Process and Load Impact Evaluation of the Disadvantaged Communities-Single-Family Affordable Solar Housing Program (DAC-SASH)

Draft Report

Submitted by Evergreen Economics

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1 Executive Summary

1.1 Introduction

In 2018, the California Public Utilities Commission (CPUC) created the Disadvantaged Communities – Single-Family Affordable Solar Homes (DAC-SASH) through the passing of Decision 18-06-027, in response to California's Assembly Bill (AB) 327 (Perea, 2013) to develop specific alternatives designed to increase adoption of renewable generation in disadvantaged communities (DACs). DAC-SASH program began offering incentives to install solar panels to low-income households located in disadvantaged communities (DACs). The broad intent of the program is to "ensure that customer-sited renewable distributed generation continues to grow sustainably… for residential customers in disadvantaged communities."

The program administrator, GRID Alternatives (GRID), administers the program under the name, "Energy for All Program." At the time of this research, in March 2022, GRID has completed 964 projects.

Without a specific targeted number of kW installed or homes served the evaluation cannot conclusively say if this level of progress is or is achieving the direction in AB 327. **Our primary recommendation is to define programmatic goals and metrics conclusively**. Where we identified program intent through this research, we have made additional recommendations about what metrics should be tracked and what program changes should be made to ensure that the program progresses towards a more specific set of goals.

Program Accomplishments

Through the installation of 964 projects from October 2019 to March 2022, the program realized the following accomplishments:

- 3,553 kW (CEC-AC[1]) total installed capacity with an average of 3.7 kW per home.
- Estimated reduced greenhouse gas (GHG) emissions of 2,030 metric tons of CO_2 equivalent (similar to the carbon footprint for one year for 46 average California households), along with criteria pollutant reductions of 63 kg methane (CH4) reduction and 7.7 kg of NOX reduction.[2]
- Participation from customers in all eligible investor-owned utility (IOU) service territories, with 67 percent of projects in PG&E's, 30 percent in SCE's, and 3 percent in SDG&E's service territory.

[1] A rating system used to determine the eligibility of a solar system by the California Energy Commission.

[2] Jones, Christopher M, Stephen M. Wheeler, and Daniel M Kammen. 2018. "Carbon Footprint Planning: Quantifying Local and State Mitigation Opportunities for 700 California Cities." https://rael.berkeley.edu/wp-content/uploads/2018/04/Jones-Wheeler-Kammen-700-California-Cities-Carbon-Footprint-2018.pdf

- $10.6 million in incentives paid out for installation projects with an average incentive of a $11,056 going to each project (DAC-SASH incentive is $3 per watt installed ($3/W)).[3]
- $20.8M total spent (administration, marketing and outreach [M&O], and incentives) out of a $30M total budget with an average of $13,941 spent per project.[4]
- Solar system performance was slightly better than projected (103 percent of projected performance).
- Most surveyed customers (88%) reported seeing lower bills after participating in DAC-SASH. Billing analysis confirmed that on average, DAC-SASH participants had an average 68 percent decrease in annual energy consumption (5.2 MWh per year) for an average total annual bill savings of $990 per year (94% reduction in annual bill costs).
- There was high customer satisfaction and appreciation for the services provided by the program.
- Solar industry participation from volunteers and trainees increased after participation in trainings and/or volunteer opportunities created by the program (9 percent worked in the industry before the program and 24 percent reported working in the industry afterwards).

1.2 Findings and Recommendations

The remainder of this section presents the main study findings and recommendations organized in the following subsections:

1. Explicit/stated program goals (i.e., those that are found in the CPUC Decision that authorized the program and set its goals);
2. Implicit program goals based on what the evaluators interpreted as unstated but desired goals for the program based on discussions with CPUC staff and stakeholders;
3. Recommendations for future research; and
4. Recommendations for improving the Program Administrator, GRID Alternatives' (GRID's) data collection in order to support future research.

1.2.1 Related to Explicit / Stated Program Goals

The goals in this section can be found in the CPUC Decision that authorized the program or in the handbook drafted by GRID that was approved through the Decision.

[3] Analysis of incentives was done on the 964 projects that were considered fully complete as of March 2022. There were additional projects which were installed but not yet interconnected, or where incentives had not yet been paid out. Those projects were excluded from this analysis of per project incentive costs.

[4] Analysis of administration and M&O costs that were done on the 1,492 projects that were started as of March 2022. These costs are reported on a semi-annual basis and include administration and M&O time spent before a per-project is fully completed.

Program Goal 1: Ensure that customer-sited renewable distributed generation continues to grow sustainably… for residential customers in disadvantaged communities. (Direct language from AB 327)

As of March 1, 2022, GRID had completed 964 DAC-SASH projects, for a total of 3,553 kW (CEC-AC) within DACs. While no metrics are set for the number of projects or kW installed, the incentive spend and discussions with GRID indicate that the program has moved at a slower pace than expected. The main barriers to serving the target population are the prevalence of poor roof conditions, the need to upgrade electrical panels, and the need to trim trees. Without a stated expectation about how much growth *should* be sustained through the course of the program, it is challenging to say if the program is successful in generating growth. Our recommendations are listed below:

- The program should use a combination of dedicated program funding and/or external funding procured by GRID to complete roof repairs, electrical upgrades, and required tree trimming for projects to address housing stock barriers.
- GRID and Energy Division should consider using the rate of market adoption of solar panel installations over time as a reference point for setting more specific, voluntary benchmarks for the DAC-SASH target population (e.g., CalDGStats tracks Net Energy Metering [NEM] interconnections, which is a proxy for solar installations, going back to 1996).
- The program will be best served by establishing annual targets and a program goal for the total number of households to participate before the program ends.

Program Goal 2: Leverage outreach and relationships built through the program offerings to enroll customers in other relevant programs. (Section 2.3 of the GRID handbook)

CARE and ESA enrollments are low amongst program participants despite having aligned income requirements. CARE enrollments may be low because customers are required to re-enroll every two years, and GRID staff members reported that many participants did not know about this requirement. Additionally, we observed that the program is not generating enrollments in the Self-Generation Incentive Program (SGIP).

We make a recommendation to align Energy Savings Assistance (ESA) program site visits with the on-site assessments for this program though that will require additional coordination with ESA contractors. We also caution that pushing beyond this to make ESA participation (rather than just referral) a requirement for the program may slow down an already low adoption rate.

- GRID should send an annual follow up letter and email to customers reminding them of related programs (ESA and California Alternate Rates for Energy [CARE] which requires reenrollment every two years, etc.).

- GRID could call the utility with the customer while doing the on-site assessment to check if they are enrolled in CARE and to help facilitate the enrollment process if they are not currently enrolled.
- GRID should be coordinating more closely with ESA contractors to provide complementary solar services. ESA and DAC-SASH share the same income eligibility requirements and a growing number of ESA contractors hold the appropriate licensing and expertise to install solar and to provide home radiation services.
- GRID should be sure to offer referrals for other programs to low energy users who are not interested in continuing with DAC-SASH to receive solar.

Program Goal 3: Ensure that customers are given insight into their solar panel generation status and panel production of solar energy over the lifespan of the equipment. (Section 7 of the Handbook)

Enphase-Enlightened (one of the two systems currently being installed for DAC-SASH customers) was missing generation data for 15 of 37 requested projects. While missing data does not mean the system is not generating, it does limit the homeowners' insight into their systems and could result in underproduction if an issue is not able to be identified. A stated benefit of the third-party ownership (TPO) systems includes monitoring and communication when the solar systems are down, but 14 of the 15 projects (in this study) with missing data were TPO, despite the requirement.

- GRID should send an annual follow up letter and email to customers reminding them of how to check in on their system production. This can be combined with the annual follow-up letter mentioned above.
- All program-installed inverters should report data to the consumer, and GRID should establish program rules and protocols to enable fleet monitoring of incented systems. This will require coordination with the third parties who selected the inverters.
- GRID should do outreach to TPO providers to address monitoring systems that have gone offline.

Program Goal 4: Leverage trainees living in DACs to do program installations (Handbook section 2.1.3)

Utilizing trained DAC members on installations is a program goal and trainees/volunteers reported that travel to training sites presented a barrier. Current data are not detailed enough to determine the location of volunteers (e.g., if they reside in DACs).

- GRID should allocate funding, like a travel stipend, for residents within DACs to travel to approved training programs and to DAC-SASH solar installation volunteer opportunities.
- GRID should continue to batch projects that are further away from regional offices.
- GRID should track data on census tracts of trainees and volunteers to understand DAC participation levels on DAC-SASH projects.

- GRID should identify a goal as to how many DAC located trainees or volunteers per project represent successful leveraging.

1.2.2 Related to Implicit / Unstated Program Goals

This section discussion relates to a second set of implicit program goals that, while not specified in statute, are supportive of the stated program goals and would improve the program offerings and ability to meet the overall intent set forth by AB 327 if codified. Codifying these goals will help to clarify:

- Where customers are served
- What share of the installation cost should be covered by the program
- System size and pace of installation

Where Customers Are Served

Currently, 70 percent of eligible participants are within the average distance traveled for installed projects, indicating that most customers can be easily served with the existing GRID office infrastructure.

The Subcontractor Partnership Program (SPP) model allows trusted and vetted solar contractors to install DAC-SASH systems under GRID staff supervision. At this point in time, a comparison of the SPP models is challenging given that only 13 SPP projects have been completed.

While the main focus of the program should be installing solar for eligible customers wherever the customer is located, a secondary concern is to ensure equitable service across the state (especially for eligible customers living in more remote areas).

Related to customer location, the data show that eligible distribution does not align with the funding distribution across IOUs. For example, 10 percent of the budget allocation for DAC-SASH comes from SDG&E, but only 2 percent of the eligible population resides in its service territory.

To support the **program serving remote customers and not limiting installations near GRID regional office locations, we make the recommendations shown below.**

- GRID should report on SPP projects in their semi-annual report and include the following metrics to facilitate future evaluation:
    - Number of projects completed with the SPP model
    - Costs of the SPP projects
    - Anecdotal challenges or successes working with the partners
- Future evaluations should survey participants that used the SPP model to capture the participant experience.
- GRID should continue to grow their partner relationships for the SPP model to ensure that projects further from the GRID offices are also served by the program.

- We recommend that GRID review Evergreen's analysis of eligible households and consider focusing efforts in areas with higher rates of eligible households. GRID can use this analysis to set up target installations at the regional level. The SPP model may be more appropriate for homes further from GRID's offices though all eligible homes are within driving distance from existing offices.
- GRID should track marketing, outreach and administrative costs at the level of regional offices.
- GRID should connect with the SDG&E ESA Program team to learn how to improve their engagement efforts.

Share of Installation Cost to Customers

GRID offers systems at no cost to customers, combining DAC-SASH program funds with external funding that they obtain by tapping additional resources. It is challenging to assess the appropriateness of the current program incentive level without a full picture of project costs, such as how much DAC-SASH funded staff time is dedicated to fundraising activities. Additionally, with rising costs of materials and labor, total project costs are likely to increase such that the gap between the incentive and the actual cost of the project may be more challenging to overcome in the future.

If the CPUC's goal is to grow the program by increasing the number of installations, GRID may not be able to scale up its fundraising efforts to meet growth targets if the incentive level is kept at the current level.

To **support analysis to assess the appropriateness of the current program incentive level, we make the recommendations shown below.**

- To substantiate the stated need for a higher incentive level, GRID should share data on what DAC-SASH-funded staff time is spent fundraising to fill the gap (i.e., to show the total cost of the project to be compared with the incentive level).
- It may be appropriate to raise the incentive amount beyond the $3/W cap to match the rise in construction costs and inflation (e.g., compare actual program costs over time to the incentive level). Current cost for installation and materials is closer to $5/W; changing the incentive amount requires a policy change by the Commission. Raising the incentive would need to be weighed against the benefits of stretching program dollars by leveraging TPO relationships and grant funding.
- Given the large amount of added recommended tracking, we suggest GRID prepare a summary of data gathered to support new program metrics after a year of collection (see last recommendations table regarding data tracking).
- Alternatively, GRID could adjust its program model to allow participants to cover part of their project costs though this would impact GRID's ability to market the program as truly

no-cost and would likely identify a new cost barrier that is very likely to exist amongst this population.

System Size and Pace of Installation

Though the systems are providing participating customers with bill and energy savings as intended, some participants have requested more panels (beyond the 5 kW cap within the program handbook) to lower their bill further and/or better enable them to pursue electrification.

To **ensure that low-income and DAC residents are able to install *similar* systems at a *similar* pace to market rate customers we make the recommendations shown below.**

- GRID should consider conducting research that compares the number of installations, the average size of installations, and average bill savings of program participants to the same rates for market-rate projects.
- GRID should clarify if the handbook cap overrules the direction of systems sizing "up to 150% of past usage" or if this language allows the program to install programs larger than 5 kW. If the 5 kW cap overrides matching the system to customer usage, this should be reconsidered.
- GRID should educate customers on the pros and cons of both the TPO or host-owned system from the customer perspective, allowing customers to make an educated choice between the two options.

Beyond the goals shared above, the evaluation set out to better understand how the TPO model varies from a homeowner-owned system.

Customers can either own their system outright or participate in a third-party ownership (TPO) model, but GRID defaults to the TPO model in most cases. A comparison of both models (ownership vs. TPO) identified benefits to the TPO model: additional funding to install projects and customer monitoring and production guarantees, though GRID does not currently collect enough data to quantify all these benefits. Impact analyses found that customers with TPO systems and customers with homeowner-owned systems are seeing similar bill impacts, indicating that the model is fairly passing benefits of solar ownership onto DAC households.

To **better assess the pros and cons of the TPO model, we make the following recommendations.**

- GRID should track staff time spent on fundraising for DAC-SASH projects
- Future evaluations should analyze:
  - GRID staff time spent on TPO coordination
  - Full cost agreement for the 25-year PPA used in the TPO model
  - Full amount of TPO payment to GRID
  - Federal tax rebate amount to TPO

- Whether underproducing systems receive a production guarantee payment, as promised by TPO agreements
- Whether partnered TPO companies discriminate against the enrollment of tribal customers.

1.2.3 Recommended Data Tracking

There were a number of data points that were unavailable and created challenges in answering research questions. This section combines recommendations to collect data that would have facilitated this evaluation and that would be helpful for *future* evaluations. In order to support future evaluations and to answer questions that arose over the course of this research, we recommend that GRID track:

- Metrics on marketing outreach on an annual basis divided by total installations, including leads received from the IOUs, purchased from other sources, direct mailers, and referrals.
    - We recommend metrics included in the logic model be integrated into GRID's handbook.
- Percent of customer on-site visits where ESA contractor was in attendance.
- GRID staff time spend on searching for other sources of gap financing.
- GRID should track data on census tracts (or zip codes) of trainees and volunteers that participate in a DAC-SASH installation.
- We recommend GRID track marketing, outreach, and administrative costs at the level of regional offices.
- GRID should collect number of projects that are originally scoped to be over 5 kW.

2 Introduction

Assembly Bill (AB) 2723 directed that at least 10 percent of California Solar Initiative (CSI) funds should be allocated to assisting low-income households in the electric investor-owned utility (IOU) service territories. The Disadvantaged Communities – Single-Family Affordable Solar Housing program (DAC-SASH) was created in 2018 to increase the adoption of renewable generation in the electric IOUs' disadvantaged communities (DACs) and included many similarities to the SASH program. While the CSI general market program closed at the end of 2016, the California Public Utilities Commission (CPUC) continues to provide incentives to low-income customers installing solar PV systems though DAC-SASH (as well as the net energy metering program for all solar systems and incentives for solar water heaters). This report contains an evaluation of the DAC-SASH program and recommendations for program improvement.

2.1 Program Background

The goal of the DAC-SASH program is to provide opportunities for existing low-income customers within DACs to overcome barriers to accessing on-site solar systems to decrease electricity usage and cost without increasing monthly household expenses.[5] Low-income, single-family homeowners residing in DACs within the service territories of the large electric IOUs—Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E)—are eligible. The program is administered by GRID Alternatives (GRID), who also administered the SASH program that preceded DAC-SASH. The program is funded first through greenhouse gas (GHG) allowance proceeds and then through public purpose program funds.

The DAC-SASH program handbook lists requirements based on the decision that adopted the program.[6] Table 1 summarizes the guidelines outlined by the handbook.

Table 1: Summary of DAC-SASH Program Guidelines

Category	Requirements
Eligibility Criteria	• Reside in a disadvantaged community (DAC)[7] • Customer of PG&E, SCE, or SDG&E • Single-family homeowner • Low Income (qualify for CARE or FERA)

[5] D. 18-06-027. Accessed via: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M216/K789/216789285.PDF
[6] GRID DAC-SASH Handbook, Section 2.
[7] The CPUC defined a disadvantaged community as a community that appears among the top 25 percent of census tracts identified by CalEnviroScreen statewide, as well as 22 census tracts in the highest 5 percent of CalEnviroScreen's Pollution Burden, but that do not have an overall CalEnviroScreen score because of unreliable socioeconomic or health data.

Category	Requirements
Generator System Requirements	• PV systems must be certified through the California Energy Commission's (CEC's) PV system certification program. • System size must be optimized for electric bill impact and must be 1 kW to 5 kW (California Energy Commission (CEC)-AC). • Sizing will be based on baseline usage, adjusted based on estimate of energy efficiency savings, and documented future load growth to determine the maximum size.
Energy Efficiency Requirements	• GRID will provide energy efficiency training and education sessions to each applicant and assist in referring them to additional energy efficiency services. • All applicants will be referred to the Energy Savings Assistance (ESA) program. • Incentives will not be paid until feasible ESA program measures are completed, the applicant is on a waiting list for ESA program completion, and/or an energy efficiency training and education session is completed.
Warranty, Permanency, Installation, and Inspection Requirements	• GRID will verify that all solar panels and inverter(s) come with a manufacture warranty between 10 and 25 years. • GRID will provide a 10-year labor and equipment warranty to provide no-cost repair and replacement of system components. • Third-party ownership (TPO) partners will provide additional warranty coverage for years 11 – 20, at a minimum, for TPO projects. • Projects must meet a minimum performance requirement of 85 percent of the Design Factor (DF) to qualify for an incentive. • An independent third party will perform system inspections for 1 in 12 projects to ensure quality ○ For Subcontractor Partnership Program (SPP)-installed systems, all systems will be independently inspected initially, then reduce the frequency as the SPP partner demonstrates consistent, high-performance.
Job Training/Workforce Development Requirements	• Each project must include at least one eligible job trainee. • Projects installed with the SPP model must include one paid workday opportunity for an eligible job trainee. • GRID will maintain an online resume bank with a focus on residents of DACs. • GRID will ensure participation of Job Training Organizations. • GRID will target installation companies located in DACs to participate in SPP.
Incentive Structure	• The program offers one non-declining incentive level of $3/W, CEC-AC
Application Process	• GRID will work directly with the applicant to assist them in filling out the application and collecting the required documentation. • GRID will perform a construction site visit to determine solar feasibility.

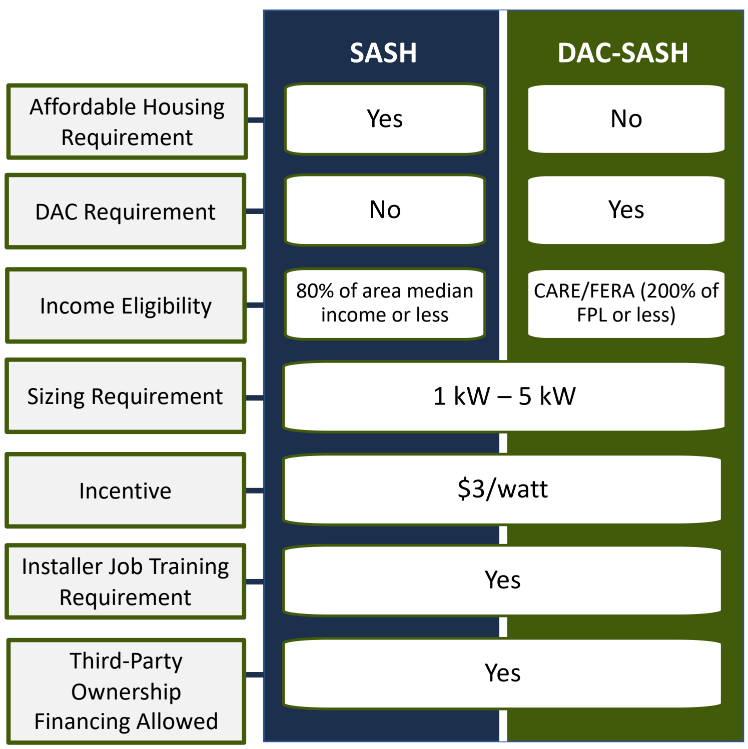
Category	Requirements
	• GRID will schedule installation, inspection, and interconnection for the participant.

Differences with SASH Program

While this report is not meant to compare the SASH and DAC-SASH programs, it is useful to understand how they differ as context for what we learned directly from the implementer, who worked previously on administering SASH, and has set up systems to serve the SASH-eligible population. The key program differences are income eligibility and geographic qualifications. SASH required household incomes to be 80 percent or less of the area median income, and homes must qualify for affordable housing (based on CPUC Code 2852) or reside in a HUD Qualified Census Tract.

DAC-SASH requires households to qualify for CARE or FERA and must be in a disadvantaged community (as identified by the CPUC).[8] In December 2020, the CPUC (in Decision 20-12-003) expanded DAC-SASH eligibility to include tribal lands.

Figure 1: Key Program Features of SASH and DAC-SASH



[8] At the time of publication (April 2023), the CARE limit was 200 percent or less of the federal poverty level (FPL) and the FERA limit included households with three or more individuals and a household income between 200% plus $1 and 250% of the FPL. The FERA limit was updated from 200% to 250% in an Advice letter filed in December 2020.

Customer Journey

GRID administers the DAC-SASH program in a few different ways. Table 2 summarizes the differences in the models.

Table 2: Deployment Models

Model	Owner of System	Responsible Party for: Finding & Qualifying Customers	Designing System	Installing System	Servicing Equipment	Monitoring Generation
Homeowner-Owned	Homeowner	GRID Alternatives	GRID Alternatives	GRID Alternatives	GRID Alternatives (10 years)	Homeowner
Third-Party Owned (TPO)	Third-Party Solar Company	GRID Alternatives	GRID Alternatives	GRID Alternatives	GRID Alternatives (10 years) AND Solar Company (25 years)	Solar Company
Subcontractor Participant Program (SPP)	Depends	GRID Alternatives	GRID Alternatives OR Subcontractor	Subcontractor	Depends on Ownership	Depends on Ownership

With homeowner-owned systems, GRID purchases solar equipment in bulk, finds and qualifies customers for DAC-SASH, designs and installs the systems, then provides a service and equipment warranty for 10 years.[9] With the third-party owned (TPO) model, GRID is responsible for all the same tasks but also pre-pays a 25-year power purchase agreement (PPA) from a third-party solar company. With the TPO model, the solar company provides monitoring services and a production guarantee for the 25-year life of the PPA. The system itself is then owned by the third-party solar company, and at the end of 25 years, the customer has the option to either:

- Purchase the system from the company at the market rate;[10]
- Pay a monthly PPA to continue to receive electric service at a reduced cost; or
- Have the third-party solar company uninstall the solar panel at no cost to them.

Costs and benefits of the TPO system are describe in detail in Section 4.3.2.

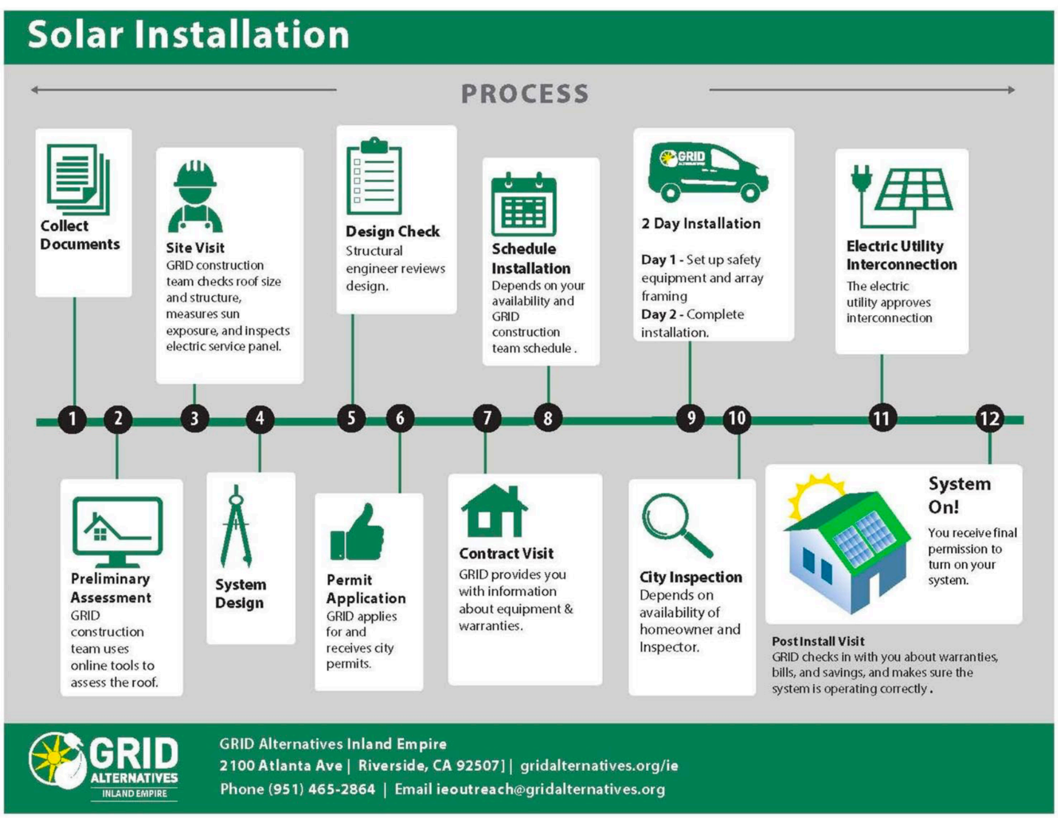
[9] After 10 years, the homeowner would be responsible for the costs of maintenance. While the equipment itself may still be under warranty after 10 years, the labor costs would be the homeowner's responsibility.

[10] In interviews and an advice letter (AL 18), GRID Alternatives states that the system should be worth $0 after 25 years, but that they cannot guarantee this will be the case, as market conditions and equipment conditions drive the market value of the old equipment.

The Subcontractor Participant Program (SPP) can be deployed with either ownership model and allows GRID to subcontract the design and installation of the solar systems out to a trusted partner in the community who is fully vetted by GRID and agrees to fulfill all requirements of solar installation as provided by GRID. The program is used in a limited capacity at the time of this research; details are in Section 4.3.3.

Figure 2, provided by GRID, illustrates the process a homeowner can expect during their participation in the program. After identifying interested participants, GRID will collect documents to verify eligibility. These typically include proof of homeownership, proof of income, and energy bills. Once customers are qualified, GRID will perform a preliminary assessment using online tools and conduct a site visit to ensure the property is fit for solar install. Many properties are screened out at this stage due to the poor quality or age of the property's roof, inadequate electrical panels, or shading from trees. Once a property is deemed solar-ready, GRID will begin the design and permitting steps necessary to schedule installation. After installation, the city inspector will inspect the solar system, and the electric utility will provide interconnection and permission to operate. The process from outreach to interconnection can take anywhere between two and six months. GRID reported that after the systems are installed, scheduling inspection and interconnection visits with the municipality can cause delays; however, only a few participants reported being unsatisfied with the time it took to complete the installation (Section 4.6.1), indicating that it is not a widespread problem for participants.

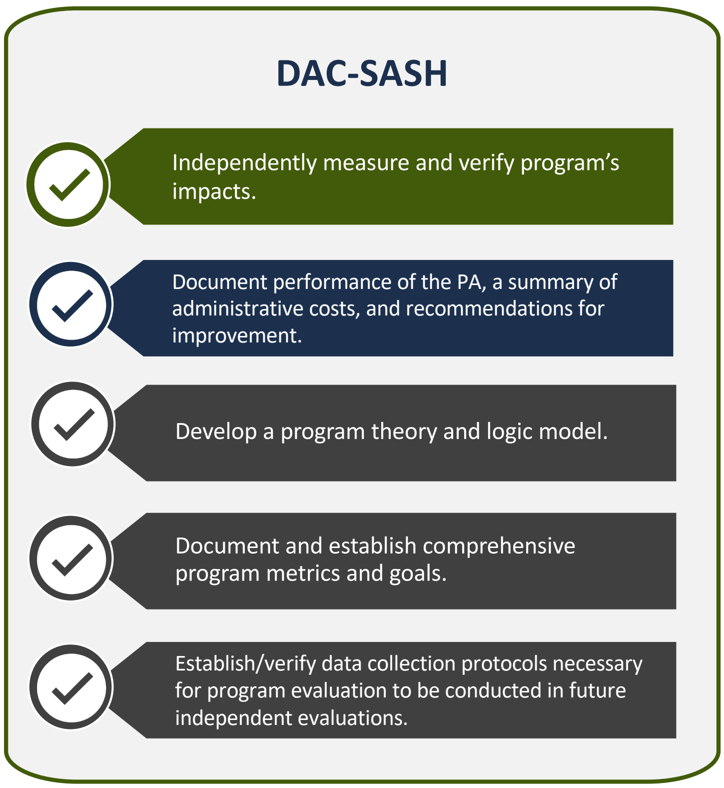
Figure 2: Customer Participation Process



This process is standard for many of GRID's regional offices, but details and order may differ by region. We examine the implications of this in Section 4.3.

2.2 Study Objectives

In Decision 18-06-027, which created the DAC-SASH program, the CPUC required the Energy Division to select a contractor to conduct a measurement and verification study every three years beginning in 2021. Per the study RFP, the study must accomplish the following:



Evergreen categorized the initial set of program evaluation metrics developed by the CPUC into a set of research questions to organize our evaluation approach. More detail is provided in Appendix A.

Program administration and marketing: How effective is program administration? What have the programs spent to-date on administration, management, direct implementation, and marketing? Have there been issues related to underutilizing the budget or other issues with tracking administrative costs? How effective has program marketing been? Has the PA made use of customer data provided by the IOUs, and has that impacted program enrollment?

Customer participation: What are the characteristics of participants versus eligible non-participants? What are the main barriers to participation? Are customers satisfied with the program? How effective are the programs in driving enrollment in other related programs? What is the size of the total eligible customer pool? How many out of program/market adoptions are happening among the eligible population?

PV system performance: Have systems degraded over time since installation? What factors contribute to such degradation?

Customer bill impacts: What is the average monthly bill reduction outcome for program participants? Are there any measurable changes in energy usage post-participation?

Environmental benefits: What environmental benefits is the program creating as a result of installed projects? Are participating customers aware of the programs' environmental benefits?

Workforce development: What job training programs are being leveraged? How many local jobs are being created? What are the longer-term job outcomes for trainees?

The study research and analyses supported the development of recommendations regarding:

- Whether incentives should be revised, where appropriate;
- The appropriateness of adjusting program design such as geographic eligibility requirements in order to expand the number of eligible households;
- Improving the program to meet its goals;
- How to course correct if underutilization of program funding is occurring;
- The feasibility, economic benefit, and cost-benefit of adjusting the program design such as instituting an "open contractor" model to diversify the installation aspect of the program; and
- Improvements based on known best practices in invoicing, project oversight, marketing, education, and outreach (ME&O), and other administrative roles.

3 Methodology

This section describes the overall study approach and details the methodology behind the various analysis tasks.

The foundation of a theory-based evaluation is the development of a program logic model. The program theory and logic model systematically identified and documented the goals and expected outcomes and impacts for DAC-SASH. Evergreen developed a comprehensive set of metrics that were used for the evaluation and may be used for future evaluations to measure the program's progress towards meeting its goals (Appendix A: Logic Model and Metric Mapping).

We linked the metrics to the research activities described to ensure that all metrics were included in the evaluation. Evergreen developed a data collection plan that documented the linkages of the study research components to the metrics, ensuring a systematic approach to assessing the program.

We used numerous data and information sources for this study including secondary and primary research:

- Secondary Research:
  - Background document review
  - Program documentation and report review
  - Program Administrator (PA) tracking data analysis
  - IOU billing system data analysis
  - Geographic and census data analysis
- Primary Research:
  - Customer surveys with program participants (n = 134) and non-participants (773 completed surveys, with 121 eligible for DAC-SASH). Only DAC-SASH eligible respondents (n=121) were included in this DAC-SASH report, and SASH eligible respondents (n=154) were included in the SASH report.
  - Web survey with trainees of the workforce development training (n = 114)
  - Phone interviews with PA, IOUs, marketing and outreach (M&O) organizations, TPO partners, CPUC Tribal Liaison (n = 17)
  - In-person field research of solar installation sites, marketing and outreach activities, and trainings (Greater Los Angeles area, Inland Empire, and North Valley)
  - On-site solar verification visits (n = 6)

Appendix B provides additional detail on sampling and analysis methodology.

4 Findings

This section presents the study findings. After a summary of data limitations and program progress to date, we provide findings with conclusions and recommendations following.

The findings follow the metrics for the evaluation and are categorized by topic:

- Data Limitations
- Program Progress
- Program Administration
- Marketing
- Customer Participation
- PV System Impacts
- Customer Bill Impacts
- Environmental Benefits
- Workforce Development and Job Training
- Program Design Recommendations

Recommendations are summarized in the conclusions section. Appendix C provides detail on all metrics and maps them to sections in this report.

4.1 Data Limitations

The study team identified several limitations for completing the evaluation. These limitations inform recommendations for future evaluations (Table 3).

Table 3: Data Limitations

Data Missing	Limitation	Implication	Recommendation for Future Evaluations
Solar System Generation Monitoring Portal	Many sites (41%) were not reporting at the time of the evaluation. However, nonreporting systems do not mean the system is not generating.	Nonreporting sites limit the evaluation's efforts to quantify actual generation from select systems, which may influence broader trends.	Send follow up letters to participants annually to remind them to ensure their system is reporting. For TPO systems, GRID must ensure that program rules and

			protocols are being followed.
IOU AMI/Billing Data	Some participants lacked enough pre- or post-solar install data to be included in the analysis (lost 15% of the participants)	Savings estimate for DAC-SASH program year 2021 may be inflated due to this imbalance in months, with less generation in late fall and early winter (the missing months) due to having fewer hours of daylight.	GRID could verify utility account numbers to help with matching to IOU data.
Trainee Contact Information	No trainee addresses collected; missing detailed trainee information field before 2019 (this field includes whether they volunteered or were part of the training curriculum provided by GRID).	Not able to compare if trainees are from DACs themselves or if they are travelling for the work.	GRID to collect trainee addresses for analysis on whether they are from DACs.
IOU Customer Information System (CIS) Data	No standardized information on own/rent, home type, or income eligibility.	Sampling was done via census analysis to target high concentrations of eligible households.	No recommendation – Future evaluations should use similar methods for sampling eligible households (i.e., Census)
PA Cost Data	No marketing, outreach, and admin costs split out by region.	Not able to compare acquisition costs for program participants across regions.	Request costs of the program by region.
PA Tracking Data	Time spent on searching for gap financing not tracked.	Not able to quantify staff time spent on gap financing.	GRID to track time spent on gap financing.

4.2 Program Progress

At the time of this research, the PA had completed 964 DAC-SASH projects, for a total of 3,553kW (CEC-AC) installed. Completed projects are defined as those that were installed, interconnected, and had incentives paid out.[11]

Interviews with GRID staff found that DAC-SASH enrollment is below regional level projections since program inception, and that it is difficult to disentangle if the driver of low enrollment is program-related or due to delays in outreach due to COVID-19. To determine if slow uptake of the program is related to a learning curve, we asked GRID staff if they felt the barriers and lack of progress were similar to the challenges that they faced during the early days of the SASH program administration. GRID staff did not relate the lack of progress to challenges faced with SASH, but

[11] There were an additional 252 projects installed at the time of data collection (March 2022), but not yet marked completed because the incentives had not been paid out to GRID.

instead see the eligibility criteria for DAC-SASH as the main barrier to meeting targets. One staff member said the comparison with SASH and DAC-SASH was not apples to apples because of the difference in qualification barriers.

