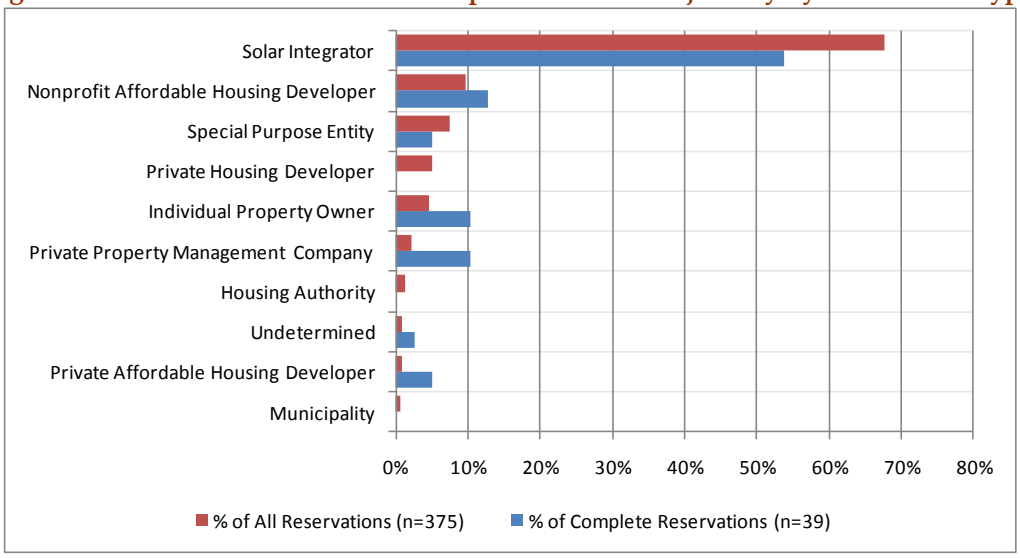
Table 3-5. Details of Unique System Owner Participation in MASH Projects (n=375)

System Owner Type	Projects	Unique Parties	Projects per Party		
			Mean	Median	Max
Solar Integrator	254	6	42.3	34.0	103
Nonprofit Affordable Housing Developer	37	13	2.8	1.0	12
Special Purpose Entity	28	3	9.3	10.0	17
Private Housing Developer	20	5	4.0	3.0	8
Individual Property Owner	16	12	1.3	1.0	5
Private Property Management Company	8	1	8.0	8.0	8
Housing Authority	5	2	2.5	2.5	4
Private Affordable Housing Developer	3	3	1.0	1.0	1
Undetermined	2	2	1.0	1.0	1
Municipality	2	1	2.0	2.0	2
Total	**375**	**48**	**7.8**	**1.0**	**103**

Source: Analysis of PowerClerk Database, November 2010.

Figure 3-8 compares the proportion of overall and completed MASH projects for each category of system owner, revealing the large majority of projects (overall and completed) held by the six solar integrators. Notably, while they each hold smaller shares of overall MASH projects, the individual property owners, private property management companies, and private affordable housing developers have greater shares of the completed projects. With fewer total projects per party, these owners can likely progress their MASH projects more quickly than the solar integrators.

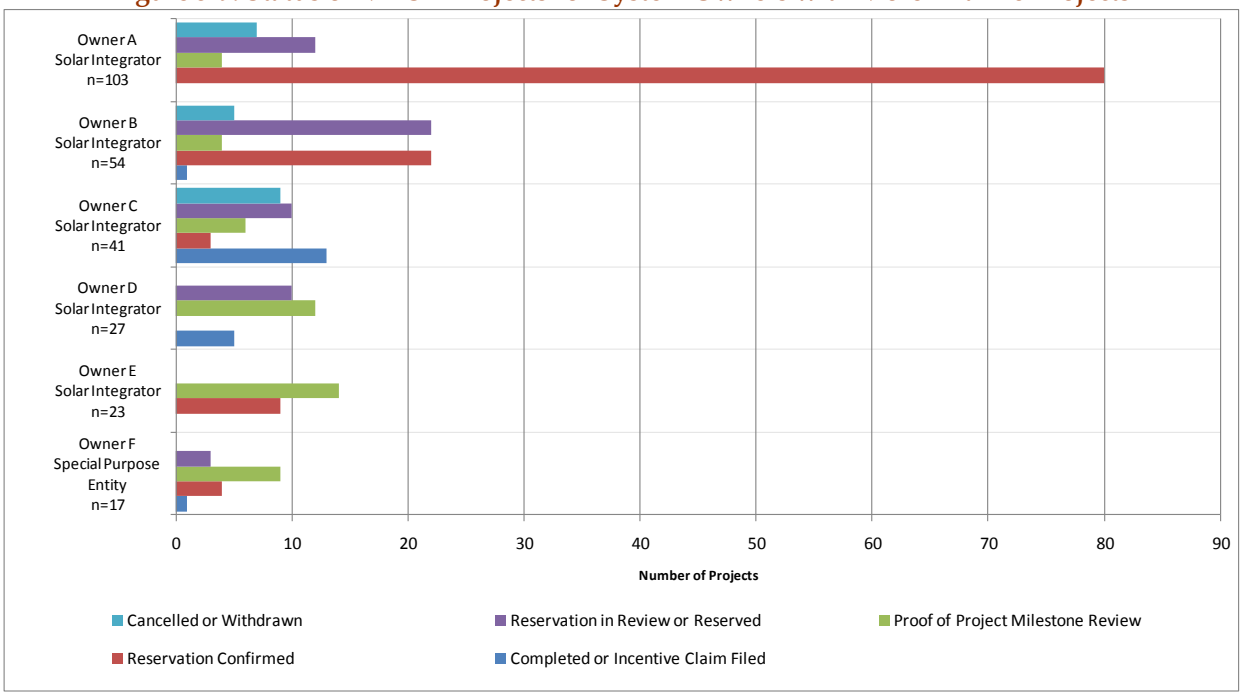
Figure 3-8. Share of Overall versus Completed MASH Projects by System Owner Type



Source: Analysis of PowerClerk Database, November 2010.

Each of the six system owners listed on more than 15 MASH projects described themselves as solar integrators. The last, Owner F in Figure 3-9, was described in an interview with the listed contact as a special purpose entity set up specifically to provide ownership of solar systems installed on properties owned or managed by a particular private property management company. The 13 projects completed by Owner C were all done in partnership with a single affordable housing developer host customer. As noted with the largest host customers, most projects for the largest system owners are moving forward based on receipt of proof of project milestones, with 125 projects (about 47 percent) approaching their 18-month time limit for reserving an incentive sometime in the first or second quarter of 2011.

Figure 3-9. Status of MASH Projects for System Owners with More Than 15 Projects

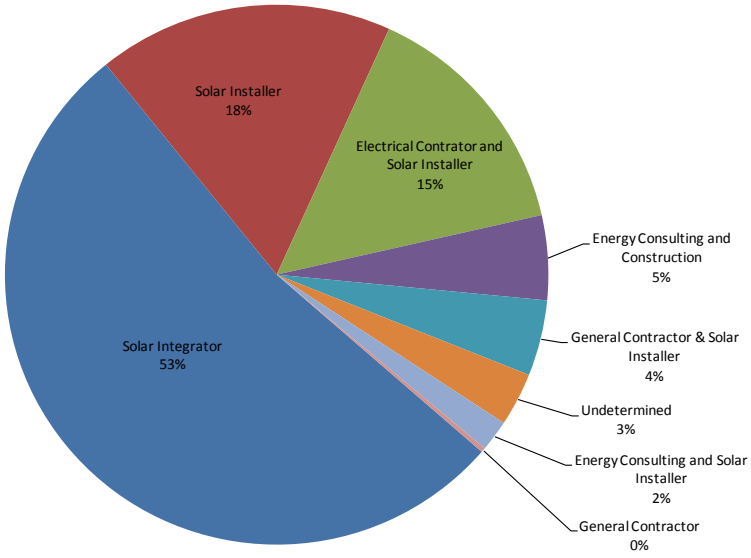


Source: Analysis of PowerClerk Database, November 2010.

PARTICIPATING CONTRACTORS

The MASH data lists eight self-described solar integrators as installers for existing projects. As shown in Figure 3-10, these eight firms together account for 53 percent of MASH projects. The evaluation team categorized an additional 18 firms either as exclusively solar installation firms or as electrical, general, or energy consulting contractors that also specifically market solar installation services. These solar installers represent another 39 percent of MASH projects. The remaining 8.5 percent of projects list an installer that does not specifically identify as a solar installation firm (or the installer has not yet been determined). Table 3-6 presents a more detailed summary of the unique parties listed as solar installers.

Figure 3-10. Share of All MASH Projects by Installer Type (n=375)



Source: Analysis of PowerClerk Database, November 2010.

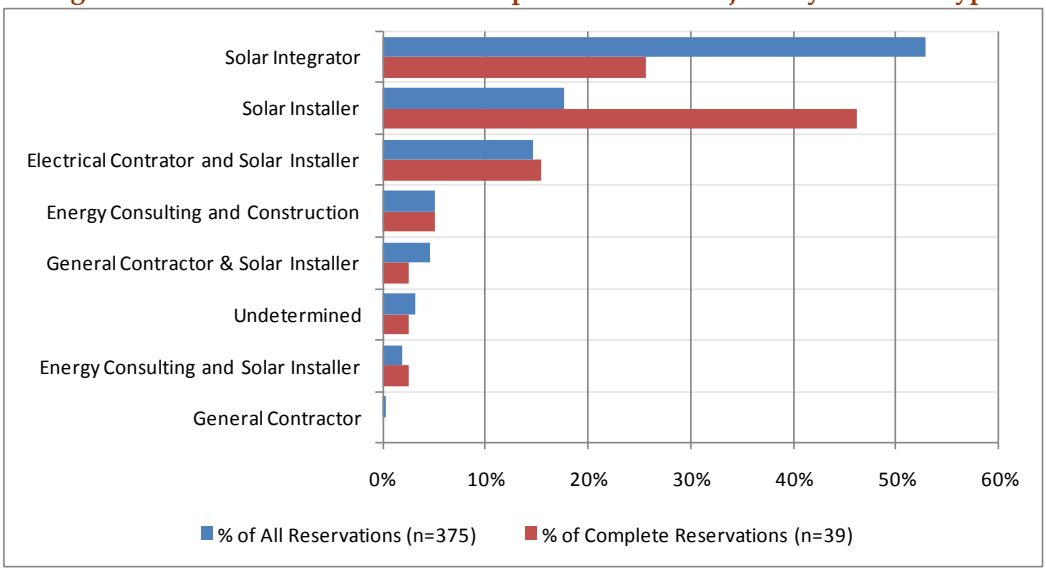
Table 3-6. Details of Unique Installer Participation in MASH Projects (n=375)

Installer Type	Projects	Unique Parties	Projects per Party		
			Mean	Median	Max
Solar Integrator	198	8	25	4	114
Solar Installer	66	10	7	2	20
Electrical Contractor and Solar Installer	55	5	11	9	31
Energy Consulting and Construction	19	1	19	19	19
General Contractor & Solar Installer	17	1	17	17	17
Undetermined	12	2	12	6	11
Energy Consulting and Solar Installer	7	2	4	4	6
General Contractor	1	1	1	1	1
Total	**375**	**30**	**12.5**	**4.0**	**114.0**

Source: Analysis of PowerClerk Database, November 2010.

Figure 3-11 compares the share that each category of system installer holds of (1) the overall and (2) the completed MASH projects. The most notable finding shows that projects listing "solar installer" as the system installer category have reached completion in greater proportion to their overall share of projects than have solar integrators. However, further analysis reveals that a greater proportion of solar installers' incentives were reserved in the first and second quarters of 2009 (21 percent) than those for solar integrators (3 percent), meaning solar installers would have had a greater share of projects approaching their 18-month deadlines in the third and fourth quarters of 2010.

Figure 3-11. Share of Overall and Completed MASH Projects by Installer Type



Source: Analysis of PowerClerk Database, November 2010.