Throughout our evaluation, we identified two main barriers to program participation: finding eligible households with solar-ready homes and covering the gap in financing for projects.

When asked which of the two barriers are greater, GRID staff varied in their answers. Many reported that the two are intertwined because once they overcome the barrier of finding eligible customers, they then face the barrier of gap financing to serve the customer. Eligible customers without solar-ready homes exacerbate the gap in available financing and strain GRID's resources or lead to eligible households being underserved. We detail the two barriers in this section, but also refer to them throughout the evaluation report.

Eligible Solar-Ready Homes

GRID staff report that with the program's current low-income threshold, it is challenging to find eligible customers that are homeowners of single-family homes and reside in a DAC. Especially in areas with higher costs of living, such as Greater Los Angeles or the San Francisco Bay Area, finding homeowners in DACs that earn less than 200 percent of the federal poverty limit has proved difficult for outreach staff. In Section 4.4.2, we characterize the eligible customer market for DAC-SASH in greater detail. Many GRID staff reported that with these eligibility criteria, many households that qualify may not live in a home that is solar-ready due to construction barriers such as poor roofing that requires replacement or repair, or old electrical panels at the customers' homes that must be upgraded.

To effectively serve this population, GRID often pays to upgrade customer homes to be solar-ready. These services that require additional costs beyond installation and materials are referred to as "professional services" and can include re-roofing, home electrical panel upgrades, shade tree removal, or other services that are required to bring a house up to solar-ready standards. We report on these services and costs associated in Sections 4.3.1 and 4.6.2.

Gap Financing

The other main barrier to participation is the gap between the program's current incentive that GRID receives through DAC-SASH and the cost of installing the solar panels for this community. Analysis of installation and materials cost data from GRID finds that the reported costs of materials and installation labor always exceeds the amount of incentive received per project. The average system cost (in terms of installation and materials) is $18,661 or $5.08/W. The average incentive is $11,056 (with the incentive level of $3/W installed). GRID staff report that with other costs they accrue to serve this population, the gap between the incentive and their costs is much wider than the data suggest. However, there are data limitations that do not allow this evaluation to quantify the size of the gap. We detail these limitations in Section 4.3 and examine how GRID has utilized a third-party ownership model to help bridge the gap in funding.

4.3 Program Administration

This section reports on a summary of costs and an assessment of underutilization of funds. We also review the program administration models used by GRID, such as documenting the differences between regional offices, the third-party ownership (TPO) model, and the Subcontractor Program Participant (SPP) model. The metrics addressed in this section are:

- How effective is program administration?
- What have the programs spent-to-date on administration, management, direct implementation, and marketing?
- Have there been issues related to underutilizing budget or other issues with tracking administrative costs?
- How effective has program marketing been?
- Has the PA made use of customer data provided by the IOUs, and has that impacted program enrollment?

4.3.1 Summary of Costs

Program costs approved by the CPUC include administration, marketing and outreach, and incentives for the cost of installation and materials (i.e., solar panels). Outside of those CPUC-funded program costs, GRID staff also fundraise and search for other sources of funding to provide professional services needed and to cover the difference between the solar system cost and incentive received. In addition to the money spent on professional services and covering the gap in financing, GRID also reports that a significant amount of DAC-SASH staff time goes towards identifying sources of gap financing. Time spent on searching for gap financing is not tracked, and thus is not quantifiable. Other regions report that finding gap financing opportunities is the responsibility of outreach coordinators on a case-by-case or word-of-mouth basis. GRID staff in different regions employ different tactics due to the unique funding opportunities in the local community, and leveraging local relationships is a strength of the program.

Availability of financing differed by region, with some partnering with their local municipalities to provide funding for specific projects, and others leveraging partnerships with other programs to fill the gap. It is worth noting that GRID was originally chosen as the program administrator for DAC-SASH in part because of its ability to leverage community-based organizations (CBOs) for this kind of funding as a non-profit. Though GRID staff could not estimate the cost of fully funding projects, many reported that virtually 100 percent of projects require additional funding to ensure the customer has no costs.

4.3.2 Cost Analysis

We also conducted cost analysis for the DAC-SASH program for program years 2019 through 2021. Evergreen was specifically tasked with gathering, summarizing, and reporting on program costs by category (e.g., program administration, marketing, and outreach), comparing forecasted versus actual values, and assessing any underutilization of program funding.

Evergreen used GRID-provided data, an export from the California Distributed Generation Statistics (CaliforniaDGStats) website, and budget allocations from the 2019 DAC-SASH Program Handbook to consider projected budget versus actual spending for the DAC-SASH program.[12] To determine yearly budget projections by utility and program function (administration, ME&O, evaluation, and incentives), we divided the allotted annual budget of $10 million by the budget allocations from the handbook, as shown in Table 4 and Table 5 below.[13] On average, GRID spent $1,819 on administrative costs per project and $11,369 on incentives, roughly meeting the allocations mandated for program functions listed in Table 5.[14]

Table 4: DAC-SASH Budget Allocation by IOU

IOU	Budget %
SDG&E	10.3%
PG&E	43.7%
SCE	46.0%
	100%

Table 5: DAC-SASH Mandated Budget Allocation Caps by Program Function

Program Function	Budget %
Administration	10%
ME&O	4%
Evaluation	1%
Incentives	85%
	100%

Budget allocations and actual spending are compared in Table 6 below.[15] The DAC-SASH program appears to have operated considerably under budget from 2019 to 2021 based on the available data, with just 69 percent of the allotted $30M spent. This is driven by lower-than-projected

[12] Retrieved from https://gridalternatives.org/sites/default/files/DACSASH%20Handbook_Final_Approved%20via%20Resolution%20E5020_9.12.19.pdf

[13] For more detail on how we calculated these figures, please see Appendix B: Methodology.

[14] Analysis of administration and M&O costs were done on the 1,492 projects that were started as of March 2022. These costs are reported on a semi-annual basis and include administration and M&O time spent before a project is fully completed.

[15] We did not include projected and actual figures for evaluation, as the evaluation budget sits with the CPUC and has not yet been recorded.

values for incentive costs. For example, SDG&E's actual incentive costs were only 22 percent of the projected incentive budget.

Table 6: Allocated Budget and Actual Spending for DAC-SASH (Thousands of Dollars)

IOU	Admin		ME&O		Incentives		Total		Percent of Actual Spent out of Allocated
	Allocated	Actuals	Allocated	Actuals	Allocated	Actuals	Allocated	Actuals	
PG&E	$1,311	$1,186	$524	$460	$11,144	$9,691	$13,110	$11,388	87%
SCE	$1,380	$1,248	$552	$484	$11,730	$6,698	$13,800	$8,484	61%
SDG&E	$309	$280	$124	$108	$2,627	$575	$3,090	$975	32%
All	**$3,000**	**$2,714**	**$1,200**	**$1,052**	**$25,500**	**$16,964**	**$30,000**	**$20,847**	**69%**

It is possible that this underspending is due in part to fewer installations between 2020 and 2021 because of the COVID pandemic, or a potential data lag in the completion date field or installations altogether in the CaliforniaDGStats website export. However, it is worth noting that even if the range for incentive costs pulled from the CaliforniaDGStats export is expanded to include 2022 incentive costs (instead of 2019-2021), the SDG&E and SCE totals remain under budget. SDG&E's low project volume can also be explained by the difficulty in finding eligible participants. We discuss this further in Section 4.4.2.

4.3.1 GRID Regional Affiliates

GRID implements the DAC-SASH program through regional affiliates throughout California. These offices work with GRID headquarters to follow up on leads, but often form their own relationships with CBOs or municipalities local to the region. This regional approach leverages other and municipalities familiar with the eligible population to overcome the barrier of trust with new orgnaizations.

In addition to helping with community trust and marketing, CBOs and local municipalities provide funding specific to regional offices. For example, the North Valley office in Sacramento leverages city grants from the City of Stockton to help pay for re-roofing projects for DAC-SASH customers that may otherwise not be able to participate.[16] This allows the program to move more efficiently with projects that may otherwise be delayed or not approved due to lack of funding.

The regional office approach also allows for experimentation between the offices. For example, in the Greater Los Angeles office (GLA), rather than qualifying customers first then conducting the construction site visit, as is typical in other offices, construction or design staff will first conduct the construction site visit before collecting all application eligibility documents. GLA claims that many customers are disqualified from the program after the site visit stage due to poor housing quality in their region; therefore, they save time by disqualifying them early in the process. Other

[16] We expand on this further in section 4.6.2

offices noted that they were aware of this approach but prefer to collect income and homeownership eligibility documentation before sending a construction crew out for the site visit. This experimentation between offices can lead to creative solutions to regionally-specific barriers and is a strength of the program.

Costs for advertising and administration across regional offices was not collected for this evaluation. Future evaluations could compare per-project costs by region to determine which experiments from various offices result in cost savings or increased enrollment for the program.

4.3.2 Third Party Ownership Model

GRID leverages a third-party ownership (TPO) model to help close the gap between the incentive and the cost of the solar systems installed. DAC-SASH projects are mostly TPO. Systems smaller than 2kW and tribal projects are excluded from this model and use the homeowner-owned model instead.[17] As described in Section 2.1, in the typical homeowner-owned process, GRID purchases all solar equipment in bulk, then designs and installs the system on the customers' homes.

In contrast, in the TPO model, GRID pre-pays a 25-year Power Purchase Agreement (PPA) to the TPO company, then purchases, designs, and installs the system on customers' homes.

The TPO company then pays for the installation cost and provides monitoring and service for 25 years. At the end of 25 years, the TPO company will uninstall the system at no cost to the homeowner, offer to sell the system to the homeowner at the depreciated value, or offer to sell a new PPA to the homeowner.

A Power Purchase Agreement (PPA) is a financial arrangement in which a third-party developer owns, operates, and maintains the photovoltaic (PV) system, and a host customer agrees to site the system on its property and purchases the system's electric output from the solar services provider for a predetermined period. In this TPO model, GRID pre-pays the 25-year PPA on behalf of the customer at a pre-arranged assumed rate of generation and energy usage. The customer receives a bill from their utility that is the net of the pre-arranged generation and their specific energy usage. The customer does not receive a bill from the TPO company.

TPO Objectives and Outstanding Questions

During this evaluation, we identified additional questions about the TPO model, which we added as metrics and objectives for future evaluations to build on. In this section, we present the objectives identified, barriers to data collection and evaluation, and recommendations for future evaluations. We also report on the limitations in answering these questions.

1. Explain the Third-Party Ownership Model: What are the costs and benefits to the homeowner, the program, program administrator,

[17] The current TPO model contracts cannot accept tribal documents.

and the TPO company? Identify areas of uncertainty and document them.

2. Determine the Full Costs of Participating: How much staff/admin time is spent coordinating these relationships and activities? What is the cost of the 25-year PPA? How much more does a TPO system cost compared to a homeowner-owned system? What other inefficiencies exist when homeowners engage with the TPO (i.e., service issues, confusion, end of contract issues)?

3. Determine the Full Benefits of Participating: How much staff/admin time is saved that would have been used to look for gap financing? How much is the TPO partner paying GRID as a contractor? What are the benefits to the homeowner (i.e., production guarantees, service, monitoring)?

4. Compare the Complexity of the TPO model and the benefits: Does the model provide a net benefit considering the perspective of the ratepayer? Are there other ways to save admin/staff time spent looking for gap financing that does not include the TPO model?

1. Explaining the Third-Party Ownership Model

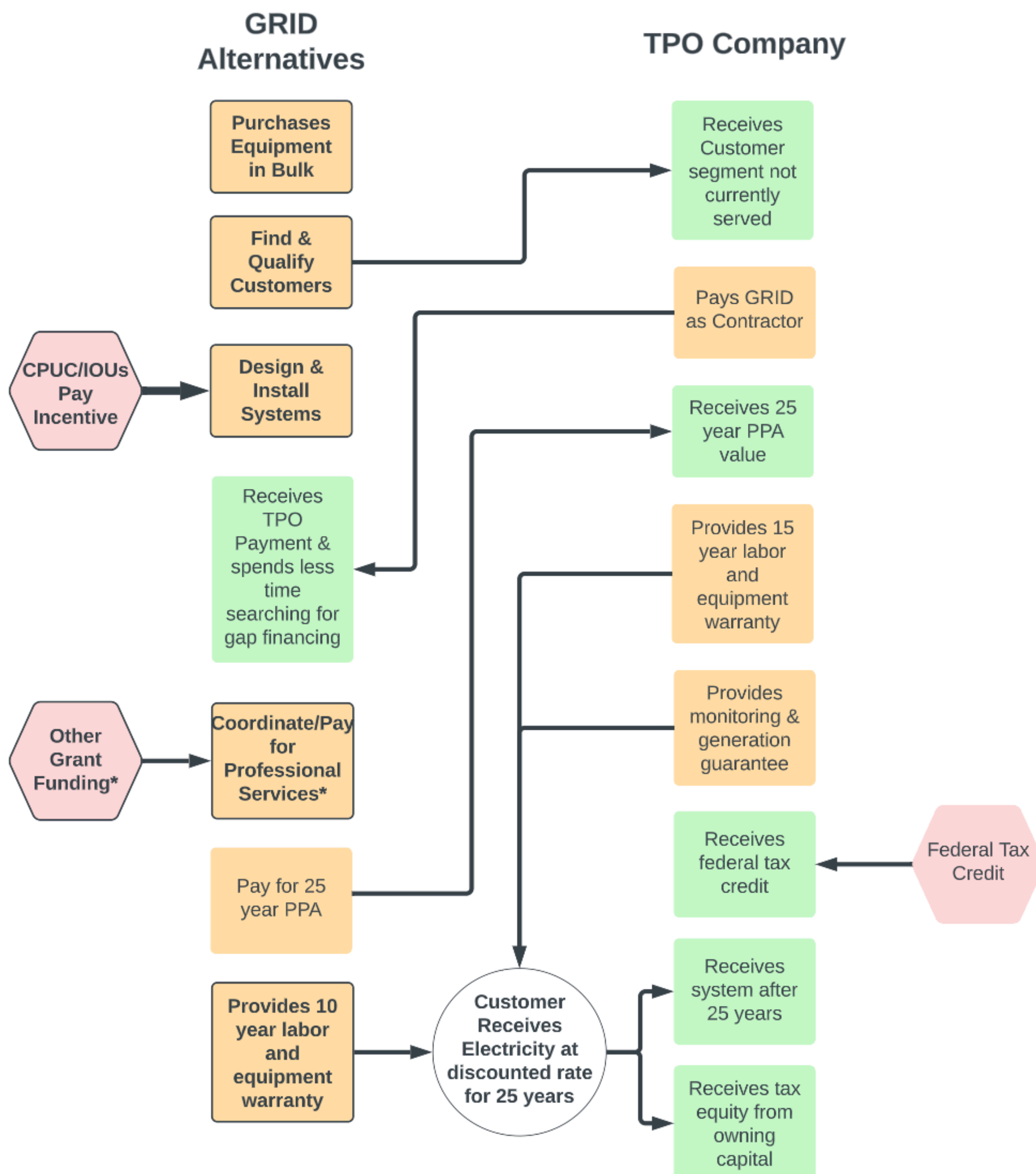
Through interviews with GRID staff members and customers, we developed a model to display the various costs and benefits between GRID, the customer, and the TPO company. Notably, the main TPO company involved in these relationships, Sunrun, did not respond to our multiple requests for an interview.

Costs for both GRID and the TPO company are depicted in orange in Figure 3. Benefits or payments to each party are in green. Red items show the benefits that accrue to the CPUC based on the program structures including the use of a non-profit that can leverage grant funding and the use of a TPO that can leverage the federal tax credit. Items with an asterisk are not necessarily involved in all projects but are common.[18]

In contrast, for an ownership model, only bolded, outlined cells are active. For example, the federal tax credit is left unclaimed and no activities on the right-hand side of the model occur. While other grant funding may be involved in both models, the amount of grant funding required to cover the full costs of installations is lower with TPO systems compared to homeowner systems due to the TPO payment. We explore these benefits and costs in more detail in subsequent sections.

[18] More details on professional services are in Section 4.6.2.

Figure 3: Benefits and Costs of the TPO Model



2. Unaccounted Costs of Participating in the TPO Model

The costs of participating in the TPO model that are unique when compared to a host customer-owned structure (not inclusive of costs of owned projects) are:

1. The pre-paid 25-year PPA that GRID pays to the TPO;
2. Staff and administrative time spent coordinating the TPO relationships; and
3. Staff time coordinating the TPO model with homeowners.

PPA Agreement Amount. GRID tracks the 25-year PPA cost on a per-project basis, but the agreement has changed over the years of its relationships with TPO companies. Future evaluations should request these data explicitly when beginning the evaluation.

Staff TPO Coordination Time. Staff and administrative time spent coordinating with TPO partners is not currently tracked. Anecdotally, many staff members reported that the solar companies, Sunrun in particular, can be hard to communicate with. They often will not hear back about service questions, project concerns, or contract issues without multiple attempts to contact them. The hours spent coordinating could be tracked in the future at the project level to characterize the amount of staff time spent as a cost of using this model. GRID also employs a staff member specifically for coordinating with TPO partners, whose salary could be used as additional data for calculating true costs.

Staff Homeowner Coordination Time. The final cost we considered in this evaluation is the cost of staff time explaining and serving as a liaison between the homeowner and the TPO company. During the evaluation, GRID staff reported that explaining the model is confusing to participants. Many participants require detailed walkthroughs of the contracts and multiple explanations before they felt comfortable. One example is the application – for TPO systems, both a contract for DAC-SASH and a contract with the TPO partner are required. The DAC-SASH contract through GRID emphasizes that the system install is at no cost to the customer. However, on Sunrun's contract, it states a dollar amount that the customer agrees to pay for the 25-year PPA. This contradiction confuses potential customers. Customers are also confused beyond the application step when it comes to servicing their equipment. We explore the customer perspective in more detail in Section 4.6.1.

This evaluation could only quantify costs per project based on installation, materials, and professional services costs. The 25-year PPA cost was not provided in a disaggregated format for analysis in time for this report. The staff time spent on TPO matters was not collected for this evaluation.

Table 7 summarizes the average cost of TPO projects compared to owned projects using costs provided to the evaluation team. This excludes the PPA agreement, staff time coordinating with TPOs, and staff time coordinating with homeowners. These costs include equipment cost, installation cost, and professional services. To normalize across all projects, we report on costs on a per project and per kW basis. Additionally, to illustrate how costs have changed over time, the table is segmented by year installed. For DAC-SASH projects, we find that costs per kW are lower for TPO systems than homeowner-owned systems, but attribute that to the difference in average sizes. TPO systems have a minimum system size of 2 kW, compared to owned systems' 1 kW minimum, so there are cost savings in economies of scale.

Table 7: Costs for TPO Systems vs. Owned Systems

Year Installed	Total number of Projects		Average Cost per Project		Average kW per Project		Average Cost per kW	
	Owned	TPO	Owned	TPO	Owned	TPO	Owned	TPO
2019	28	122	$14,144	$18,792	1.77	3.79	$8,007	$4,956
2020	50	410	$16,273	$19,970	2.34	3.82	$6,944	$5,222
2021	22	295	$15,892	$20,653	2.31	3.91	$6,871	$5,283

3. Unaccounted Benefits of Participating in the TPO Model

The benefits of participating in the TPO model that are unique when compared to the host-owned structure (not inclusive of benefits of owned projects) are:

1. The payment from the TPO to GRID as the installation contractor;
2. Staff and administrative time saved not needing to search for additional funding to cover the gap between the incentive and installation and equipment costs; and
3. The homeowner receives monitoring and production guarantees.

TPO Payment. Interviews with GRID found that though the TPO model can be complex, the net benefit provided by the agreement (funding to pay GRID as a contractor minus the cost of the 25-year PPA) helps GRID cover the gap between the incentive received through the DAC-SASH program and the total cost of solar. This evaluation did not capture the gross value of the TPO payment received but does capture the net value between the cost of the PPA and the payment from the TPO.

Staff Time Saved. GRID staff report that they can spend less time searching for external funding for DAC-SASH projects when they are a TPO because the gap in financing is smaller; however, this staff time is not tracked or documented.

Homeowner Monitoring Benefits. Finally, a homeowner benefits from TPO systems because of the monitoring and production guarantees. If a system goes offline or underproduces, the TPO company will fix the system or pay the homeowner for the amount of guaranteed production. For owned systems, the homeowner is responsible for monitoring their systems on their own, and typically would not be aware if their system is offline until they receive their electricity bill. Though there are production and monitoring guarantees, our evaluation found that TPO systems were sometimes not reporting or not being properly monitored. We report on these findings in detail in Section 4.6.3.

In this report, we have included a range of figures to illustrate the average gap in financing GRID must overcome to keep systems at no-cost for homeowners; however, the contracting cost and

PPA pricing agreements between GRID and the third-party solar companies are confidential, so we provided a separate, confidential memo to the Energy Division with further detail on these discrepancies. Table 8 illustrates the gap in financing for TPO projects compared to owned projects. The gap that GRID must fill with TPO projects is significantly less than the gap they need to fill for host-owned projects. This does not account for grant acquisition costs or the PPA and coordination costs mentioned in the previous section.

Table 8: Gap in Financing for TPO Systems vs. Owned Systems

Year Installed	Total number of Projects		Average kW per Project		Average Gap per Project		Average Gap per kW	
	Owned	TPO	Owned	TPO	Owned	TPO	Owned	TPO
2019	28	122	1.77	3.79	$8,844	$1,500 - $2000	$5,007	$200 - $500
2020	50	410	2.34	3.82	$9,243	$4,000 - $5,000	$3,944	$1,000 - $1,500
2021	22	295	2.31	3.91	$8,954	$4,500 - $5,500	$3,871	$1,000 - $1,500

4. *Compare the Complexity of the TPO Model and the Benefits*

We are unable to calculate the net benefit or cost of the TPO model without full cost and benefit data (such as the cost of the PPA), the amount of staff time spent on TPO coordination and searching for other sources of gap financing, or the full amount the TPO pays GRID. To summarize the need for more data, as mentioned throughout this section, the evaluation would require the following:

- Full cost agreement for the 25-year PPA
- GRID staff time spent on TPO coordination tracked
- GRID staff time spent on searching for other sources of gap financing tracked
- Full amount of TPO payment to GRID

Without these values, we can only report on GRID's perspectives and customer experiences. We expand on customer confusion with the TPO model here, and report on other costs incurred by customers and GRID in Section 4.6.2.

Through onsite visits and customer survey responses, we find that customers are confused about their ownership model. Across all respondents, only 65 percent accurately reported the own/lease status of their solar panels. People who reported that they lease their system were more likely to report accurately (100% vs. 33%), as highlighted in green rows in Table 9.

Table 9: Reported vs Actual Ownership

Reported Ownership	Actual Ownership	n	%
Owned System (n = 30)	Own	10	33%
	TPO	20	67%
TPO (n = 76)	Own	0	0%
	TPO	76	100%
Not sure (n = 27)	Own	6	22%
	TPO	21	78%

There does not appear to be a correlation between the year installed and the number of people reporting their ownership correctly, indicating it is not a function of time causing people to forget (Table 10). Nor does it seem to be someone other than the person who was involved with GRID at the time of signing the contract responding to the survey, as would be more common in larger households (Table 11). In fact, more recently installed systems are more likely to be misreported, and are more likely to be TPO, suggesting that the model itself is confusing for participants.

Table 10: Accurate Ownership Reporting, by Year Installed

Year Installed	Correctly reported	Total N	% Correct
2019	10	18	56%
2020	36	56	64%
2021	36	51	71%
2022	2	5	40%

Table 11: Accurate Ownership Reporting, by Household Size

Household Occupancy	Correctly reported	Total N	% Correct
1 – 2	26	40	65%
3 – 5	15	25	60%
6+	41	60	68%

This confusion about TPO systems and owned systems was observed during evaluation field visits as well. During a homeowner orientation meeting, homeowners spent a lot of time asking questions about the ownership model and returned to the topic frequently. GRID staff interviews found that outreach coordinators will need to remind homeowners that their system is TPO throughout the process. Staff members say that even with this confusion, once the system is installed, customers are happy to benefit from the TPO model's offerings, such as guaranteed production, monitoring, and service and equipment warranties.

4.3.3 Subcontractor Program Participant (SPP) Model

The subcontractor program participant (SPP) model allows GRID Alternatives to hire an external company to take on aspects of the design or installation for a portion of DAC-SASH projects. Partners in the program are solar companies that are fully vetted by GRID and agree to fulfill all requirements of solar installation as provided by GRID. The requirements for contractors are listed below. Contractors must be:

- Licensed by the California Contractors State License Board (CSLB) and hold a C-10 or C-46 license;
- Have completed at least 20 installations under their current license;
- Provide professional and customer references that GRID verifies;
- Provide financials, which GRID reviews to ensure strong financial positions; and
- Pass two Quality Assurance (QA) inspections by a third-party inspector on projects selected at random from the 20 installations listed in their application.

These requirements ensure that utilizing the SPP model still provides the consumer protections and integrity of GRID's projects, while also allowing GRID to scale and provide DAC-SASH projects across the state.

The model is deployed in a limited capacity at the time of this research, and follows two structures:

1. **Install-Only:** In this model, GRID staff will subcontract the installation of solar panels only. GRID will find and qualify customers, purchase materials in bulk, design the system, obtain permitting and inspections, and provide interconnection support. The subcontractor will come in just to install the GRID-approved designs on the home.
2. **Full Service:** In this model, GRID staff will still find and qualify customers, but a subcontractor will design and install the system themselves. GRID's in-house construction team will still confirm the design to ensure compliance but do not need to be directly involved in the installation.

In both models, DAC-SASH projects follow the same installation guidelines required, require that the partner pay a trainee for at least one workday for installation, and undergo inspections on all projects until the partner is fully vetted. GRID still provides a 10-year labor warranty and equipment warranty, and the SPP projects can be deployed with TPO or homeowner-owned projects. Currently, the Inland Empire regional office utilizes the SPP model the most. Staff members reported that that while there are challenges, they choose to invest in the model because the benefits outweigh the costs. Table 12 summarizes the challenges and benefits.

Table 12: Benefits and Costs of the SPP Model

Pros	Cons
Trainees receive paid job training: DAC-SASH projects require trainees to participate in sites, and the SPP model sets a minimum wage that is higher or equal to the market rate. This allows trainees to received on-site training and be paid. In normal installations, the amount trainees are paid depends on the structure of the training program.[19]	**Finding reliable partners can be challenging:** Staff members reported that the requirements to become a subcontractor with the program (listed in the beginning of this section) are more challenging to meet compared to the average solar contractor. Finding partners willing to meet those standards, and to upkeep them is challenging.[20]
Eases staff and scheduling constraints: The use of the SPP model increases the capacity of GRID's in-house construction team by having more available time slots for homeowners and the additional partners to take on installation jobs.	**Managing partners is time-intensive:** The Inland Empire regional office hired a dedicated staff member to manage the subcontractor relationships. This includes ensuring they are meeting standards, communicating about projects, and ensuring quality installations.
Helps with geographically far installations: Installations further from the regional office can be done at lower cost with less travel time. This is especially pertinent in the Inland Empire where travel times to installations are already high.	**Full-service subcontractors may face supply issues:** Install-only subcontractors use GRID supplied panels, but full-service subcontractors must source their own panels, which can be less reliable depending on the market. GRID pre-purchases in bulk where possible and is more insulated against supply issues.
Increases trust in communities: Especially in tribal communities, using an SPP familiar with the homeowners may increase trust with the program. The same was reported to be a benefit for rural communities.	

Program cost data did not include whether projects were subcontracted using either of these models, but only 13 projects were completed during the time period analyzed for this evaluation (2019-2021). Future evaluations should request that the contractor field for all DAC-SASH projects be populated.

[19] We examine the trainee programs in more depth in Section 4.114.11

[20] Subcontractors and trainees must complete the DAC-SASH SPP Affidavit certifying that a job training opportunity was provided. Job task analysis categories include directly working on solar installation, project design, and coordination.

4.4 Identification of Eligible Customers

This section reports on the characterization of eligible customers. The evaluation focused on understanding the eligible customer market, solar adoptions within that group, and how participation levels vary across the state:

Evaluation Objective	Summary of Findings
4.4.1 Participation/non-participation by DAC, geographic location, and other characteristics – The CPUC defined program eligibility based on geographic location and income for DAC-SASH, and findings may be used to determine if any changes (to marketing and outreach efforts and/or eligibility requirements) are warranted to ensure sufficient levels of participation and equal access among the target population. **4.4.2 Size of the eligible customer market** – We attempted to identify the eligible customer pool for the DAC-SASH program to inform assessments of customer participation, program eligibility and the effectiveness of program outreach and marketing.	Evergreen estimates the total eligible customer pool at 176,000 households, though this does not account for households with barriers related to the home's construction. DAC-SASH has thus far served less than 1 percent of the 176,000 households. Eligibility requirements make it challenging for GRID to find eligible customers, though Evergreen concludes that the current requirements are necessary to meet the intent of the program in serving DACs. Given the low penetration rate of the eligible market, we do not determine that finding eligible homes is the largest barrier to participation, but that a bigger barrier to serving eligible customers is the state of their homes, which often require additional services to be solar-ready, such as roof or electrical repairs. Our analysis confirms GRID's reported difficulty in finding eligible homes in some regions compared to others (such as San Diego) and may be useful in assessing how regional office targets are set.
4.4.3 Market adoptions of rooftop solar among eligible households – We attempted to identify how much natural solar adoption is happening outside of the program among eligible households.	While natural solar adoption is happening outside of the program, only 7 percent of aware non-participants from our sample group got solar before or after hearing about the program. We heard from respondents that other solar companies had approached them, and this was in part responsible for distrust in the program truly being no-cost.

Additional details on these findings can be found in the remainder of this section.

4.4.1 Participant Distribution Across California

Interviews with GRID staff found that they are facing challenges finding eligible customers. Historically, GRID had developed partnerships with affordable housing organizations, and in regions that were eligible for SASH. Since DAC-SASH has different eligibility requirements, GRID has had to change its approaches and build new relationships to serve the DAC-SASH eligible population.

For example, while SASH participants could be in HUD-qualified census tracts or affordable housing, DAC-SASH participants are limited to census tracts defined as DACs. Once GRID staff find eligible customers, they report that the barriers to participate are higher than they were SASH because the income requirement is lower for DAC-SASH. GRID staff report seeing higher levels of construction barriers, such as older and smaller roofs, older electrical panels that require updating, and code issues than with households that met the eligibility requirements to participate in SASH. We discuss these barriers to participation further in Section 4.6.2.

Table 13 characterizes the population served by DAC-SASH to date. GRID shared that some regions are harder to serve than others (an example being San Diego) and that each region provides unique challenges to identifying and serving eligible customers. The majority of the participants have been in PG&E's service territory, and the fewest have been in SDG&E's service territory, reflecting the differences in the size of DACs and utility customers within each service territory.

Table 13: Program Participation

Category	Participants	Percent
DAC	957	99%
Non-DAC[21]	7	1%
Total		100%
PG&E	654	68%
SCE	285	30%
SDG&E	25	3%
Total		100%
Bay Area/North Coast	208	22%
Central Coast	28	3%
Central Valley	146	15%
Greater LA	110	11%
Inland Empire	95	10%
North Valley	352	37%
San Diego	25	3%
Total		100%

[21] Participants are considered non-DAC if they were not in a DAC at the time of the project. These include tribal projects.

The definition of a DAC has changed over the course of program implementation, but GRID has been able to serve eligible communities across the state. In Appendix D, we map all past participants' locations. Sections 4.4.2 and 4.6.2 go into detail on barriers to participation beyond eligibility and estimates the number of eligible households in California.

4.4.2 Size of the Eligible Customer Market

For the program, customers must reside in a DAC, be served by one of the three electric IOUs, own their home, live in a single-family home, and be income eligible for California Alternative Rates for Energy (CARE) or FERA, which was 200 percent of the federal poverty level (FPL) at the time of this research. As discussed in previous sections, GRID reported that finding eligible customers with solar-ready homes is the biggest barrier to meeting its program goals. In this section, we review the size of the eligible customer market and the program penetration to date.

This Census analysis only considers eligibility criteria for the program (i.e., home ownership, single-family, income, DAC). The true number of eligible, solar-ready homes is likely smaller. To estimate the number of eligible households in California, we used Census data. First, we started at the Public Use Microdata Area (PUMA) level. PUMAs provide specific household data such as house type, income, number of occupants, and homeownership. We can determine if a household is eligible for DAC-SASH using PUMA data, but because the data at the PUMA level are anonymized across geographic areas containing at least 100,000 people each, we are not able to confirm if they reside in a DAC or not. DACs are determined at the Census tract level, which does not contain single household eligible information like PUMAs. To apply the PUMA estimates of eligible households to the required geographic level of Census tracts, we built a linear regression model based on PUMA characteristics and applied to Census tracts. We then filtered all non-DAC Census tracts from the estimates to estimate the numbers provided in this section. More detail on how we estimated the eligible homes is in Appendix B: Methodology.

In addition to Census data, we also leveraged IOU-provided CIS data, and GRID provided non-participant customer data.

Eligible Customer Maps

Across the state, we estimate there are about 176,000 eligible households, which is 8 percent of all DAC households and 1 percent of all households within the state. Of those eligible households, most reside in Pacific Gas and Electric's service territory (45%, or about 78,800 households) or Southern California Edison's service territory (53%, or about 92,500 households). Very few eligible households reside in San Diego Gas & Electric's service territory, with only 2 percent of the state's eligible households in the region, or about 4,300 households (Table 14).

Table 14: Estimated Number of Eligible Households by IOU

IOU	Estimated Eligible Households	% of Eligible Population
PG&E	78,800	**45%**
SCE	92,500	**53%**
SDG&E	4,300	**2%**
TOTAL	**176,000**	**100%**

When defining eligibility, GRID first checks a customer's address to see if they reside in a DAC. Table 15 shows the percentage of the population that live in DACs and the percentage of those households that are eligible. Once they are confirmed to live in a DAC, PG&E customers are more likely to be eligible by income, homeownership, and home type, with almost 9 percent of households in DACs eligible (compared to 7.6% or 7.9% in SCE's and SDG&E's).

Table 15: Eligibility Estimates by IOU

IOU	Households Served	DAC Households		Estimated Eligible Households		
		N	% of All IOU HH	N	% of DAC	% of All IOU HH
PG&E	4,711,933	890,069	18.9%	78,800	8.9%	1.7%
SCE	4,227,833	1,217,855	28.8%	92,500	7.6%	2.2%
SDG&E	1,050,568	54,354	5.2%	4,300	7.9%	0.4%

Figure 4 displays the eligibility rate by Census tract, with more detail in the San Francisco Bay Area and Greater Los Angeles Area in Figure 5. Most tracts are grey, as eligibility is constrained by DACs. The percentage eligible is shown by a gradient and tracts with higher proportions of eligible households are filled in yellow, while homes with lower proportions are filled in purple. On average, 5 percent of households in a DAC are eligible for the program.

Figure 4: Eligibility for Program by Tract

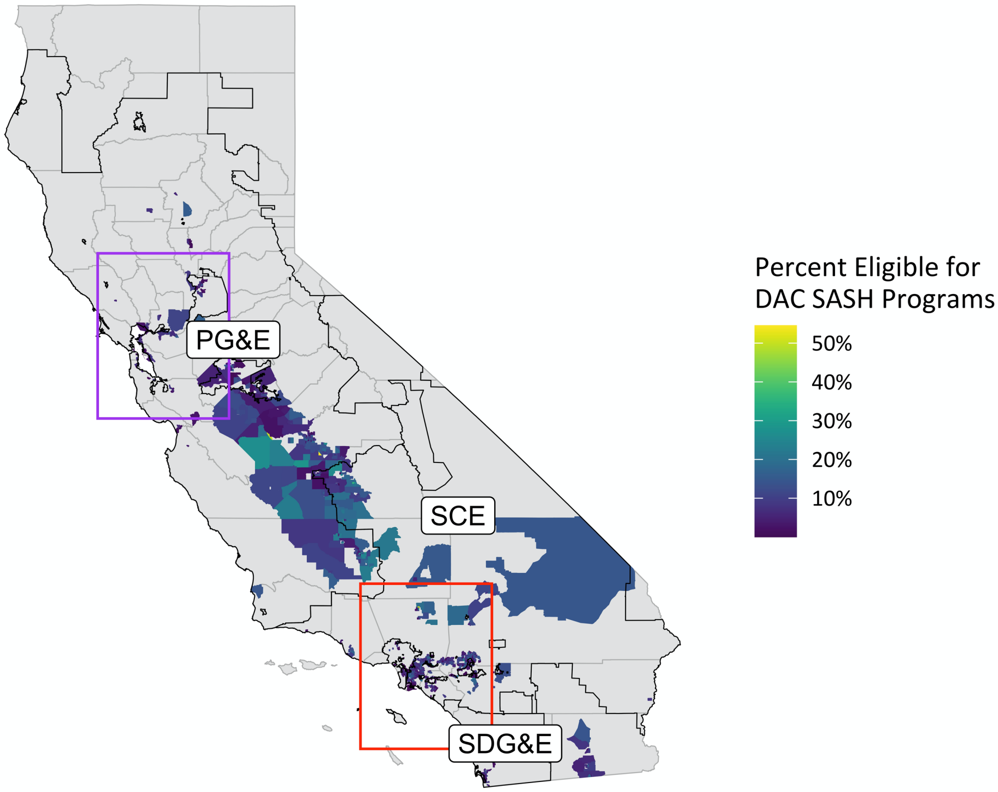
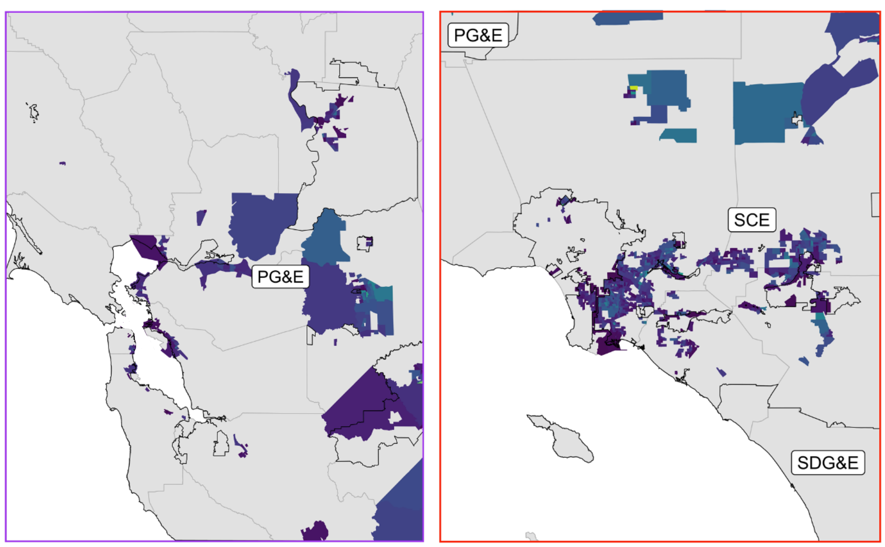


Figure 5: Eligibility for Program by Tract - Bay Area and Greater LA



Interviews with GRID staff found that each office will serve specific counties near them, but there are exceptions in cases where leads for new customers are managed directly by the regional office and there is flexibility to accommodate capacity constraints. To examine the difficulty in finding eligible customers by GRID regional office, we analyzed the estimated number of eligible households within certain radii of each office location. We pulled the addresses of all completed projects and their associated offices to determine the minimum, average, and maximum distance each office travels. Note that distance has implications for drive time for both outreach staff and installers, who must travel both to the office for equipment and to homes for installations. Evergreen staff visited the North Valley office and observed trainees carpooling to the office and installers commuting close to an hour to perform an installation.

Historically, GRID will pursue projects within a certain range of each office, but that range differs based on location. For example, Table 16 shows that projects in the Inland Empire may be much farther out than projects in Greater Los Angeles, and North Valley staff are most likely to travel greater than average distances, with only 46 percent of their projects having occurred within the average distance.

Table 16: Historic Data on Distance Travelled for DAC-SASH Projects by Office

GRID Office Assigned	Minimum Distance (Miles)	Average Distance (Miles)	Maximum Distance (Miles)	Number of Projects	% Projects within Average Distance
Bay Area	2	15	89	208	69%
Central Valley	1	38	125	146	47%
Greater Los Angeles	4	15	53	110	64%
Inland Empire	5	46	249	95	57%
North Valley	2	49	64	352	46%
San Diego	0	11	46	25	72%

To assess the coverage based on the current offices, we used these historic distance data to estimate the number of eligible households within a reasonable range from each office. All eligible homes are within the maximum distance that GRID has historically traveled to in the past for an installation, but only 70 percent of all homes are within the average driving distance, suggesting that nearly a third of the eligible households require additional travel time compared to the current average. However, all eligible households are within the maximum distances that regional offices have travelled, suggesting that all eligible homes are within feasible reach of the program. These findings are reported on in more detail and visualized in Section 6.1.

Program Penetration

As explained in the previous section, we estimate the number of DAC-SASH-eligible households at around 176,000. With the number of completed installations at 964 at the time of this research, program penetration is estimated to be less than 1 percent across California. In Table 17, we analyze the program penetration by GRID regional office and find that North Valley and the Bay Area offices have the highest program penetration, and Greater Los Angeles and the Inland Empire have the lowest. As expected, program penetration goes down if we assume the maximum historical distance travelled for each regional office (Table 18).[22]

Table 17: Program Penetration by GRID Regional Office, Average Distance

GRID Regional Office	Distance Assumed (mi)	Total Households Served by IOU	Total DAC Households Served by IOU	Estimated DAC-SASH Eligible	Total Program Participants[23]	Program Penetration
Bay Area	15	1,027,870	127,149	6,000	208	3.5%
Central Valley	38	358,900	213,706	26,000	146	0.6%
Greater Los Angeles	15	1,073,487	562,100	41,000	110	0.3%
Inland Empire	46	2,258,273	488,609	35,000	95	0.3%
North Valley	49	920,723	151,067	12,000	352	2.9%
San Diego	11	587,492	75,864	4,000	25	0.6%
Outside of Office Range		3,763,589	543,783	53,000		

Table 18: Program Penetration by GRID Regional Office, Maximum Distance

GRID Regional Office	Distance Assumed (mi)	Total Households Served by IOU	Total DAC Households Served by IOU	Estimated DAC-SASH Eligible	Total Program Participants	Program Penetration
Bay Area	89	2,896,332	311,330	16,000	208	1.3%
Central Valley	125	908,929	446,693	58,000	146	0.3%

[22] Notably, the program penetration in North Valley increases when we increase the distance assumed by each regional office. This is because we assigned each eligible household to its closest regional office within the radius. When we increased the radius assumed, some households were closer to other offices, which decreased North Valley's total estimated eligible population. For example. If a home is 20 miles away from the Bay Area office, but 40 miles away from the North Valley office, it would have been categorized under the North Valley office under the average distance assumed (Table 17); once we increase the distance assumed to the maximum, that home is closer to the Bay Area office and within its assumed distance.

[23] Twenty-eight program participants were assigned to the Central Coast office, which no longer exists.

GRID Regional Office	Distance Assumed (mi)	Total Households Served by IOU	Total DAC Households Served by IOU	Estimated DAC-SASH Eligible	Total Program Participants	Program Penetration
Greater Los Angeles	53	2,432,850	799,545	56,000	110	0.2%
Inland Empire	249	1,826,919	388,492	30,000	95	0.3%
North Valley	64	816,430	140,354	11,000	352	3.2%
San Diego	46	1,035,539	75,864	4,000	25	0.6%
Outside of Office Range		73,334	-	-		

Our analysis concludes that travel time to cover the wide spread of eligible homes, especially in rural tracts or tribal lands that are further from regional offices, is a challenge to finding eligible customers, but not necessarily a barrier. Interviews with GRID found that for tribal projects in the Inland Empire, staff members will arrange to set up at a community center for a few days. This time aligns with multiple scheduled installations in the area. GRID staff will conduct marketing and outreach activities, arrange site visits to assess solar potential, and take applications for the program. This batched process allows for more one-on-one engagement of the population, but also reduces per-unit costs of installation for these further regions.

4.4.3 Market Adoptions of Rooftop Solar

Evergreen heard from both customers and from GRID that targeted customers had been reached by other solar companies with offers to install rooftop solar. These offers were partly responsible for distrust in the program truly being no-cost to customers and indicated that there may be eligible participants who take a different pathway to solar. Evergreen triangulated an estimate of market adoptions outside of the program using both CIS data and non-participant responses to our survey. Overall, only 7 percent of surveyed non-participants who had heard of the program had installed solar through some other means, though this percentage was higher when we looked at CIS data and at the broader pool of non-participants that were interviewed.

Based on analysis of IOU CIS data of non-participants, the upper bound of market adoption in the eligible population is about 11 percent (13% for PG&E, 7% for SCE, 7% for SDG&E).[24] Surveyed eligible non-participants reported a much higher rate of market solar adoption. About a third of unaware non-participant respondents (31%, total n = 70) had installed solar panels without the use of the program. This is likely due to the recruitment method for the survey because the

[24] Additional details on how we estimated the upper bound of 11 percent and the motivations non-participants gave as to why they received solar may be found in Appendix 6.1.1.

evaluation recruitment postcard mailed to non-participants mentions the CPUC and that we were conducting a survey about solar panels. Customers with solar panels may have been more likely to take the survey, while customers without were more likely to think the survey was not relevant to them.

We examined how this group of low-income homeowners was able to install solar and found that many reported paying for the system on their own with the help of a tax credit or another organization (Table 19).

Table 19: Assistance Received by Non-Participants (n = 24)

Type of Assistance	N	%
Paid on own	12	50%
Received a tax credit	6	25%
Received help from another program or organization	6	25%

In our research, Evergreen heard of other possible forms of assistance that may be responsible for participation outside of the program. The evaluation team is aware of a new program for solar in San Diego, the San Diego Equity Solar Program (SDESP) (described in the call-out box).[25] The SDESP is likely to reduce the volume of projects in San Diego because it will be easier to qualify households under the program than with DAC-SASH. SDESP's income limit requires households to make less than 120 percent of San Diego's Area Median Income (AMI), which is $102,650 for a family of two. In comparison, to qualify for DAC-SASH, a family in San Diego must make less than 200 percent of the Federal Poverty Limit (FPL), which is $36,620. In the future, SDESP recognizes that funds set aside for the program could be layered with the

San Diego Equity Solar Program (SDESP): The program's stated goal is to increase access to solar for residential customers in the City of San Diego. Eligibility requirements include:

- Household income of 120 percent or less of the San Diego County Area Median Income (AMI)
- Must reside in the City of San Diego; with a preference for households within Communities of Concern (as defined by the City's Climate Equity Index)
- Homes must be single-family (expanded definition that includes owner-occupied duplex and quadplex buildings, and mobile and manufactured homes)
- Systems must be host-owned

SDESP provides an incentive of $4/Watt installed, which is intended to cover 100 percent of the system cost. Additionally, funding for panel upgrades up to $3,500 per project is also provided. It is funded at $10 million over 10 years.

[25] Program details were accessed via: https://sdsolarequity.org/

DAC-SASH program to maximize their impact, but that will be determined at a later date. GRID's San Diego office reported that they will be monitoring this.

4.5 Marketing to Customers

In this section, we share GRID's marketing strategy including their use of data from external sources before sharing customer opinions on solar in general, on GRID's marketing strategies, and on the clarity of marketing material from both GRID and the IOUs.

GRID uses several marketing and outreach strategies to reach eligible customers. These strategies differ by regional office and IOU service territory to best serve the population reached. Based on the review of background documents, we understand that GRID uses a variety of marketing and outreach strategies. It leverages partnerships with existing organizations, provides consumer education sessions encouraging adopters to share their participation experience with their friends and neighbors, and uses media, marketing collateral (including co-branding with cities, counties, and IOUs), and events to raise awareness. GRID modified its strategies to adapt to COVID-19-related constraints that impacted construction logistics and marketing and outreach approaches.

Interviews with GRID and IOU staff provided additional background regarding marketing approaches and offer their perspectives on what has worked well and what might be improved going forward. Customer surveys from both program participants and eligible non-participants provide the customer perspective. In-person field research also provided an opportunity to observe marketing strategies by M&O organizations and how this is received by customers. We observed the following marketing methods:

- Referrals
- Mailers and postcards
- TV, radio, and social media ads
- CBO event tabling
- Door-to-door outreach
- Co-branding with cities, counties, and IOUs
- Co-marketing with other IOU programs

4.5.1 Program Lead Generation

GRID's headquarters typically purchases lists of potentially eligible customers from sources such as Faraday,[26] an online prediction-based marketing tool, then cleans the data and forwards it onto the regional offices; since 2021 it has also begun receiving leads from IOUs as mandated by D.20-12-003. Regional offices leverage existing relationships with local CBOs and host their own

[26] Accessed at: https://faraday.ai/

marketing and outreach events, as well as follow up on referrals to generate leads. This section evaluates the data limitations and successes with current practices.

Once customer leads are generated, regional offices take different approaches to qualifying and moving customers through the program. All regional staff interviewed will pre-screen customers by phone or in-person (if at an event). In some regions, like the Central Valley and the Bay Area, they first qualify customers by requiring proof of income and home ownership, but others, such as in the Greater LA area, they begin with a site visit to ensure the home is solar ready. Outreach coordinators in LA mentioned that out of around 550 site visits last year (DAC-SASH and SASH projects), only about 250 homes qualified after the construction site visit. In other regions, outreach coordinators agree that home quality was a significant barrier to participation, but that they start with the income and ownership verification to save time driving out to sites that are not ultimately eligible. This difference may be attributable to different housing stock and drive time requirements for each regional office. For example, in the Greater LA area, housing stock issues are a frequent barrier, so the office finds it more efficient to conduct the construction site visits before gathering all documentation from the homeowner. On the other hand, in the Inland Empire, projects are more spread out, so gathering all documentation and ensuring homeowners are eligible before conducting the site visit is more appropriate. Allowing GRID to experiment across regional offices is a benefit of the flexibility of the program rules.

Data Sources

GRID receives leads through IOU-mandated reporting as of early 2021, CBOs and municipal partners, online marketing lists, and customer referrals. Table 20 describes different sources and their successes and limitations.

Table 20: Success and Limitations of Different Lead Sources

Data Source	Description	Successes	Limitations
IOU CIS Data	CPUC Decision 20-12-003 mandated that all IOUs provide lists of eligible customers to GRID Alternatives for lead generation.	Co-branding efforts with SCE	IOU data do not reliably include homeownership, home type, or income.
Partner Leads	Local CBOs, municipalities, and other low-income programs will refer customers to DAC-SASH.	Similar eligibility requirements, leads tailored to the needs of the regional office	Eligibility for DAC-SASH is harder to meet than other low-income programs.
Faraday	Faraday is an online prediction-based marketing tool that purchases data from various sources, then uses a proprietary predictive model to provide lists of potentially eligible leads.	Eligibility information on ownership and income are fairly accurate.	Purchased lists are not geographically strategic and cannot filter out non-DACs. GRID staff must manually do so in a cleaning step.

Data Source	Description	Successes	Limitations
Referrals	GRID Alternatives provides a referral bonus for DAC-SASH customers to refer friends. Sunrun also provides a bonus that can be stacked.	Communities are likely to share with each other, and word-of-mouth is trustworthy.	Not able to break into new markets by word-of-mouth only

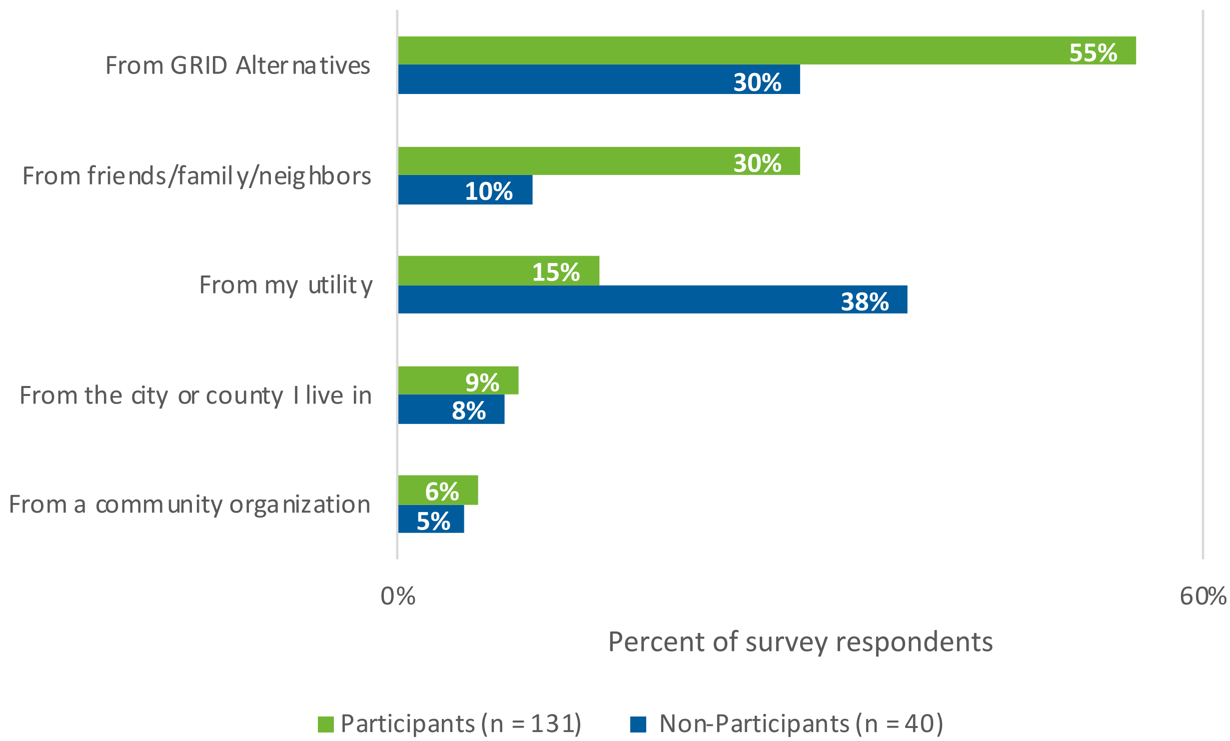
Many GRID staff reported that referrals were the best way to generate new leads for the program, and customers confirmed this in the surveys (Section 4.5.2). GRID's referral program provides a cash referral bonus for participants that refer an eligible neighbor to the program. Participants are also able to stack a referral bonus from Sunrun if they have a TPO system. The monetary incentive, paired with the established credibility of hearing about the program from someone they know, helps increase word-of-mouth about the program and leads to increased participation.

GRID reported that leveraging co-marketing efforts has been successful with SCE and expanded this with PG&E in mid-2022. Working with CBOs lends credibility to GRID and allows staff to reach eligible populations that may not trust IOUs or the CPUC.

4.5.2 Customer Perspectives on Marketing

As discussed in the previous section, GRID reported that most participants hear of the program through referrals. Survey responses from program participants confirmed referrals as a popular information source, second only to hearing about the program from GRID itself. In Figure 6, survey results from both program participants and non-participants aware of the program found that both groups heard of the program from GRID (55% and 30%, respectively), or from friends, family, or neighbors as a referral (30% and 10%, respectively). Non-participating customers more often heard of the program from their utility (38% vs. 15% of participants). Neither participants nor non-participants emphasize learning about the program from a community organization.

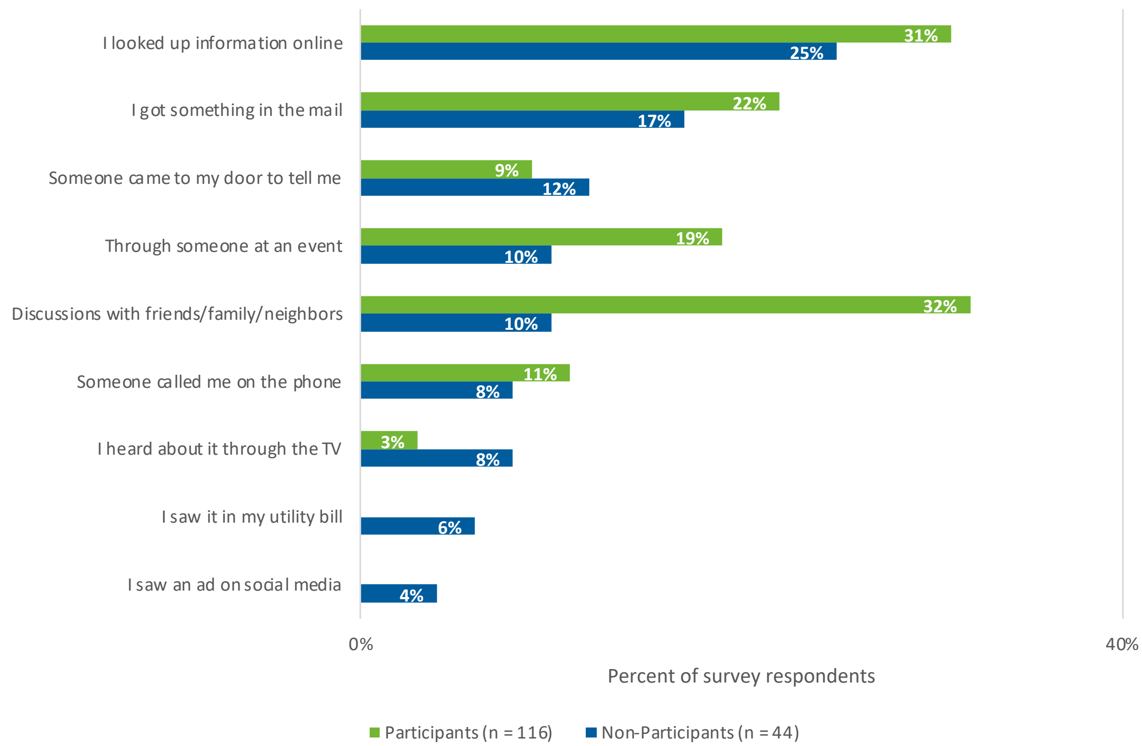
Figure 6: Program Information Source Reported by Survey Respondents (multiple responses allowed)



The participant and non-participant respondents that heard about the program through their utility were mainly Southern California Edison (60%) and Pacific Gas and Electric customers (40%). This aligns with what we heard in GRID interviews—co-marketing with Southern California Edison has been successful in generating leads.

Figure 7 reiterates the way in which people learned about the program through word of mouth, with 32 percent of participants reporting receiving information from friends/family/neighbors. Non-participants were less likely to have discussed the program with friends/family/neighbors, indicating that respondents are more likely to participate if they already know and trust the opinion of someone else who has participated.

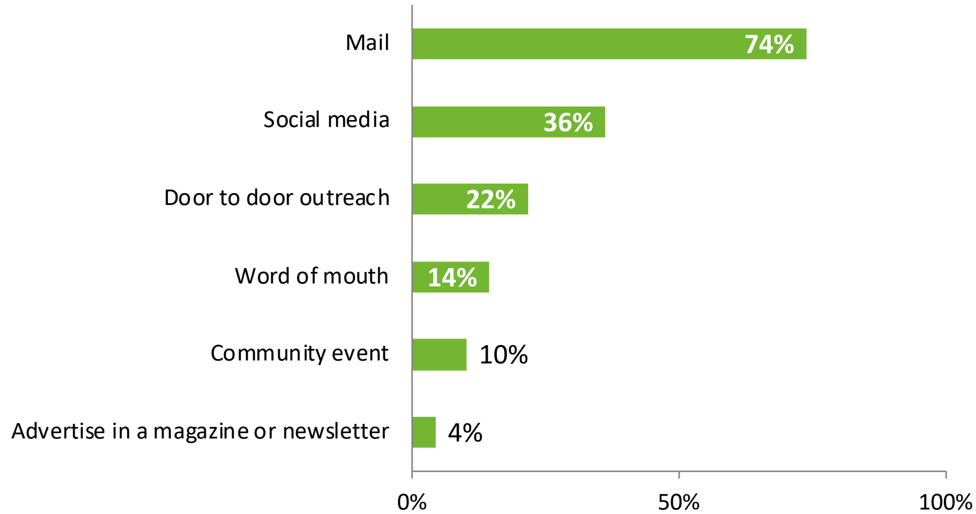
Figure 7: Program Information Mode Reported (multiple responses allowed)



Both participants and non-participants were asked to suggest outreach strategies that may work within their communities to spread information about DAC-SASH. Participants suggested expanding outreach about the program to social media (54%, n = 123), which was not a common source of information for current participants, indicating it may be a good area to expand outreach to.

Non-participants familiar with the program were more likely to suggest mail (59%, n = 41). Some respondents also cited specific magazines and events for better community outreach (24% of participants and 10% of non-participants): church gatherings, commerce council meetings, school events, Earth Day celebrations, Commerce Newsletter, and La Opinión. We also asked non-participants not familiar with the program about their preferred sources of information about energy programs. Mail and social media were both popular responses (74% and 36%, Figure 8).

Figure 8: Preferred Marketing Methods by Unaware Non-Participants (n = 69)



Of unaware non-participant respondents that selected “other” (10%), some offered examples including door flyers/tags/poster, displays in shops, schools, TV, or the internet. Of respondents that selected community events (10%), a few provided examples, including “festivals”, “National Night Out”, “holiday events”, and “community meetings”. A handful of respondents (4%) recommended advertisements in a magazine or newsletter.

The majority (80%) of non-participant respondents stated that they receive information about energy programs from their utility.

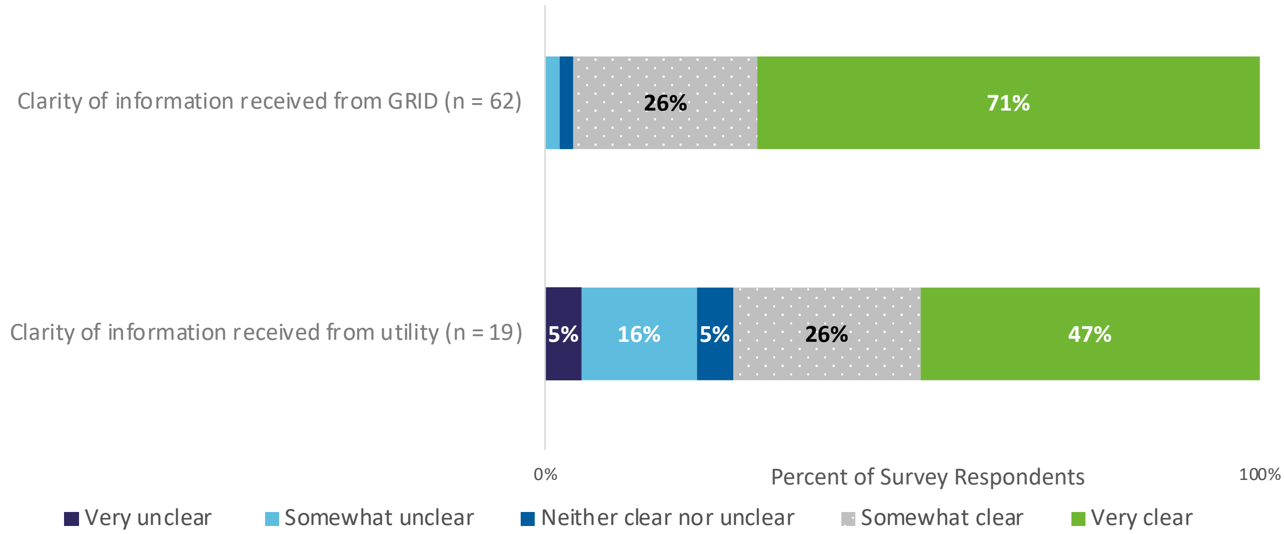
4.5.3 Clarity of Marketing Materials

Over the course of the program, GRID has tested different marketing materials and messaging to recruit eligible participants. Field visits to regional offices allowed us to confirm that marketing materials are translated into the regions’ most common languages: English, Spanish, Mandarin, and Cantonese. GRID’s ME&O plan also lists Korean, Vietnamese, and Tagalog.

As part of its customer journey, GRID presents all customers with a homeowner orientation. These orientations can vary by region and are presented by GRID outreach coordinators. Some homeowner orientations are one-on-one, while others are in small group settings. During a field visit, we attended an orientation and found the outreach coordinator was diligent about answering questions. The questions the homeowner had mirrored what we found in the survey: needing to understand the ownership model, how solar panels work, and how their bill would change.

A significant percentage of respondents reported that the marketing materials received from both GRID and their utility were ‘very’ or ‘somewhat clear’, with only a very small minority saying otherwise (Figure 9). However, respondents were more likely to report that the information received from their utility was 'very' or 'somewhat unclear.'

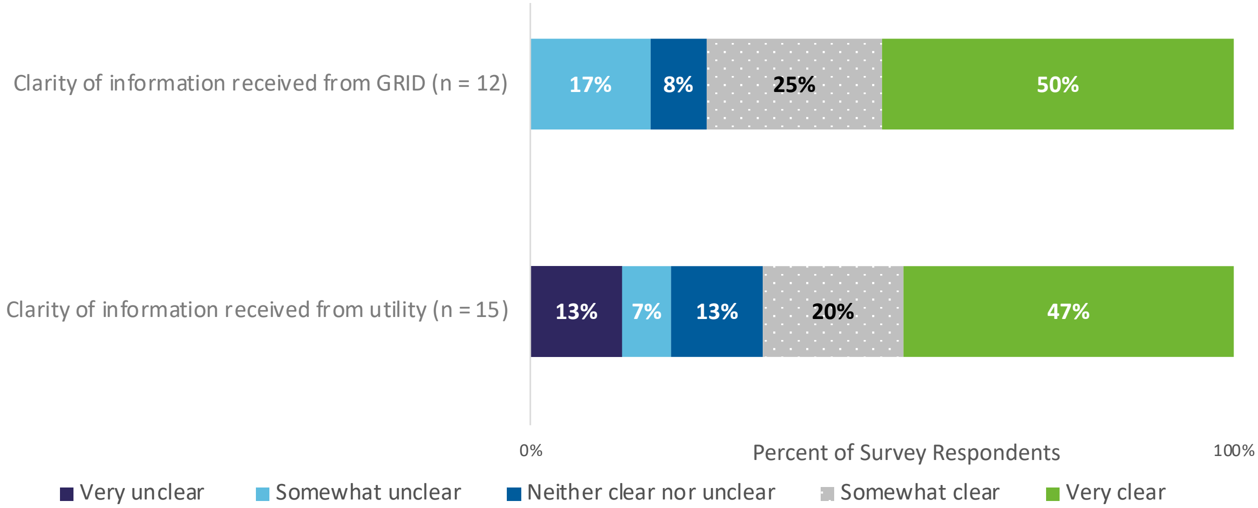
Figure 9: Clarity of Information Reported by Participants



In Figure 10, non-participants who were aware of DAC-SASH followed the same trend and reported that information received from both GRID and their utility was overall clear: 'very clear' (GRID 50%, utility 47%) or 'somewhat clear' (GRID 25%, utility 20%). Aware non-participants were less likely to say that the GRID information was 'very clear' compared to participants, suggesting that participants derived a better understanding of the program from GRID's material than non-participants; however, this difference is not statistically significant.[27] Non-participating customers may be earlier in the process than participants, and therefore have less of an understanding of the process, or they could not be participating because they did not have a good understanding of the process. Interviews with GRID indicate that educating customers on the program and gaining their trust is a barrier to participation.

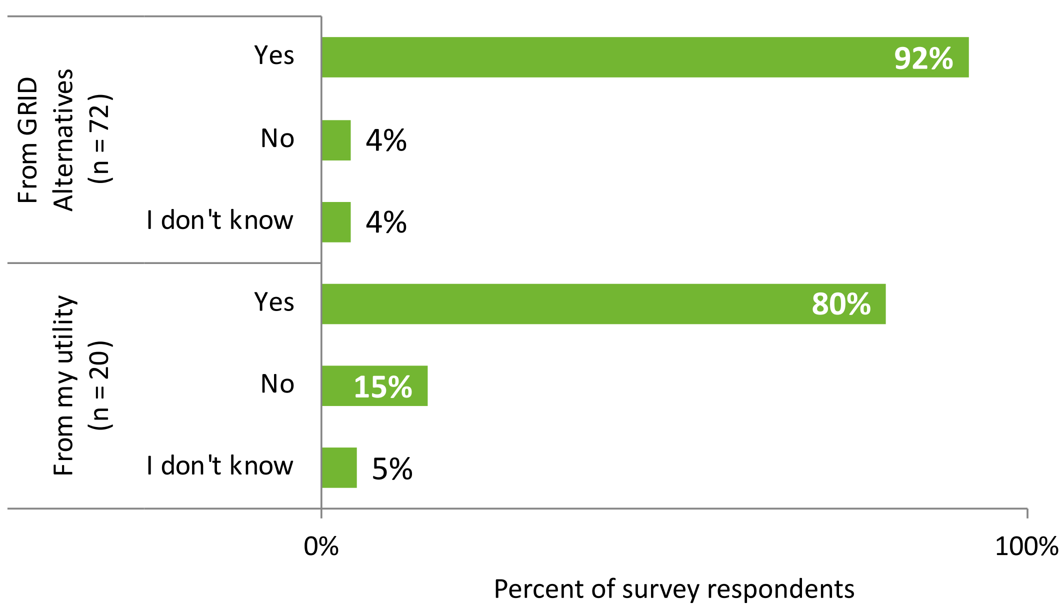
[27] Six participants reported that they heard about the program from both GRID and their utility.

Figure 10: Clarity of Information Received Reported by Non-Participants



Ultimately, most surveyed participants reported that they had access to enough information needed to participate in the program (90%), regardless of how they first heard about the program. As shown in Figure 11, respondents that learned about the program through GRID were more likely to report that they had enough information compared to those that heard about the program through their utility (92% and 80%).

Figure 11: Access to Enough Information Needed for Program Participation

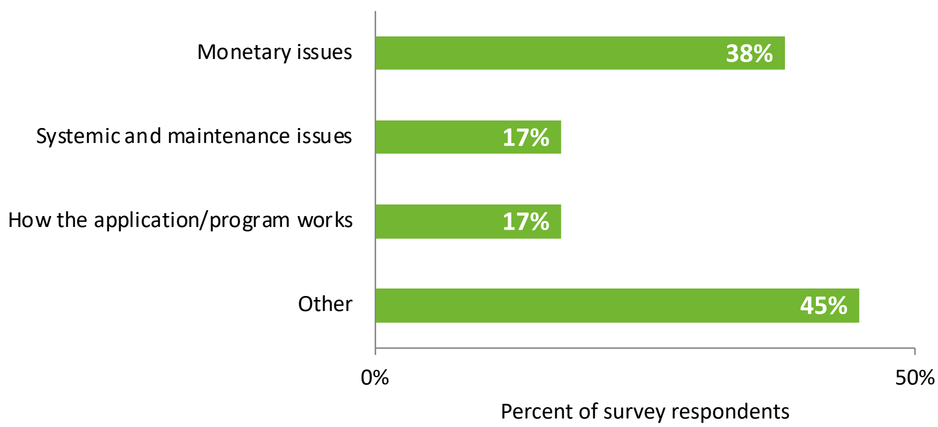


Surveyed participants who did not feel they had enough information to participate provided free-text responses to explain why (n = 29). We categorized those responses by topic and found that many did not understand monetary issues (38%), issues related to the system itself (including maintenance) (17%), and how the program or application process works (17%, Figure 12). Other responses included:

- Not understanding:
    - How ownership works (n = 7)
    - How the program works in relation to their utility (n = 1)
    - How to receive a battery system (n = 1)
- Identifying ambiguity regarding policy (n = 1)

Figure 12: Topics that GRID Alternatives Discussed that Have Not Been Understood Properly - Participants

(n = 29)



A few (n = 5) non-participants that were aware of the program also shared what was unclear about information they received. The responses included confusion around the following topics:

- Process: getting started (1), impact of roof inspection (1)
- Financial implications: mounting costs (1), rent instead of own (1)
- Communication: privacy/personal information (1), slow response time (1)

4.6 Customer Participation

The evaluation focused on the following metrics associated with customer participation. Findings are expanded upon in the sections below.