3.2 Market Channels

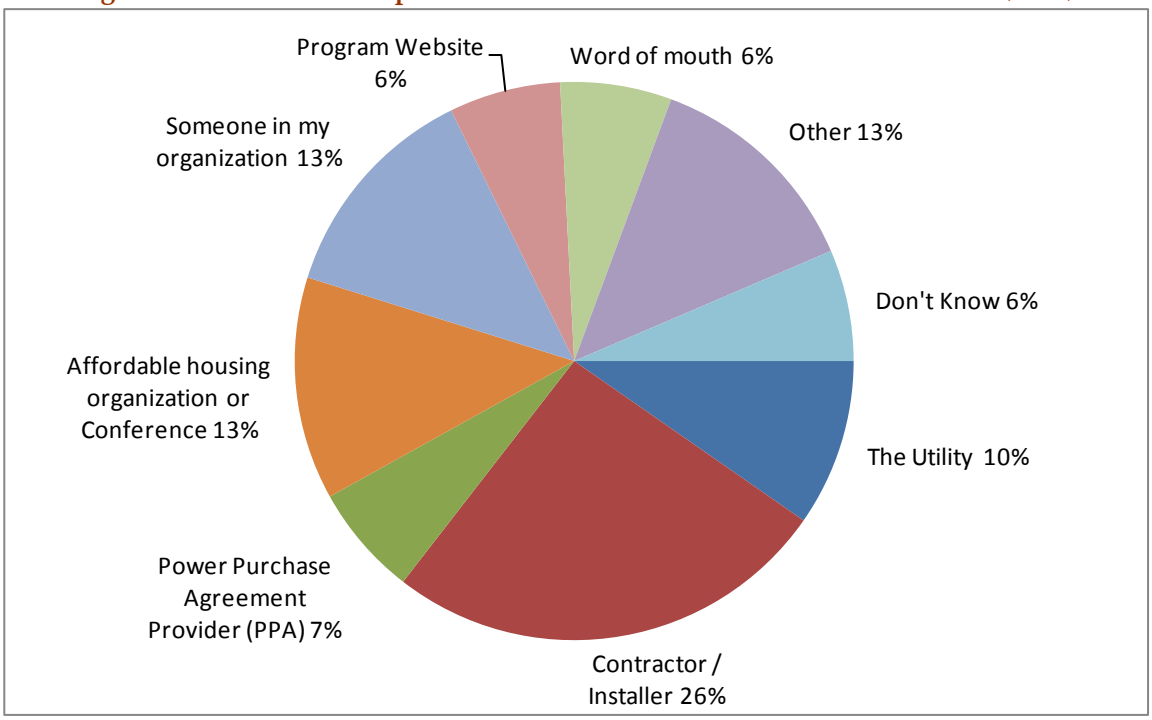
MASH has used an intensive distribution model in which many entities have the ability to distribute information about MASH and recruit participants for the program. Whereas the SASH program retains control over the messaging and customer interaction, the MASH program allowed a variety of market actors to perform the outreach and promote the program. This section describes the channel strategy that MASH has employed and identifies the channels through which participants most frequently initially learn about MASH.

The PAs relied almost exclusively on contractors for distribution of their offering under MASH's Track 1. Early in the program, contractors attended conferences that the PAs held to familiarize the public with the MASH program. All of the PAs report that almost all of the projects came in through these contractors. Customers who came directly to the PAs were still able to participate in the program, but it was a less common way to enter the program according to the PAs.

In the early months of program implementation, the PAs started to form partnerships with affordable housing and community organizations. The PAs intended to leverage such partnerships to identify low-income units in order to target marketing materials. Since the applications for Track 1 incentives were fully subscribed so quickly, however, the PAs did not have time to fully develop such partnerships, and they were not leveraged for distribution of the Track 1 offering.

Figure 3-12 identifies the channels through which MASH participants initially learned about the program.

Figure 3-12. MASH Participants' Initial Source of Information about MASH (n=31)



Source: Analysis of MASH participant surveys, 2010.

Combined, solar contractors and PPA providers serve as the most common channels to initially learning about CSI. One-third of participants surveyed indicated that they initially learned about MASH through one of these two channels. The incentive available for MASH accrues directly to these entities in most cases, and the potential financial benefits for these entities drive their efforts to recruit participants. The training that the PAs held about the program, which the contractors attended, provided them with the information necessary to effectively present the benefits and processes of the program.

Participants reported that affordable housing organizations served as the initial source of information about MASH second most frequently (13 percent of respondents). Despite the fact that the PAs never completed their outreach efforts to these organizations, the organizations still served as an important conduit to the program.

The utilities and the program websites also served as initial sources of information for some participants. It is not clear which websites the respondents had viewed; the PAs' websites, the CSI website, and CPUC's MASH website all provide relevant information that could have incited the participants to learn more about the program. Thus, the evaluation team did not group these altogether under one "utility" bundle.

The diversity in the channels that the PAs use to distribute the MASH program is highlighted by the fact that nearly a quarter (23 percent) of the survey respondents indicate that some channel other than those listed served as their primary source of information about the program. Other sources include the U.S. Department of Agriculture's rural newsletter, an independent marketing group, and a consultant for the solar initiative. This is different from SASH, in which less than five percent of respondents indicate that their initial information came from somewhere other than the channels that GRID had provided.

3.3 Drivers and Barriers to Participation in MASH

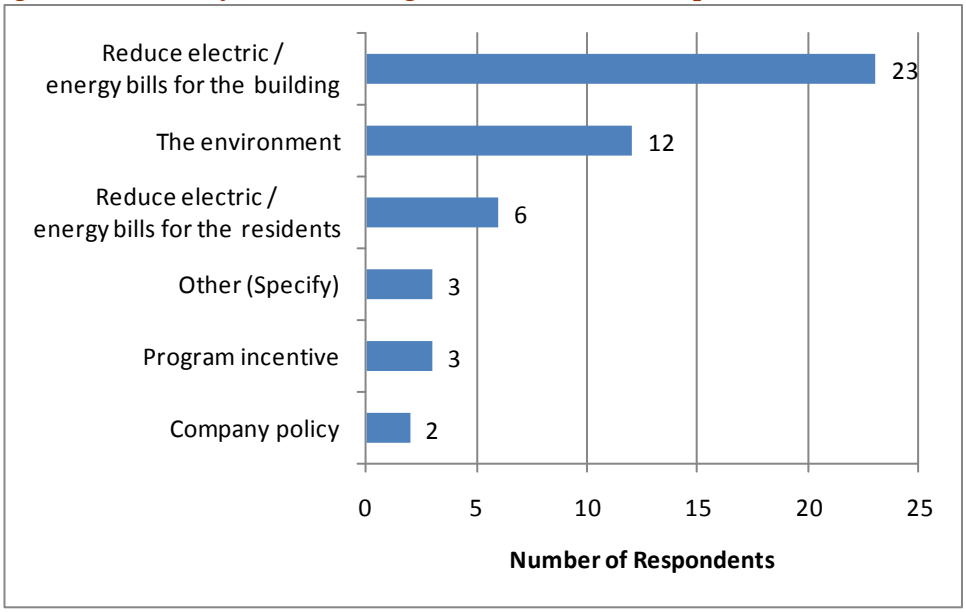
The drivers to participation in MASH are similar to those in SASH, but the barriers are more diverse, reflecting the different characteristics of the target market and relationships among the market actors. Section 3.3.1 first discusses the drivers to participation; these are consistent across market actor groups. Section 3.3.2 then outlines the major barriers to participation in MASH; these differ across the market actor groups. Finally, section 3.3.3 presents both sides of the virtual net metering issue; it warrants this special attention because of the continued confusion in the marketplace about it, even though it is not specifically cited as a barrier to participation.

3.3.1 Drivers to Participation in MASH

Across the board, the primary motivation for participating in MASH is the attractive financial benefit. Host customers, installers, PPA providers, and agencies that support the low-income multi-family owners all indicate that the primary reason that they enrolled in the program was to achieve some financial gain. In order for the solar market to become sustainable among low-income multifamily building owners, the financial case will need to continue to meet their financial goals.

Figure 3-13 indicates the primary reasons cited by MASH host customers for participating in MASH. Host customers cited the reduction in electric bills for the building by nearly twice as many survey respondents as any other factor. As in SASH, the environmental benefits of installing solar came in a distant second behind the bill savings. Passing on the benefit of lower bills to tenants was a primary driver for about 12 percent of respondents.

Figure 3-13. Primary Factor Driving Host Customer Participation in MASH (n=49)



Source: Analysis of MASH Participant surveys, 2010.
Note: Two of the "Other" respondents indicated that both bill savings and the environment factored into their decision.

In addition to similar reasoning around the financial benefits, host customers and PPA providers cited another similar driver to participate in MASH: corporate strategies or policies. Two host customers indicated that the primary reason that their facility participated in MASH was because it fit with their organization's mission. In parallel, two of the three PPA providers interviewed indicated that they decided to offer financing for MASH projects because of the fit of these investments with their broader corporate strategies, which often involved investments related to affordable housing.[68] Identifying partners with similar corporate objectives will contribute to the long-term sustainability of the market for solar among low-income multifamily building owners.

3.3.2 Barriers to Participation in MASH

Market actors report a variety of concerns about the MASH program. In some cases, multiple types of market actors reported the same concerns. In other areas, a host customer expressed concerns that can be characterized as project-specific concerns. This section discusses the key barriers to participation, beginning with the high-level issues and then identifying other issues that may be less common.

[68] This is similar to the cross-over seen between affordable housing investors and other renewable energy system investment. Tax equity investors often serve as an important contributor of equity for affordable housing developments. When tax equity became a more important part of renewable energy project finance (especially for wind), many of these investors entered the renewable energy market as tax equity investors.

Need for education and outreach on financing options. Agencies that support the low-income multifamily segment and at least one participant indicate that owners of these types of buildings have a steep learning curve to overcome before they will agree to participate in a project. While many building owners understand the concept and benefits of solar power, they lack experience in negotiating a PPA. Ensuring that they secure a fair deal for their facility (and possibly their tenants) requires them to understand the risks and implications very well. It takes time for the individuals and organizations that are new to solar to gather the needed information from trusted sources and determine the implications for their own organization.

Data indicate that many of the organizations that have participated in MASH to date may be considered "early adopters." Survey responses indicate that 65 percent of participants had considered solar prior to applying for MASH. These organizations would have considered at least some of the issues and may have met with a PPA provider or installer previously. Installers and PPA providers indicate that they developed projects first with organizations with which they had previous relationships. Organizations that needed time to get up to speed would have had limited time to do so; given the myriad of other issues on their plate, it is possible that they missed the window for participation. In the future, an expansion of MASH would need to consider the additional needs of organizations that are further down the technology adoption curve. This is similar to how product companies adjust their sales tactics to reach consumers at different points of the technology adoption curve.

Access to client energy usage data. Another barrier to enabling participation from the PPA provider's perspective is the inability to access a data about a potential client's past energy usage. PPA providers would use such information to assess the appropriate match between the host customer's energy usage and system size. This is an important consideration for the PPA provider's due diligence on their investment. The PPA provider interviewed indicated that they submitted the appropriate paperwork to the utility which then went into "a black hole." Facilitating access to those records will accelerate the process for negotiating PPAs.

Process-related issues. Host customers, PPA providers, and installers all cited process-related issues. These are covered in more depth in the PA Assessment Report. A brief list is as follows:

- Application cycle (sales cycle) is too long.
- Paperwork to prove low-income eligibility is too complex.
- Energy efficiency requirement could be an issue because these types of facilities operate with limited capital.
- Delays in receiving payment on rebates.
- Dealing with the utility companies – e.g., net metering and interconnection processes not standardized among the utilities.

Technical considerations. Finally, installers list two technical concerns. One installer indicated difficulty installing monitoring equipment because he lacked the ability to establish internet connections in appropriate locations. Another installer mentioned that accessing and working at the points of interconnection can pose challenges due to constrained space.

3.3.3 Virtual Net Metering Issues

Survey responses from MASH participants about virtual net metering (VNM) reveal inconsistencies about their understanding of VNM and the role that it played in their decision to complete their projects. VNM itself was not usually cited as a barrier or a benefit, but interview and survey respondents did indicate their perceptions of the benefits of VNM and also discussed the challenges of VNM as currently designed.

The most commonly cited reasons for not using VNM on MASH projects were the service delivery point issue, a lack of awareness or understanding of VNM, and having enough common area load to use the generation of a PV system (or having a roof too small to warrant allocating credits to tenant area load).

- **Service delivery point issue.** By far, the most commonly named issue with VNM was the definition of the service delivery point within the IOU VNM tariffs. For instance, a six-building project would likely have six utility delivery points. Currently, for example, to be eligible for VNM, a developer would have to wire PV system to each of the six delivery points as the IOU tariffs[69] do not permit taking power out of one service delivery point and put it into another. If a developer were to wire six different systems, the project costs could increase significantly. Many times, these extra costs have made or broken projects. Respondents mentioned resolution of the "service point issue" as a key area for improvement. Many projects were delayed to await this resolution.

- **Lack of awareness and understanding.** Very few respondents understood or had experience with VNM. Some respondents indicated that there needs to be more clarity around what installers can and cannot do to make a system eligible for VNM and what the associated costs may be. Other survey and interview respondents had never even heard of VNM.

- **Sufficient common area load.** Some respondents mentioned that they only pursued Track 1A funds as the size of the roof, and consequently the system, did not warrant allocation among the tenants. The load on the common area meter is often large enough to be offset the PV system, so the installers pursue those savings rather than tenant area savings.

Of the survey and interview respondents that were aware of VNM, most found the potential benefits of VNM attractive. The mostly commonly cited positive attribute was the ability to pass on the direct benefits of solar to tenants. Respondents indicated that without VNM, potential solar adoption would have a much lower ceiling as roughly half of residential and commercial units are multi-tenant. Of 10 host customer survey respondents, eight considered VNM either very important or somewhat important

[69] In September of 2010, the CPUC approved an advice letter filed by PG&E that would relax the service delivery point requirement and allow the tenant benefits to be netted beyond the service delivery point within a defined low-income development through the end of 2011.

in the decision to install solar under the MASH program. Of eight respondents, only three indicated that they would have installed solar in the absence of VNM.

3.4 Project Financing and Incentive Levels

This section discusses the financial aspects of MASH projects, including financial structures and incentive levels. Section 3.4.1 describes the financing arrangements used to pay for the systems installed. The remainder of the section focuses on the incentives offered through MASH. Section 3.4.2 sets the stage by providing basic information about the sizes, costs, and incentives associated with MASH systems installed to date. Section 3.4.3 compares these statistics, particularly the impact of incentives on project finances, to those of related programs in California. Section 3.4.4 crafts a picture of the market's perception of MASH incentive levels by summarizing feedback collected through interviews with key market actors. Finally, Section 3.4.5 provides a discussion about how different incentive levels may affect the market for solar in the multi-family affordable housing market.

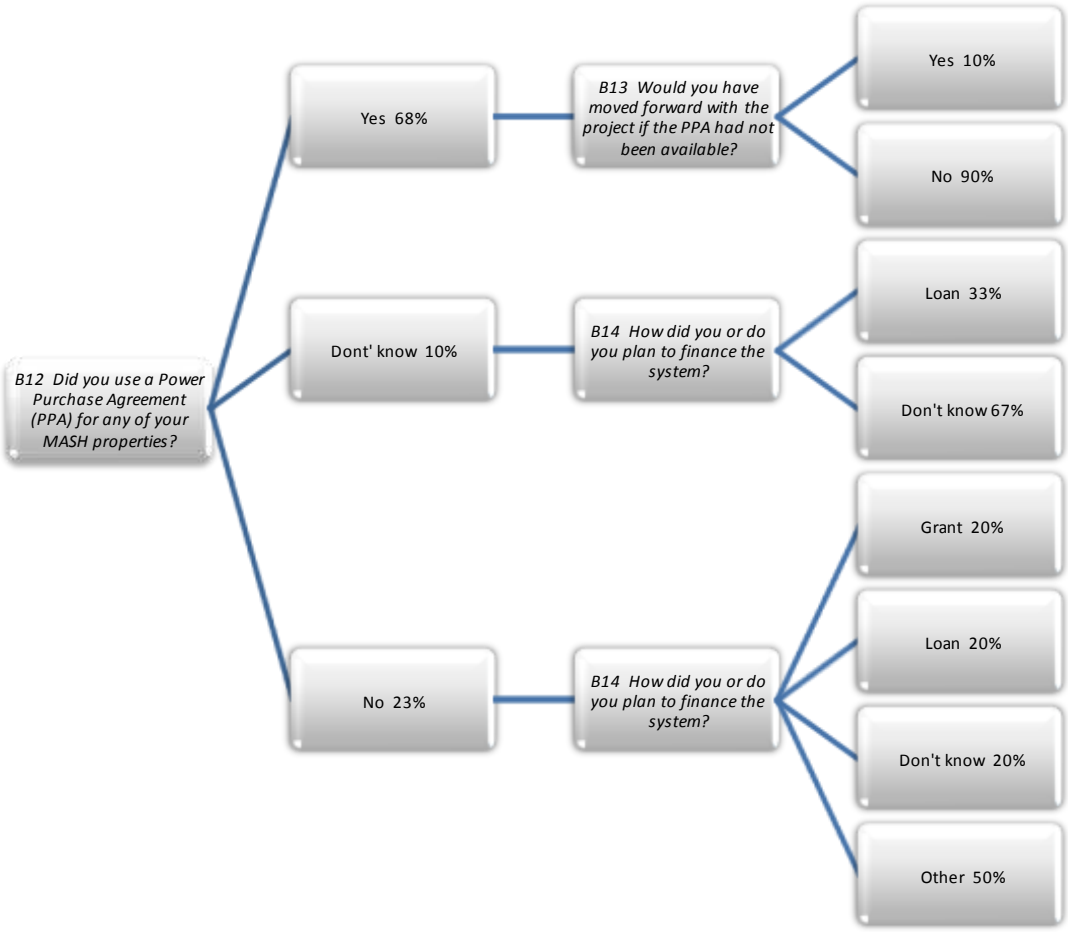
This MASH program statistics in this section draw primarily from Power Clerk data exported for CCSE and SCE on November 12, 2010, and acquired from PG&E on November 17, 2010. In most cases, the project size, cost, and incentive data in the following analysis draws from active Track 1 projects (excluding those that have been cancelled or withdrawn) through early November. In addition, the analysis presents results from the MASH Participant Survey, as well as anecdotal responses from earlier interviews with participating host customers and various market actors (e.g., system installers, third-party owners, and affordable housing advocacy organizations).

3.4.1 Structures Used to Finance Projects

As mentioned in the Market Description section, approximately 78 percent of the projects in the PAs' Power Clerk database appeared to list a third party as the system owner. Surveys and interviews with participants and market actors confirmed that most of these arrangements were Power Purchase Agreements (PPAs) with solar integrators or solar financing firms. The following provides additional insights from the surveys and interviews.

Figure 3-14 summarizes the survey responses related to participants' use of various financing mechanisms for MASH projects. As shown, 68 percent of host customer survey respondents said they had used a PPA to help finance their MASH projects. This is within range of the above estimate of third-party financing provided by the Power Clerk analysis (not all third-party ownership arrangements use PPAs). Of PPA participants, only 10 percent believed their MASH projects would have moved forward if a PPA had not been available.

Figure 3-14. Project Finance Mechanisms Used, as Cited in Participant Survey (n=31)



Source: Analysis of MASH participant interviews, November 2010.

Those who did not specifically cite a PPA mentioned a variety of other mechanisms used to complete their financing needs, including permanent debt, tax credits, loans, grants, and "self funding" (e.g., cash).

During interviews with market actors, all three of the solar installers mentioned PPAs as the primary financing mechanism for the projects in which they were involved. In addition, the installers felt that the PPA providers' ability to take advantage of the federal tax credits were essential to the viability of most projects, as the nonprofit affordable housing developers could not directly use them.

The combination of federal tax incentives offered during the time that MASH received applications were lucrative. The American Recovery and Reinvestment Act (ARRA) initially adopted or extended some of these enhanced tax benefits for investment in renewable energy:

» Investment Tax Credit / Treasury Cash Grant – Instead of receiving a tax credit for 30 percent of the capital cost of certain renewable energy investments (including PV), eligible project owners could opt to receive a cash grant in the same amount. No tax liability is required. Systems installed after December 31, 2009, and before January 1, 2012, are eligible.[70,71]

» Bonus Depreciation – System owners can take advantage of bonus depreciation before applying any benefits of accelerated depreciation. The Economic Stimulus Act of 2008 instituted a 50 percent bonus depreciation, which system owners could apply to the taxable basis[72] of the equipment in the first year of ownership. The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 expanded this benefit to 100 percent of taxable basis for property placed in service between September 8, 2010, and before January 1, 2012.[73]

» Modified Accelerated Cost Recovery System (MACRS) – Reducing the number of years over which a project owner can depreciate the capital cost of equipment increases the effective return on investment. PV systems can be depreciated over a five-year property class life. Before applying MACRS, the taxable basis must be reduced by one-half of the ITC and the full amount of any bonus depreciation.[74]

All four of the third-party financing firms interviewed relied primarily on PPAs to finance the projects in which they were involved. In addition, two of the interviewed firms also mentioned using equipment leasing arrangements, new market tax credits from the U.S. Treasury, and other rebates (e.g., from GoSolar in San Francisco).

A contact from a nonprofit affordable housing advocacy organization believed the majority of participating nonprofit affordable housing developers were either trying to find grant funding or were pursuing third-party financing through PPAs. He felt that the initial understanding of the PPA model among the nonprofit affordable housing community was somewhat limited, but that interest in the approach had existed prior to MASH.

An interviewee with a governmental affordable housing agency reiterated the important role the PPA providers were playing in bringing the investment tax credit to bear for nonprofit affordable housing developers and housing authorities who could not take advantage of it directly. In addition, the solar companies who offer PPAs can serve as a "one-stop" shop to help host customers address all of the technical barriers associated with developing and installing a project, effectively lowering the transaction costs associated with the project.

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[70] U.S. Treasury Department. June 2009. *Election of Investment Tax Credit in Lieu of Production Tax Credit; Coordination with Department of Treasury Grants for Specified Energy Property in Lieu of Tax Credits.* Notice 2009-52. Available: http://www.irs.gov/pub/irs-drop/n-09-52.pdf

[71] Database of State Incentives for Renewable Energy. 2011. "Business Energy Investment Tax Credit." Available: http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US02F&re=1&ee=0

[72] For bonus depreciation, the taxable basis of PV systems and other eligible renewable energy equipment is reduced by one-half the value of the ITC. (IRS Publication I4562)

[73] Database of State Incentives for Renewable Energy. 2011. "Modified Accelerated Cost Recovery System + Bonus Depreciation (2008-2012)." Available: http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F&re=1&ee=0

[74] *Ibid.*

3.4.2 Basic Project Statistics: System Capacity, Cost, and Incentive Levels Provided to Date

This section includes basic statistics about active MASH projects, painting a general picture of the capacities and costs of projects pursued by market actors in response to the program's incentive design. These statistics also create a baseline for comparing the MASH program to other solar programs in the state of California. Figure 3-15 includes four charts highlighting system capacities, total system cost, cost per Watt, and percent of total project cost covered by incentives, with relevant findings for each discussed below.

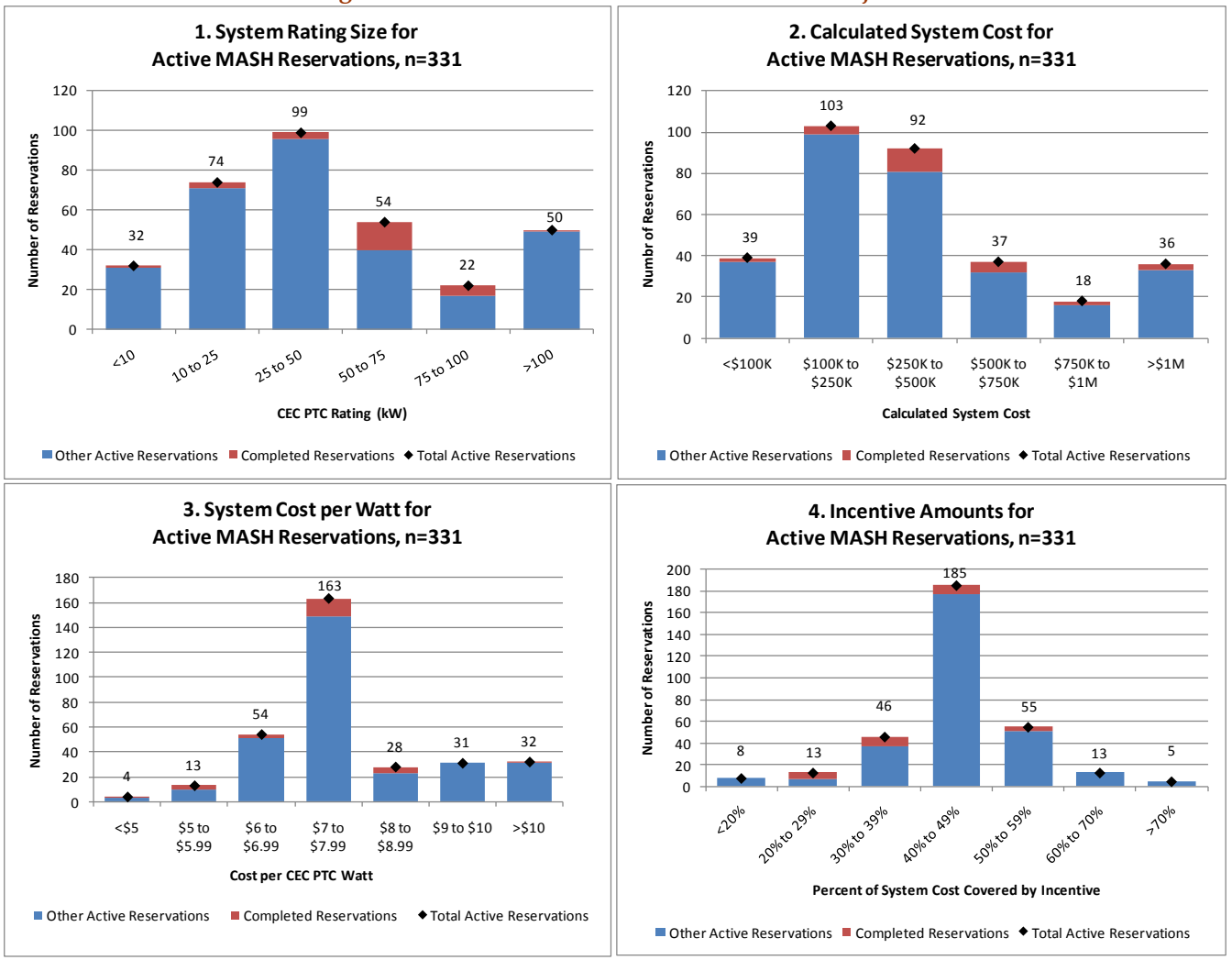
SYSTEM CAPACITY. Chart 1 reveals that 30 percent of all active systems fall in the 25 to 50 kW range. However, for completed projects, installed system capacities have trended higher, with most falling in the 50 to 75 kW range. System size appears to mostly follow a normal standard distribution, but with a more significant number of projects for larger systems (>100 kW).