Evaluation Objective	Summary of Findings
4.6.1 Customer satisfaction with the program – A study component was used to solicit input from customers on their experience enrolling	Customer satisfaction is high amongst participants though non-participant satisfaction levels reflect frustration with realizing they are

Evaluation Objective	Summary of Findings
in the program and their experience, and satisfaction with the PA, and to ways to improve their satisfaction going forward.	ineligible for reasons such as solar-readiness or unpermitted work.
4.6.2 Effectiveness of the programs in addressing barriers to participation – The CPUC identified several barriers to clean energy adoption among residential customers in DACs, and these programs were designed to address those barriers.	Barriers identified include: • Trust in the program offering • Lack of solar-readiness • Presence of unpermitted work • Low energy usage
4.6.3 Enrollment in related programs such as San Joaquin Valley Disadvantaged Communities (SJV DAC) pilots and CARE/FERA and ESAP for income-eligible customers – DAC-SASH is part of a larger set of programs targeted to DACs and CARE/FERA-income eligible customers.	Part of the study's charge was to identify awareness among target customers of the various programs designed to serve them and whether the programs helped increase enrollment in the other programs. Interviews with GRID staff found that there has not been a formal process to actively refer program participants to CARE, and this is reflected in our findings of lower participation numbers in programs such as CARE (46%). Despite GRID reporting monthly referrals to Energy Savings Assistance (ESA), participation was also low, with participation at 19 percent.

4.6.1 Customer Satisfaction

This section details the participant experience and includes findings from the customer surveys on satisfaction with the program. Overall, customers reported high satisfaction.
Interviewees (staff from GRID and IOUs) reported that they perceived customer satisfaction to be high, and this was confirmed via customer surveys. From the perspective of program implementation staff, complaints from program participants were related to timing, and most complaints came from non-participants who were frustrated to find that they were ineligible.

Thirty-four percent of DAC-SASH participants provided feedback about the program via free-text response. Of the respondents that provided feedback, well over half (59%, 27) expressed general gratitude, such as "great program", or "I love that I qualified and feel very very grateful…" Table 21 displays the other topics mentioned in the free-text response, including program communication, general feedback, and requests for additional support, with some respondents mentioning more than one thing.[28]

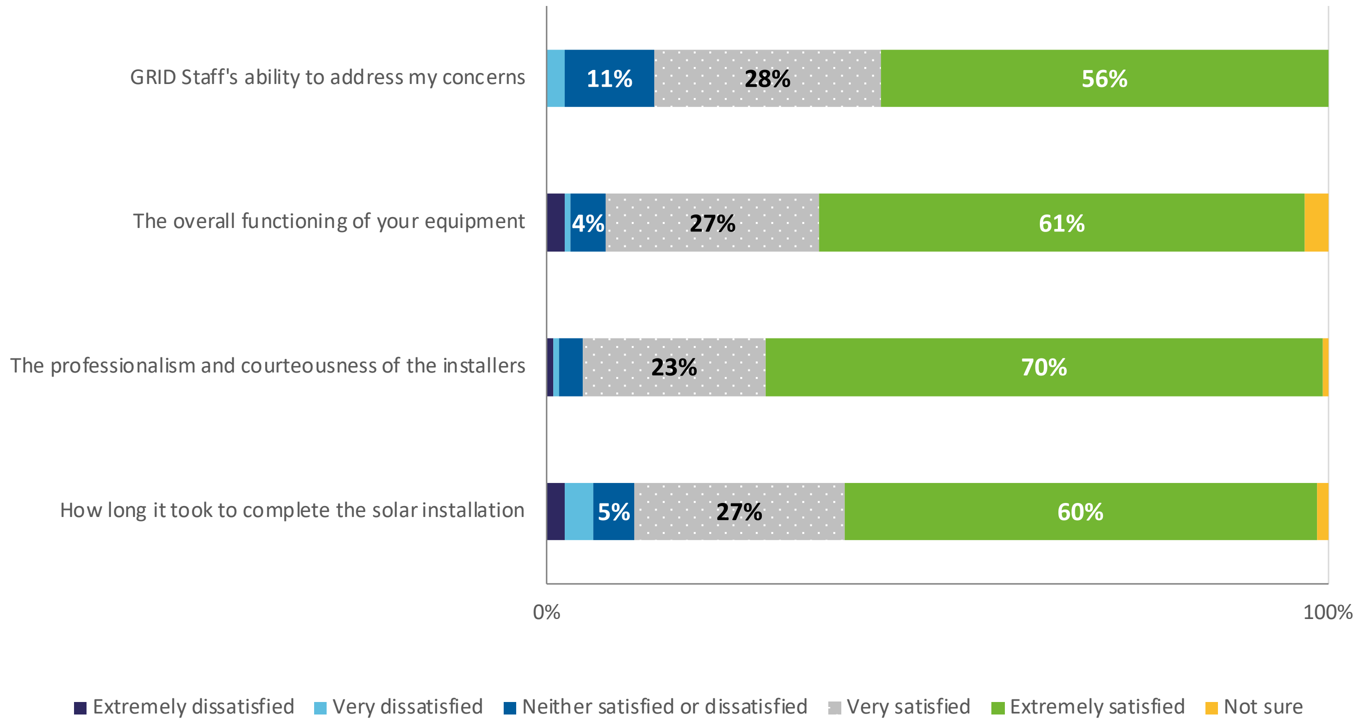
Table 21: Participant Program Feedback from Subset of Respondents (n = 46, multiple responses allowed)

Feedback Theme	Types of Responses	% Of All Respondents
General gratitude	Includes expressions of gratitude such as "thank you to everyone involved" and "I'm just so grateful…"	59%
Program communication	Includes requests to increase bill transparency, bill amount concerns, recommendation for more accessible outreach/marketing/educational resources, and notes on customer service	37%
General feedback	Includes specific notes on savings from program, demand for program or eligibility criteria expansion, criticism on overall process and providers, complaints on installation, notes on ethical impact of program or opinion on program	28%
Request for additional support	Includes requests for upgraded or additional technology or battery installation, additional support: demand for more maintenance, need for general repair or installation, need for greater assistance or referral to other assistance	9%

Surveyed participants were mostly satisfied across four main components of their experience with GRID and DAC-SASH (Figure 13): GRID's staff ability to address their concerns (84% satisfied), the overall functioning of their equipment (88%), the professionalism and courteousness of the installers (93%), and how long it took to complete the solar installation (87%).

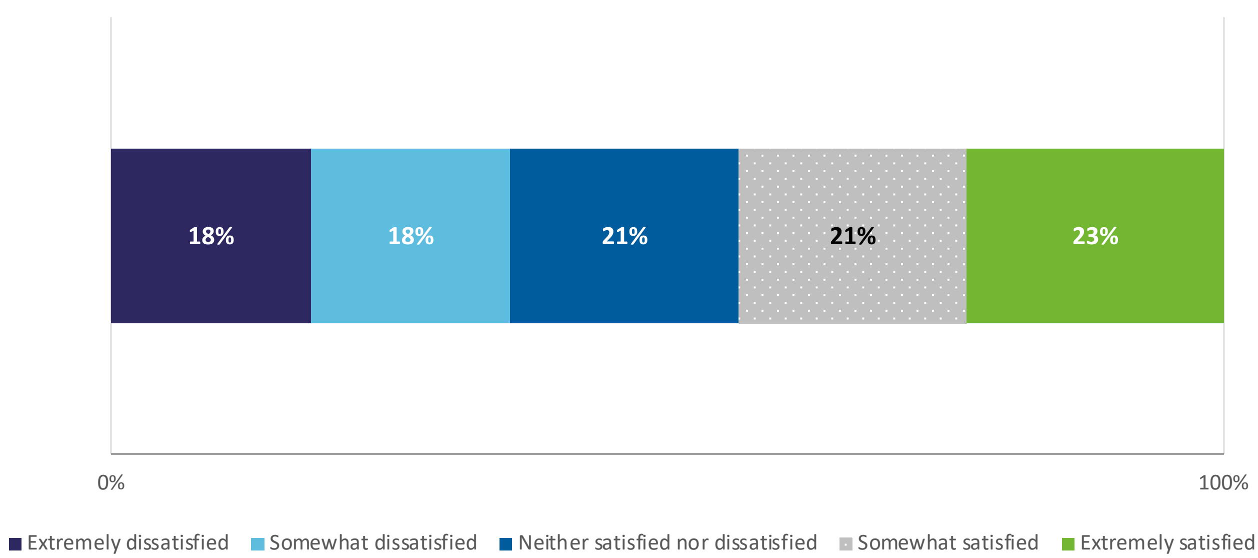
[28] A response could be included in one or more categories. For example, some respondents expressed general gratitude, but also requested additional support.

Figure 13: Participant Satisfaction with Installation (n = 134)



We asked non-participants that had interactions with GRID to share their level of satisfaction with GRID. Figure 14 shows that while respondents were more satisfied than not, there were more dissatisfied responses than among participants.

Figure 14: Non-Participant Satisfaction with GRID Alternatives (n = 39)



Many respondents expanded on their response in a free text section. Most dissatisfied respondents cited eligibility criteria or solar readiness for their complaints against GRID, although some did report a lack of communication or poor customer service. We expand upon these barriers in Section 4.6.2. Among satisfied respondents, however, most reported that GRID's explanations were clear and that staff members were friendly. Table 22 categorizes these findings and provides quotes to illustrate the groups' responses.

Table 22: Satisfaction Among Non-Participants (n = 37)

Satisfaction	Topics	Quotes
Dissatisfied (36%)	Eligibility (11) Customer Service (19)	"They had my hopes up…" "I waited over a year to be told there was no more money" "GRID never followed up"
Neither Satisfied nor Dissatisfied (21%)	Eligibility (7)	"[time] waste went into the application process… could have been prevented if I had the house inspection first" "Our hopes were up and then shattered by being misrepresented by qualifying"
Satisfied (44%)	Customer Service (9) Information (4)	"Representative was very nice and knowledgeable" "The process was clear and the people were very friendly" "They were very easy to understand and [gave] me all the information needed"

Application Process

GRID Alternatives has started to shift to more paperless program processes to increase efficiency. About half of survey respondents (48%) reported that they filled out their application via email and/or DocuSign. The next most common method was via a paper application with help from GRID (34%), via a paper application on their own (10%), and over the phone (7%). Most respondents found the application submission very easy or somewhat easy, as shown in Figure 15.[29]

[29] Only one respondent shared that the application was very difficult. They said that providing tax documents, proof of income, proof of homeownership, and a recent utility bill was difficult, as well as understanding the application itself.

Figure 15: Difficulty Completing Application for Participants (n = 84)

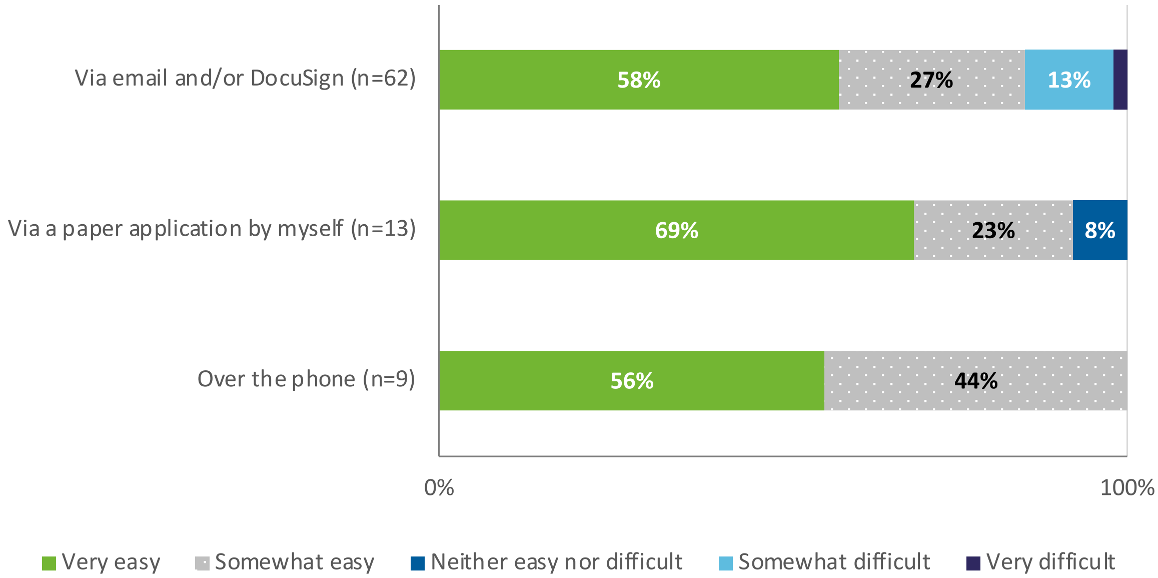
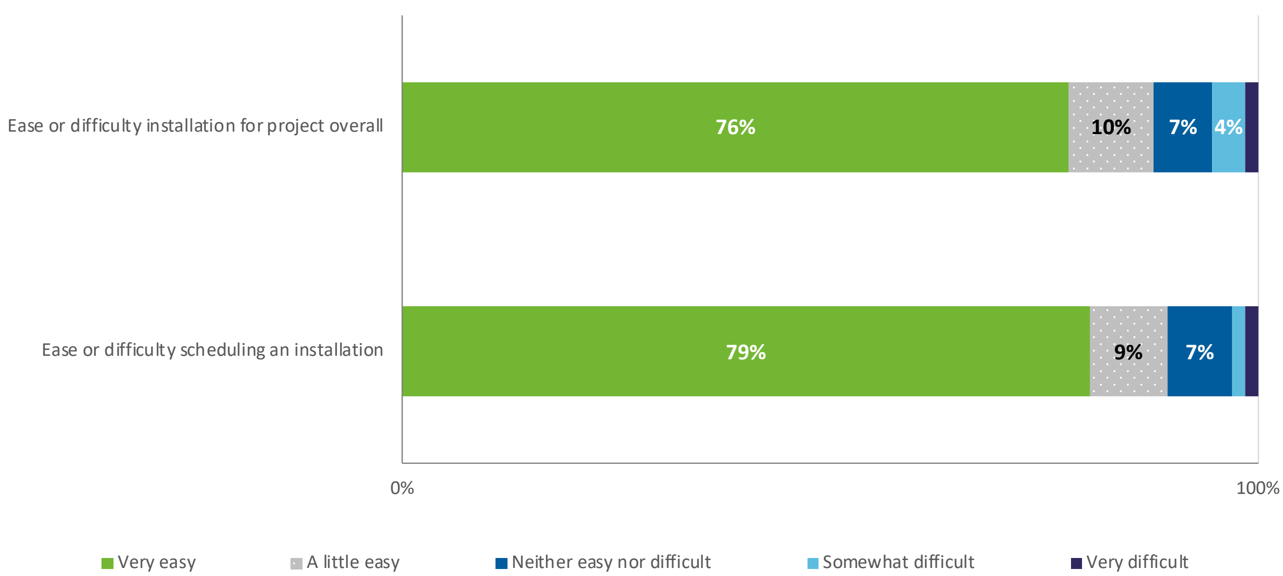


Figure 16 displays levels of ease or difficulty participants experienced when scheduling an installation and the installation overall. Most participants responded that their experiences with installation and its scheduling were 'very easy' (76%, 79% respectively).

Figure 16: Ease of Difficulty with Program Elements for Participants (n = 134)



4.6.2 Barriers to Participation

In addition to the challenges of finding eligible customers to participate, GRID staff interviews found many barriers that eligible customers may face. Common factors where eligible customers did not move forward with the program, as reported by GRID staff, are:

- Ensuring the home is solar ready
- Distrust in the program
- Energy usage too low to qualify
- Unpermitted work on property

GRID tracks barriers to participation in its program data by indicating whether a customer is inactive or active. Inactive customers include an inactive reason and may include one or more reasons. An analysis of these inactive customers confirmed that many customers did not move forward due to solar-readiness issues such as problems with the roof (43%), code enforcement issues (13%), shading (8%), or other services needed (4%). Less than a third of inactive customers (30%) were inactive due to lack of interest or lost contact, and only 12 percent of customers were deemed ineligible after initial screening of homeownership and income. Table 23 displays all reasons documented by GRID. Note that a customer could be marked inactive for more than one reason, so the percentages shown are of all inactive customers but do not add up to 100 percent.

Table 23: Recorded Reasons for Inactivity (n = 508)

Inactive Reason	Detailed Reason	Percent of All Inactive Customers
Home not solar-ready	Roof Issues (Unsafe, repairs needed, or too small)	43%
	Code barriers	13%
	Solar shading	8%
	Other professional services needed	4%
Not interested	Not interested in program	20%
	GRID lost contact with customer	10%
Eligibility	Not eligible	6%
	Energy usage too low	3%
	Other ineligible	3%

In addition to program data and interviews with GRID staff, the evaluation surveyed eligible customers who did not participate in the program (non-participants) and asked why they did not end up moving forward with the program. Table 24 shows that over a third of non-participants report that they are still interested in participating, and the rest of the respondents would have needed to repair their roof (36%), upgrade their electrical panel (9%), or undertake some other service (3%) before participating. Only a few respondents reported that they were unsure of the benefits (9%), did not have time to participate (3%), or something else (6%). Notably, a lack of interest in solar in general was not a large barrier (see Section 6.3).

Table 24: Reported Reasons for Eligible Customers Not Participating (n = 33, multiple responses allowed)[30]

Reported Reasons	% of Respondents
I would have needed to pay to improve my roof	36%
I am still interested and waiting to move forward	36%
I was unsure of the benefits	9%
I would have needed to pay to upgrade my electrical panel	9%
I would have needed to pay for tree trimming	6%
I was told I was not eligible	3%
I did not have time to participate	3%
I did not want to get a permit	3%
I would have needed to pay for some other service before installing solar panels	3%
Something else	6%

In the remainder of this section, we expand on the barriers identified by GRID, participants, and non-participants.

Solar-Readiness

Interviews and site visits with GRID found that one of the largest barriers to enrollment of eligible customers is the gap between the cost to install projects and the incentive received through the DAC-SASH program. Eligible customers' homes are often not solar-ready and require costly upgrades before solar panels can be installed. To keep the program at no-cost to the customer, GRID often tried to bridge this gap with external funding and third-party ownership agreements, as discussed in Section 4.3.2.

[30] Out of the 12 respondents who stated that they were waiting to move forward with installing solar, 10 reported an answer about what they were waiting for to move forward. Reported answers included the process being stalled due to time and implementation lags as well as bureaucratic stalls (5), needing resources and assistance before installing solar (2), hesitancy about the program's legitimacy (1), and a lack of necessity and urgency (1).

This section reports on costs that are not inherent to the installation or materials reported, but the additional professional services costs that are required to make the homes solar-ready. The costs recorded from program data are often covered by grant funding, either through large partnerships with municipalities, or smaller, one-off grants from CBOs.

Our analysis of program data found that of all projects *completed* under DAC-SASH, almost half (42%) recorded some professional service. Electrical service upgrades were the most common, with 153 projects, but roof-related expenses were the most expensive on average (Table 25).

Table 25: Professional Services Costs Recorded by GRID

Service Recorded	N	Minimum Cost	Average Cost	Maximum Cost
Electrical service upgrade	153	$533	$2,568	$6,580
Professional engineer letter/stamp	108	$100	$168	$500
Electrical services other	81	$144	$738	$3,198
Re-roofing	32	$2,900	$10,935	$20,000
Code compliance	6	$150	$163	$200
Roof repair	6	$2,450	$5,208	$9,600
Equipment rental	1	$500		
Tree trimming / removal	1	$1,200		

GRID staff reported that when they are not able to secure funding for the additional costs required, customers either cannot move forward with the program, or have to pay out of pocket before participating with the program. The survey of program participants found that some customers who needed additional funding to complete their installation received financial help from GRID (38%, Table 26) either directly or through a connection with external funding sources such as a grant.

Table 26: Participant Reported Services Needed in Order to Complete Installation (n = 29)

Service	Required Service	Help from GRID	Paid on Own	Average Total Cost	N Cost Info
Electrical or panel upgrades	9	66%	33%	$544	4
New roof	4	25%	75%	$6,833	3
Roof repair	5	-	100%	$5,875	4

Service	Required Service	Help from GRID	Paid on Own	Average Total Cost	N Cost Info
Tree trimming	5	-	100%	$960	5
Remove items	1	100%	-	-	-
Did not specify	5	60%	40%	-	-
TOTAL	**29**	**38%**	**62%**	**$5,158**	**16**

We also asked non-participants if there were needed services that prevented them from moving forward with the program. Table 27 shows that 13 non-participants responded that some service was needed. No respondents reported that GRID successfully connected them with an organization for funding or that funding was sufficient to move forward. This supports GRID's claim that additional costs are preventing eligible customers from participating, despite efforts to find funding.

Table 27: Non-Participants' Cost Estimates to Upgrade Home for Solar (n = 13)

Service Needed	Minimum	Average	Maximum
Roof repair (n = 9)	$4,000	$15,167	$25,000
Tree trimming (n = 2)	$5,000	$5,500	$6,000
Electrical panel (n = 2)	$2,500	$2,750	$3,000

During our site visit to the North Valley office, we learned that the City of Stockton has a program that complements the DAC-SASH program by providing funding for roof repairs for eligible customers.[31] This allows GRID staff to take on more projects in Stockton and serve eligible customers that they may otherwise not have been able to. In staff interviews, we found that some outreach coordinators feel they are not serving the neediest communities due to solar-readiness issues. When households are eligible and either have a solar-ready home or are able to pay for a roof repair, they are easier to serve with the DAC-SASH program as written. However, when households are eligible but have poor quality roofs or electrical panels and do not have the means to replace or repair them on their own, they are often left underserved because GRID cannot find funding for them to move forward.

Trust in Program Offering

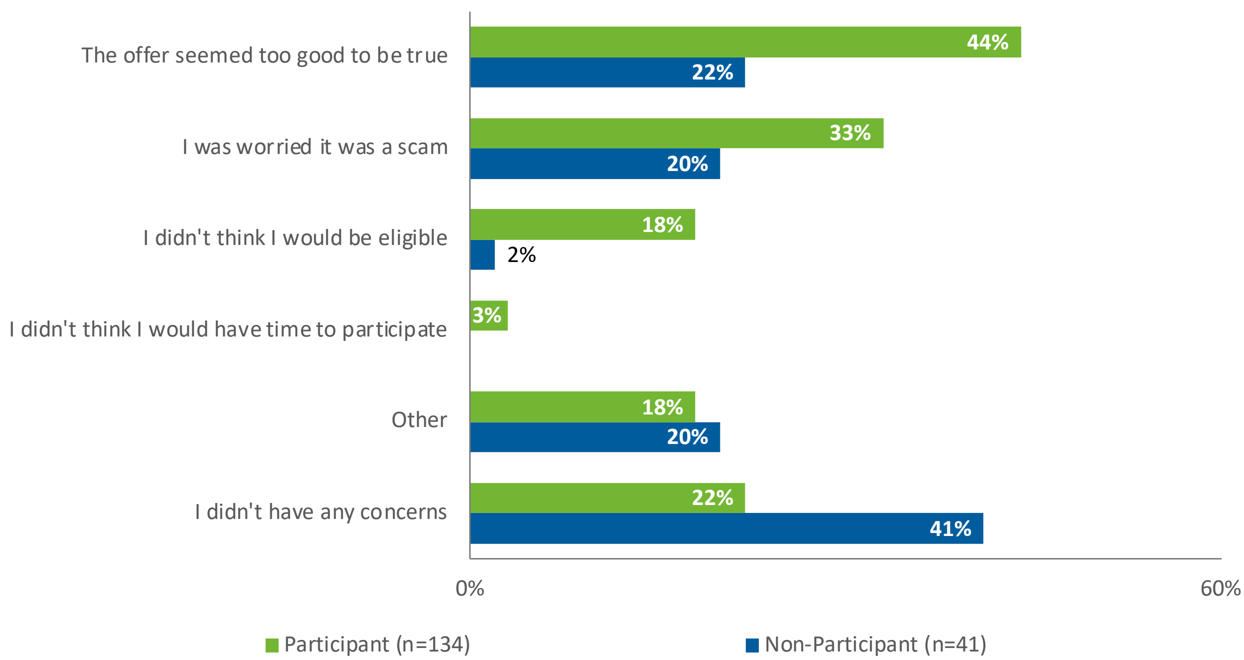
Many DAC-SASH participants (44%) shared that they felt that the offer seemed too good to be true while deciding to participate in the program (Figure 17). Eighteen percent shared a free-response answer, including:

[31] City of Stockton's TCC grant: https://www.stocktonca.gov/government/departments/manager/sustainability/projects.html

- Concerns surrounding future responsibility for maintenance, repairs, costs/taxes (5);
- Length or difficulty of process (paperwork or bureaucracy) (2);
- Potential effects on roof (2);
- General concerns with installation (2); and
- Concerns about calculating solar panel and energy needs (1).

Notably, non-participants were more likely to say they did not have any concerns (41%), but also wrote in that they had other concerns more often than participants. Twenty percent of the non-participant respondents stated that they had other concerns and when asked to elaborate, they mentioned concerns such as worries about cost (2), issues with the program administrator (2), and their own personal reasons that inhibited them (2).

Figure 17: Concerns When Deciding Whether to Participate (multiple responses allowed)



To combat the lack of trust, GRID works with trusted partners local to the communities in which they are working. Partnerships with CBOs and municipalities allow the program to leverage relationships that community members already have with other organizations. The evaluation found that despite the lack of trust experienced by GRID staff and reported by participants and non-participants alike, a lack of interest and willingness to participate in the program is not a limiting barrier at this time.

Energy Usage

The evaluation also found two groups of non-participants for whom low energy usage is a barrier. One group of non-participants perceive their energy bills as too low for them to benefit from solar panels. This group self-selects out of the program because they do not think they will qualify or benefit.

The other group is comprised of non-participants who applied and were interested in the program but were disqualified due to their low energy usage. Many low-income, eligible households already adhere to cost-saving energy-efficiency practices, and therefore their energy usage is too low to qualify for solar. These instances are not as common as eligibility or cost barriers but do occur. One outreach coordinator sympathized with these cases and said it was difficult to explain to someone who could really benefit from the program that they're being penalized for saving energy and money.

As reported earlier in this section, 3 percent of inactive customers (out of 508 inactive) were disqualified from participating due to low energy usage, indicating this is not a main barrier faced by the program.

Unpermitted Work on the Property

Another barrier reported by GRID staff was the existence of unpermitted work on the property. Unpermitted work can either impede an installation directly or serve as a deterrent to having an inspector in the customer's home. During the DAC-SASH solar installation process, an official from the municipality must inspect the solar project after completion before interconnection can occur. At this stage, if there is unpermitted work on the property (i.e., a deck or patio), the inspector has the right to enforce compliance – either by issuing a fine or having the homeowner remove the unpermitted structure. GRID staff are not involved in this process but allow customers to choose when participating in DAC-SASH if they would like to risk the inspector's enforcement, get the work permitted, or not move forward with the project.

Data are limited on this barrier, but staff from several different regional offices mentioned that it is something they must plan for. An implementer of an IOU program that has faced similar permitting barriers (Richard Heath and Associates, which was an implementer for the San Joaquin Valley DAC Pilot) suggested that a separate permitting process for utility programs could help to ease this process.[32] This may prove challenging given that permitting is done at the local level.

4.6.3 Enrollment in Related Programs

Part of the study's charge was to identify awareness among target customers of the various programs designed to serve them and whether the program helped increase enrollment in the other programs such as CARE, ESA, or the Self-Generation Incentive Program (SGIP).

[32] Online presentation attended by evaluation staff on November 9, 2022. Workshop summary retrieved from: https://pda.energydataweb.com/api/view/2732/Final%20CEIQP%20Workshop%20Presentations%20Nov%207.pdf

The DAC-SASH program handbook requires that GRID provide education sessions for all program applications and assist in referring them to providers of additional energy efficiency services. Interviews with GRID staff found that some regional offices have direct relationships with ESA program administrators and share leads between the two programs, but this was not formally documented in the program handbook.

We looked at two additional data sources – IOU Customer Information System (CIS) data and self-reported enrollment from surveyed program participants – to understand if enrollment in other programs is happening alongside enrollment in DAC-SASH.

IOU Data Findings: The income eligibility threshold for CARE (a rate discount program) and DAC-SASH are the same (200 percent of the FPL), meaning that we can assess CARE enrollment as a percentage of the total participants. There are, however, limitations to analyzing IOU CIS data to determine CARE enrollment. The data we analyzed from the IOUs capture CARE enrollment as of the date the data were retrieved. Other studies, such as the 2022 Low Income Needs Assessment, have found that many CARE participants enroll, but do not recertify their income and can fluctuate on and off the CARE rate. Pulling these data at different days of the year could produce different enrollment figures. In Table 28, we show that the enrollment at the time of the data pull (February 2022) varied by IOU, with higher rates of enrollment for SCE and SDG&E customers than for PG&E customers (69%, 68%, and 36%, respectively).

Table 28: CARE Eligibility and Enrollment Among DAC-SASH Participants

Utility	# Participants	# Eligible	# Enrolled	% Enrolled
PG&E	649	649	234	36%
SCE	281	281	193	69%
SDG&E	25	25	17	68%
Total	**955**	**955**	**444**	**46%**

DAC-SASH participants are also income eligible for ESA, a program that offers free energy-saving improvements. If the customer has previously participated in ESA, they may only be able to participate if previously installed measures have expired or if new measures are offered . Therefore, the number of total eligible households is likely smaller than the number of participants in DAC-SASH. In our analysis, we did not request premise-level participation data, so we could not calculate the total number of eligible DAC-SASH customers.

In Table 29, we report on the percentage of all participants that enrolled in ESA, based on IOU CIS data pulled in March 2022. In Figure 19 in the next section, we report on self-reported enrollment from the participant and non-participant survey and see similar values of ESA enrollment (13% and 17% of participants and non-participants enrolled, respectively). Notably, GRID's semi-annual reports include numbers of referrals and enrollments in ESA but include both participants and non-participants it has enrolled, while the evaluation only analyzed participants.

Table 29: ESA Income Eligibility and Enrollment Among DAC-SASH Participants

Utility	# Participants	# Enrolled	% Enrolled
PG&E	649	169	26%
SCE	281	3	1%
SDG&E	25	11	44%
Total	**955**	**183**	**19%**

The San Joaquin Valley DAC (SJV DAC) pilot offered electric appliances to customers who had to rely on propane and wood for heating and cooking. Eligibility requirements for the project varied over the course of the pilot, and for this analysis the only requirement used to determine eligibility was whether the consumer resided in an eligible community. We found that 3 percent of DAC-SASH participants also participated in the SJV DAC pilot (Table 30). GRID staff noted that they had a close partnership with the SJV pilot staff (in PG&E's service territory) and shared leads, but IOU CIS data did not find many that actually enrolled.

Table 30: SJV DAC Eligibility and Enrollment Among Participants

Utility	# Participants	# Eligible	# Enrolled	% Enrolled
PG&E	649	10	2	20%
SCE	281	68	-	0%
SDGE	25	-	-	NA
Total	**955**	**78**	**2**	**3%**

No participants were enrolled in SGIP – a program that provides incentives to support installation of energy storage systems – even though all DAC-SASH customers are eligible for the program. A rebate from the SGIP program could cover approximately 85 percent of the cost of an average storage system. The low enrollments may be due in part to the contractor-driven nature of that program.

Participants with additional qualifications, such as those who reside in a Tier 2 or 3 High Fire Threat District (HFTD) or who have experienced two or more utility Public Safety Power Shutoffs (PSPSs) are eligible for rebates that cover close to 100 percent of the cost of an average energy storage system. Table 31 shows that 1 percent of all program participants are eligible for this higher rebate provided by the SGIP Equity Resiliency fund.

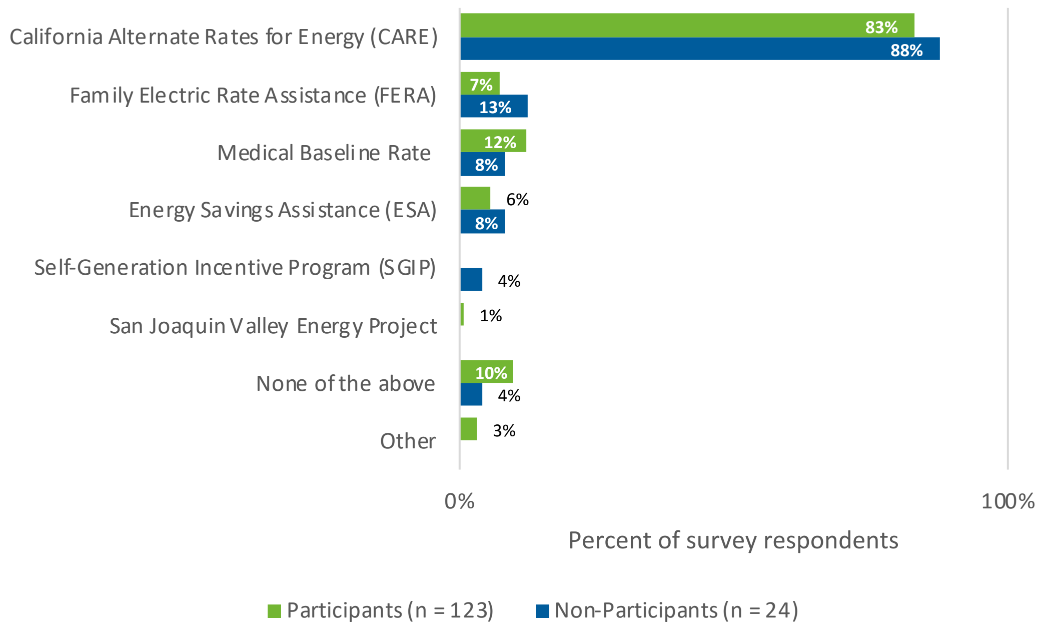
Table 31: SGIP Eligibility Among Participants

Utility	# Participants	# Eligible for Equity	# Eligible for Equity Resiliency	% Eligible for Equity Resiliency
PG&E	649	649	1	0%
SCE	281	281	5	2%
SDGE	25	25	7	28%
Total	**955**	**955**	**13**	**1%**

Interviews with GRID staff found that they were ramping up storage work, but funding ran out quickly. Staff members stated that the auto-qualification for SGIP is helpful but that their participants do not often overlap with the HFTD map, so they do not focus on it as much. Future evaluations could investigate barriers to additional enrollment in SGIP and other programs reported here.

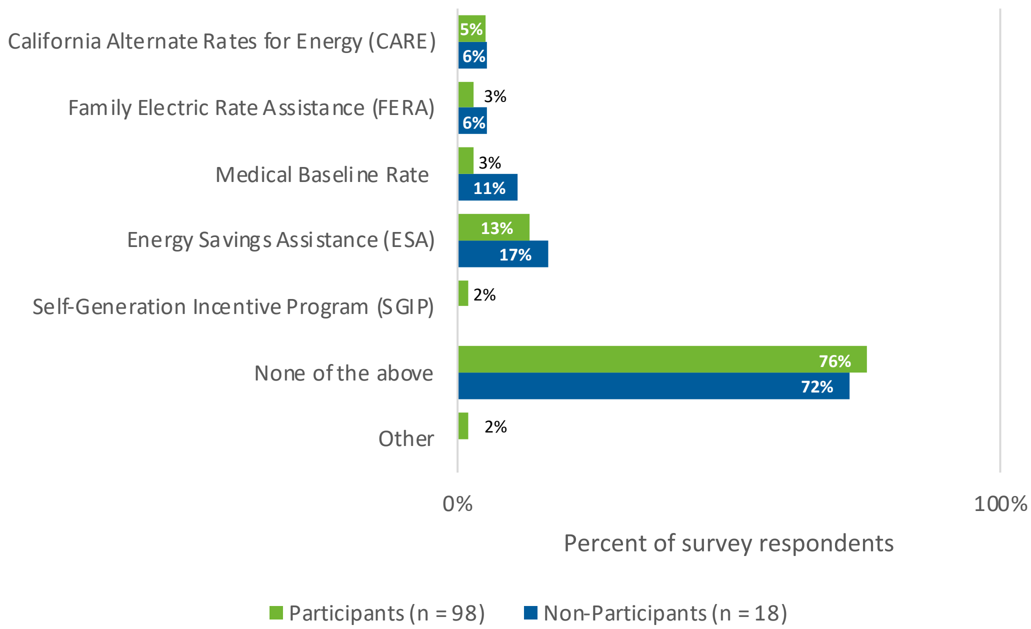
Self-Reported Enrollment in Non-DAC-SASH Programs: In addition to analyzing the IOU CIS data, we also asked survey respondents about their enrollment in other utility programs. Figure 18 shows that most surveyed participants and non-participants (83% and 88%, respectively) reported they enrolled in CARE before applying for the DAC-SASH program. These findings align with GRID's semi-annual reports, in which they state that around 80 percent of all customers that apply to DAC-SASH are enrolled in CARE. While these two reports align with each other, they are higher than the CARE enrollment that we observed in the IOU CIS data extract, which shows that only 46 percent were actively enrolled in CARE. It is feasible that participants are accurately reporting that they had enrolled in CARE, but that they were not actively receiving benefits from CARE at the time of our data pull due to the recertification requirements. During our interviews, GRID staff reported that some customers believe they are enrolled in CARE but are not aware that they need to re-certify their eligibility every two years to continue receiving benefits.

Figure 18: Enrollment in Other Energy Program Before Applying to DAC-SASH (multiple responses allowed)



Most respondents did not report enrolling in any other energy programs around the same time as applying for DAC-SASH. Out of the few that did, ESA was the most popular program (13% of participants and 17% of non-participants enrolled, Figure 19). These findings align with our analysis of the IOU data.

Figure 19: Enrollment in Other Energy Program Around the Same Time as Applying for DAC-SASH (multiple responses allowed)



4.7 Post-Installation Customer Experience

GRID offers a 10-year equipment and service warranty after installation, which is standard in the industry. For TPO systems, the customer receives a 25-year warranty where GRID will service the system for the first 10 years and the TPO company will service the system for the remaining 15 years.

At the time research was conducted, the maximum age of an installed system for DAC-SASH was four years, thus limiting our ability to report on the full warranty period. Only a few survey respondents (10%) reported having some issues with the solar system since installation. Of those respondents, nine expanded on the issues:

- Specific component (e.g., inverter) (4)
- Billing or customer service (2)
- Roof issues – leaks, birds, cleaning (1)
- Panel replacement, addition, or maintenance (1)
- System needing updates and or an unspecified system malfunction (1)

Only a few respondents reported needing maintenance for their solar panels since installation (n= 6, 5%). Respondents primarily describe maintenance as cleaning, dusting, or washing solar panels. Of the three respondents who shared costs of maintenance, the average cost was $78. An additional two respondents reported spending their own money on repairs. Both respondents were under a TPO model, meaning certain repairs should be under warranty. The reported repairs were for a panel replacement and for repairing a roof leak.

In addition to survey responses, our evaluation captured a few anecdotal reports of service requests to GRID Alternatives and Sunrun. One participant reported that their inverter installed in 2020 for a system owned by Sunrun has repeatedly tripped and that they were referred to Sunrun by GRID. Sunrun reportedly gave them the option to assess the problem through a help ticket that required access to an email account (which they did not have). An alternative option was paying up front for an electrician to potentially fix the issue, and then waiting to see if the electrician fee could be refunded. These challenges may be particularly difficult for program participants who have lower incomes and less ability to pay money up front. GRID was informed of this issue and reported that they would reach out to the participant.

4.8 PV System Impacts

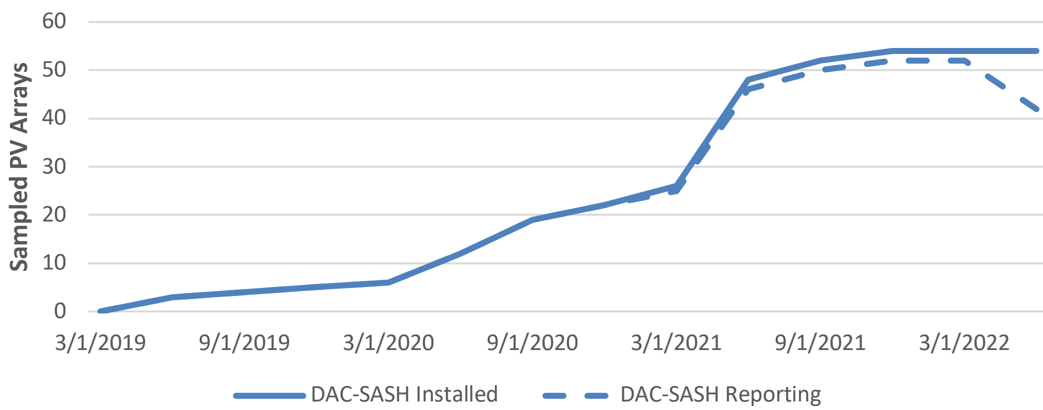
To assess PV impacts, the evaluation had a two-part goal: 1) verify total PV installed capacity achieved through the programs, and 2) understand how this installed capacity performed compared to expectations and what factors may be most impactful on system performance.

4.8.1 Data Limitations

We discovered several data limitations in assessing the PV impacts. We summarize the limitations here to provide context for the findings and go into more detail in Section 6.6.

The Evergreen team reviewed generation data from two different monitoring systems – Enphase and Solar Edge. Figure 20 illustrates generation data availability across the sample of projects. Data availability and reporting issues for each of the monitoring systems are described in more detail in the following two sections.

Figure 20: Installed and Reporting Sampled DAC-SASH PV Arrays



Through the evaluation, we found that Enphase-Enlighten does not automatically identify and share outage events with GRID. It is the responsibility of the system owner to identify monitoring system errors and report to their respective monitoring system company. For homeowner-owned systems, that requires the homeowner to actively monitor their production. For TPO systems, the contract with the TPO states that it is the solar company's responsibility to monitor, communicate, and reimburse customers to fix any system outages. However, Sunrun communicates with its customers via email or online, so participants without an email address or internet access are less likely to receive help or notification of these issues.

Table 32 outlines the daily data availability for the sampled projects that were monitored with Enphase-Enlighten, from project installation through June 30, 2022.

Table 32: Enphase-Enlighten Sample Daily Availability

Projects Missing Data	Total Instances of Reporting Error	Total Days	Days with Reporting Error	Percent of Days Missing
15 of 37	19	27,829	704	3%

Reporting errors (i.e., missing data) do not necessarily indicate that the solar system is malfunctioning. One customer indicated during the on-site assessment that despite data missing from their Enphase-Enlighten portal, their utility bills continue to reflect that their PV system is generating.

4.8.2 Program Data Errors

Program tracking and data reporting errors found in legacy SASH programs seem to be resolved in DAC-SASH. The EPBB files and program tracking data aligned for 46 of the sampled projects, and 50 samples were within 1.5 percent of the annual estimate (Table 33). Projects with greater differences were frequently included in the field verification activities conducted by GRID. This likely indicates that either the EPBB database or the program tracking data are being updated post verification, while the other is not.

Table 33: EPBB and Program Tracking Data Discrepancies

EPBB-Tracking Energy Generation Diff. (%)	Project Quantity	GRID Field Verification Quantity
0%	46	3
1%	2	1
3%	2	2
6%	2	2
7%	1	1
TOTAL	**53**	**9**

4.8.3 Overall Realization Rates

The Evergreen team calculated a realization rate for each project in the evaluated sample. The realization rate was calculated as the ratio between the verified normalized energy production and the program-reported energy production. Realization rates are determined using the most recent 12 months of generation data available for each system, ending no later than June 30, 2022. A realization rate greater than 100 percent indicates that the solar array is producing more energy than originally estimated by the program via the EPBB tool.

The average annual sample realization rate is 103 percent across participating IOUs (Table 34). In other words, the solar arrays in the evaluation sample are generating 103 percent of the program's original estimate.

Table 34: Sample Realization Rates by IOU

IOU	Sample Quantity	Reported Energy Production (MWh)	Verified Energy Production (MWh)	Realization Rate
PG&E	28	170	179	105%
SCE	24	145	146	101%
SDG&E	1	2	2	116%
TOTAL	**53**	**317**	**327**	**103%**

Table 35 presents the realization rate by monitoring system type (Enphase and SolarEdge), and Table 36 shows third-party owned (TPO) systems and residence-owned system realization rates were found to be similar, within 5 percent of each other.

Table 35: Sample Realization Rates by Monitoring System

Monitoring System	Sample Quantity	Reported Energy Production (MWh)	Verified Energy Production (MWh)	Realization Rate
Enphase	36	211	221	105%
SolarEdge	17	107	107	100%
TOTAL	**53**	**317**	**327**	**103%**

Table 36: Sample Realization Rates by Ownership

System Ownership	Sample Quantity	Reported Energy Production (MWh)	Verified Energy Production (MWh)	Realization Rate
TPO	34	206	216	105%
Non-TPO	19	111	111	100%

4.8.4 Program Energy Impacts

We extrapolated the results of the sample analysis to the total program population to quantify the annual impact of the full DAC-SASH program, estimated to be 5,745 MWh per year. Table 37 presents energy impacts for the DAC-SASH program by IOU for the most recent 12 months of generation data available for each project, ending no later than June 30, 2022.

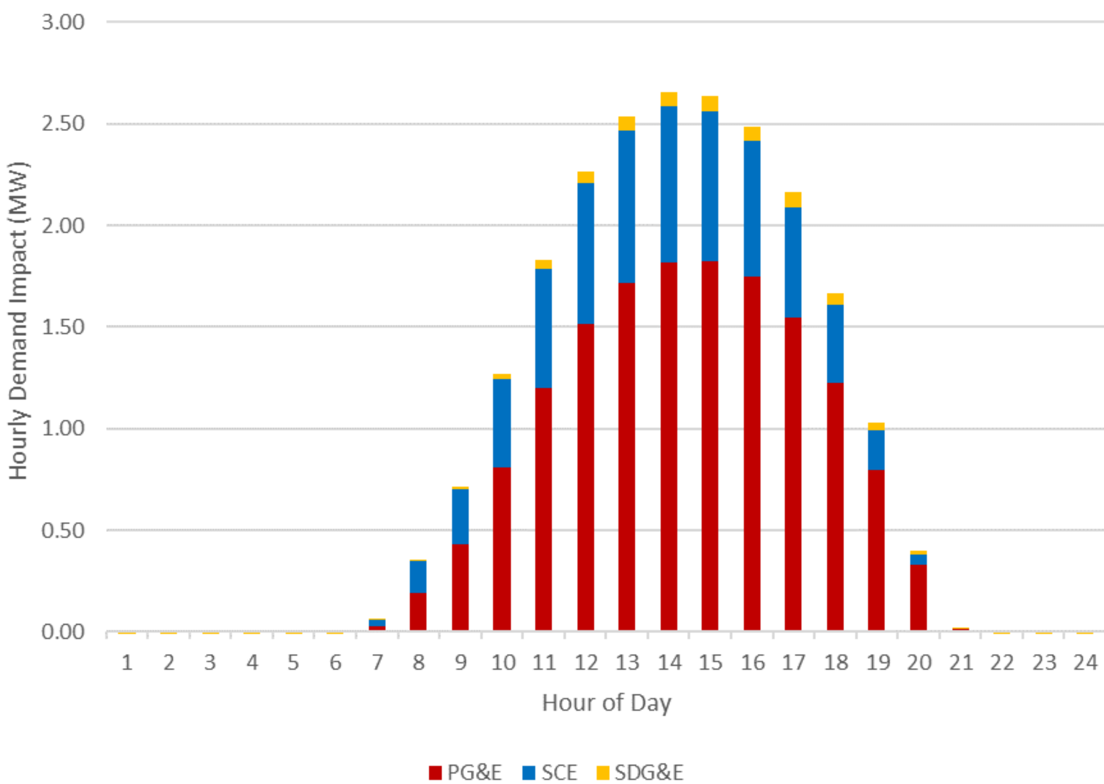
Table 37: Energy Impacts by IOU

IOU	Installed kW-Rating (kW-DC)	Energy Generation (MWh)
PG&E	2,647	3,860
SCE	1,170	1,713
SDG&E	98.4	172
TOTAL	**3,916**	**5,745**

4.8.5 Demand Impacts

The load shape of energy generated by PV shifts with the angle of the sun hourly and daily throughout each year. The load shape of DAC-SASH PV installations for an average July day is shown in Figure 21**.** The maximum impact to hourly demand in July is estimated to be about 2.7 MW, occurring in the 14th hour of the day, which is 1pm to 2pm.

Figure 21: Average Hourly Demand Impacts by IOU - July

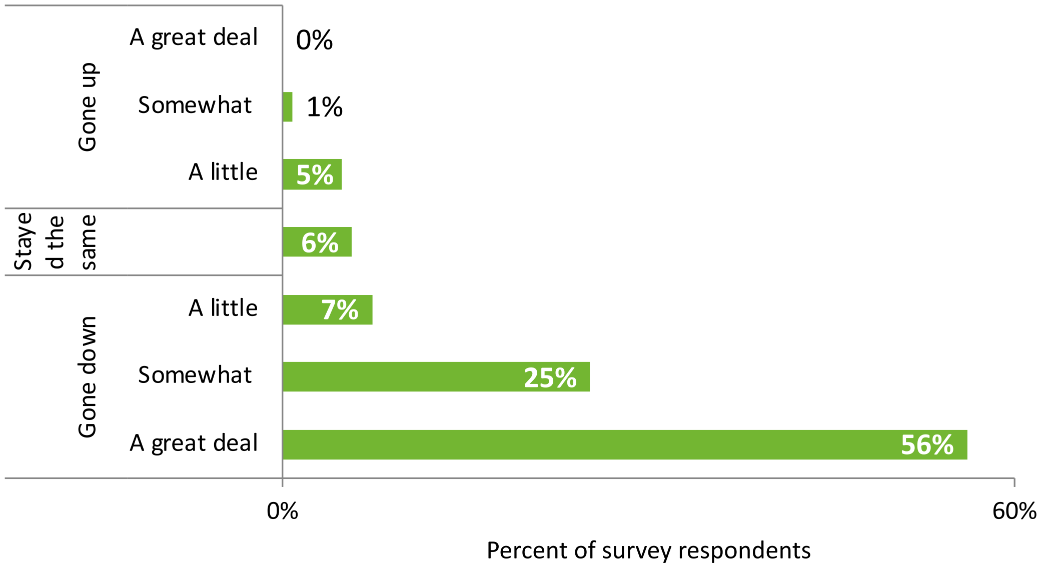


4.9 Customer Bill Impacts

Our examination of the respondents' electric bills since the installation of solar panels on their rooftops suggest that the programs have indeed been effective in the fulfillment of their intended objectives to reduce energy bills.

Figure 22 shows that over half of the respondents (56%) noted that their bills have gone down a great deal, with approximately 88 percent saying that their bills have gone down at least a little, signaling a positive effect overall and confirming customer awareness. However, there is a small percentage of respondents who said that their bills have gone up (6%). While most participants exhibited substantial reductions in their electricity bills after the solar installation, we confirmed that a small group of participants exhibited increases in their annual electricity bills after the solar installation.

Figure 22: Self-Reported Bill Impacts After Installation (n =123)



A few survey respondents who reported that bill *and* usage went up gave reasons as to why this may be the case, including:

- The charging of electric vehicles (n=1);
- A lack of panel maintenance (n=1); and
- The increased use of appliances for heating and cooling purposes (n=1).

Of those who reported that bill *and* usage went down, five respondents gave an explanation as to why this may be the case. Multiple reasons were recorded for some participants, including:

- Increased mindfulness of energy usage (n=2);
- A decrease in occupancy (n=2); and
- Increased environmental consciousness (n=1).

Our assessment of the impacts related to installing a solar system through the DAC-SASH program using billing and usage data were in alignment with customer survey reports. Next, we report on findings related to:

- Gross annual savings in kWh and bill costs;[33]

[33] Throughout this section, we will refer to "gross energy savings" as the savings found when comparing participants' pre- and post-solar install kWh usage.

- Net annual savings in kWh and bill costs that are attributable to the program; and [34]
- Cumulative program impacts.

4.9.1 Annualized Savings

We used the most granular energy consumption data available (monthly billing kWh and costs, daily and hourly interval kWh from advanced metering infrastructure [AMI] data) in a series of regression models to estimate the energy and bill savings attributable to the solar panels (in kWh and $). See Appendix B for details on the impact analysis methods, sample size, and regression model fit.

Energy and Bill Savings

The energy savings estimates from the installation of the solar systems for the post-period were calculated by combining the estimated gross regression coefficients with the weather conditions from the post period and the Net-to-Gross (NTG) ratio.

The gross energy savings estimates were calculated using participants' pre- and post-solar install kWh usage and contain both the decrease in kWh usage due to the energy being generated by the solar panels as well as any change in kWh energy consumption that happened after the panels were installed. When the solar generation credits start being issued, customer energy bills will drop, which often motivates them to use a little more energy (e.g., increase cooling for comfort).

In general, we would expect to see an increase in energy consumption over the years, as the climate in California has gotten more extreme (e.g., hotter summers require more cooling) and new electronics are added to the home. An increase in consumption from these types of external pressures will be exhibited by the comparison group. We calculated an NTG adjustment for each program by measuring the savings estimates of the solar installation relative to a matched comparison group of non-participating similar customers. We estimated this NTG adjustment using gross and net savings for the 2019-2021 participants for the DAC-SASH program. The net savings estimate tells us how much the participants saved *above and beyond* any change exhibited by the comparison group.

Table 38 shows the estimated gross savings, NTG adjustment, estimated net savings (in kWh or $ and as a percentage of baseline energy use), and the number of observations that went into the model by program and year of participation. **The energy usage NTG adjustment ranged from 1.02 to 1.24, suggesting that without the program, we would have expected to see a small *increase* in energy usage and bill costs among participants over the study period (2019-2021) if they had not installed solar.** The middle column provides the adjusted net savings estimate (for energy and electricity bill cost, respectively) with 90 percent confidence intervals. **On average, DAC-SASH**

[34] Throughout this section, we will refer to "net energy savings" as the savings found when comparing participants' pre- and post-solar install kWh usage relative to a matched comparison group of future participants over the same time period.

participants are estimated to have a 68 percent decrease in net energy usage (5.2 MW annually) and a 94 percent decrease in their net electric bill cost ($990 annually).

Table 38: Estimated Annual Savings Per Home

Savings	Gross Estimated Annual Savings	NTG Adjustment (net / gross)	Net Estimated Savings (after NTG adjustment)	Percent of Savings	N Observations
Annual Energy Savings	4,577 kWh	1.132	5,179 ± 28 kWh	68%	2,425,533
Annual Bill Savings	$870	1.177	$990 ± 6	94%	2,528,294

Source: Evergreen analysis of electricity consumption and costs of program participants and matched comparison group for program years 2019-2021.

The solar systems installed through DAC-SASH are intentionally undersized to motivate customers to consider efficiency. The program rules include a provision that "the maximum system size that can receive incentives would be based on an estimate of the household's annual load, assuming all weatherization and energy efficiency measures with a two-year payback or less are undertaken."[35] Notably, the rules do not include a specific benchmark, such as 80 percent of the baseline, to aim for.

One downside to this rule is that there is no allowance for future loads from electrification, such as heat pumps and electric vehicles. GRID staff reported that they hear from customers often about wishing they could add more panels. Although the survey did not directly ask about electrification and the number of panels installed, the number of free text responses mentioning these topics suggests there is a need to investigate the system sizing rules for the program (n=3 for DAC-SASH, n=17 for SASH). Specifically, one said that they "wish it [would] produce 100% of my electricity needs and not have a true up bill." Another mentioned electrification, as "We would like to move away from gas appliances. It would be nice if more panels could be added to keep up with these changes."

On Panel Sizing: "We would like to move away from gas appliances. It would be nice if more panels could be added to keep up with these changes." – Survey Respondent

In absence of the program, we would expect participants' energy bills to have increased by around 18 percent (or to 1.177 times the size). **Instead of increasing, like the comparison group, participants' bill costs *decreased* by $870 per year, as we expected. The overall benefit of the**

[35] Decision 07-11-045 that established SASH. DAC-SASH rules reference this decision, so the text applies to both programs. Retrieved from: https://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/75400-05.htm#P233_54557

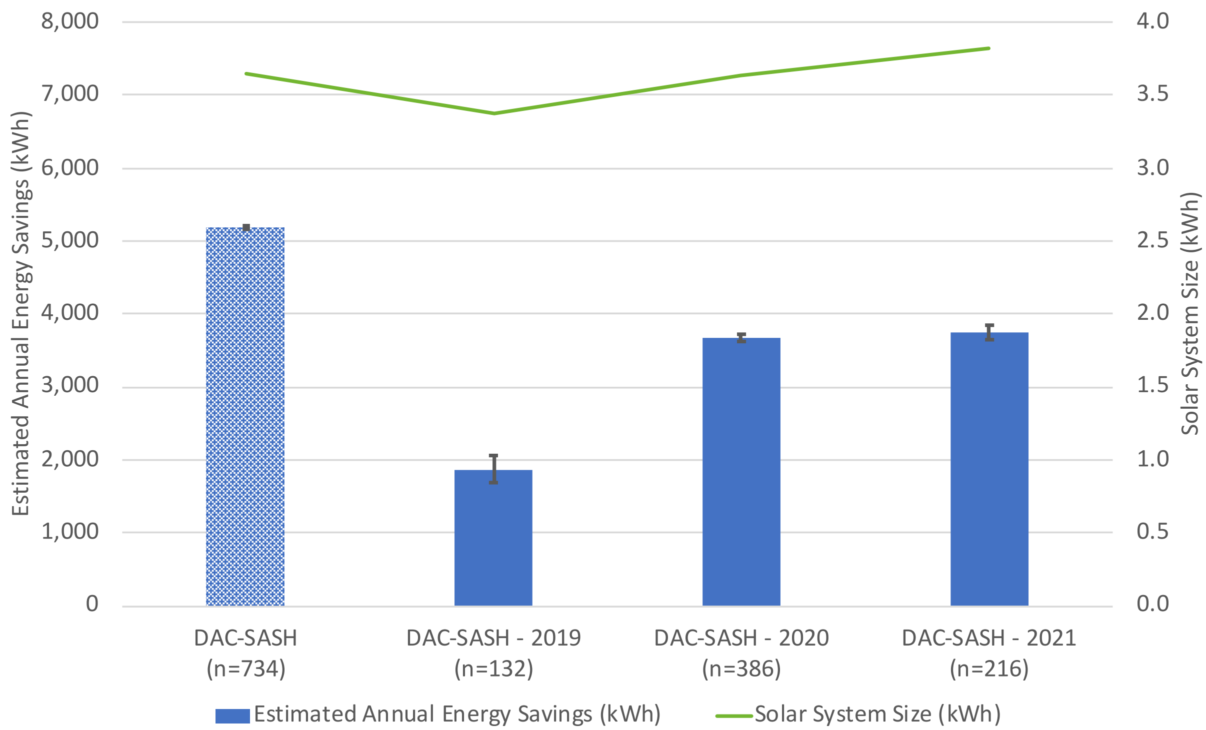
program includes the gross bill savings as well as the avoided bill increases, which increases our savings estimate from $870 to $990 per year for DAC-SASH.

Though participants are seeing bill savings, when shifting to net metering, many participants go from monthly to annual true up bills (10% of participants mentioned this). As one participant put it, "I was surprised I have not received a bill in over 12 months from [my utility] since installing the panels. I have called but apparently, I was switched to an annual plan." Even though solar has decreased their annual electricity bill, it also caused some customers to incur a single large bill that is difficult to predict.

Savings by Program Year

Figure 23 shows the net annual energy savings per home for each year of the DAC-SASH program and the average size of the solar system installed during each year. The left-hand column shows the overall program-level estimate, followed by individual estimates for each program year on the right. Program years 2020 and 2021 are estimated to have saved participants around 3.7 MW annually; when combining all the years into an overall DAC-SASH model, the annual net energy savings estimate is 5.2 MW.[36]

Figure 23: Estimated Net Annual Per Home Energy Savings



Source: Evergreen analysis of energy consumption of program participants and matched comparison group for program years 2019-2021

[36] The program level results are not the average of the yearly results; the program level estimate is based on a pooled model, including participants from all program years to estimate savings at the program level.

Table 39 shows the estimated annual gross energy savings per home, NTG adjustment, estimated annual net energy savings per home, percent of energy savings, and the number of observations in the model, by program and year that the solar was installed. **The estimated annual net energy savings per home fluctuates around 3 to 5 MWh per year, which is 45 to 68 percent of a participant's annual energy usage.**[37] Again, these systems were intentionally undersized to motivate participants to pursue energy efficiency to further reduce their bill.[38]

Table 39: Estimated Annual Energy Savings Per Home

Program - Year	Gross Estimated Annual Energy Savings (kWh)	NTG Adjustment (net/gross)	Net Estimated Annual Energy Savings (kWh, after NTG adjustment)	Percent of Energy Savings	N Observations
DAC-SASH - Overall	**4,577**	**1.132**	**5,179 ± 28**	**68%**	**2,425,533**
DAC-SASH - 2019	1,654	1.132	1,871 ± 188	27%	424,990
DAC-SASH - 2020	3,241	1.132	3,667 ± 51	49%	1,312,202
DAC-SASH - 2021	3,311	1.132	3,746 ± 96	45%	688,341

Source: Evergreen analysis of energy consumption of program participants and matched comparison group for program years 2019-2021.

Note: The overall program level results are not the average of the yearly results because this is based on a pooled model, including participants from all program years to estimate savings at the program level.

Table 40 shows the estimated annual gross electricity bill savings per home, NTG adjustment, estimated annual net electricity bill savings per home, percent of bill savings, and the number of observations in the model, by program and year. **The estimated annual net electricity bill savings per home fluctuates from approximately $689 to $990.** There are a few changes in the solar industry over this time period. The gross bill savings fluctuate likely due to changes in annual generation, consumption, net energy metering (NEM) rate (as NEM 1.0 offered higher compensation for generation) and increases in rates.

[37] The program year that falls outside this range (2019) has a small sample size, which is less reliable as it would be more prone to error.

[38] The maximum allowed system size is based on the household's annual load assuming all weatherization and energy efficiency measures with a two-year payback or less are undertaken. In other words, the solar systems incentivized by the program will always be less than the baseline consumption.

Table 40: Estimated Annual Bill Savings Per Home

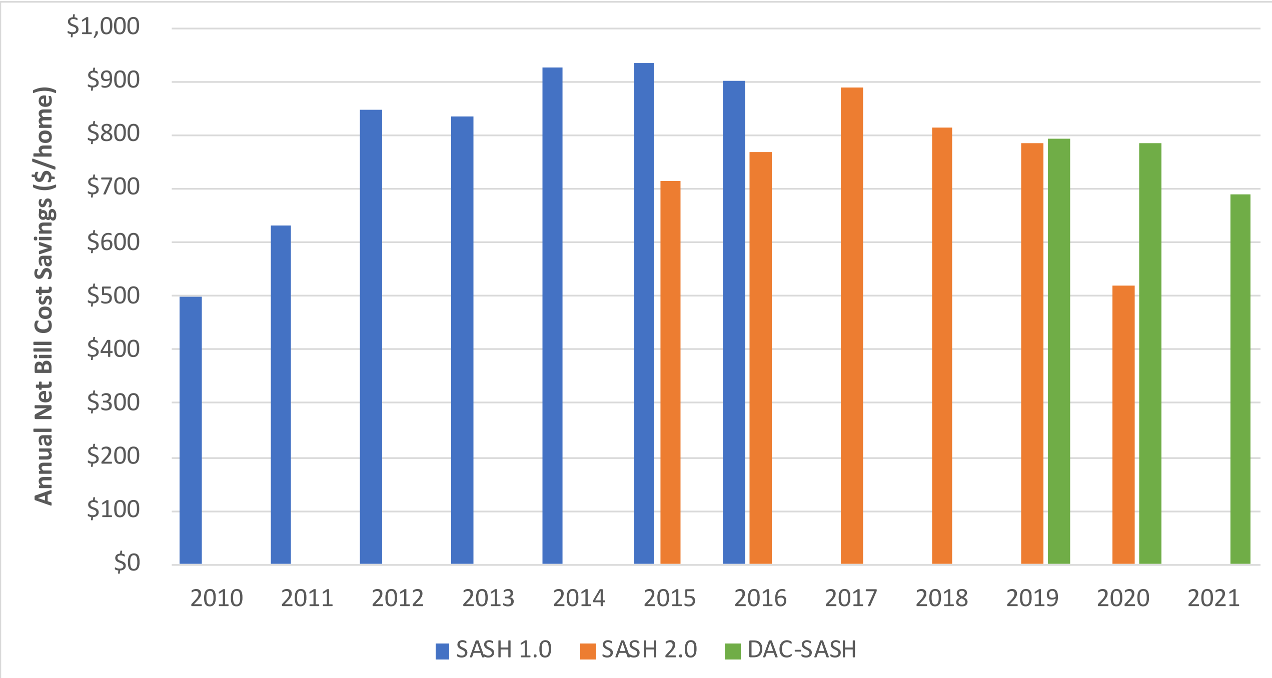
Program - Year	Gross Estimated Annual Electricity Bill Savings ($)	NTG Adjustment (net/gross)	Net Estimated Annual Electricity Bill Savings ($, after NTG adjustment)	Percent of Electricity Cost Savings	N Observations
DAC-SASH - Overall	**$870**	**1.177**	**$990 ± 6**	**94%**	**2,528,294**
DAC-SASH - 2019	$698	1.177	$795 ± 27	89%	520,548
DAC-SASH - 2020	$688	1.177	$784 ± 12	73%	1,316,659
DAC-SASH - 2021	$605	1.177	$689 ± 13	61%	91,087

Source: Evergreen analysis of electricity costs of program participants and matched comparison group for program years 2019-2021.

Note: The overall program level results are not the average of the yearly results because this is based on a pooled model, including participants from all program years to estimate savings at the program level.

In Figure 24, we show the estimated annual net electricity cost savings, after the NTG adjustment, by program and installation year. We include bill impacts for SASH 1.0 and SASH 2.0 as a point of comparison for DAC-SASH. During 2019, the first year of the DAC-SASH program, participants saved an average of $795 with DAC-SASH and $785 with SASH 2.0. **This suggests that DAC-SASH is providing similar benefits as the SASH 2.0 program. The DAC-SASH bill savings were relatively consistent from 2019 to 2022, ranging from $689 to $795 per year.** Average energy savings for SASH 2.0 dropped off in 2020 (to $520), but this may be driven by a dramatic drop in sample size, with only 85 participants contributing to the impact estimate for SASH 2.0 in 2020 (down from n=577 in 2019), as the program came to an end.

Figure 24: Estimated Annual Net Bill Savings per Home



Cumulative First-Year Savings by Program Year

We extrapolate from the impact analysis sample to the full population of program participants to provide an estimate of the cumulative program impact. **To date, the DAC-SASH program is estimated to have a first-year net savings total of 4,946 MWh, and a first-year electricity bill net savings total of $945,450.** Solar panels have an expected useful life of 25 years, so these savings will continue beyond one year, as the panels will continue generating electricity; please note that the energy savings depends on many factors (e.g., panel degradation, weather, and energy consumption), as does bill savings (e.g., energy consumption and utility NEM rates). For detail on all years of the program (including SASH 1.0 and SASH 2.0), see Section 6.5.

Savings by Customer Segment

Next, Table 41 provides the estimated energy savings by program and selected customer segment. We omitted customer segments with fewer than 30 customers, as the sample is likely too small to draw meaningful conclusions from. The segmentation analysis revealed some important differences across segments:

- PG&E has slightly lower estimated annual kWh savings when compared to SCE; however, the average SCE participants' pre-install kWh usage is larger, resulting in SCE participants having a slightly lower percent of energy savings.

- The size of the solar system installed is related to kWh usage, as demonstrated by the percent of energy savings for the 2-4 kWh size bins being roughly 62 to 75 percent.[39] An increase in solar size over time does not necessarily mean an increase in percent of kWh savings over time.
- Homes that own their solar panels had much lower average pre-install kWh usage, resulting in a much lower estimate of kWh energy savings when compared to third-party owned (TPO) panels. This is likely due to differences in the system size, as all participants are defaulted to TPO unless they are on tribal land or the roof cannot support enough panels to meet the minimum generation requirements (i.e., owned systems are almost always smaller than TPO systems).[40]

Table 41: Estimated Annual Net Energy Savings by Subgroup

Category	Sub-group	Est Annual Net kWh Energy Savings (After NTG adj)	Percent of Energy Savings	N
Overall		5,179	68%	734
Utility	PG&E	4,934	72%	501
	SCE	4,587	59%	216
	SDG&E			17*
Size	1 kWh system	2,114	80%	76
	2 kWh system	3,329	62%	125
	3 kWh system	4,771	75%	198
	4 kWh system	6,201	68%	335
Owner	TPO	5,144	68%	655
	Homeowner owned	3,439	93%	79

Source: Evergreen analysis of energy consumption of program participants and matched comparison group for program years 2019-2021.

4.9.2 Timing of Savings by Hour and Day

This section provides estimates for the average energy usage following the installation of the solar panels by time-of-day and day-type.

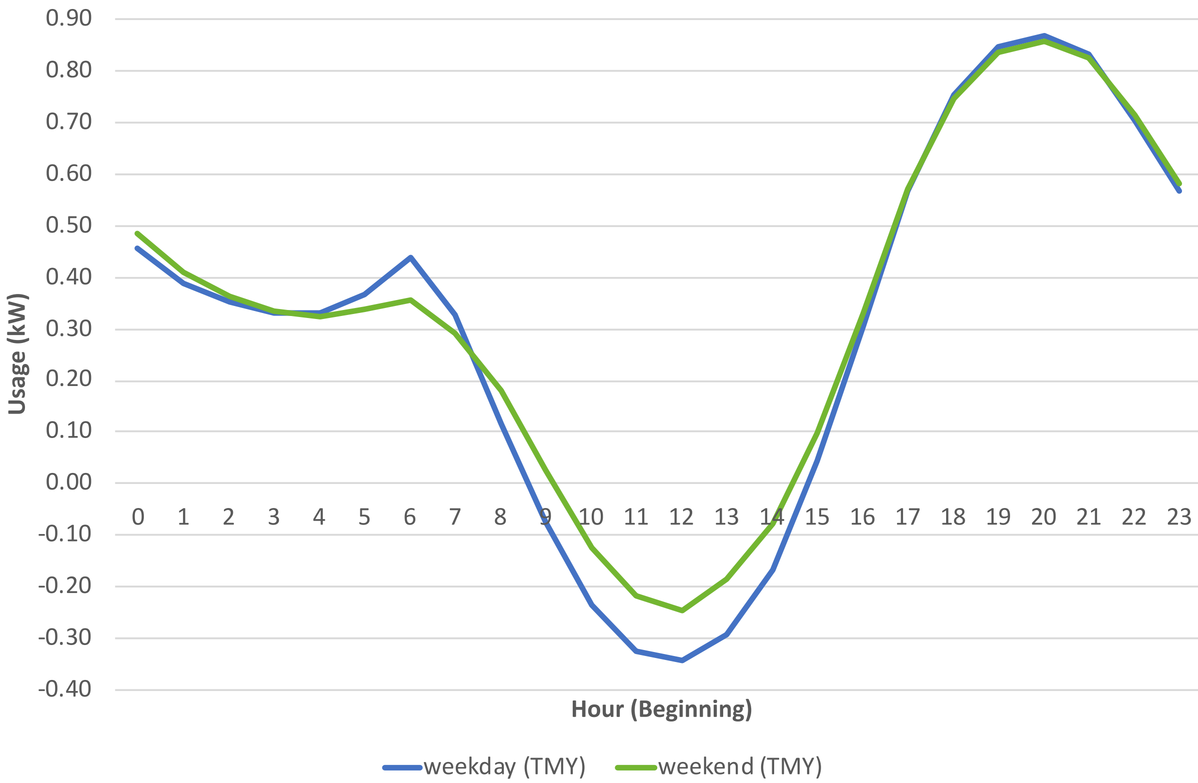
[39] These systems are intentionally undersized (per program rules) to motivate participants to pursue energy efficiency to further reduce their bill.

[40] As of 2020 or earlier, TPOs were used whenever possible.

Estimated Hourly Energy Usage

Figure 25 shows the estimated load shape for a normalized weather-year. After solar panels have been installed, the average customer in a weather normalized year has peak energy usage in hour 20 (0.87 kW on a weekday and 0.86 kW on a weekend), the lowest usage at noon (below zero kW when the panels are generating) and has a smaller morning peak at 6am (0.44 kW on a weekday and 0.36 kW on a weekend).