SYSTEM COST. Chart 2 illustrates the calculated system costs for active MASH projects. As with the above system capacity statistics, while 31 percent of all active projects fall in the $100,000 to $250,000 range, the costs for systems installed and categorized as completed have tended to fall in the $250,000 to $500,000 range. The median calculated system cost for all active projects is $305,309; however, several multi-million dollar systems fall in the >$1M category.

SYSTEM COST PER WATT. Chart 3 combines the two proceeding statistics, showing the per-Watt system costs for all active MASH projects. The greatest portion (49 percent) of system costs fall between $7/W and $8/W, with a median of $7.44/W.

INCENTIVE COVERAGE. Chart 4 illustrates the degree to which MASH program incentives cover the total system cost across all active MASH projects. Nearly 57 percent of systems have between 40 and 50 percent of their total costs covered by their MASH incentive. Only 22 percent of active MASH projects have incentives that cover greater than 50 percent of the expected total system cost.

Figure 3-15. Basic Statistics for Active MASH Projects



Source: Analysis of PowerClerk Database, November 2010.

3.4.3 Comparison to CSI General Market and Large Residential Statistics

The evaluation team sought to provide context to the project sizes and costs achieved by actors in the MASH market by comparing them to projects installed through other general market CSI programs. This analysis can help inform future analysis and decisions regarding the economics of MASH projects and the suitability of future incentive levels.

Navigant used records pulled from the publicly available CSI California Solar Statistics database to create two sets of baseline data:

» CSI (All): This dataset represents projects across all categories of CSI general market programs (e.g., small and large residential, and all commercial). To align the General Market data with the time period covered by MASH Power Clerk records, Navigant included only projects reviewed between January 1, 2009, and November 11, 2010, and excluded projects categorized as cancelled, withdrawn, waitlisted, or removed. The data were also scrubbed of projects missing total cost or system rating and those for which incentives were higher than total cost.

» Large Residential Projects: This dataset approximates only those projects most likely to involve larger residential applications. In addition to the filters applied to the General Market Programs dataset, Navigant additionally excluded systems with non-residential host customers and systems below 2.60kW (in order to exclude those likely to be single-family housing). This system size is the smallest that occurs for any active MASH projects.

Table 3-7 provides comparative statistics for the three project types between January 1, 2009, and November 17, 2010. The key findings from this analysis include the following:

» As revealed by the total cost and system capacity statistics, MASH projects are generally larger than most CSI General Market Program and Large Residential projects.

» On a cost-per-watt basis, MASH projects appear to be achieving an average cost $0.89/W lower than the residential-only segment, and up to $1.12/W lower than the entire general market program. This may result directly from economies of scale associated with the MASH program's larger per-project system capacities, enabling system owners and installers to use bulk purchasing to influence equipment vendors.

» The incentives designed for MASH projects are substantially greater than those for other CSI programs are. The MASH incentives cover three times as much of projects' total costs as the general market program.

Table 3-7. MASH and CSI General Market Statistical Comparison

	Total Cost			Incentive Amount		
Program	**CSI (All)**	**CSI* (Large Res)**	**MASH**	**CSI (All)**	**CSI (Large Res)**	**MASH**
Min	$1,400	$7,730	$19,187	$308	$915	$8,342
Max	$17,000,000	$1,726,706	$3,940,000	$6,153,935	$99,341	$2,084,080
Median	**$35,447**	**$39,445**	**$305,309**	**$4,887**	**$5,741**	**$131,225**
	Cost/Watt			**Incentive/Watt**		
Program	**CSI (All)**	**CSI (Large Res)**	**MASH**	**CSI (All)**	**CSI (Large Res)**	**MASH**
Min	$1.29	$1.29	$3.60	$0.35	$0.35	$3.30
Max	$151.55	$151.55	$77.38	$3.36	$2.28	$4.00
Median	**$8.56**	**$8.33**	**$7.44**	**$1.10**	**$1.10**	**$3.30**
	System Capacity - CSI Rating (kW)			**Incentive as Percent of Total Cost (Calculated)**		
Program	**CSI (All)**	**CSI (Large Res)**	**MASH**	**CSI (All)**	**CSI (Large Res)**	**MASH**
Min	0.63	2.61	2.61	0.4%	0.4%	4.0%
Max	3193.20	49.56	525.69	100.0%	85.4%	90.0%
Median	**4.19**	**4.68**	**37.71**	**14.2%**	**14.8%**	**43.5%**

Source: Analysis of PowerClerk Database, November 2010, and of CSI California Solar Statistics Database, January 20, 2011.

Notes:

All data are for the period 1/1/2009 through 11/17/2011 and exclude systems categorized as cancelled, withdrawn, waitlisted, or system remover. Data also excludes reservations missing total cost or system rating and those for which incentives were higher than total cost.

*CSI (Large Res) statistics exclude systems with non-residential host customers as well as systems below 2.61kW (in order to exclude those likely to be single-family housing).

3.4.4 Participant and Market Actor Feedback about Incentive Levels

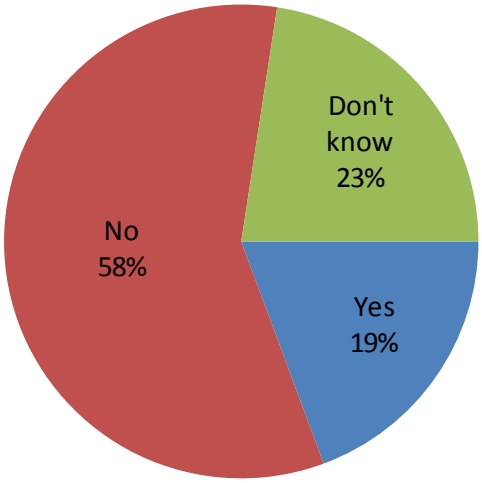
The participant surveys and market actor interviews conducted by the evaluation team provide additional qualitative context regarding the market's response to the MASH program design decisions. The following analysis presents these findings as they relate to perceptions of current and future MASH incentive levels.[75]

[75] An important note about bias: The results of all participant surveys and market actor interviews should be considered with the assumption that respondents were aware that the evaluation team was contracted by the CPUC to assess the MASH program, and that this evaluation would include recommendations about the future of the program, including incentive levels. As higher incentive levels are in the best interest of each of these market actors, it is possible that such interest influenced some of the responses.

FEEDBACK FROM PARTICIPANTS

Figure 3-16 summarizes the responses of surveyed host customers when asked if they believed that any of their MASH projects (many had numerous projects) would have moved forward under a lower MASH incentive. As shown, 58 percent felt that the projects would not have been viable with lower incentive levels. Respondents who were unsure qualified their responses with additional information. Some thought that it would depend on what PPA providers were willing to offer, while others simply said that it would depend on the project-specific sizes and payback calculations. Nearly one in five host customers responded that at least some of their projects likely would have moved forward despite lower incentives.

Figure 3-16. Participants Who Felt Any of Their MASH Projects Would Have Worked with a Lower MASH Incentive (n=31)



Source: Analysis of MASH Participant surveys, November 2010.

When asked if they would consider installing solar on additional properties in the future, all respondents confirmed that they would; however, 94% of respondents subsequently replied that they would still require incentives to do so; three percent were unsure. Asked what level of incentives they would require in order to install solar on additional properties, only 59 percent of respondents provided an actual per-Watt incentive level or other qualifying comments. Table 3-8 summarizes these responses.

Table 3-8. Summary of Survey Responses Regarding Future Incentive Levels (n=31)

# of responses	% of responses	Amount That Would Have Been Sufficient	Equivalent Common/Tenant
5	29%	$4.00/W	
1	6%	$3.75/W	
6	35%	Similar to Current Level	$3.30/$4.00
1	6%	80-100% of Current	$2.64-$3.30/$3.20-$4.00
1	6%	50-60% of Current	$1.65-$1.98/$2.00-$2.40
1	6%	$1.15/W	
2	12%	Depends on Project	

Source: Analysis of MASH Participant surveys, November 2010.

As shown, 70 percent of those who suggested an incentive level provided an amount either at or above the current level; this group represented 41 percent of the total sample. Another 18 percent suggested some reduced portion, ranging from 50 to 99 percent of the current incentive levels. Table 3-8 provides equivalent per-Watt dollar values for these percentages for both common area and tenant incentive levels. The remaining 12 percent of respondents replied that appropriate incentive levels would depend on the economics of individual projects.

FEEDBACK FROM INSTALLERS

The evaluation team interviewed contacts at three firms listed as installers for MASH projects. Two were exclusively solar installers, while the third was a general contractor who also installed solar systems. Solar Installer 1 related the degree to which the incentive level itself was a driving factor in his firm's pursuit of MASH projects, calling it "five times higher" than other incentives. Describing his firm's strategy for bidding on projects, he continued, "The rebate was so big that companies like [names two solar integrator firms] kind of went out and did the marketing for us."

Asked whether any of the MASH projects for which they are the listed installer would have moved forward with a lower MASH incentive, the two solar installers replied "Yes" (one under the condition that the federal tax credits were still available), while a general contractor replied "No." Solar Installer 1 continued by suggesting that a MASH incentive of "roughly 65 percent of the original, maybe a $2 rebate" would allow his firm to do more business. "If it was more like in the $2-3 range we have a lot more going on in low-income housing." This is because larger companies are securing larger numbers of incentives for themselves under the initial incentive amounts; this installer believed that the larger companies would have paid less attention to the market with lower incentive levels.

FEEDBACK FROM THIRD-PARTY FINANCING FIRMS

The evaluation team spoke with four firms that were providing third-party financing for MASH projects. Three describe themselves as developers and/or solar integrators, while the last is a special purpose entity established to provide third-party ownership for PV systems on "other building owners' properties."

Asked why they decided to finance systems through MASH, all four interviewees specifically mentioned the attractiveness of the rebates. When describing the incentive level, one solar integrator said it's "essentially a double grant," referring to the cash grant equivalent of the federal Investment Tax Credit. Three interviewees also mentioned that parent companies or affiliates had specific interests in building solar on affordable housing properties.

When asked if any of the MASH projects for which they were listed as the system owner would have moved forward with a lower MASH incentive, the respondents were generally skeptical. Most gave responses along the lines of "probably not" and stated, "The rebates were set at a pretty good level to make these projects viable." On the other hand, one installer suggested that lower incentives may be feasible now, citing that the solar cost curve had come down since the MASH program launched.

Asked for recommendations for expanding the PV market among low-income multi-family buildings, the interviewees provided a few suggestions related to incentive levels. These included the following:

» "I think the MASH program really had it right in that they had...a heightened incentive for tenant offset. Because you get more on the installed costs for the tenant load, it really pushed us to try that." When asked if the incentive disparity between Track 1 and Track 2 was sufficient to drive interest in providing tenant benefits, he replied, "I think MASH probably had it close to right. You still need to give something to the property host [for common area load]."