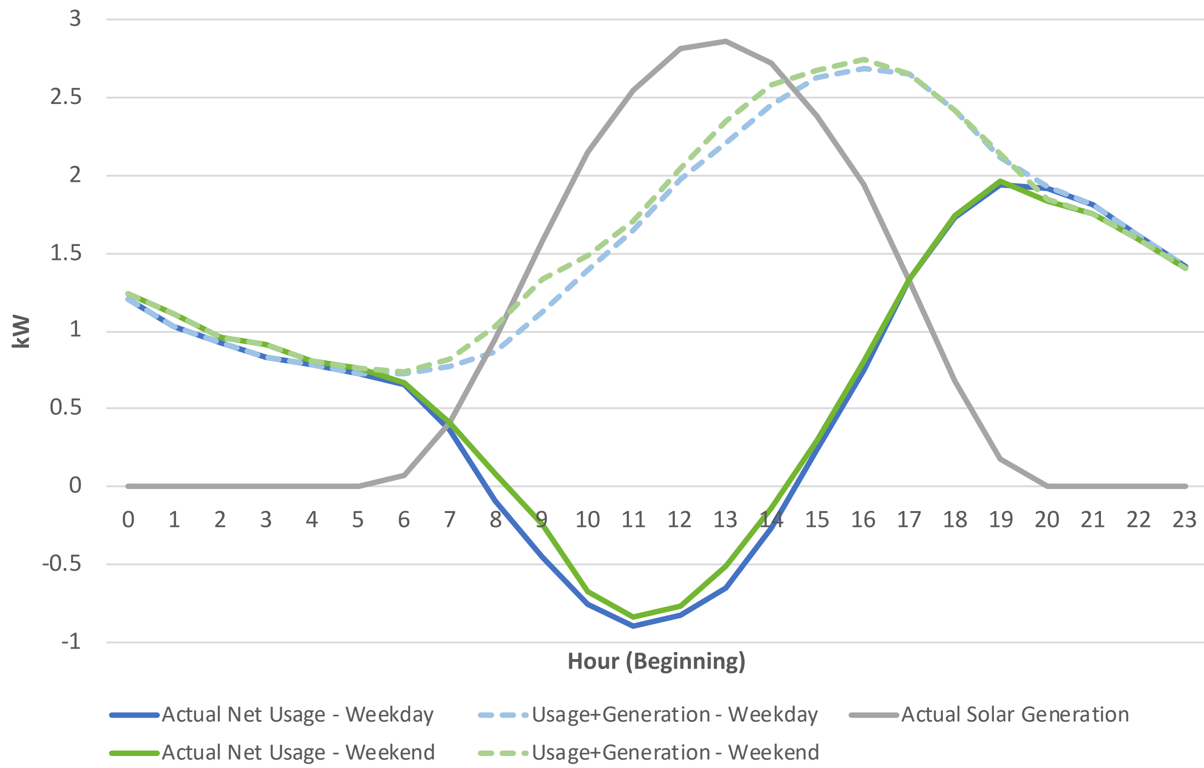
Figure 25: Estimated Average Post-Install Hourly Load Shape for a Normalized Year



Source: Evergreen analysis of energy consumption of a sample of 100 program participants for program years 2010-2021.

Figure 26 shows the average net energy usage (solid green and blue lines), average generation (grey line), and the average consumption (i.e., net usage + generation; dotted lines) plus generation load shapes for two weeks in July 2022 (July 12 - July 25, 2022). The average sampled participant in July 2022 has peak energy consumption in hour 16 (2.69 kW on a weekday and 2.75 kW on a weekend). The average solar panel is at its peak generation during hour 13 (2.86 kW). What the utility will experience is a peak in net usage (i.e., consumption from the grid beyond self-generation) during hour 19 (1.94 kW on a weekday and 1.96 kW on a weekend) and the lowest net usage at noon (-0.90 kW on an average weekday and -0.84 kW on an average weekend, when the panels are generating).

Figure 26: Average Post-Install Hourly Load Shape for July 2022



Source: Evergreen analysis of energy consumption of a sample of 100 program participants for program years 2010-2021.

4.10 Environmental Benefits

GRID staff reported that most participating customers are motivated by lower energy bills. Part of the program's charge, however, is to educate customers on the environmental benefits as well. This section explores the perceptions of environmental benefits and the actual calculated impacts.

4.10.1 Greenhouse Gas (GHG) Emissions Analysis

The Evergreen team estimated the GHG impacts of the DAC-SASH program PV systems in reference year 2021. This evaluation relies on avoided grid emissions rates developed by WattTime as part of the self-generation incentive program (SGIP) GHG Signal efforts.

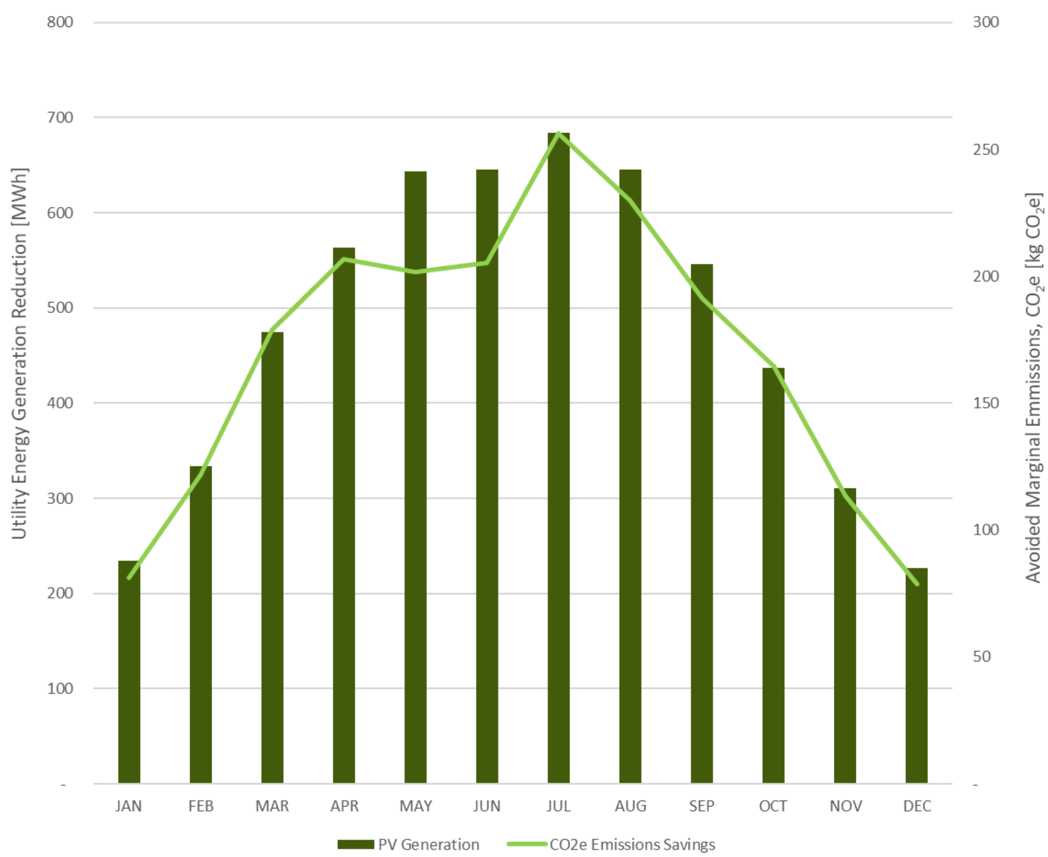
Program PV systems are estimated to reduce GHG emissions by 2,030 metric tons (MTons) of CO_2 equivalent (CO_2e) or 2,026 MTons of CO_2 using 2021 emission rates. Criteria pollutant reductions equate to 63 kg of methane (CH_4) reduction and 7.7 kg of nitrogen oxide (NOx) reduction (Table 42).

Table 42: Distribution of Estimated GHG Impacts by IOU

IOU	CO_2 Emissions Savings [MTon CO_2]	CH_4 Emissions Savings [kg CH_4]	NO_x Emissions Savings [kg NO_x]	CO_2e Emissions Savings [Mton CO_2e]
PG&E	1,415	44	5.4	1,417
SCE	556	17	2.1	557
SDG&E	56	1.7	0.2	56
TOTAL	**2,026**	**63**	**7.7**	**2,030**

Figure 27 shows estimated GHG savings by month along with the estimated total PV system generation from DAC-SASH projects. Note that the magnitude of GHG savings is not directly aligned with the PV system generation alone. More GHG savings result from specific months due to the source-mix of the avoided electricity that would have been provided by the electric utility. July was the month with the highest share of top 200 demand hours and is also the month that provides the most GHG savings from DAC-SASH PV systems.

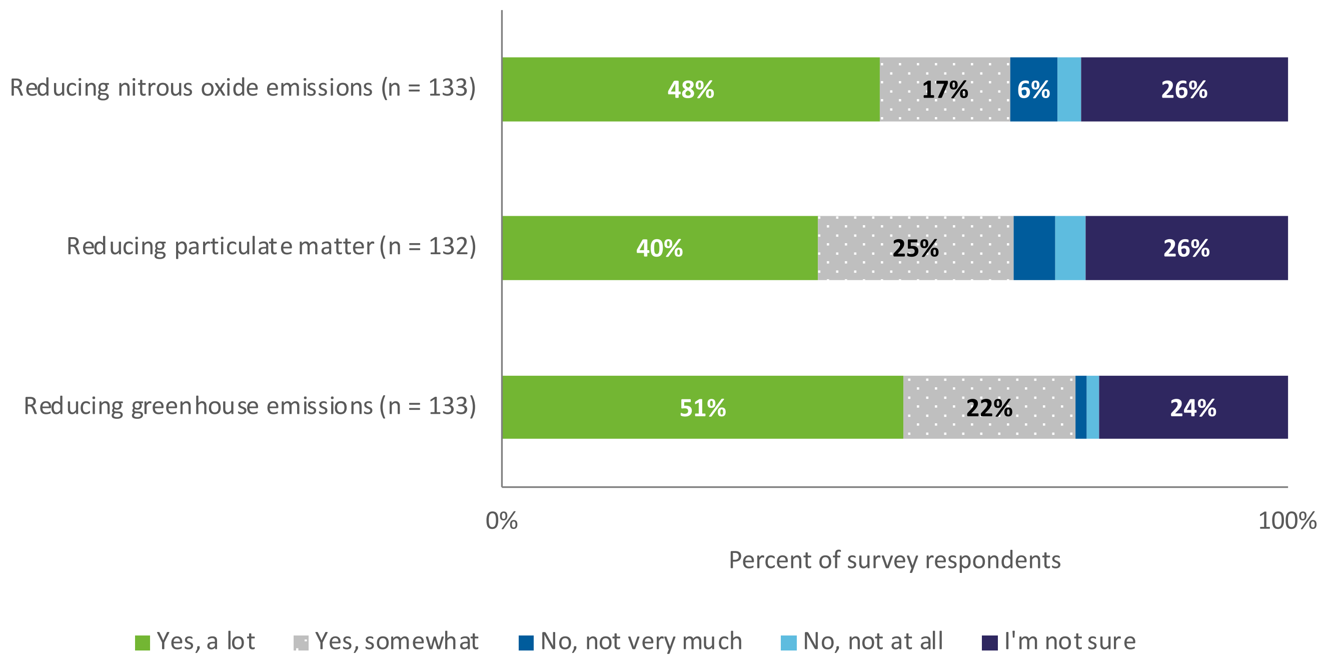
Figure 27: Estimated GHG Impacts and DAC-SASH Generation



4.10.2 Customer Perceptions

The survey found that over half of participant respondents believed that the DAC-SASH program is responsible somewhat or a lot for reducing nitrous oxide emissions, particulate matter, and GHG emissions (Figure 28).

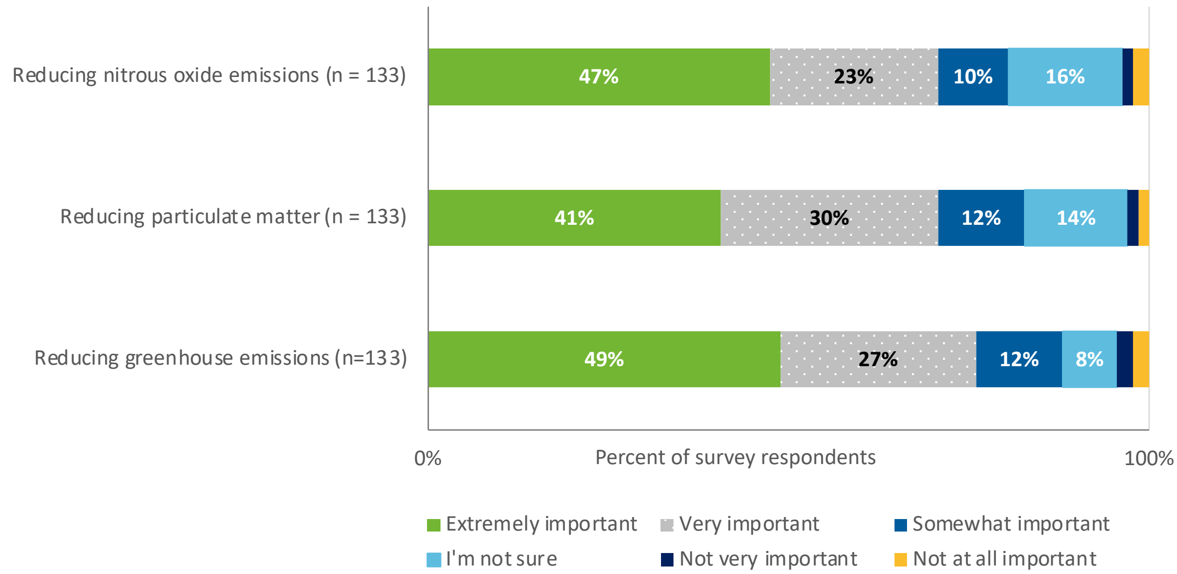
Figure 28: Participant Perception of Program's Environmental Impact



Non-participant respondents were equally likely to report that the program could help in the reduction of emissions and provide environmental benefits.

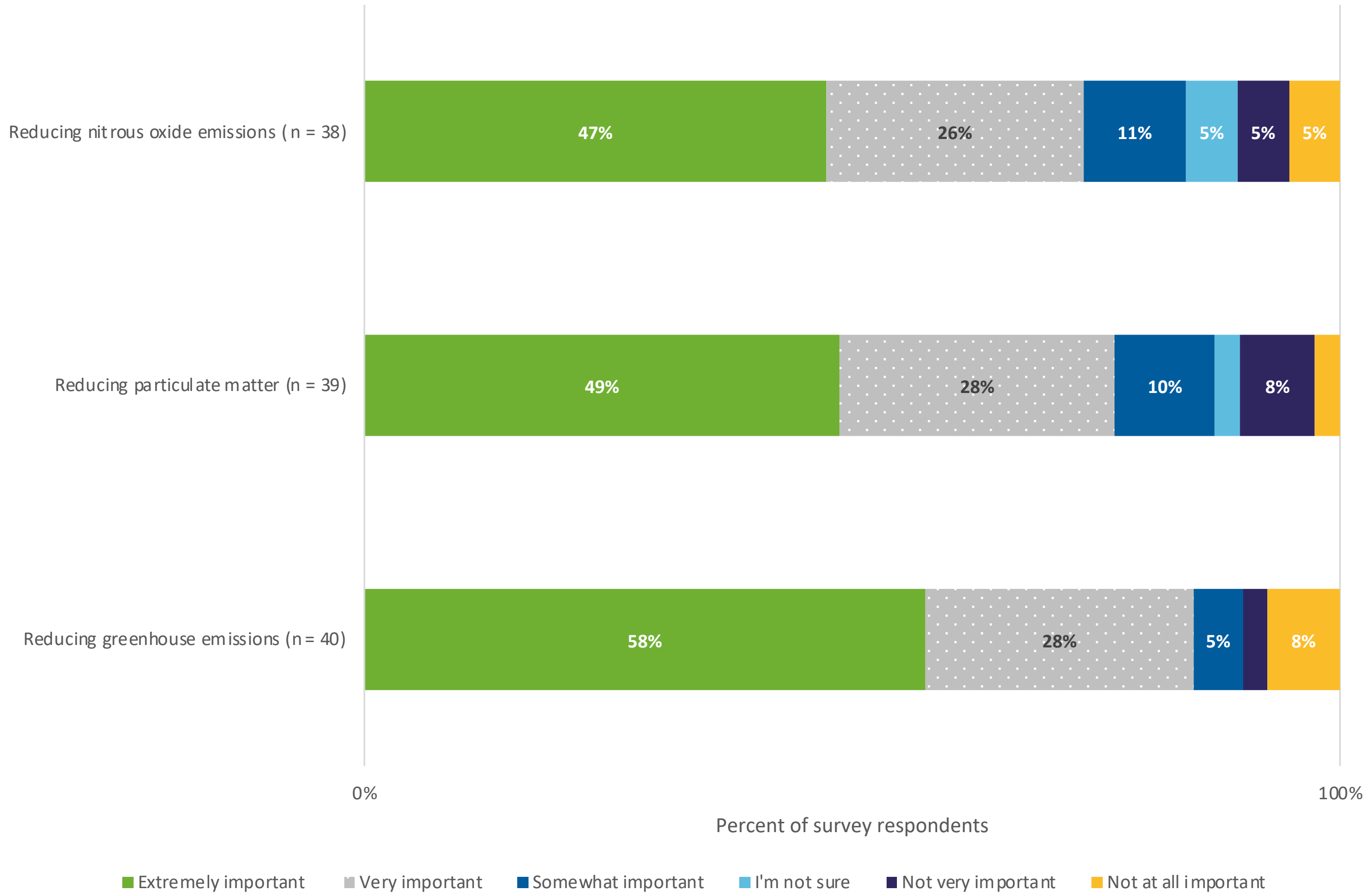
Although participants and non-participants had similar perceptions of the program's impact on environmental benefits, participants were more likely to report that those benefits were important to them personally. Figure 29 shows that most participants reported that the reduction of the emissions listed was important.

Figure 29: Importance of the Program's Environmental Benefits (Participants)



In contrast, Figure 30 shows that more non-participant respondents said the benefits were not at all important to them, indicating that participants may be more likely to care about environmental benefits than non-participants.

Figure 30: Importance of the Program's Environmental Benefits (Non-Participants)



4.11 Workforce Development and Job Training

A defining feature of the DAC-SASH program is integrated workforce development. In this section, we present findings from the trainee web survey, the onsite field visits, and interviews with trainees to characterize the workforce development mandate of the DAC-SASH program to answer the following questions:

1. What job training programs are being leveraged?
2. How many local jobs are being created?
3. What are the longer-term job outcomes for trainees?

Findings related to the value of training courses and volunteer outcomes, career progression, and barriers to participating in the trainings are below. Further findings from the trainee survey on program marketing and the value of different elements of the training program are in Appendix 6.4 and 6.5.

4.11.1 Training Program Background

To promote green jobs in low-income communities, GRID administers Install Basic Training (IBT), a solar installation training program. GRID designed the IBT course with the help of a consulting firm, Accenture, and runs it out of its regional offices. The IBT courses provide classroom instruction, lab activities, and real-world experience on solar installations to participants. The goal of the IBT program is to provide an effective, efficient, and equitable pathway into the solar industry.

The IBT program is not funded by DAC-SASH but integrates well with the workforce development goals of the program. Each DAC-SASH installation requires at least one trainee to be present to gain on-the-job experience. Trainees can either be volunteers or IBT members.

GRID often partners with municipalities or CBOs to offer trainings that provide a stipend for the IBT classes. This external funding allows for greater reach, as targeted communities may not be able to participate without compensation.

GRID also utilizes volunteers as part of its mission to educate local communities about solar opportunities. We differentiate between these two groups in our analysis due to the significant differences in experience for the participants.

GRID-provided data were often missing a trainee type (volunteer or trainee) so for analysis purposes, we used self-reported data from survey respondents to identify if they were IBT trainees (n=56) or volunteers (n=57).

Table 43 shows the range of trainee types listed in GRID's database, compared to how they self-reported in the survey.

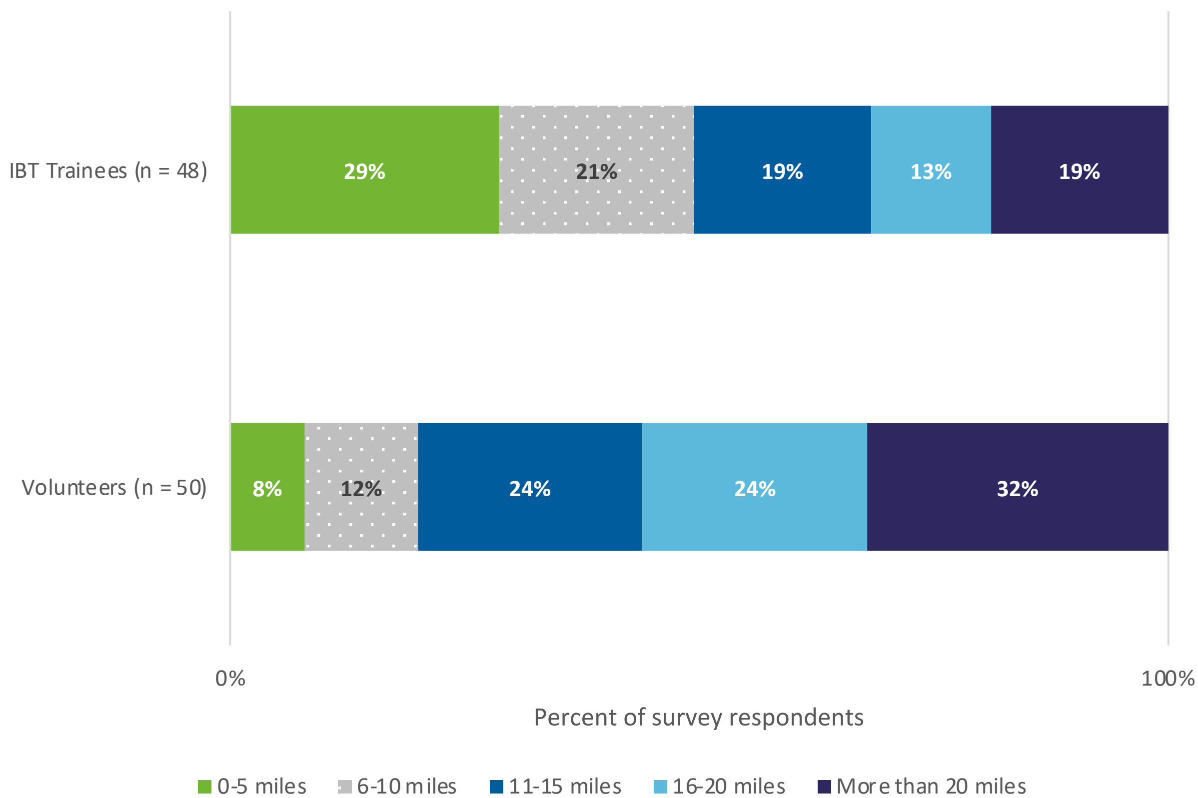
Table 43: Trainee Types Surveyed (n = 114)

Category for Survey Analysis	Trainee Type	N
IBT Trainee	Paid Cohort Trainee	5
	Paid Intern	2
	SolarCorps (paid internship with GRID)	3
	Unpaid Cohort Trainee	16
	Unpaid Intern	1
	Not Reported	29
Volunteer	SolarCorps	2
	Unpaid Cohort Trainee	1
	Not Reported	55

GRID administers the IBT classes out of its regional offices but did offer a virtual option during the COVID-19 pandemic. Our evaluation included an onsite visit to an IBT training at the North Valley office to observe training and speak to trainees and staff. Staff there noted that most trainings and volunteers work in the North Valley due to their capacity to train and the number of installation opportunities available in the region. The location of trainings was important to the context of the evaluation to determine if trainees and volunteers are coming from DACs or tribal communities or travelling to those communities for the opportunity. The intent of the workforce development component of the program is to encourage green job training within DACs and to provide economic benefits for those communities.

Trainee data did not include the trainees' home addresses, so we could not determine if most trainees were coming from DACs themselves. Our survey analysis did include questions about distances travelled, however. On average, to attend the GRID's IBT course, half of respondents only traveled between zero- and 10-miles roundtrip, while only about a fifth traveled more than 20 miles (Figure 31). By comparison, roughly one-third of volunteers traveled more than 20 miles to attend installations.

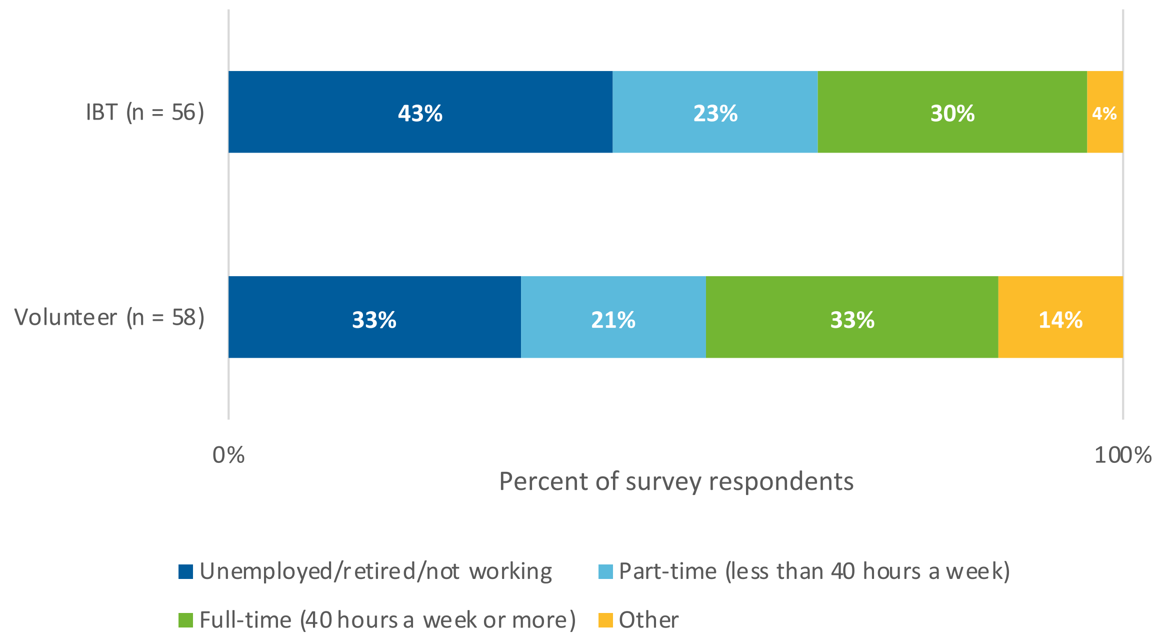
Figure 31: Distances Travelled to Attend Training or Volunteer Location



4.11.2 Training and Career Outcomes

Most IBT participants and about a third of volunteers reported that they were unemployed, retired, or not working before participating with GRID (43% and 33%, Figure 32). The percentage of those who worked full-time before was also very similar for both groups (30% for the IBT participants and 33% for the volunteers).[41]

Figure 32: Employment Status Before Participation



After participation, respondents were more likely to report that they had a full-time job. As shown in Figure 33, participants in both groups (46% of IBT participants and 52% of volunteers) reported that they are now working full-time. There was also a significant reduction in unemployment, with only 16 percent of those who attended the IBT course and 5 percent of the volunteers reporting unemployment post-participation.[42] These numbers align with GRID's estimate that 45 percent of job trainees are employed after the training.[43] GRID staff interviews found that there is no formal method of tracking trainees' job prospects after they leave the program, but that many regional offices make efforts to survey their participants. At the time of this research, GRID headquarters was working to create a statewide survey of trainees to better capture these effects in a

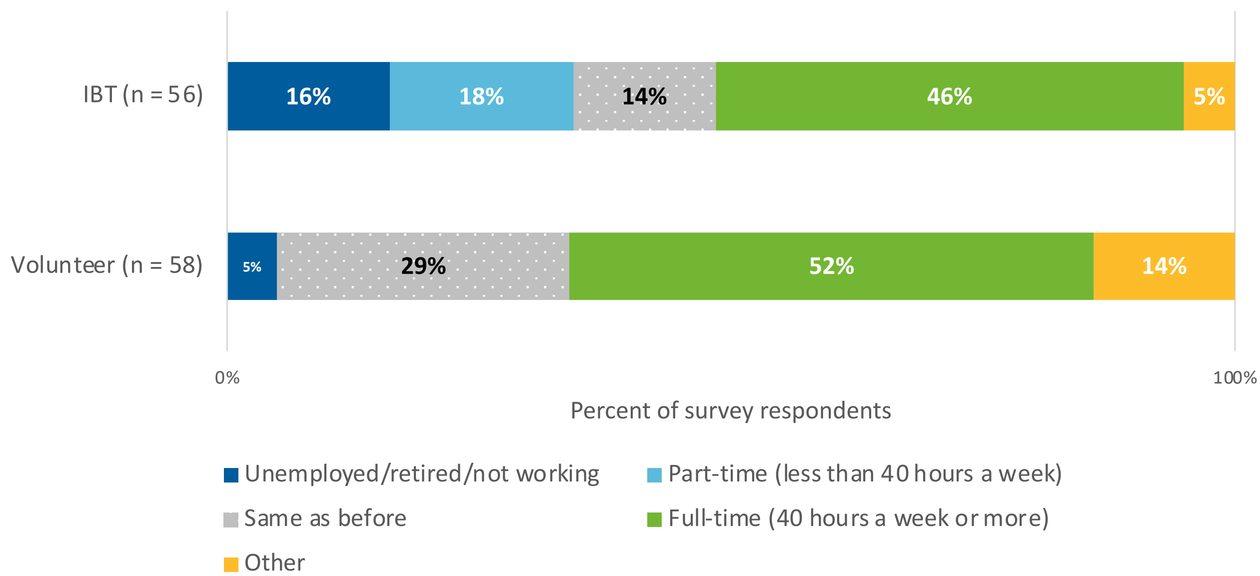
[41] Those who selected "other" were asked to specify. Answers from both sets of participants included studying at educational institutions (4), working other jobs (2), health-based incapacitation (1), and doing commission-based work (1).

[42] Those who chose 'other' in both groups were asked to specify and the answers that were reported included attaining work in the solar and environmental industry (4), attaining education (3), working as instructors (2), and attaining work not within the solar field (1).

[43] GRID provided this estimate via email during the evaluation but did not provide the source.

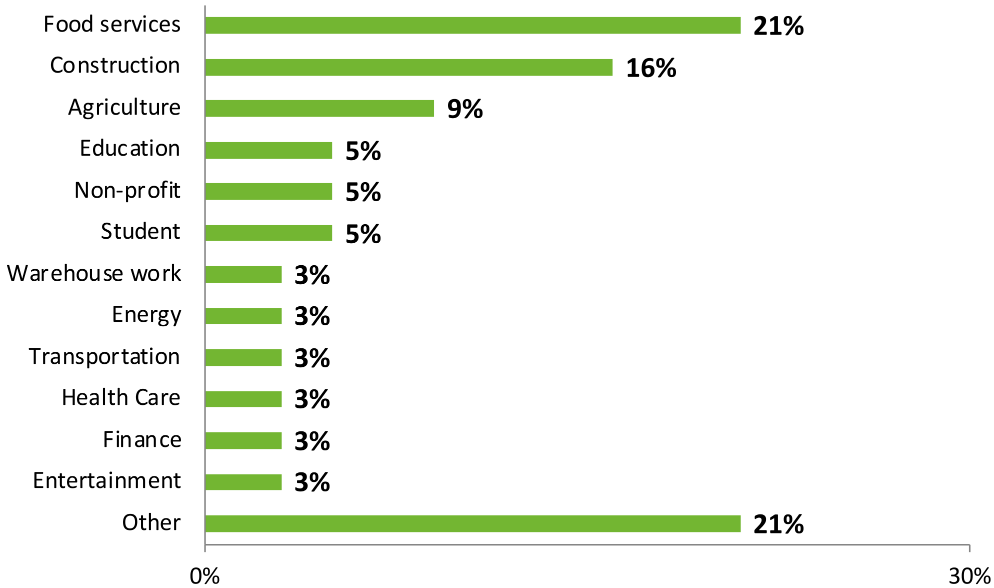
systematic way. Additionally, GRID estimated that 11 percent of the trainees were hired by GRID after its training program. Our survey did not ask about specific employers, but the evaluation team did speak to a few staff members at regional offices who were hired after the trainee program.

Figure 33: Employment Status After Participation



We asked participants to specify types of employment before GRID involvement. Most participants (91%) had not been employed in the solar industry before participating in the training. Twenty-one percent of respondents indicated that they worked in food services, while 16 percent said construction. Figure 34 displays all other responses chosen.

Figure 34: Type of Employment Before Participation (n = 58)

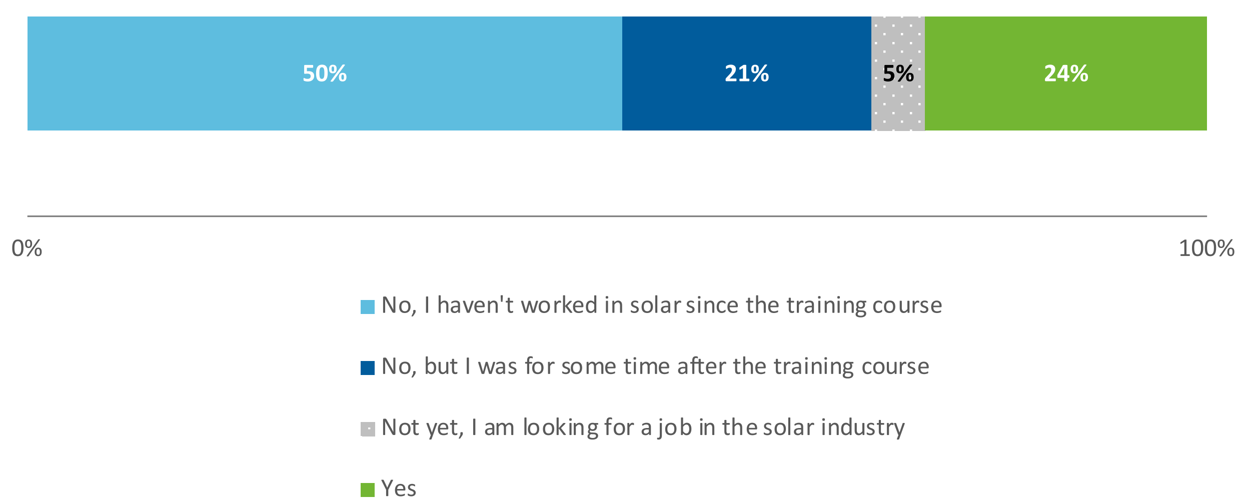


For those who selected “Other,” respondents filled in free text to indicate that they were working in science research, technology, engineering, pharmacy, and fiber optics.

4.11.3 Career Progression

Figure 35 shows that half of all respondents have not worked in solar since the training course or since volunteering. The other half of respondents either worked in the solar industry for some time (21%), currently work in the solar industry (24%), or are looking for employment in the solar industry (5%). Comparing the pre-employment industries, however, the number of people in the solar industry did increase significantly after participation (9% to 24%).