» In response to the speed with which incentives were reserved, one interviewee suggested implementing an application fee. "I think there should be...a substantial application fee so that parties aren't just claiming reservations and have no stake in the game…whether a project is done or not. I think it would be reasonable to look at a substantial application fee to discourage that type of behavior." When asked about an amount, the interviewee replied, "several thousand dollars. . . Enough to say that someone seriously believes the project is going to happen."

FEEDBACK FROM AFFORDABLE HOUSING AGENCIES AND ADVOCATES

The evaluation team spoke with contacts from three organizations that support or advocate for affordable housing developers. Two represented non-profit organizations, while the third represented a governmental agency.

When asked about his perceptions of the MASH incentive levels, one of the nonprofit organization contacts replied that most affordable housing developers think the incentives should be higher. He recognized that some of the "pioneers…have taken the lead on issues related to green, sustainable development" were probably already committed to installing solar before MASH. His concern was, however, about the larger tier of developers who are interested in doing something "green" but require more outreach before they will pursue it.

The government agency contact, on the other hand, felt that "a lower rebate level, even under a Track 1 approach, would be pretty marketable." He continued by citing the difference between the CSI general market and MASH program incentive levels. "To the extent that that difference is important, whatever that price point is, they [PPA providers and building owners] would no doubt look for other resources to fund that gap."

When asked about the sustainability of the solar market for multifamily affordable housing, this contact also pointed out an aspect of the market that may continue to attract PPA providers regardless of reduced incentive levels.

> "What you have in affordable housing that's really different than market housing is you don't have this [principal-agent problem]. Affordable housing owners own that asset for a long time. . . These properties are retained, and they look at maintaining that investment for a long while. So I think that from the PPA providers' standpoint...they're going to particularly see these owners as…having a long-term interest in stable energy pricing."

3.4.5 Recommendation for MASH Incentive Levels

The project team conducted a preliminary analysis to determine the incentive levels that would achieve the targeted rates of return for investors in projects that receive incentives through MASH. This section intends to illustrate the dynamics of this analytical approach. This analysis is subject to many assumptions, some of which should be confirmed with market actors before making decisions using this analysis.

The remainder of this memo presents the following information:

- A brief overview of the approach used to develop this analysis;
- A summary of the results of the preliminary analysis and the key assumptions used;
- A description of additional steps that the project team recommends to enhance the reliability of this analysis.

ANALYTICAL APPROACH

Navigant used a bottom-up approach to develop estimates of incentive levels that MASH could offer that enable project owners to meet targeted returns on investment. Navigant modified a model that Lawrence Berkeley National Laboratory (LBNL) had originally developed to solve for the optimal price of energy in a PPA. Navigant modified this model in three key aspects:

1. To solve for the incentive level needed to meet a desired rate of return.
2. To account for an ownership model that is common among PPA providers; in the Navigant model, the tax equity investor is external to the PPA provider.
3. To enable the analysis of different scenarios (e.g., different levels of bonus depreciation, different system costs, and different levels of targeted rates of return).

In addition, Navigant adjusted the input assumptions about the elements of project financials to reflect current market conditions. Where possible, Navigant used data directly from the MASH data in Power Clerk, including the system cost and system size. In other areas, Navigant updated assumptions to reflect policy changes, including the extension and expansion of Bonus Depreciation. Other assumptions rely on Navigant's extensive work in the commercial-scale solar market around the United States, such

as assumptions about the capital structure, annual maintenance costs, and annual performance degradation.

Using these and other assumptions, the model simulates the financial dynamics of the project, including cash flows and other tax benefits. The model allocates these benefits to the appropriate project partner (i.e., tax equity investor or PPA provider). By modeling the flow of these benefits and incorporating the appropriate rates of return for each partner, the model determines the incentive level necessary to enable the project to meet the targeted return on investment established by the project partners.

In short, the model assumes that the MASH incentive is the last piece of revenue available to the project partners. Therefore, the model adjusts the MASH incentive level until the specified tax equity investor and PPA targets are met.

Preliminary Results and Key Assumptions

Navigant considered the incentives levels needed under several different scenarios. This enabled the team to identify the effect of changing certain assumptions on the MASH incentive levels needed to meet targeted rates of return. Table 3-9 outlines the assumptions remained constant throughout all the different scenarios. These assumptions rely heavily on Navigant's work in examining solar PPA business models throughout the United States and may or may not reflect the current conditions in the market for MASH projects.

Table 3-9. Key Assumptions

Assumption	Value	Units
Tax Equity Investor Required IRR	8%	%
PPA Provider Required IRR	15%	%
Equity	60%	%
Debt	40%	%
Loan Interest Rate	8%	%
Loan Term	8	years
PPA Contract/System Life	20	years
PPA First Year Price	$ 0.15	$/kWh
PPA Price Escalator	4%	%/year
System Derate	85%	kW_{AC}/kW_{DC}
Annual Performance	1500	kWh/kW_{DC}
Annual Performance Degradation	0.6%	%/year
Annual O&M	$30.00	$/kW_{DC}$
Installed Cost	***Varied***	$/kW_{AC}$
Bonus Deprecation	***Varied***	%

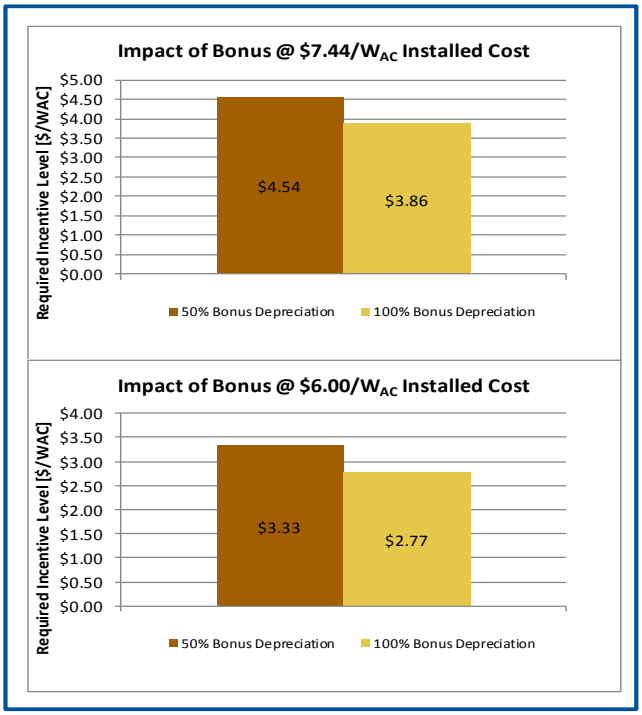
Using the assumptions in Table 3-9 as a starting point, Navigant examined the MASH incentive level needed to meet the desired rates of return. The team varied two other variables to reflect current and anticipated changes in market conditions:

» ***Project Installed Cost:*** The median installed cost for active MASH reservations at the end of November 2010 was $7.44 per Watt.[76] In the future, however, installed cost for PV systems at the scale of MASH projects could approach $6.00/Watt.[77]

» ***Bonus Depreciation Level:*** In September 2010, Congress increased the Bonus Depreciation level to 100 percent through the end of 2011.[78] Previously, the Bonus Depreciation level had been 50 percent during the 2008, 2009, and 2010 tax years; the second scenario considers the effect on the MASH incentive if Congress returns the Bonus Depreciation level to 50 percent upon the expiration of the current legislation.

Figure 3-17and Table 3-10 present the MASH incentive levels that investors would need to meet their desired rates of return as the values of these two assumptions change.

Figure 3-17and Table 3-10. MASH Incentive Levels Needed to Achieve Target Rates of Return



	50% Bonus Depreciation	100% Bonus Depreciation
$7.44/Watt Installed Cost	$4.54	$3.86
$6.00/Watt Installed Cost	$3.33	$2.77

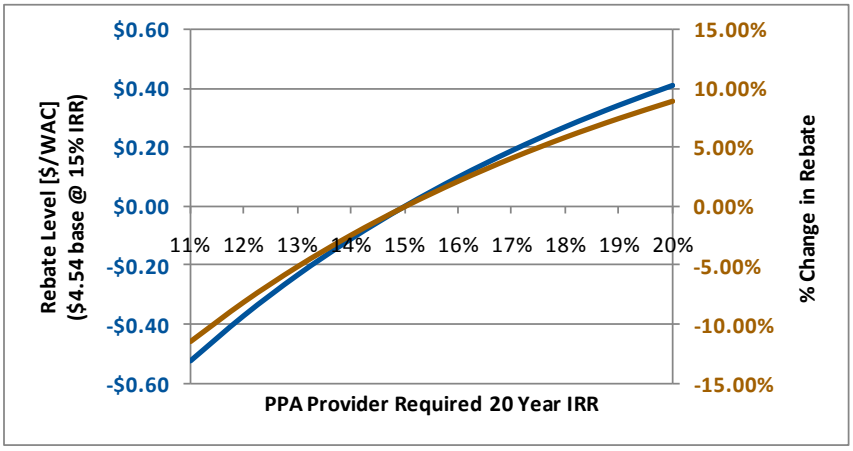
Source: Navigant analysis 2011.

[76] Navigant. Forthcoming. *California Solar Initiative – Low Income Solar Program Evaluation: Market Assessment Report.* Prepared for the California Public Utilities Commission.
[77] Navigant analysis, 2011
[78] Database of State Incentives for Renewable Energy. 2011. "Modified Accelerated Cost Recovery System + Bonus Depreciation (2008-2012)." Available: http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F&re=1&ee=0

Entities outside of the CPUC control both of these variables, which have tangible effects on the project economics. A 24 percent change in the installed cost results in a 36 to 39 percent change in the needed MASH incentive level, holding all other assumptions constant. Changing the level of the Bonus Depreciation results in a change in the needed MASH incentive level of 18 to 20 percent. Changes to either of these inputs after the adoption of a new MASH incentive level may have significant effects on the number of projects actually completed using MASH incentives.

In addition, Navigant considered the effect of changes in the PPA provider's desired rate of return on the MASH incentive needed. As shown in Figure 3-18, the MASH incentive level would need to increase as the target rate of return for the PPA provider increases. For every one percent increase in the targeted 20-year internal rate of return for the PPA provider, the MASH rebate would need to increase by an average of 2.3 percent (or about $0.10 per Watt$_{AC}$).

Figure 3-18. Effect of Changes in PPA Provider Rate of Return on MASH Incentive Level



Source: Navigant Analysis 2011.
Note: This analysis considers systems with installed costs of $7.44 per Watt that are eligible for 50 percent Bonus Depreciation.

Areas for Additional Investigation

The scenario analysis demonstrates the effect of certain assumptions on the outputs of the model. Additional attention is needed to ensure that other assumptions are accurate before making policy decisions. A range of business models prevail in the market for MASH projects, and it is important to consider how certain incentive levels may affect the viability of these different types of business models. Ensuring that these assumptions in the model reflect the current practices in the MASH market in California will provide policy makers with information that can more effectively influence decision making in the investment and project development community at lower cost to ratepayers.

Navigant recommends gathering additional input on the following assumptions before moving forward with any decision making:

- Term of the PPA contract in years
- PPA first-year price of energy
- PPA annual price escalator
- Structure of the project partnership (i.e., relationship between tax equity investor and PPA provider)

3.5 Track 1 and Track 2 Differences

The small number of awards and the unique nature of the Track 2 project budgets make direct comparisons with Track 1 per-Watt incentive levels unfeasible.[79] Instead, the evaluation team sought to understand the market's perception of Track 2 through Participant and Market Actor interviews. To provide some context to these interviews (which were not specifically targeted toward Track 2 participants),Table 3-11 lists the types of host customers and system owners listed on successful Track 2 projects.

Table 3-11. Parties Involved on Awarded Track 2 Projects, November 2010

Host Customer	System Owner
Housing Authority A	Housing Authority A
Housing Authority B	Solar Integrator A
Individual Property	Solar Integrator C
Nonprofit Affordable Housing Developer A	Solar Integrator A
Nonprofit Affordable Housing Developer B	Solar Integrator B
Nonprofit Affordable Housing Developer B	Solar Integrator B
Nonprofit Affordable Housing Developer B	Solar Integrator B
Nonprofit Affordable Housing Developer C	Municipality
Private Housing Developer	Solar Integrator A

Source: Analysis of PA MASH Program Management Data, November 2010

Among the five host customers interviewed, respondents showed mixed levels of familiarity with the Track 2 program. Two respondents had a confident understanding of the different tracks, while the other three had little or no awareness of the differences. Only one of the five host customers had actually applied for a Track 2 incentive. The reasons provided for not pursuing Track 2 generally involved it level of complication, properties lacking master metering, or simply the fact that property owners had already secured Track 1 incentives for all of their properties. The interviewed host customer who had applied for Track 2 funding expressed that the primary drivers for pursuing a Track 2 incentive were the higher

[79] Through the end of November 2010, all three PAs combined had awarded only nine Track 2 awards. Track 2 budgets include funding for energy efficiency and additional measures beyond the PV system, and the applications do not consistently break out the costs for each component.

incentive level and the fact that potential project in questions was substantially larger than their other properties.

Only one of the three installers offered any feedback on Track 2, having applied for a Track 2 grant during the first round of solicitations in March 2010. Having had their application rejected without much explanation from the PA, the installer suggested, "Track 2 isn't worth doing."

Similarly, only one of the four third-party financing organizations discussed Track 2. Unlike the installer, this firm was involved in three separate projects that had received Track 2 funding. This contact had positive things to say about Track 2, suggesting that it "is the only part of the program that is really passing any benefits along to the tenants in the buildings" since so little was going into Track 1B. Two of the three affordable housing advocacy contacts suggested that Track 2 was generally too complicated to garner much meaningful participation. One of the nonprofit contacts suggested that the limited roof space for a property with three- to four-story buildings meant that systems could not be sized sufficiently to provide enough power to cover full tenant loads. He stated that trying to allocate partial financial benefits to tenants caused issues related to utility allowance requirements.

The government agency contact suggested that, while the program was well intended, Track 2 became too complex to attract much of a market. He felt that the PPA providers' strong response to Track 1 and the quick decisions they enabled host customers to make had made Track 2 unnecessary. He suggested that Track 2 funding be made available as part of Track 1.

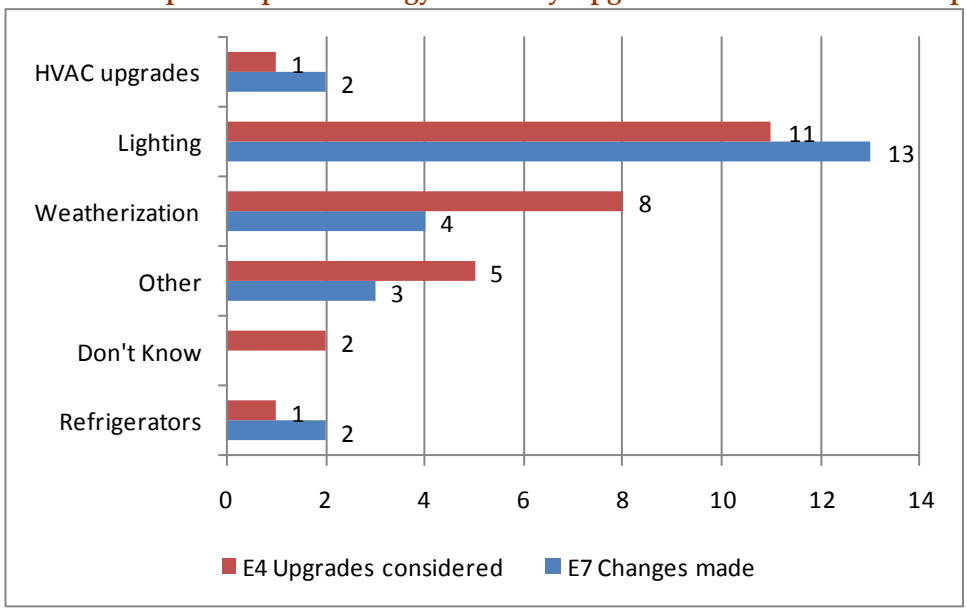
To distribute the offerings for Track 2, the PAs have relied mainly on program staff. Contractors are not the best vehicle for Track 2 outreach because the application and project implementation requirements go beyond the traditional areas of expertise; for the contractors working on a project that receives incentives through Track 1 or through the general market program is more cost effective for these contractors. In their place, program staff have had to be more active in generating interest in the program. PG&E invited input from the affordable housing community during the design of the Track 2 incentives but has not relied on it significantly in terms of distribution.

3.6 Spillover

Spillover effects of MASH appear to be less diverse than for SASH. Spillover effects of MASH include some energy efficiency upgrades and some benefits for tenants. The broader market (i.e., nonparticipant population), however, reports low levels of awareness about MASH and their consideration of PV due to MASH. Further, some of the market actors that initially entered the market for solar on low-income multifamily homes have left since the incentive pool expired. A discussion of these issues follows.

Energy Efficiency Upgrades. More than half of participants report having completed (43 percent) or planning to complete (14 percent) some energy efficiency upgrades as a result of the program. Those who report having completed the upgrades report that they completed a range of types of upgrades, as seen in Figure 3-19.

Figure 3-19. Participant-Reported Energy Efficiency Upgrades Considered and Completed



Source: Analysis of MASH participant surveys, 2010.
Note: Multiple responses allowed.

The responses indicate some inconsistencies in the participants' self-report. Due to these inconsistencies, it is difficult to rely on these data for precise accounts of the program's effect of energy efficiency upgrades. It is not clear how these upgrades were distributed among common area spaces and tenant spaces. In the future, the program may consider adding a field to the check request form to capture this information from the host customers before a rebate is paid in order to collect better data about the energy efficiency aspects of the program and to better understand the distribution of benefits among common areas and tenant spaces.

Non-Participant Awareness. Non-participants interviewed as part of this study indicate that the broader market's awareness of PV and its affordability are unrelated to MASH. None of the five non-participants had heard of MASH prior to the interview. All of them had considered installing PV systems previously, and two of them had followed through with installation. Together, these facts indicate that MASH is not reaching the broader market consistently.

Flight of capital. One disadvantage of the commercial sector's heavy interest in MASH due to financial returns (which was discussed in section 3.3.1) is that some market actors exited the market once the incentives were fully subscribed. This was a very common theme among PPA providers, which have more mobility than an installer that invests in the hiring and training of technical staff in a local market. The PPA providers indicated that they reallocated their capital to other markets with more favorable financial returns. Some PPA providers remained in California while others went to other states; these were not typically low-income markets.

The long-term implications of this flight of capital are not supportive of a sustainable market for solar on low-income multifamily buildings. The PPA providers see the MASH market in terms of rate of return, and once the rate of return falls below other competitive markets, the PPA providers can shift their resources relatively easily. As seen in the stop-and-go of the national wind market during the early 2000s due to a short-term (and sometimes expired production tax credit), such cycles create barriers to deployment of capital resources. If CPUC plans to allocate additional incentives, a plan for creating long-term stability will strengthen the effect on the sustainability of the market.

3.7 Key Findings

This section summarizes the main findings discussed in the MASH section of this report. Section 5 includes a discussion of the recommendations connected to these findings.

3.7.1 Market Description

» **Participation in the MASH market is dominated by a handful of large host customers, third-party system owners, and solar installers.** The top six host customers hold 48 percent of MASH projects, with the most prolific holding 52 projects. The top six third-party system owners are listed on 71 percent of projects, with the largest appearing on 103 projects (27 percent of the total). Finally, the top eight installers are listed on 78 percent of projects, with the largest appearing on 114 projects (30 percent of the total).

» **In many cases, several MASH projects may be required for multiple service points on a single property.** For completed projects, 27 individual projects were allocated to only 16 unique host customer locations, with one location comprising five projects. The average for completed projects is 1.69 projects per project site.

» **Nonprofit affordable housing developers and solar integrators participate more frequently than other types of organizations.** Nonprofit affordable housing developers are the most common type of participating host customer; 31of these types of organizations hold 58 percent of reservations. Solar integrators hold the top spot for both system owners and installers. Six unique solar integrators are listed on 68 percent of projects as system owners, and eight unique solar integrators are listed as the installer on 53 (non-mutually exclusive) percent of projects.

3.7.2 Market Channels

» **MASH has used an intensive distribution model in which many entities have the ability to distribute information about MASH and recruit participants for the program.** Whereas the SASH program retains control over the messaging and customer interaction, the MASH program enables a variety of market actors to perform the outreach and promote the program.

» **Contractors served as the primary distribution channel for MASH's Track 1 program.** The incentive available for MASH accrues directly to these entities in most cases, and the potential financial benefits for these entities drive their efforts to recruit participants. In parallel, participants report that solar contractors and PPA providers, combined, serve as the most common channels to initially learning about MASH.

3.7.3 Drivers and Barriers

» **Across the board, the primary motivation for participating in MASH is the attractive financial benefit.** Host customers, installers, PPA providers, and agencies that support the low-income multifamily owners all indicate that the primary reason that they enrolled in the program was to achieve some financial gain. In order for the solar market to become sustainable among low-income multifamily building owners, the financial case will need to meet their financial goals.

» **Participants also cite environmental benefits, tenant bill savings, and alignment with organizational priorities as their primary reason for participating in MASH.** A subset of host customers and PPA providers cited alignment with corporate strategies or policies as a primary driver to MASH. Identifying partners with similar corporate objectives will contribute to the long-term sustainability of the market for solar among low-income multifamily building owners.

» **Without previous experience in solar, potential host customers need support in learning about the issues related to negotiating PPAs.** Agencies that support the low-income multifamily segment and at least one participant indicate that owners of these types of buildings have a steep learning curve to overcome before they will agree to participate in a project. While many building owners understand the concept and benefits of solar power, they lack experience in negotiating a PPA. Ensuring that they secure a fair deal for their facility (and possibly their tenants) requires them to understand the risks and implications very well.

» **Data indicate that many of the organizations that have participated in MASH to date may be considered "early adopters."** Survey responses indicate that 65 percent of participants had considered solar prior to applying for MASH. These organizations would have considered at least some of the issues and may have met with a PPA provider or installer previously. It takes time for the individuals and organizations that are new to solar to gather the needed information from trusted sources and determine the implications for their own organization, which may have prevented them from participating in MASH already.

» **Survey responses from MASH participants about virtual net metering (VNM) reveal inconsistencies about their understanding of VNM and the role that it played in their decision to complete their projects.** VNM itself was not usually cited as a barrier or a benefit, but interview and survey respondents did indicate their perceptions of the benefits of VNM and also discussed the challenges of VNM as currently designed. The most commonly cited reasons for not using VNM on MASH projects were the service delivery point issue, a lack of awareness or understanding of VNM, and having enough common area load to use the generation of a PV system (or having a roof too small to warrant allocating credits to tenant area load). The most commonly cited positive attribute was the ability to pass on the direct benefits of solar to tenants. Respondents indicated that without VNM, potential solar adoption would have a much lower ceiling as roughly half of residential and commercial units are multi-tenant.

3.7.4 Project Financing and Incentive Levels

- **Systems that have reached completion are larger than the average project in the program tracking database.** The median system capacity for active MASH projects is 37.7 kW_{AC}, with 69 percent falling between 10 and 75 kW. However, the capacities for completed projects have tended higher, with most falling between 50 and 75 kW.

- **MASH projects are both larger and less expensive on a capacity basis than comparable projects under the General Market CSI program.** When compared to both the General Market CSI program and a subset meant to represent Large Residential CSI projects, active projects in the MASH program exhibit much larger system capacities. The median MASH system size is 37.7 kW versus 4.2 kW and 4.5 kW for the General Market and Large Residential subsets, respectively. These larger systems appear to be generating economies of scale as reflected by lower average per-watt costs for MASH projects. The median cost for MASH systems is $7.44/W versus $8.56/W and $8.33/W for the General Market and Large Residential subsets, respectively.

- **Financing Structures**

  - **The third-party ownership structure permeates MASH projects.** Two-thirds (68 percent) of surveyed MASH participants said they used PPAs to help finance their projects, while 78 percent of projects in the Power Clerk data appeared to use some form of third-party ownership structure. Market actors related that the Investment Tax Credit and the related Treasury Cash Grant remained strong financial drivers for projects, reinforcing the importance of third-party ownership for host customers with nonprofit status.

- **Incentive Levels**

  - **Incentives cover a smaller portion of overall project costs than in the SASH program.** For the majority (57 percent) of projects, incentives cover 40 to 49 percent of the calculated system cost, with a median of 43.5 percent of project costs covered.

  - **The evaluation revealed mixed perceptions about the level of the MASH incentive.** More than half of participants surveyed indicated that their projects required the full amount of MASH incentive available and would not have reached completion with a lower incentive. On the other hand, installers and third-party financing firms provided anecdotal evidence that the incentive levels were very high. Two of three installers suggested that their MASH projects likely could have moved forward under a lower incentive. The four third-party financing firms all cited the attractiveness of the incentives as a primary driver for their involvement in the MASH market. Third-party financing firms were more skeptical about projects moving forward with lower incentives.