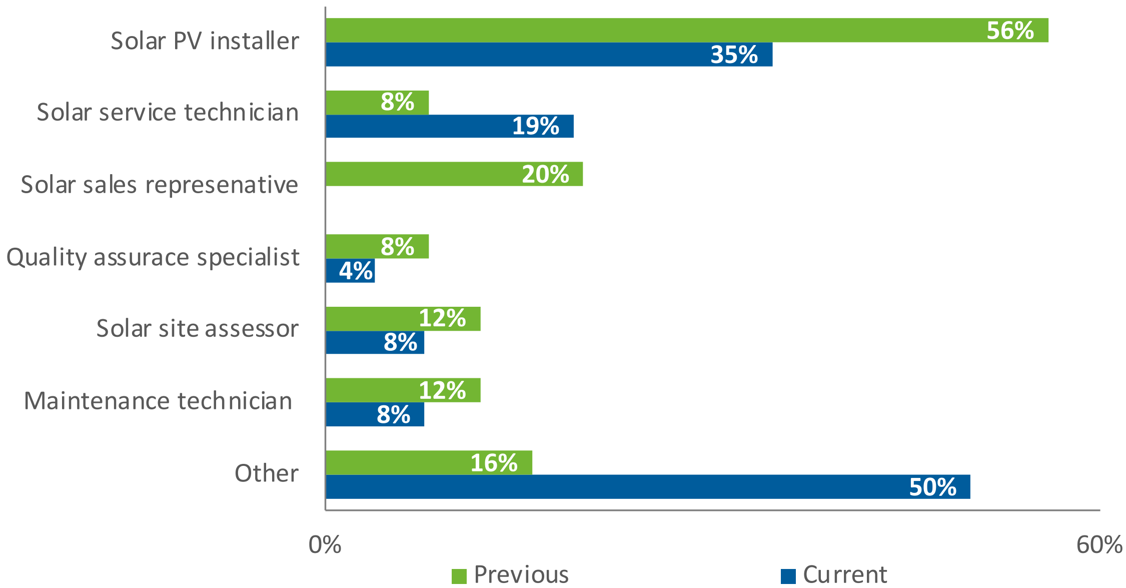
Figure 35: Solar Industry Employment Since Participation (n = 109)



Of the respondents now working in the solar industry (n=26), the majority (81%) found employment within two years of participating with GRID. Over half (57%) were employed in solar less than six months after the training.

Among respondents employed in the solar industry, there was a shift in their role after their involvement with GRID and working on a DAC-SASH or SASH project, as shown in Figure 36. Participants listed their current or previous roles in the solar industry. Of those holding current positions in the solar industry, half (50%) fell into the “Other” category and wrote in that they hold positions such as instructors, project managers, and designers. Of those who previously held a position in the solar industry, most (56%) were solar PV installers. Figure 36 provides an overview of respondent current and previous roles in the solar industry and suggests that many respondents are currently working in more complex and likely higher paid roles after involvement.

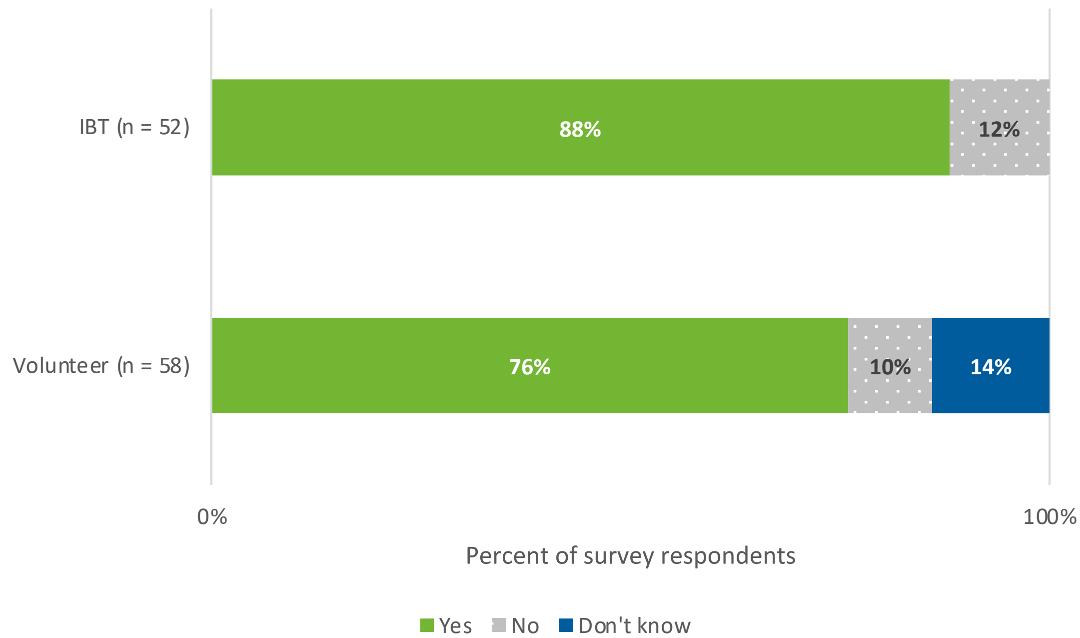
Figure 36: Roles in Solar Industry (n = 51)



Very few participants shared reasons for no longer working in the solar industry. Of those that shared (n=3), the responses were "I am in the greenhouse building industry," "Back injury," and "Because I went back to my trade which is electrician."

Both IBT and volunteer respondents mostly reported that involvement with GRID projects improved their career opportunities (Figure 37), with volunteers reporting “don’t know” more frequently.

Figure 37: Belief in Improvement of Career Opportunities after Participation



The participants who said 'yes' to whether they believed that spending time with the GRID projects doing on-site installations improved their career opportunities in the solar industry were further asked to describe how the on-site training helped them. Forty-one IBT participants and 39 volunteers gave several explanations as to how they believed their career prospects were improved, most of which are summarized in Table 44 below.

Table 44: Respondent Belief on How Participation Improved Career Prospects (n = 80, multiple responses allowed)

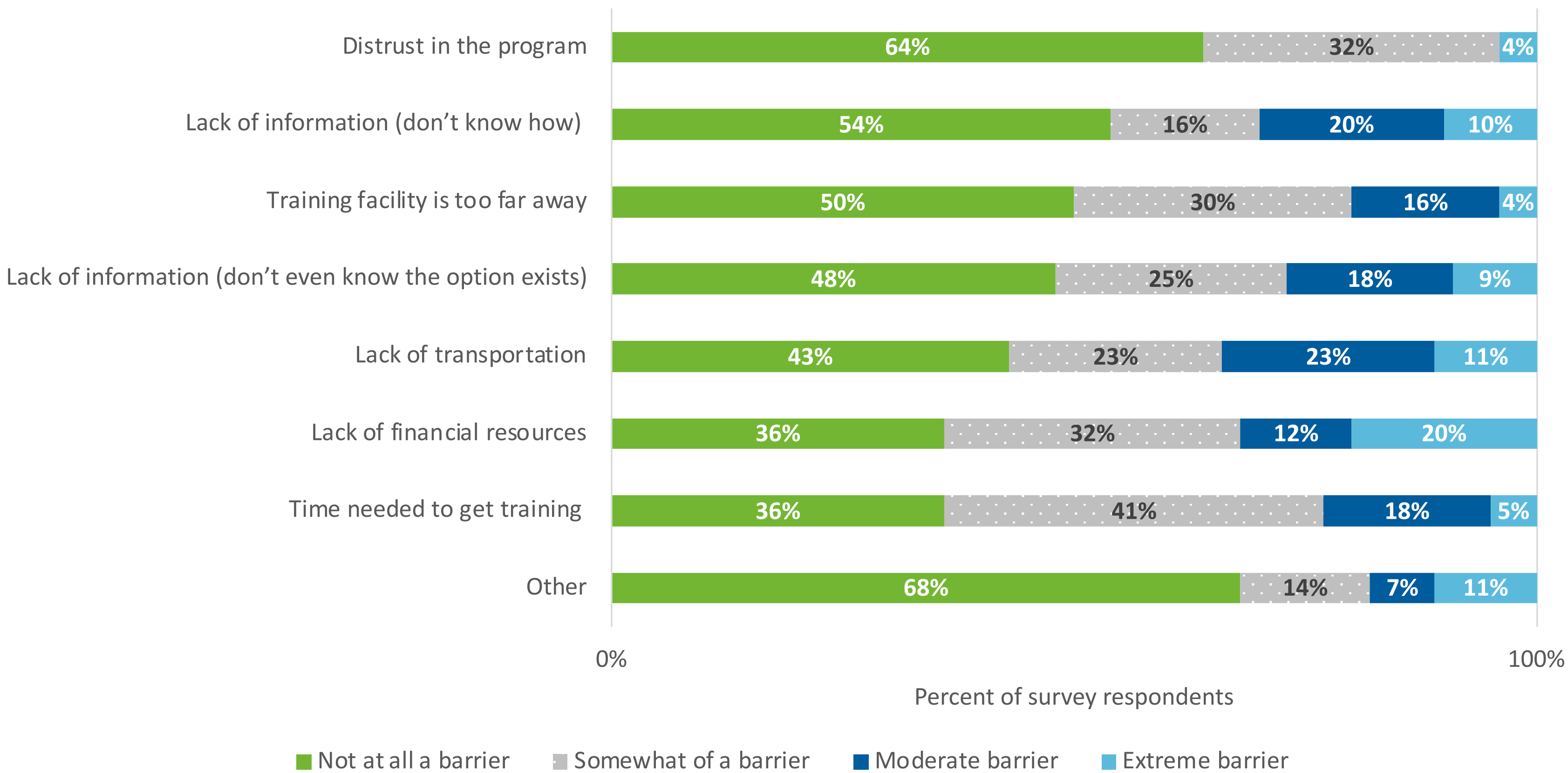
Gaining more technical knowledge and hands-on experience (n=60, 75%) 	"Being able to sit in a classroom and learn about solar, then get hands on experience made getting into the industry a reality." (IBT) "Having hands on experience seems like it will be valuable if I ever interview to work in solar. The process was especially helpful because we were working with more experienced installers who helped to explain everything." (Volunteer)
Assistance with employment and networking opportunities (n=31, 39%)	"After taking the course I feel I can install a solar panel with little to no help. I know there can be great doors open for me in solar work. All I have to do is apply." (IBT) "Volunteering made me a familiar face with GRID staff, so that created the opportunity to intern, then become a

	SolarCorps fellow and then project manager…” (Volunteer)
Personal development (n=11, 14%) 	“It helped me in my interpersonal people skills, it provided me with basic solar installation knowledge, and it taught me how to be a better team player.” (IBT) “If I chose to pursue a career in solar, GRID prepared me from beginning to end including prep, the install processes, and what to expect. I developed customer service skills speaking with homeowners and had the opportunity to work more with conduits…” (Volunteer)

4.11.4 Barriers to Participation

Participants in both courses were asked how much of a barrier various factors are to getting hands-on experience in the industry (Figure 38). Most respondents said that the options listed were “not at all a barrier.” However, lack of financial resources, lack of transportation, and lack of information were most reported as a moderate or extreme barrier.

Figure 38: Barriers to Gaining Experience in the Industry (n varies)



Those who chose ‘other’ were asked to further specify what they meant, to which the answers reported were:

- Inclusivity barriers due to gender and language (6);
- Lack of work opportunities (3);
- Difficult work environment because of constant schedule changes, long commutes, and no breaks (3);
- Personal motivation (2);
- No job guarantee and low starting pay (2); and
- Family and childcare responsibilities (1).[44]

The IBT participants who were affected in some way by the barriers reported (n=44) were asked if they had any suggestions for how programs might be developed to overcome any of the barriers. Table 45 categorizes the free response answers into four groups: General improvement, assistance with financial and transportation issues, improving inclusivity, and greater advertisement.

Table 45: Suggestions to Improve Training Programs

(n = 25, multiple responses allowed)

Suggestions	%
Overall improvements in classes, training, and employment opportunities	48%
Assistance with financial and transportation issues	40%
Improving inclusivity and support systems	24%
Greater advertisement and outreach	12%

Onsite visits at the regional offices found that GRID staff were concerned about the distance trainees are required to travel to attend the DAC-SASH installations. Many job training organization partnerships were made during the SASH program, and therefore did not consider the locations of DAC-SASH projects. Staff reported that to serve DAC communities, trainees are often travelling further than they were for the SASH program.

[44] Inclusivity barriers were identified as lacking a “sense of belonging for females in the industry,” or that it was “male-dominated.”

5 Conclusions and Recommendations

Without a specific targeted number of kW installed, homes served, or guidance on the type of customers within DACs that should be prioritized the evaluation cannot conclusively say if this level of progress is or is not meeting the overall program goal. **Our primary recommendation is to define goals and metrics more conclusively**. Where we identified program intent through this research, we have made additional recommendations about what metrics should be tracked and what program changes should be made to ensure that the program progresses towards a more specific set of goals.

5.1 Program Accomplishments

Through the installation of 964 projects from October 2019 to March 2022, the program realized the following accomplishments:

- 3,553 kW (CEC-AC) total installed capacity with an average of 3.7 kW per home.
- Estimated reduced GHG emissions of 2,030 metric tons of CO_2 equivalent (similar to the carbon footprint for one year for 46 average California households),[45], along with criteria pollutant reductions of 63 kg methane (CH4) reduction and 7.7 kg of nitrogen oxides reduction.[46]
- Participation from customers in all eligible investor-owned utility (IOU) territories, with 67 percent of projects in PG&E's, 30 percent in SCE's, and 3 percent in SDG&E's service territory.
- $10.6 million in incentives paid out for installation projects with an average incentive of $11,056 going to each project (DAC-SASH incentive is $3/W).[47]
- $20.8 million total spent (administration, M&O, and incentives) out of $30 million total budget with an average of $13,941 spent per project.[48]
- Solar system performance was slightly better than projected (103 percent of projected performance).
- Most surveyed customers (88%) reported seeing lower bills after participating in DAC-SASH. Billing analysis confirmed that on average, DAC-SASH participants had an average 68

[45] https://rael.berkeley.edu/wp-content/uploads/2018/04/Jones-Wheeler-Kammen-700-California-Cities-Carbon-Footprint-2018.pdf

[46] https://rael.berkeley.edu/wp-content/uploads/2018/04/Jones-Wheeler-Kammen-700-California-Cities-Carbon-Footprint-2018.pdf

[47]Analysis of incentives was done on the 964 projects that were considered fully complete as of March 2022. There were additional projects that were installed but not yet interconnected, or where incentives had not yet been paid out. Those projects were excluded from this analysis of per project incentive costs.

[48] Analysis of administration and M&O costs were done on the 1,492 projects that were started as of March 2022. These costs are reported on a semi-annual basis and include administration and M&O time spent before a project is fully completed.

percent decrease in annual energy consumption (5.2 MWh per year) for an average total annual bill savings of $990 per year (94% reduction in annual bill costs).

- High customer satisfaction and appreciation for the services provided by the program.
- Solar industry participation from volunteers and trainees increased after participation in trainings and/or volunteer opportunities created by the program (9 percent worked in the industry before the program and 24 percent reported working in the industry afterwards).

The remainder of this section presents the main study findings, organized by program goal. The first set of findings and recommendations relate to explicit program goals (i.e., those that are found in the CPUC Decision that authorized the program and set its goals). The second set are implicit program goals based on what the evaluators interpreted as unstated but desired goals for the program based on discussions with CPUC staff and stakeholders.

5.2 Findings and Recommendations

5.2.1 Related to Explicit / Stated Program Goals

Program Goal 1: Ensure that customer-sited renewable distributed generation continues to grow sustainably… for residential customers in disadvantaged communities. (Direct language from AB 327)

As of March 1, 2022, the Program Administrator (GRID Alternatives) had completed 964 DAC-SASH projects for a total of 3,553 kW (CEC-AC) within Disadvantaged Communities (DACs). The program does not have a goal set for the number of installations or quantity of system capacity installed but the language in AB 327 implies that there should be *growth* and that the growth in installations should be *sustainable*. The incentive budget spent thus far is lower than expected, indicating that solar installations for this program may be growing slower than originally intended.

This research identified housing stock barriers that have made the lower income households (at 200% of FPL) targeted by this program hard to serve including greater prevalence of poor roof condition, the need to upgrade electrical panels, and trim trees, compared to a similar program that GRID administered that had higher income limits.[49] Non-participating customer survey responses and interviews with GRID staff, along with a review of data collected by GRID, indicate that housing barriers often become a reason that income-eligible customers do not participate in the program, after meeting the income requirements.

The program is currently able to serve the households in the target population *without* these barriers, but the current level of growth will become harder to sustain as the program moves to serve remaining households with housing stock barriers.

[49] GRID also administered SASH, which was the predecessor to DAC-SASH but had different funding sources and eligibility requirements.

Without a stated expectation about how much growth *should* be sustained through the course of the program, it is challenging to say if the program is successful. GRID can set voluntary benchmarks to track their progress, but it would be best if the Commission formally adopted treatment goals for the program.

Recommendations	Implication
The program should use a combination of dedicated program funding and/or external funding procured by GRID to complete roof repairs, electrical upgrades and required tree trimming for projects to address housing stock barriers.	Assisting with housing stock barriers would likely improve the program's rate of installation while still helping the intended group of households.
GRID and Energy Division should consider using the rate of market adoption of solar panel installations over time as a reference point for setting more specific, voluntary benchmarks for the DAC-SASH target population (E.g., CalDGStats tracks NEM interconnections, which is a proxy for solar installations, going back to 1996). The program will be best served by establishing annual targets and a program goal for the total number of households to participate before the program ends.	A set numerical goal in terms of installations or capacity would help to assess if the program is on target in the future.

Program Goal 2: Leverage outreach and relationships built through the program offerings to enroll customers in other relevant programs. (Section 2.3 of Handbook)

The DAC-SASH program handbook mandates referrals to other related programs to encourage enrollment in energy programs with similar eligibility criteria. We found that while the program is enrolling potentially eligible customers in programs such as California Alternative Rates for Energy (CARE) and Energy Savings Assistance (ESA), these enrollments are low (46% for CARE and 19% for ESA of eligible participants). CARE enrollments may be low because customers are required to re-enroll every two years, and GRID staff members reported that many participants did not know this. Additionally, we observed that the program is not generating enrollments in the Self-Generation Incentive Program (SGIP), despite the overlapping program requirements, though this may be due to the contractor-driven nature of that program.

We make a recommendation to align ESA site visits with the on-site assessments for this program though that will require additional coordination with ESA contractors. We also caution that pushing beyond this to make ESA participation (rather than just referral) a requirement for the program may slow down an already low adoption rate.

Recommendations	☐ GRID should send an annual follow-up letter and email to customers reminding them of related programs (ESA, CARE which requires reenrollment every two years). ☐ GRID could call the utility with the customer while doing the on-site assessment to check if they are enrolled in CARE and to help facilitate the enrollment process if they are not currently enrolled. ☐ GRID should be coordinating more closely with ESA contractors to provide complementary solar services. ESA and DAC-SASH share the same income eligibility requirements and a growing number of ESA contractors hold the appropriate licensing and expertise to install solar and to provide home radiation services. ☐ GRID should be sure to offer referrals for other programs to low energy users who are not interested in continuing with DAC-SASH to receive solar. To track progress towards this goal going forward, we recommend GRID track: ☐ Percent of past installations that received an annual follow up letter from GRID, until all past participants have been reached. ☐ Percent of customer on-site visits where ESA contractor was in attendance.	**Implication**	Timing the referrals to happen after the installation, or during follow up visits, could help increase parallel enrollment if presented at a time when the homeowner is less overwhelmed. Additionally, including bi-annual reminders for CARE enrollment will help ensure customers stay on the CARE rate after involvement with GRID. This will ensure that the outreach time spent by GRID is still used to share information about other programs, regardless of solar adoption.

Program Goal 3: Ensure that customers are given insight into their solar panel generation status and panel production of solar energy over the lifespan of the equipment. (Section 7 of the Handbook)

For homeowner-owned systems, the onus is on the homeowner to monitor their solar production and ensure the system is operated as expected over time. For third-party ownership (TPO) systems, the contract with the TPO states that it is the solar company's responsibility to monitor, communicate, and reimburse customers to fix any system outages. In our request to review monitoring data we found that Enphase-Enlightened (one of the two monitoring systems currently being used for DAC-SASH customers) was missing for 15 of 37 requested projects. Of the nonreporting systems, 14 of 15 were TPO, despite monitoring being a requirement for all TPO systems in the program. Projects that have fallen out of monitoring compliance with program should be addressed immediately. Participants with TPO systems are not receiving this promised benefit from the TPO agreements.

Recommendations		Implication	
	☐ GRID should send an annual follow up letter and email to customers reminding them of how to check in on their system production. This can be combined with the annual follow-up letter mentioned above. ☐ All program installed inverters should report data to the consumer and GRID should establish program rules and protocols to enable fleet monitoring of incented systems. This will require coordination with the third parties who selected the inverters. ☐ GRID should do outreach to TPO providers to address monitoring systems that have gone offline.		This will allow for a more accurate view of historical energy generation logs to better assess degradation and generation of panels.

Program Goal 4: Leverage trainees living in DACs to do program installations (Handbook section 2.1.3)

GRID has seven regional offices, which are not always located near DACs, increasing drive time requirements for installers and outreach staff to attend GRID trainings. While providing training is not an explicit goal of the program, *utilizing* trained DAC members on installations is a program goal and trainees/volunteers reported that travel to trainings presented a barrier. Current data is not detailed enough to determine the location of volunteers (e.g., if they reside in DACs).

Recommendations	Implications
GRID should allocate a portion of program funding for residents within DACs to travel to approved training programs and to DAC-SASH solar installation volunteer opportunities (i.e., travel stipend).	A stipend would help address financial barriers keeping DAC residents from getting trained in solar installation and would likely be more affordable than having GRID move offices closer to DACs or to host additional mobile trainings.
GRID should continue to batch projects that are further away from regional offices.	This will reduce the cost for projects in harder to reach areas. Tribal projects done in the Inland Empire are already using this model, arranging for all marketing, site visits, and installations to be done for multiple homes at a time, for example, during a week-long visit.
GRID should track data on census tracts of trainees and volunteers to understand DAC participation levels on DAC-SASH projects. GRID should identify a goal as to how many DAC located trainees or volunteers per project represent successful leveraging.	This will allow for an understanding of if the workforce development element of the program, which is in fact training residents of DACs rather than residents in nearby communities. It may also help GRID determine if their regional offices are located in close proximity to trainees and installers.

5.2.2 Related to Implicit / Unstated Program Goals

This section discussion relates to a second set of implicit program goals that, while not specified in statute, are supportive of the stated program goals and would improve the program offerings and ability to meet the overall intent set forth by AB 327 if codified. Codifying these goals will help to clarify:

- Where customers are served
- What share of the installation cost should be covered by the program
- System size and pace of installation

Where Customers Are Served

As the program continues to grow, we recommend that the program reassess the distribution of installations across the state. Currently, 70 percent of eligible participants are within the average distance traveled for installed projects, indicating that most customers can be easily served with the existing GRID office infrastructure.

The program offers the option for a Subcontractor Partnership Program (SPP) model where contractors can install projects. The SPP model allows trusted and vetted solar contractors to install DAC-SASH systems under GRID staff supervision. At the time of the research, the SPP ,odel was used in a limited capacity by the Inland Empire regional office. At this point in time, an analysis of SPP is challenging given that only 13 SPP projects have been completed. This made it challenging to compare structural benefits and costs.

While the main focus of the program should be installing solar for eligible customers wherever the customer is located, a secondary concern is to ensure equitable service across the state (especially for eligible customers living in more remote areas).

To support the **program serving remote customers and not limited installations near GRID regional office locations, we make the recommendations shown below.**

<table>
<tr>
<td>Recommendation</td>
<td>
- GRID should report on SPP projects in their semi-annual report and include the following metrics to facilitate future evaluation:
  - Number of projects completed with the SPP model
  - Costs of the SPP projects
  - Anecdotal challenges or successes working with the partners
- Future evaluations should survey participants that used the SPP model to capture the participant experience.
- GRID should continue to grow their partner relationships for the SPP model to ensure that projects further from the GRID offices are also served by the program.
</td>
<td>Implication</td>
<td>If the SPP model is analyzed and found to be supportive of broader geographic reach, while still providing quality customer support and being cost effective to administer, GRID should consider outsourcing outreach and expanding the SPP model for eligible households located away from GRID’s regional offices</td>
</tr>
</table>

Related to customer location, the data show that eligible distribution does not align with the funding distribution across IOUs. For example, 10 percent of the budget allocation for DAC-SASH comes from SDG&E, but only 2 percent of the program's eligible population resides in its service territory.

Recommendations	Implications
We recommend that GRID review Evergreen's analysis of eligible households and consider focusing efforts in areas with higher rates of eligible households. GRID can use this analysis to set up target installations at the regional level.	This will allow for resources to be focused on areas where marketing efforts are more likely to successfully identify eligible homes.
We recommend GRID track marketing, outreach and administrative costs at the level of regional offices.	This will allow for comparison of acquisition costs for program participants at the regional level, further allowing for more sophisticated cost analysis by region.
GRID should connect with SDG&E ESA Program team to learn how to improve their engagement efforts.	

Share of Installation Cost to Customers

GRID offers systems at no cost to customers, combining DAC-SASH program funds with external funding that GRID obtains by tapping additional resources, such as municipal partnerships, grant funding from community-based organizations, in-kind donations, TPO agreements, and other sources regionally available.

GRID has implied in conversations with the CPUC that the program funding portion of the incentive amount is too low, leaving too wide a gap for them to fill to continue providing installations at no-cost for customers.[50] While our research showed that program incentives are below the market rate cost of systems, we were unable to get visibility into GRID's fully loaded per-project costs (time spent acquiring grant funding and creating contracts with TPOs). To assess the appropriateness of the current program incentive level, GRID would need to provide data on its per-project costs so that the CPUC can weigh the incentive amount with the actual costs. Additionally, with rising costs of labor and materials, future evaluations should compare actual projects costs over time to reassess incentive amounts.

[50] Note that providing systems at no cost is not a program requirement, but reflects how GRID has designed the program

If the CPUC's goal is to grow the program by increasing the number of installations, GRID may not be able to scale up its fundraising efforts to meet growth targets if the incentive level is kept at the current level.

The current incentive amount is $3/W. The current cost for installation and materials is closer to $5/W; changing the incentive amount requires a policy change by the Commission, and raising the incentive would need to be weighed against the benefits of stretching program dollars by leveraging TPO relationships and grant funding.

To support analysis to assess the appropriateness of the current program incentive level, **we make the recommendations shown below.**

Recommendations	Implication
☐ To substantiate the stated need for a higher incentive level, GRID should share data on what DAC-SASH-funded staff time is spent fundraising to fill the gap (i.e., to show the total cost of the project to be compared with the incentive level). ☐ It may be appropriate to raise the incentive amount beyond the $3/W cap to match the rise in construction costs and inflation (e.g., compare actual program costs over time to the incentive level). ☐ Given the large amount of added recommended tracking, we suggest GRID prepare a summary of data gathered to support new program metrics after a year of collection (see last recommendations table regarding data tracking). ☐ Alternatively, GRID could adjust its program model to allow participants to cover part of their project costs though this would impact GRID's ability to market the program as truly no-cost and would likely identify a new cost barrier that is very likely to exist amongst this population.	With this additional data, GRID could substantiate whether the incentive amount should be increased. Ideally, the incentive level could be set so that it encourages GRID to continue to acquire external grant funding which ultimately helps to reduce program costs and extends the reach of program funding.

System Size and Pace of Installation

Though the systems are providing participating customers with bill and energy savings as intended, some participants have requested more panels (beyond the 5 kW cap) to lower their bill further and/or better enable them to pursue electrification. The solar systems are only covering around half of participants' energy usage (45% to 49%, on average between 2020 and 2021) and referrals to ESA are meant to help also reduce customers total energy usage.

Despite the 2022 program handbook noting that for system size, limits in capacity "… will be in place up to 150% of past usage and then beyond 150%, future load growth will need to be documented by GRID and the verified homeowners," we did not see evidence of many systems over 5 kW. It may be useful for future evaluations to track that the program is able to provide equitable offerings to what market rate customers can afford and install. Based on CalDGStats, the average system size for all residential installations interconnected between 2019 and 2021 was 6.3 kW (n = 444,622), however, DAC-SASH eligible homes have lower usage and smaller roofs than the general population.[51]

To **ensure that low-income and DAC residents are able to install *similar* systems at a *similar* pace to market rate customers we make the recommendations shown below.**

[51] The 2019 Residential Appliance Saturation Survey data found that households with higher income had higher energy consumption and larger homes, so general market installations are not perfectly comparable to the DAC-SASH eligible population.

Recommendations	Implication
• GRID should collect number of projects that are originally scoped to be over 5 kW • GRID should consider conducting research that compares number of installations, average size of installations, and average bill savings of program participants to the same rates for market-rate projects. • GRID should clarify if the handbook cap overrules the direction of systems sizing “up to 150% of past usage” or if this language allows the program to install programs larger than 5 kW. If the 5 kW cap overrides matching the system to customer usage, this should be reconsidered.	If the true intent of the program is to create an equal opportunity for low-income participants to benefit from rooftop solar, these data will help to better understand what equity would look like in terms of system sizing and the pace of installation.
• GRID should educate customers on the pros and cons of both the TPO or host-owned system from the customer perspective, allowing customers to make an educated choice between the two options.	GRID would then be educating customers on solar ownership choices and would avoid making decisions on behalf of the homeowner as to which system type is most appropriate for their needs. This decision process would be closer to what market rate customers face.

Beyond the goals shared above, the evaluation set out to better understand how the TPO model varies from a homeowner-owned system.

For DAC-SASH, customers can either own their system outright or participate in a third-party ownership (TPO) model, but GRID defaults to the TPO model in most cases. Eleven percent of customers installed host-owned systems ($14,969 average cost) and 89 percent of participants received third-party owned (TPO) systems ($19,182 average cost). Note that on average the TPO systems are larger than host-owned systems, so per-kW costs are lower for TPO systems. A comparison of both models (ownership vs. TPO) identified benefits to the TPO model: additional funding to install projects, leveraging of federal tax rebates that GRID (as a non-profit) would otherwise be unable to leverage, and customer monitoring and production guarantees, though GRID does not currently collect enough data to verify all of these benefits. Impact analyses found that customers with TPO systems and customers with homeowner-owned systems are seeing similar bill impacts, indicating that the model is similarly passing bill benefits of solar ownership to DAC households.

To better assess the pros and cons of these models we make the following recommendations.

Recommendations	GRID should include metrics mapped to the logic model into the handbook. GRID should track: ☐ GRID staff time spend on searching for other sources of gap financing Future evaluations should analyze: ☐ GRID staff time spent on TPO coordination ☐ Full cost agreement for the 25-year PPA ☐ Full amount of TPO payment to GRID ☐ Federal tax rebate amount to TPO ☐ If underproducing systems receive a production guarantee payment Partnered TPO companies should enable, not discriminate against, the enrollment of tribal customers.	Implication	Without these data, we can only report on GRID's perspectives and customer experiences. Collection of the data will allow for a more robust comparison of the benefits and costs of the TPO model and can make it more clear if the TPO model is generating financial savings for the program that would be more effectively addressed through an increased incentive.

6 Additional Findings

6.1 Additional Eligibility Findings

We used historic distance data to estimate the number of eligible households within a reasonable range from each GRID regional office. Table 46 and Table 47 show eligibility estimates for households within the maximum and average distances travelled for projects by each regional office.

Table 46: Eligibility Estimates by GRID Office, Maximum Distance

GRID Regional Office	Distance Assumed (mi)	Households Served by IOU	DAC Households		Estimated Eligible Households		
			N	% of all IOU HH	N	% of DAC	% of all IOU HH
Bay Area	89	2,896,332	311,330	10.7%	15,669	5.0%	0.5%
Central Valley	125	908,929	446,693	49.1%	58,619	13.1%	6.4%
Greater Los Angeles	53	2,432,850	799,545	32.9%	57,037	7.1%	2.3%
Inland Empire	249	1,826,919	388,492	21.3%	29,711	7.6%	1.6%
North Valley	64	816,430	140,354	17.2%	11,517	8.2%	1.4%
San Diego	46	1,035,539	75,864	7.3%	3,961	5.2%	0.4%
No office within distance		73,334	-	-	-	-	-

Table 47: Eligibility Estimates by GRID Office, Average Distance

GRID Regional Office	Distance Assumed (mi)	Households Served by IOU	DAC Households		Estimated Eligible Households		
			N	% of all IOU HH	N	% of DAC	% of all IOU HH
Bay Area	15	1,027,870	127,149	12.4%	5,668	4.5%	0.6%
Central Valley	38	358,900	213,706	59.5%	26,371	12.3%	7.3%
Greater Los Angeles	15	1,073,487	562,100	52.4%	40,600	7.2%	3.8%
Inland Empire	46	2,258,273	488,609	21.6%	34,891	7.1%	1.5%
North Valley	49	920,723	151,067	16.4%	12,014	8.0%	1.3%
San Diego	11	587,492	75,864	12.9%	3,961	5.2%	0.7%
No office within distance		3,763,589	543,783	14.4%	53,010	9.7%	1.4%

Figure 39 displays these findings, with more detail in Figure 40. Each Census tract is colored by the estimated percent of households that are eligible for the program. Note that any tracts that are not DACs are colored gray due to automatic ineligibility. Each GRID regional office has two rings, one with the average distance assumed (blue), and one with the maximum distance assumed (red).