3.7.5 Spillover

» **Spillover effects of MASH appear to be less diverse than for SASH.** Spillover effects of MASH include some energy efficiency upgrades and some benefits for tenants. The broader market (i.e., nonparticipant population), however, reports low levels of awareness about MASH and their consideration of PV due to MASH. Further, some of the market actors that initially entered the market for solar on low-income multifamily homes have left since the incentive pool expired.

4 Overview of Similar Efforts in Other States

This section presents an overview of low-income programs offered in four other states. The programs are the Connecticut Clean Energy Fund (CCEF)'s Affordable Housing Initiative, the Low-income Energy Affordability Network (LEAN)'s Alternative Energy & Repairs Program in Massachusetts, Pennsylvania's PA Sunshine Residential/Small Business Solar PV Program, and the Vermont Small Scale Renewable Energy Incentive Program. Section 4.1 presents a table that summarizes the main points of comparison for these four programs. Section 4.2 provides a more in-depth discussion of programs offered in Connecticut, Massachusetts, and Pennsylvania.[80] Research methods for this section included web searches to identify ongoing or recent low-income programs for single family and multifamily markets; analysis of program literature (e.g., websites, publications, reports, program applications, press and media releases); and telephone interviews with key staff involved in the design and implementation of the programs.

4.1 Overview of Other Low-Income Solar Programs in the United States

Table 4-1 provides a comparison of four programs offered outside California for low-income single family and multifamily markets. Only Connecticut's Affordable Housing Initiative and Massachusetts' Alternative Energy & Repairs Program are exclusively for the benefit of low-income residents. Vermont's and Pennsylvania's programs offer programs for multiple customer types and include additional benefits for low-income customers.

[80] Vermont's program was not selected for additional review because the program is funded currently through the American Recovery and Reinvestment Act, which was not considered a replicable, viable funding source in the long-term, and because the program had the least robust offering for low-income customers.

Table 4-1. High-Level Overview of Four U.S.-Based Programs Providing Incentives for Low-Income Solar

Program Name	Eligibility Criteria	Other Technologies	Budget	Incentive Type	Incentive Levels & Steps
Connecticut Connecticut Clean Energy Fund's Affordable Housing Initiative (Multifamily)	Available to commercial entities: • Affordable housing developers • Companies that own or manage affordable housing projects • Third-party energy services providers	• Wind • Fuel cells • Landfill gas • Waste heat recovery-powered generators • Low-emission advanced biomass conversion technologies • Class 1 hydro[1] • Other	• For 2008-2010: $2 million for rebates only (no administrative costs included) • 2010-2010: $4 million (but not yet approved by regulatory agency)	Rebate	• **Small development PV (1-4 units):** $6/watt(W)[2] for the first 10 kilowatts (kW); up to 10 kW and $60,000 • **Large development PV:** $6/W for the first 200 kW up to $850,000 per project, • Any PV project on a site with LEED Silver, Gold or Platinum designation received an additional $0.25/kW incentive
Massachusetts LEAN Alternative Energy & Repairs Program (Single family)	Low-income single-family homeowners, defined as households with annual income less than 60 percent of the state's median income.	• Solar hot water • Wind • Micro combined heat & power • Geothermal	• **For 2006-2007:** $800k • **For 2008-2009:** $2200k • **For 2009-2010:** Unknown • **For 2010-2012:** Unknown	Full system cost including installation	Not applicable
Pennsylvania PA Sunshine Residential/Small Business Solar PV Program (Single family)	Home must be owned by a Pennsylvania resident and serve as primary residence	Solar hot water	$100 million total budget for residential and small business customers. Low-income is one of several eligible classes. No budget set-aside for low-income.	Rebate	Low-Income customers are eligible for rebates of up to 35% of installed costs per the initial legislation.[3]

Program Name	Eligibility Criteria	Other Technologies	Budget	Incentive Type	Incentive Levels & Steps
Vermont Vermont Small Scale Renewable Energy Incentive Program (Single family & Multifamily)	• New equipment purchased or installed after September 1, 2006 • Cannot apply for a VT Solar Tax Credit • Prior to ARRA funding in 2009, PV systems could be off-grid	• Solar hot water • Wind • Micro-hydro	• **Round I (FY03-05): $892k** [$385k for PV] • **Round II, FY05-06: $524k** [$149k for wind] • **Round III, FY06-07: $807k** [$187k for wind] • **Round IV, FY07-08: $1035k** [$163k for wind] • **Round V, FY08-09: $2,049k** • **Round VI, FY10-12: $5,250k**	Rebate	**Special category** (includes low-income): $2.50/W up to 10 kW OR 35% of installed cost, whichever is lower. (**Residential rebates** are $0.75/W up to 10 kW.) Special category solar electric incentives will be reduced when 250 kW in capacity has been reserved

Notes:

[1] Conn. Gen. Stat. §16-1(a)(26) defines "Class I hydro" as: "(A) energy derived from…a run-of-the-river hydropower facility provided such facility has a generating capacity of not more than five megawatts, does not cause an appreciable change in the river flow, and began operation after July 1, 2003 … or (B) any electrical generation, including distributed generation, generated from a Class I renewable energy source." http://www.ct.gov/dpuc/cwp/view.asp?a=3354&q=415186

[2] CCEF specifies that projects must be tested using the Photovoltaic USA Test Conditions (PTC)of 1,000 watts per square meter solar irradiance, 1.3 Air mass, and a 20°C ambient temperature at 10 meters above ground level and a wind speed of 1 meter per second.

[3] DSIRE entry on PA Sunshine Residential/Small Business Solar PV Program: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=PA37F

Sources:

Connecticut: Interview with Christin Cifaldi, Program Manager of Connecticut Clean Energy Fund's Affordable Housing Initiative on January 13, 2011; CCEF Affordable Housing Initiative website: http://www.ctcleanenergy.com/YourBusinessorInstitution/AffordableHousingInitiative/tabid/101/Default.aspx and program application: http://www.ctcleanenergy.com/Portals/0/CCEF-CIIDG-001v2%207-1-08.pdf

Massachusetts: Interview with Bruce Ledgerwood, Program Manager of MA LEAN Alternative Energy & Repairs Program, on January 6, 2011; program presentations available: http://www.nliec.org/2007%20Conference/Presentations/BLedgerwood.pdf and http://www.affordablecomfort.org/images/Events/39/Courses/1169/AVE4_Wilcox__Renewables.pdf

Pennsylvania: Interview with Tom Bell, Executive Director of Pennsylvania Energy Development Authority, on January 11, 2011; Department of Environmental Protection program website: http://www.portal.state.pa.us/portal/server.pt/community/grants_loans_tax_credits/10395/PA_Sunshine_Solar_Program/821790

Vermont: Program website: http://www.rerc-vt.org/incentives/; DSIRE database: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=VT17F

4.2 *Program Highlights from Select States*

This section discusses program progress and lessons learned from states with low-income solar incentive offerings that are relevant for California. Findings discussed here are based on data available on program Web sites, program documents and reports, and the Database of State Incentives for Renewable Energy (DSIRE), as well as interviews with individuals who designed, implemented or played a key role in each program.[81]

4.2.1 Connecticut

Connecticut Clean Energy Fund (CCEF)'s Affordable Housing Initiative provides rebates for a wide range of alternative energy projects at low-income multifamily residential buildings. The Affordable Housing Initiative targets developers and owners/managers of low-income multifamily properties as well as third-party energy services providers. In addition to PV installations, projects may include wind, fuel cells, landfill gas, waste heat recovery-powered generators, low-emission biomass conversion, and Class 1 hydro. The broader CCEF program is open to all customers of the state's two investor-owned utilities, Connecticut Light & Power and United Illuminating.

The Affordable Housing Initiative began in 2008 with a two-year budget of $2 million. With a $6 per Watt rebate for PV systems, small developments (1-4 units) were eligible for rebates of up to $60,000 or 10 kW; large developments (>4 units) were eligible for up to $850,000 or 200 kW, whichever was lower. Additionally, any project qualifying as LEED Silver, Gold, or Platinum could receive an additional incentive of $0.25/kW. The Affordable Housing Initiative provided rebates to four PV projects at large developments as well as several smaller projects through Habitat for Humanity. These incentives are higher than those available to for-profit ventures, which are eligible for a $4.50 per Watt rebate.

For the planning cycle of July 2010 to June 2012, the Affordable Housing Initiative had a proposed budget of $4 million. However, the program is currently on hold because the budget has not yet been approved. Program administrators expressed confidence that the program would be reinstated and that the rebate level for PV would be similar to the rate offered in the first cycle.

All commercial rebates offered by CCEF require applicants to complete an energy audit at each facility. Additionally, the Affordable Housing Initiative requires applicants to implement all options from the audit that have a payback of five years or less. CCEF validates applicants as eligible for the Affordable Housing Initiative rebate using 501(c)3 incorporation documents and a letter from the U.S. Department of Housing and Urban Development (HUD), a state housing authority, or a municipal housing authority.

The Connecticut program verifies that a multi-family property was low-income through a combination of 501(c)3 status and a letter from a relevant housing agency.

[81] Interviews were conducted during January 2011. The following individuals participated in these interviews: Christin Cifaldi, Program Manager of Connecticut Clean Energy Fund's Affordable Housing Initiative on January 13, 2011; Bruce Ledgerwood, Program Manager of MA LEAN Alternative Energy & Repairs Program, on January 6, 2011; Tom Bell, Executive Director of Pennsylvania Energy Development Authority

One of the challenges faced by the program was converting interest into participation. Many of the developers did not have time to think about scoping and installing alternative energy projects, despite the generous rebates from CCEF and federal tax credits available. CCEF worked to educate and contact potential participants but found that the most progressive developers were for-profit entities. In some cases, CCEF was able to work with for-profit developers of multi-family affordable housing by pro-rating the rebates based on the percentage of the development that qualified as affordable.

Prior to the Affordable Housing Initiative, CCEF ran another PV program for the lower income residential market. Connecticut's CT Solar Lease program targeted single-family homeowners with an annual household income of no more than 250 percent of the area median income. The program provided homeowners with a no-money-down, fixed-rate lease on rooftop solar installations. CCEF partnered with U.S. Bancorp, which purchased the federal tax credit available for the project, and Gemstone Lease Management and ACF First Financial, which managed the leases. With an average system size of 7.2 kW, participants pay $100-$125 per month toward their systems, depending on which rebate level was received.

4.2.2 Massachusetts

Since 2006, the Low-Income Energy Affordability Network (LEAN) has provided low-income owners of single-family homes and multi-family facility owners with renewable energy technologies and energy efficiency repairs through the Alternative Energy & Repairs Program. Services provided include installation and associated repairs. In each of its three budget cycles, the program has funded a wide range of technologies and services including the following:

- 2006-07 program cycle: Twenty-five PV systems, eight solar hot water systems, two geothermal systems, and one wind system on single family homes,
- 2008-09 program cycle: Advanced energy efficiency retrofits including roof repairs and electrical wiring upgrades,
- 2009-2010 program cycle: Micro combined heat and power systems in the, and
- Beginning in October 2010, solar hot water systems for multifamily dwellings.

LEAN serves as a coordinating body for 24 agencies across Massachusetts that deliver a broad range of energy services, including fuel assistance, tax credits, and retrofits, to low-income ratepayers. Budget for the Alternative Energy & Repairs Program comes from the statewide, ratepayer-funded Massachusetts Clean Energy Center and Massachusetts Technology Collaborative (MTC). LEAN selects participants for the Alternative Energy & Repairs program from a pool of utility customers recruited by community development corporations, housing authorities, and LEAN's 24 member agencies.

The Massachusetts program defined low-income as households with annual income less than 60 percent of the state's median income.

As in other states, participants are selected using several eligibility criteria. To start, participants must be customers of one of the Massachusetts investor-owned utilities or one of the four municipal utilities that pay into the ratepayer fund. Additionally, customers must make no more than 60 percent of the Massachusetts median income and must have previously received weatherization services through the statewide energy efficiency retrofit program.

LEAN found that potential participants were very interested in the program and that actual participants were pleased with the energy use reductions on their bills. At the same time, some potential participants did not like the look of solar panels and others had unrealistic expectations associated with system electricity production. The LEAN Program Manager reported that contractors recruited for the program were generally enthusiastic about working with LEAN, provided high quality service at reasonable prices, and were able to fix any minor issues that arose during or after installation.[82] One of the challenges faced by the program was recruiting prospective participants; the task was handled by LEAN's member agencies. Only a few were able to generate multiple prospects.

4.2.3 Pennsylvania

Pennsylvania's Department of Environmental Protection launched the PA Sunshine Residential/Small Business Solar PV Program in May 2009. The program targets residential and small business customers with rebates for PV and solar hot water systems. The PA Sunshine Solar Program was funded by the Pennsylvania legislature with a total lifetime budget of $100 million. Low-income residential customers were just one of several classes of customers eligible for the program, and there were no set asides for any customer classes.

Residential customers, including low-income participants, are required to install the system on a home that they own and which serves as their primary residence. Although the program does not require an energy efficiency audit or retrofit, homes built after May 2009 must be ENERGY STAR certified. The program defines low-income participants as homeowners whose annual income does not exceed 60 percent of the state median income level.

The Pennsylvania program defined low-income as households with annual income less than 60 percent of the state's median income level.

The incentive structures are different for low-income residential customers than for the general market. Low-income residential customers may receive up to a maximum rebate of 35 percent of the total project cost while residential and small business customers are limited to the incentive "steps" identified in Table 1. For low-income residents, the maximum rebate throughout the life of the program is 35 percent of project cost. Low-income multi-family properties received incentive awards in some cases through the small business category, provided that the organization had met the definition of a "small business": fewer than 100 employees and legally a for-profit entity.

[82] Wilcox, A. and B. Ledgerwood. Undated. "LEAN Alternative Energy-Repair Program."Available: http://www.affordablecomfort.org/images/Events/39/Courses/1169/AVE4_Wilcox__Renewables.pdf

Because the program is funded by the state government, participation is open to all homeowners and small businesses across the state. By the fourth quarter of 2010, the program had reached its fourth and final step with $35 million still available. Participation has outpaced expectations: program administrators had anticipated running through the budget within three to four years yet now expect funds to be fully reserved by the second quarter of 2012, and possibly earlier. Over the 21 months the program has been in existence, administrators have seen the average total installed cost drop from $7.50 per Watt to $6.30 per Watt.

Administrators for PA Sunshine Solar report that the program has run smoothly overall. One challenge has been with the long installation timeline permitted under existing program rules; currently, PA Sunshine Solar allows installers to start a project up to a year after the application has been approved. This time frame will be shortened considerably if the program is renewed. Additionally, the small number of inspectors (a team of four) constrains the pace at which finished installations can be approved for their rebate payments.

5 Recommendations

This section summarizes the key recommendations that are found throughout the report. These recommendations are closely related to the key findings in Section 2.6 (SASH) and Section 3.7 (MASH). These recommendations focus on opportunities to improve the effect of MASH and SASH in the marketplace, to facilitate more comprehensive evaluation in the future, and to create a more sustainable market for PV among low-income households in California.

5.1 SASH Recommendations

This section outlines the recommendations for the SASH program moving forward.

5.1.1 Market Channels

» **GRID should continue to maintain tight control over its channels for the foreseeable future.** Developing the brand equity required to meet SASH's ambitious goals requires a dedicated and knowledgeable sales force that keeps the best interests of SASH and its participants in mind. The alternative structures allow for much more variation in messaging and customer experience than the current one does, creating the potential to erode GRID's brand equity and damage the long-term effectiveness of the SASH program.

» **Making a concerted effort to involve children in the households that GRID serves in its outreach efforts may create longer-term effects of the program.** GRID may consider exploring this aspect of its outreach further. Research from the energy efficiency evaluation community indicates that children retain knowledge gained about energy efficiency and continue to practice energy efficiency behaviors as long as six years after initially encountering the information.[83] SASH can realize similar effects by including children in the educational component of the outreach and possibly incorporating them into the installation of the project (in very low-risk ways).

» **Engaging previous program participants to provide testimonials to the program can leverage the important role of neighbors, friends, and family in recruiting participants to the program.** Where appropriate, GRID staff may attend community meetings organized by previous participants to answer any formal questions about the program. This is already ongoing at some level, but it warrants additional attention, especially in Spanish-speaking communities where friends, family, and neighbors are the primary source of initial information about the program.

[83] Hanson, R. & Siegel, D.F. 1995. "The Enduring Effects of an Elementary School Energy Education Program." *Proceedings of the 1995 International Energy Program Evaluation Conference, pp. 493-504.* NEPEC.

5.1.2 Project Financing

» **Finding a more sustainable alternative than fully funding projects through a combination of SASH incentives and GRID fundraising will enhance the program's long-term success.** The ongoing economic downturn creates doubts about the sustainability of the fundraising model to cover funding gap amounts. Given the likely administrative burden associated with filling funding gaps on a per-project basis, significant potential exists for a broader financing approach to address these gaps and increase the rate of SASH project installations. At the same time, however, soliciting such personal contributions and securing a vehicle to enable them will increase the cost of the program and pose additional barriers to participation. These should be considered moving forward.

» **GRID may consider developing a strategic partnership with one or a limited number of third-party financing providers.** These types of relationships would facilitate the process for developing financing agreements for SASH participants. GRID could work with these partners to develop standard application templates that make sense for low-income homeowners and that still meet the third party's requirements. Building trust with a limited number of strategic partners would align with GRID's broader approach to building trust in the marketplace. In addition, this approach would help to overcome homeowners' initial resistance to making a financial contribution. GRID would need to take precautions to ensure that the partner or partners met strict ethical criteria, as well as provide a strong financial base.

» **Power purchase agreements (PPAs) with third parties are likely not appropriate for SASH.** First, PPAs require third-party ownership, which is counter to SASH's exclusion as described above. The focus of the SASH program is participant ownership. Second, the transactional costs likely negate the limited financial returns. Third, it would be difficult to structure rules related to contract length, ownership "flip" schedules, among other issues, that are both fair for the PPA providers and discernable for the SASH participants.

» **Projecting monthly energy bill savings—especially with access to financing—could increase potential participants' ability and willingness to contribute financially to the cost of a system.** Understanding the financial benefits more clearly would likely increase the rate of SASH installations. At the same time, any resulting personal contributions would leverage GRID's fundraising efforts to reach a greater number of participants.

5.1.3 Spillover

» **Continue to develop relationships with job training programs.** These mutually beneficial relationships create opportunities for hands-on field experience that is critical to securing full-time jobs in the solar industry. GRID's approach to providing job training program participants with the opportunity to participate on jobs as volunteers plays an important role in the participants' professional development. GRID may consider developing more formal relationships with these job training programs to (1) strengthen its network of volunteers while providing important value to the participants and (2) create a pipeline of candidates for the SPP program.

5.1.4 Recommendations for Future Evaluations

» **At some point in the future, it may be appropriate to revisit the effectiveness of SASH's channel strategy.** Reconsideration may occur after GRID has developed broader recognition and acceptance within the market. Additional investigation may also be warranted as more SPP contractors install systems and become more familiar with the requirements of SASH and the distinct needs of the low-income population. Neither of these scenarios are the case at this time, however.

» **Clearer definitions for the "source of gap funding amount" field in the database would create a more comprehensive picture of clients' contributions to their system cost.** Specifically, it would be useful to list the homeowner as the source when they apply for and use HUD loan funds to pay for a portion of the system. Although the capital initially comes from HUD, the homeowner commits to repaying it in the future.

» **A non-participant survey would provide a vehicle to better gauge the willingness to pay a portion of the gap amount funding through bill savings.** Structuring the interview guide using an appropriate willingness-to-pay methodology (e.g., contingent valuation) would provide the data needed to quantitatively analyze the amount of funding gap that homeowners who are new to SASH would willingly contribute. Future evaluation teams should consider including such analysis in their evaluation plans, although this was not part of the scope for this year's evaluation; as such, the evaluation team did not conduct non-participant surveys for this evaluation cycle.

» **Better tracking of job trainees and volunteers would provide the evaluation team with a better starting point for assessing the effectiveness of this aspect of SASH.** On-the-job training for solar installers and broader industry experience for a broader range of clean energy workers are important components of MASH's value proposition. Tracking contact information, their job training program, the number of times they provided SASH project installation assistance, and the identity of future employers will provide important information for future evaluation teams. This information will be useful for both SPP job trainees and those job trainees and volunteers that assist in SASH-led installations.

» **Collecting more information about energy efficiency upgrades completed during the client's engagement with GRID would facilitate better evaluation of the program's total benefits.** In the event that CPUC determines that energy efficiency is a higher priority and worthy of the resources necessary to track progress in this area, GRID may consider collecting additional information about how participants alter their energy use. For example, the outreach coordinator might conduct an inventory of the energy efficiency measures installed at the time of the visit for reviewing the client's electric bill after system installation. Again, this approach would add cost to the program in terms of staff time, database alteration, additional data entry, and other administrative tasks. This approach would enable the next evaluation team to focus additional resources on this issue while using a strong, data-driven approach.

5.2 *MASH Recommendations*

There are several potential paths forward for MASH. This section provides recommendations in two main categories. The first set of recommendations apply to MASH in its current state, as it continues to manage the process for projects that have already secured reservations. The second set of reservations address a situation in which CPUC considers extending or expanding MASH with some modifications.

5.2.1 As the Program Currently Stands

» **Provide additional education to low-income multifamily property owners about the business aspects of PV project to further expand the market for PV among low-income multifamily facilities.** The PAs could provide education to low-income multifamily facility owners about the PPA terms and conditions, key decision criteria for selecting key partners (such as installers and financing partners), and additional resources available to assist with the development of PV projects. This would enable a broader group of organizations to gain access to the solar market, even in the absence of further incentives from MASH. Case studies about success stories that relate key financial metrics may be especially useful.

» **Provide additional outreach and education about VNM to system hosts.** Lowering the barriers to accessing VNM for system hosts, would enable tenants to reap additional benefits from PV systems installed on their buildings. Regardless of whether or not CPUC decides to expand MASH, this additional information would provide additional opportunities for building owners to create these benefits for their tenants.

5.2.2 Modifying MASH

» **Establish a stable policy environment to provide a less risky environment in which businesses can invest.** To build on the momentum gained by MASH for the market for solar among low-income multifamily facilities, key market actors need a clear idea of the market opportunity going forward. As seen in the stop-and-go of the national wind market during the early 2000s due to a short-term (and sometimes expired production tax credit), such cycles create barriers to deployment of capital resources. By enacting a policy that provides for a clear view of future incentives and a plan for ensuring that those incentives are available in a consistent flow, CPUC can make the market more attractive to investors in the long term.

» **Increase the pricing differential between projects that benefit common area and tenant load.** CPUC may consider creating incentives for projects to decrease energy use and costs for affordable housing building occupants. One option for doing so would be to create a greater differential in the pricing for projects that allocate benefits to common areas and for projects that allocate benefits to tenant spaces. This approach would help to overcome one aspect of the principal-agent barrier.

» **For those projects with existing reservations that meet the ongoing requirements of the program at the time that they secured their reservation, keep incentive levels consistent with those set at the time of the reservation request.** These project owners, installers, and host customers met the requirements of the program at the time of enrollment, and they should be able to retain the benefits that were available under the program at the time of enrollment. Changing incentives for these projects would create undue stress and uncertainty in the marketplace. Just as it is important to ensure stable policies in the years to come, ensuring that reservation-holders receive treatment commensurate with the terms of the program at the time of enrollment will create a policy environment in which investors are willing to do business. Increasing the uncertainty in the marketplace effectively increases the cost of projects for end users by driving up investors' required rates of return in order to counterbalance the increased risk.

5.2.3 Recommendations for Future Evaluations

» **Collect more information about energy efficiency upgrades prior to awarding the MASH rebate.** If CPUC views the energy efficiency benefits of MASH as high enough priorities, future evaluation teams will need additional information to effectively review progress in this area. The program may consider adding a field to the incentive request form to capture the types of energy efficiency upgrades implemented from the host customers before a rebate is paid and inputting this information into the program database. This could be as simple as a box that they check that indicates which energy efficiency upgrades the building owner made as a result of their participation in MASH.

» **Revisit the distribution of financial benefits among tenants, project hosts, and project owners.** Due to the limited number of projects completed at the time of this evaluation, a comprehensive assessment of the distribution of financial benefits from MASH was not possible. Future evaluations may consider the extent to which tenants, who the CPUC intended to benefit from the MASH program, actually receive financial benefits from the program.

» **Gather data about the PPA terms and conditions.** Future evaluation teams may inquire about the PPA terms and conditions to better understand the financing schemes, the bill impacts for tenants and project hosts, and the long-term financial benefits of the systems for tenants, project hosts, and project owners. MASH may need to require that program participants share this data as a precondition for participation in the program.

» **Investigate the "host customer" component of the MASH value chain in further depth.** Further exploring the types of market actors in the multifamily affordable housing community, their business models, and motivations will provide a more comprehensive picture of the factors that influence their decisions to participate. In addition, this information may provide a better understanding of how the program can reach a broader slice of the market.