Figure 39: Eligible Households by GRID Regional Offices

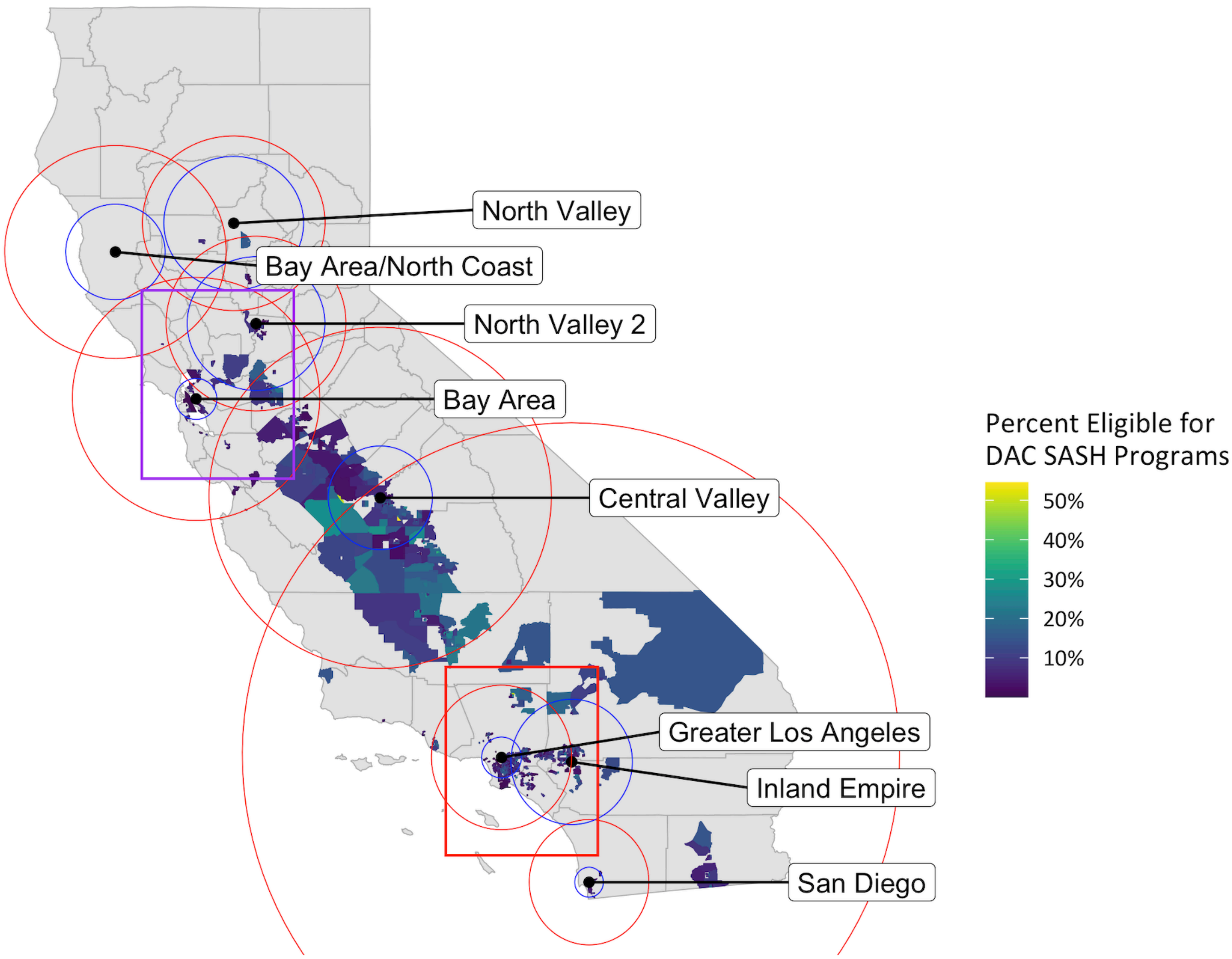
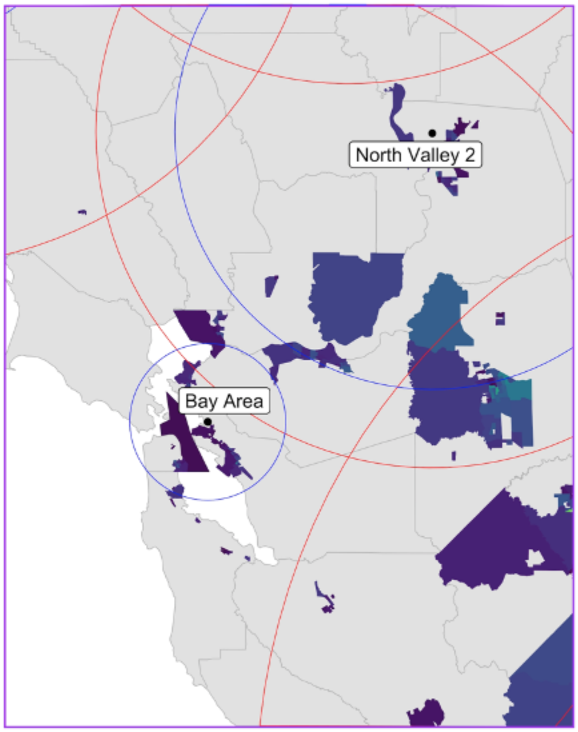
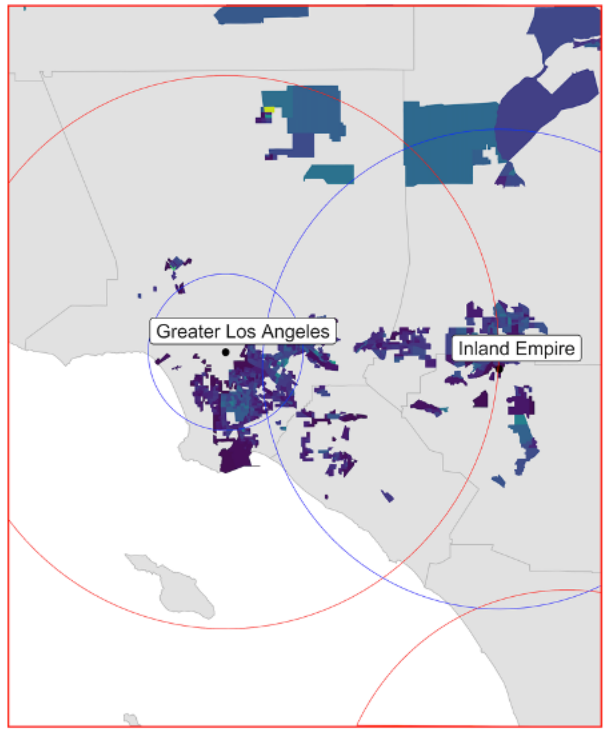


Figure 40: Eligible Households by GRID Regional Offices – Bay Area and Greater LA





6.2 Market Adoption of Rooftop Solar

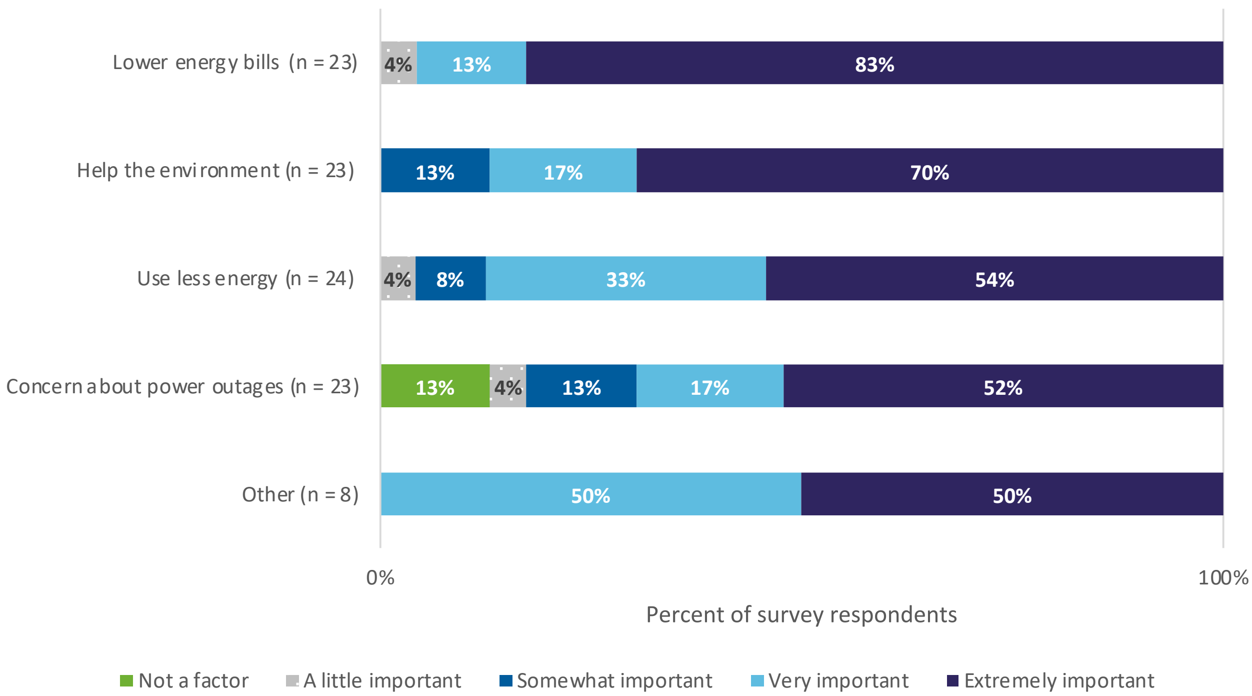
We reviewed non-participant data from 10,728 customers across the three IOUs to estimate the market adoption rate of eligible customers. In this section, we report on the few non-participant survey respondents who had installed solar panels without the help of the program.

Based on analysis of IOU CIS data of non-participants, the upper bound of market adoption in the eligible population is about 11 percent (13% for PG&E, 7% for SCE, and 7% for SDG&E). Program eligibility is not confirmed in the IOU data, as home type, home ownership, and income level are not reliable variables within the CIS system. Therefore, to estimate the number of eligible customers, we filtered the data for households living in DACs that are also enrolled in or eligible for CARE, due to their income requirements aligning with DAC-SASH. Notably, this is an overestimate because many households in DACs are not eligible for DAC-SASH.

Surveyed eligible non-participants reported a much higher rate of market adoption. About a third of unaware non-participant respondents (31%, total n = 70) and a small minority of aware non-participant respondents (7%, total n = 44) had installed solar panels without the use of the program. This is likely due to the recruitment method for the survey. The evaluation recruitment postcard mailed to non-participants mentions the California Public Utilities Commission (CPUC) and that we were conducting a survey about solar panels. Customers with solar panels may have been more likely to take the survey, while customers without were more likely to think the survey was not relevant to them.

According to the non-participant survey respondents, all listed factors were "extremely important" in their decision to install solar panels on their roofs, with lowering energy bills having the highest percentage of respondents (83%), followed by the desire to help the environment (70%) and using less energy (55%, Figure 41).

Figure 41: Importance of Factors in Decision to Install Solar Panels (Eligible Non-Participants)

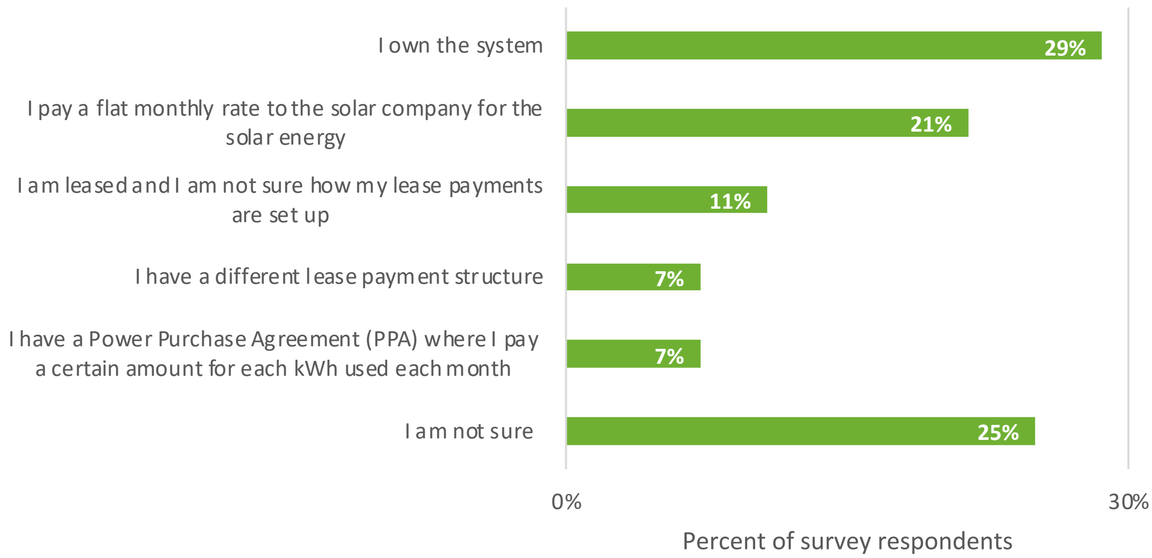


Eight respondents mentioned that there were other factors involved in their decision to install solar panels, and five responded to the free-response question to specify those factors, which included:

- Cost concerns and saving opportunities (2)
- Increasing their property value (1)
- The opportunity to get a good quality installation (1)
- Email outreach (1)

A quarter of the non-participants who installed solar on their own reported that they were not sure of how their solar system was set up (Figure 42). Of those who did understand how their system was set up, most respondents owned their system (29%).

Figure 42: Description of Solar System, Non-Participants (n = 28)



We examined how this group of low-income homeowners were able to install solar and found that many reported paying for the system on their own, with the help of a tax credit, or with help from another organization (Table 48).

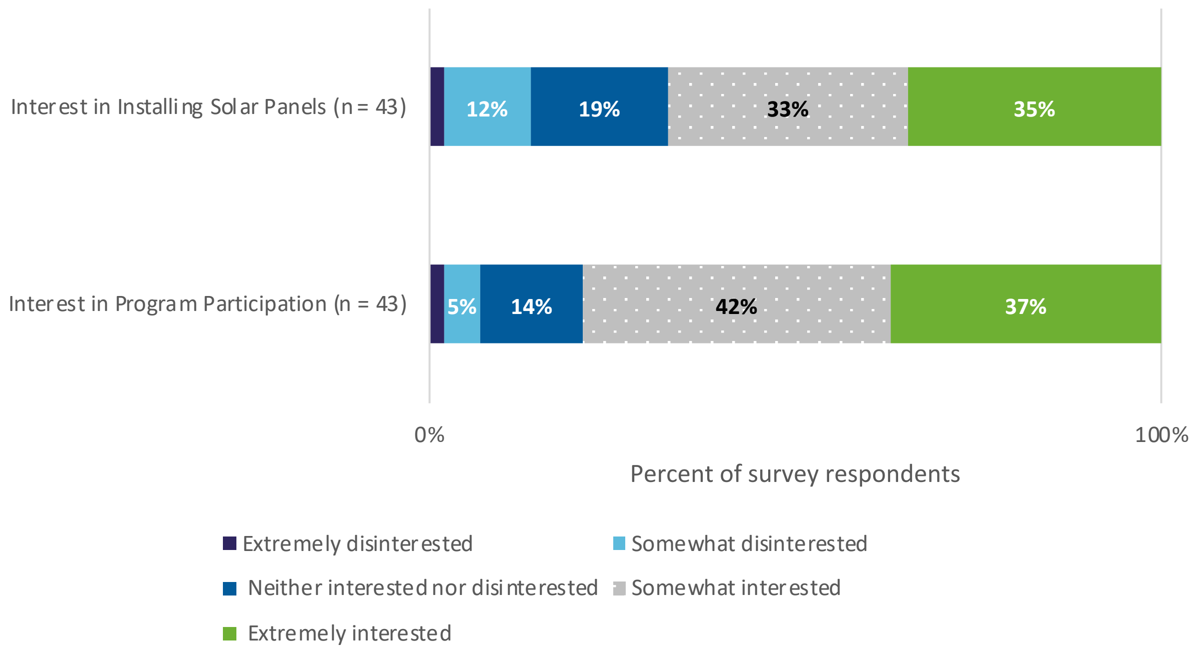
Table 48: Assistance Received (n = 24)

Type of Assistance	N	%
Paid on own	12	50%
Received a tax credit	6	25%
Received help from another program or organization	6	25%

6.3 Non-Participant Perspectives on Solar

We asked eligible non-participants about their interest in installing solar panels and participating in a program that helped with free solar installation. Many respondents reported that they were extremely interested or somewhat interested in installing solar panels on their home (35% and 33%, Figure 43), and interest increased when asked if they would be interested in a program that helped with free solar installation (37% and 42%). These findings indicate that a lack of interest in a program is a not a large barrier among eligible customers.

Figure 43: Reported Interest in Solar Panel Installation versus Interest in Participation in a Program to Install *Free* Solar Panels



The unaware non-participant respondents who reported an answer regarding their interest in having solar panels installed were asked to elaborate on why they chose that answer (Table 49).

Table 49: Interest in Solar Panels (Unaware Non-Participants, n = 37)

Interest	Topics	Quotes
Disinterested (13%)	Distrust (2) Cost concerns (2) Personal (1)	"I am not interested in solar. I feel it's overall a scam" "I don't like the look of panels"
Neither Interested nor Disinterested (19%)	Personal (6) Need more information (1)	"I don't use much electricity" "This cottage is over 120 years old, and I don't think it would easily support panels" "I don't know exactly how it all works"
Interested (68%)	Lowering Costs (17) Environment and energy (5)	"To save on my electric bill" "Me gustaría ahorrar más en mi pago de electricidad y al mismo tiempo ayudar al medio ambiente (I would like to save more on my electricity bill and help the environment at the same time)."

Respondents also provided free-text responses to explain their interest in a program that provides *free solar* (n = 32)**.** While the portion of respondents that were interested in a program for free solar is higher than the portion of respondents interested in solar generally, there were still people who were not interested (Table 50).

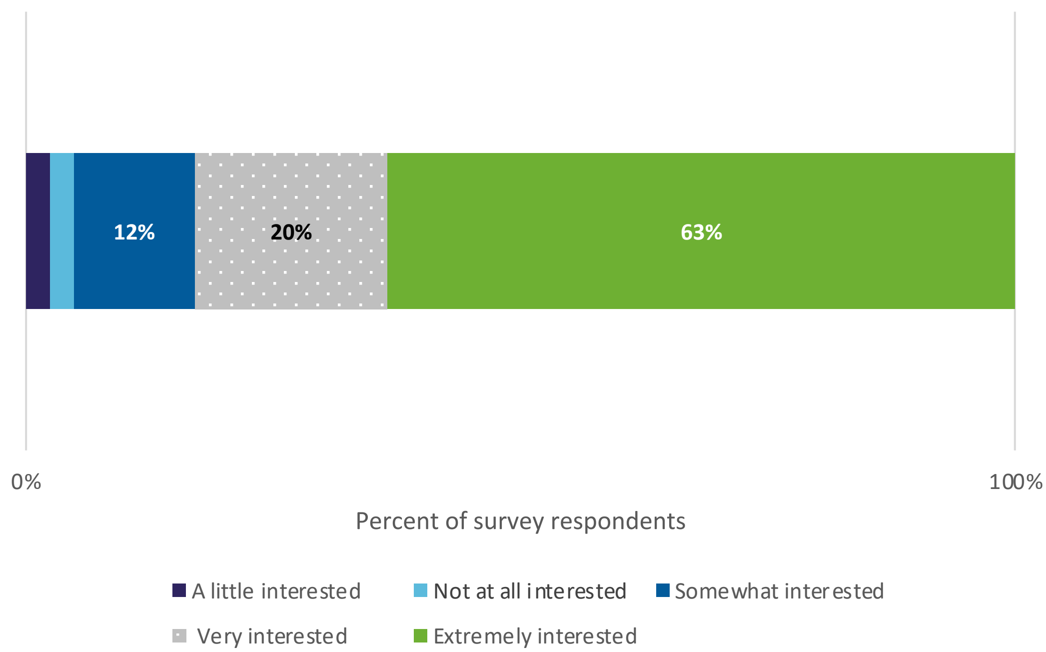
Table 50: Interest in a *Free* Program to Install Solar (Unaware Non-Participants, n = 32)

Interest	Topics	Quotes
Disinterested (21%)	Lack of Necessity (4) Distrust (3)	"I'm not interested in solar. Free or not." "Nothing is 100 percent free ever"
Interested (79%)	Lowering Costs (14) Environment and energy (3)	"Saving money is extremely important" "Ayudar a generar energia (Help generate energy)." "Environmental purposes, progressive purposes, water shortages, clean air..."

6.3.1 Motivation for Participation Amongst Non-Participants

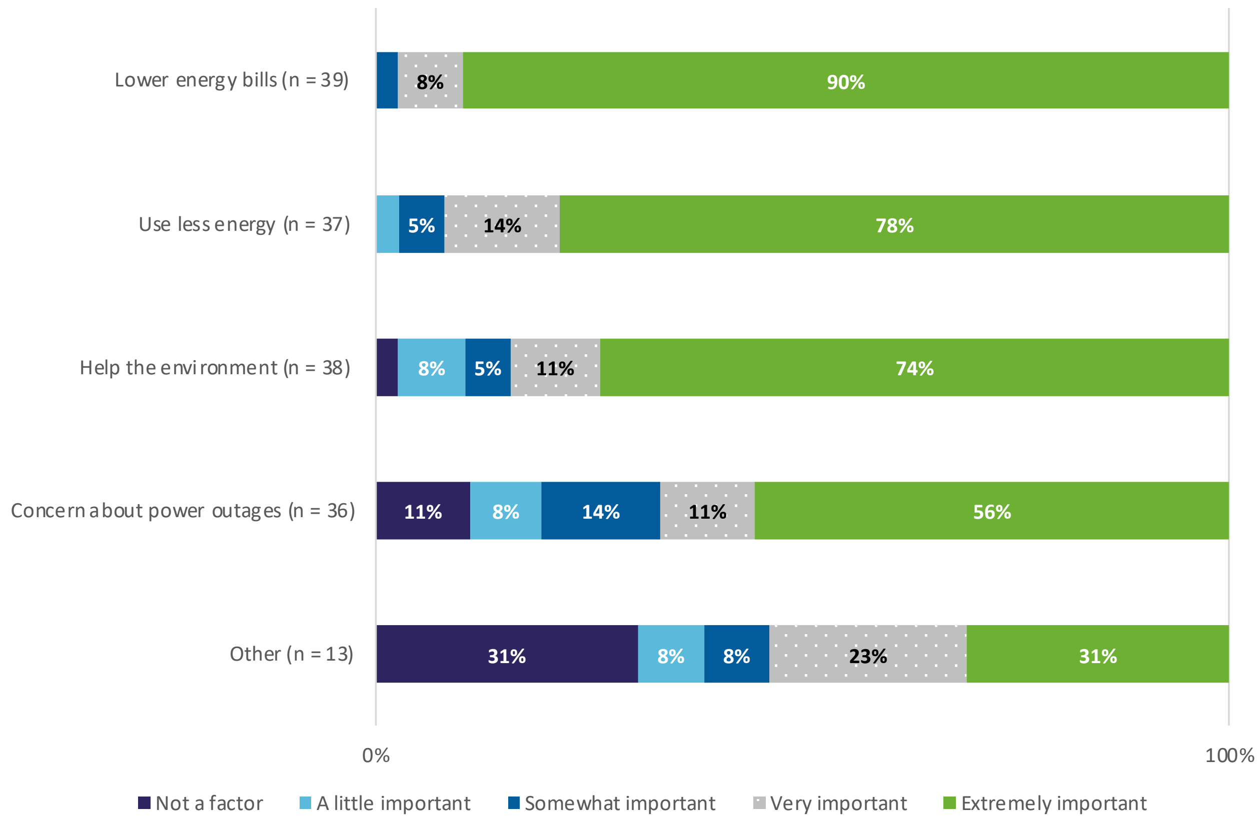
A lack of interest in the program does not appear to be a barrier. Most eligible non-participants responded that they were extremely interested in DAC-SASH when they first learned about the program (Figure 44).

Figure 44: Non-Participant Interest in DAC-SASH Program (n = 41)



According to the respondents, all listed factors were "extremely important" in their interest in participating, with lowering energy bills having the highest percentage of respondents (90%), followed by the desire to use less energy (78%) and help the environment (74%, Figure 45). Thirteen respondents responded that there were other factors that came into play in forming their interest to install solar panels on their roof, including the chance to improve their home value, the mitigation of any possible fires, and the perceived notion that this would serve as an alternative to their provider PG&E.

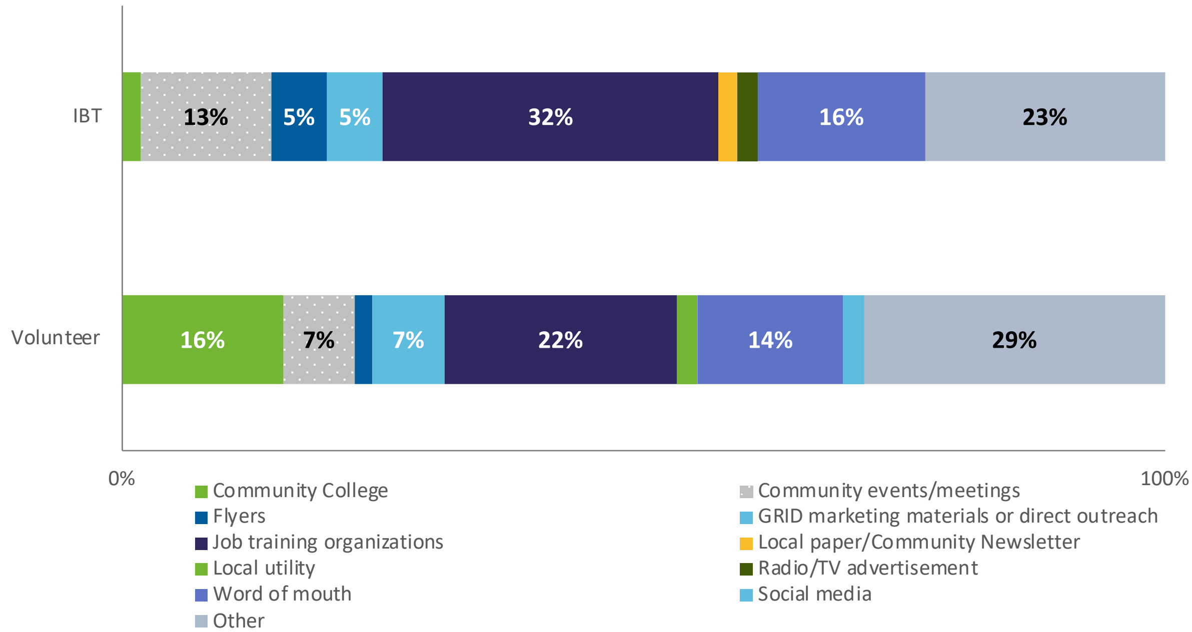
Figure 45: Importance of Factors in Interest in Participating



6.4 Marketing for the Training Program

Through interviews with GRID and onsite visits we found that trainees learn about the program in many ways. GRID staff emphasized the importance of local partnerships with job training organizations and community colleges, and surveyed trainees agreed. Trainees and volunteers were provided a multiple-choice list. Job training organizations were the main avenue (32%, 22%, IBT and Volunteer, respectively) by which participants learned about the GRID opportunity. Figure 46 displays all options selected.

Figure 46: How Respondents Heard about GRID Training (n = 114)

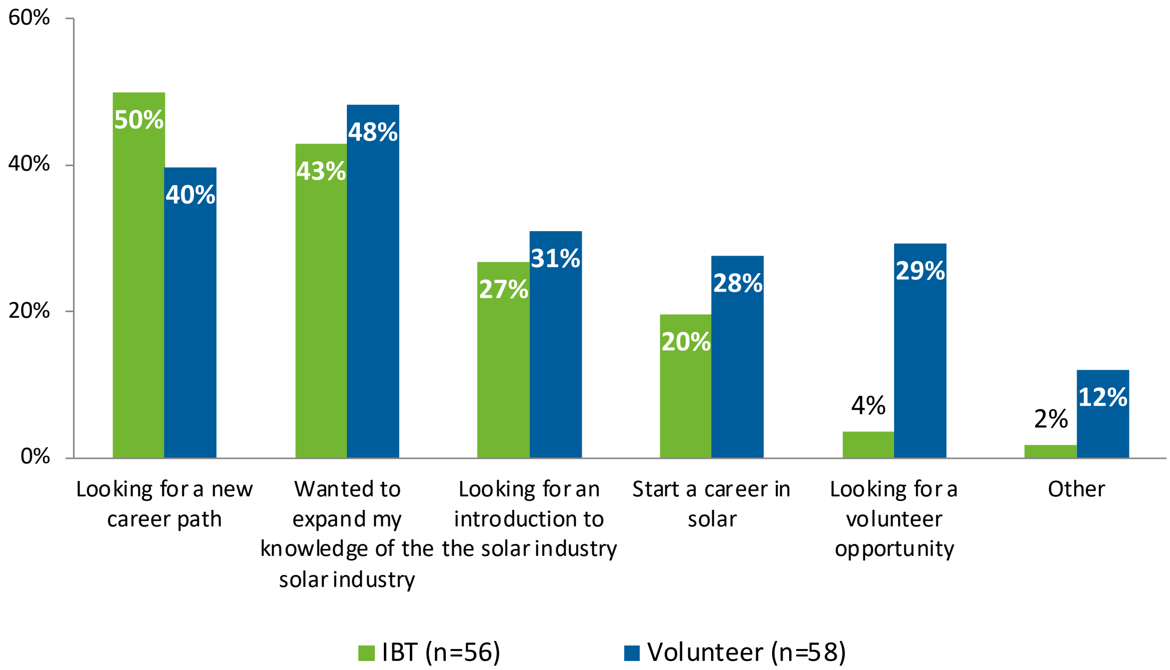


Of those who selected "Other", the most frequent sources cited were:

- IBT: Trade school or employment program (11%), internally (employed at GRID) (4%)
- Volunteer: Trade school or employment program (16%), university organization (3%)

Trainees reported different motivations for participating in the IBT or volunteer opportunities. The majority (50%) of the IBT respondents shared that they were looking for a new career path, while many (48%) of the volunteer respondents noted wanting to expand knowledge of the solar industry (Figure 47).

Figure 47: Reason for Participation (n = 114)



The eight volunteer respondents who provided free-text response noted that this was a teaching or training opportunity for students, or fulfilled a requirement for work.[52] These findings are congruent with how most respondents learned about the program, given that most participants heard about the opportunity from a learning/training source, and most were interested in participating for a new career or to build upon knowledge of the solar industry.

Some respondents provided additional free-response answers to what they were looking to gain through the training or volunteer opportunity.

Out of the IBT respondents:

- 32% of the responses mentioned career development.
- 27% specifically referenced preparing for or seeking a job in the solar industry.
- 15% noted wanting transferable skills.

Of the volunteer respondents:

- 35% of the responses pertained to career development.
- 31% noted wanting transferable skills.
- 29% specifically noted wanting to learn how to work with solar.

[52] The one IBT respondent who shared a free-text response for interest in participating stated that they "wanted a fall-back career".

6.5 Additional Bill Impact Findings

In Table 51, we extrapolated from the impact analysis sample to the full population of program participants to provide an estimate of the cumulative program impact. To date, the DAC-SASH program is estimated to have a first-year saving total of 4,946 MWh. Solar panels have an expected useful life of 25 years, so these savings will continue beyond one year, as the panels will continue generating electricity; please note that the energy savings depends on many factors (e.g., panel degradation, weather, and energy consumption). DAC-SASH and SASH participants look very similar.

Table 51: Estimated Cumulative Energy Savings

Program - Year	Number of Participating Homes	Estimated First Year Annual Energy Savings Per Home (kWh)	Annual First Year Energy Savings for All Homes (MWh)
SASH 1.0**	**5,196**	**4,362**	**22,665**
SASH 1.0 – 2009*	29	2,628	76
SASH 1.0 – 2010	199	2,856	568
SASH 1.0 – 2011	759	3,587	2,723
SASH 1.0 – 2012	1,341	4,890	6,557
SASH 1.0 – 2013	1,045	3,928	4,105
SASH 1.0 – 2014	868	3,843	3,336
SASH 1.0 – 2015	799	3,394	2,712
SASH 1.0 – 2016	151	2,001	302
SASH 1.0 – 2017*	2	4,855	10
SASH 1.0 – 2018*	3	4,182	14
SASH 2.0**	**4,212**	**4,997**	**21,047**
SASH 2.0 – 2015	193	4,024	777
SASH 2.0 – 2016	668	4,877	3,258
SASH 2.0 – 2017	797	5,002	3,987
SASH 2.0 – 2018	1,090	4,127	4,498
SASH 2.0 – 2019	957	4,527	4,332
SASH 2.0 – 2020	367	3,249	1,192
SASH 2.0 – 2021*	134	5,008	671
SASH 2.0 – 2022*	6	4,687	28
DAC-SASH**	**955**	**5,179**	**4,946**

Program - Year	Number of Participating Homes	Estimated First Year Annual Energy Savings Per Home (kWh)	Annual First Year Energy Savings for All Homes (MWh)
DAC-SASH – 2019	149	1,871	279
DAC-SASH – 2020	464	3,667	1,701
DAC-SASH – 2021	319	3,746	1,195
DAC-SASH – 2022*	23	4,147	95

Source: Evergreen analysis of energy consumption of program participants and matched comparison group for program years 2010-2021.

* Regression models were not run for program years with fewer than 30 participants or less than a year of post-install data. The estimated annual savings for these program years are based on the overall average for the corresponding program, adjusted to reflect the average size of the solar system installed in the given year.

** The program level results do not add up to the sum of the yearly results because this is based on a pooled model, including participants from all program years to estimate savings at the program level.

Table 52 presents the number of homes that participated in the program during each year, the estimated annual first-year electricity bill savings per home for each year, and the overall projected first-year electricity bill savings by program year. Solar panels have an expected useful life of 25 years, so these savings will continue beyond one year, as the panels will continue generating electricity; please note that the dollar value of savings depends on many factors (e.g., panel degradation, weather, energy consumption, and utility net energy metering (NEM) rates).

Table 52: Estimated Cumulative Bill Savings

Program - Year	Number of Participating Homes	Estimated First Year Annual Electricity Cost Savings Per Home ($)	Annual First Year Electricity Cost Savings for All Homes ($1,000)
SASH 1.0**	**5,196**	**$1,032**	**$5,361**
SASH 1.0 – 2009*	29	$559	$16
SASH 1.0 – 2010	199	$498	$99
SASH 1.0 – 2011	759	$632	$480
SASH 1.0 – 2012	1,341	$848	$1,137
SASH 1.0 – 2013	1,045	$835	$873
SASH 1.0 – 2014	868	$925	$803
SASH 1.0 – 2015	799	$936	$748
SASH 1.0 – 2016	151	$902	$136
SASH 1.0 – 2017*	2	$1,033	$2
SASH 1.0 – 2018*	3	$889	$3

Program - Year	Number of Participating Homes	Estimated First Year Annual Electricity Cost Savings Per Home ($)	Annual First Year Electricity Cost Savings for All Homes ($1,000)
SASH 2.0**	**4,212**	**$904**	**$3,807**
SASH 2.0 – 2015	193	$715	$138
SASH 2.0 – 2016	668	$769	$514
SASH 2.0 – 2017	797	$890	$709
SASH 2.0 – 2018	1,090	$814	$887
SASH 2.0 – 2019	957	$785	$751
SASH 2.0 – 2020	367	$520	$191
SASH 2.0 – 2021*	134	$987	$132
SASH 2.0 – 2022*	6	$924	$6
DAC-SASH**	**955**	**$990**	**$945**
DAC-SASH – 2019	149	$795	$118
DAC-SASH – 2020	464	$784	$364
DAC-SASH – 2021	319	$689	$220
DAC-SASH – 2022*	23	$887	$20

Source: Evergreen analysis of electricity costs of program participants and matched comparison group for program years 2010-2021.

* Regression models were not run for program years with fewer than 30 participants or less than a year of post-install data. The estimated annual savings for these program years are based on the overall average for the corresponding program, adjusted to reflect the average size of the solar system installed in the given year.

** The program level results do not add up to the sum of the yearly results because this is based on a pooled model, including participants from all program years to estimate savings at the program level.

6.6 PV Monitoring System Errors

This section describes the data and documentation issues observed by the Evergreen team throughout the evaluation process in more detail.

6.6.1 Enphase-Enlighten Data Availability

Enphase-Enlighten monitoring systems continue to log energy generation during communication outages, then sometimes upload the backlog to the database when communication is reestablished; however, this delayed upload does not occur after every communication error. There are clear instances where communication was lost and generation data never uploaded to the system, such as when generation is zero (0) kWh on one or more days. As shown in Table 53, there are two types of data reporting errors that we observed in the Enphase portal for the DAC-SASH projects:

1. Retirement of antiquated 3G cellular communication systems; and
2. Gateway communication errors

Table 53: PV System Reporting Communication Errors

Antiquated Cellular Connection	Gateway Communication Error
3	4

Retirement of antiquated 3G cellular communication systems: Some of the communication errors observed during the evaluation were determined to be related to the ongoing phase out of the 3G cellular network. Enphase systems are installed to communicate energy reporting by either a cellular network or Wi-Fi. In 2022, mobile carriers were actively discontinuing 3G wireless service, with completion expected by the end of 2023. Enphase monitoring systems that are connected to a 3G network must be reconfigured to resume communication. Affected customers have two options; (1) install a new modem that is compatible with modern wireless networks, or (2) connect the monitoring system to their home's wireless internet network. GRID reported that households with a TPO system were notified of this change in late 2021. Sunrun performed meter or cell modem replacements at no cost to clients for about 1,400 systems as of November 2022. It is unclear how homeowner-owned systems may have received notice, and it is believed that such notice may have only happened once through their Enphase portal and therefore, homeowners may not be aware of the change.

Gateway communication errors: These errors indicate that the broadband Internet connection that the Enphase gateway uses to communicate to the Enphase servers is experiencing a problem. This condition does not affect a system's ability to produce power. When the connection is restored, the gateway will catch up with the transmission all energy data it has stored. These errors can occur if the internet service is experiencing an outage, or the router may be unplugged or turned off.

There were four (4) DAC-SASH projects with a reporting communication error at the time of this analysis, and these could include one or more errors noted herein, all which limit communication to the Enphase servers.

6.6.2 SolarEdge Data Availability

GRID provided the SolarEdge-monitored PV system energy generation data in monthly increments from June 2021 through July 2022. We identified reporting errors for each sampled project when the generation for a single month was either zero (0) kilowatt-hours (kWh) or approximately 80 percent less than an adjacent month. Identified errors are summarized in Table 54.

Table 54: SolarEdge Sample Monthly Availability

Projects Affected	Total Instances of Reporting Error	Total Months	Months with Reporting Error	Percent Missing
4 of 17	4	199	11	6%

6.6.3 Discrepancies Between EPBB and Tracking

The program tracking database and the EPBB files provided by GRID were generally aligned on estimated annual energy generation and the design factor (DF). Nuances in program implementation may explain the minor discrepancies that the Evergreen team found. The following sections explain these instances in more detail.

Estimated Annual Energy Generation: The EPBB files and program tracking data aligned for 46 of the sampled projects, and all 53 samples were within 100 kWh of the annual estimate (Table 55). Projects with higher energy generation differences were frequently included in the field verification activities conducted by GRID. This likely indicates that either the EPBB database or the program tracking data are being updated post verification, while the other is not. Out of the 53 projects in the sample, field verification reports were provided for nine projects. These field verification reports were developed by GRID and described adjustments to originally submitted project parameters for five projects. Revisions were suggested for azimuth angles, module quantity, shading factors, and mounting method. However, field verification findings are not always translated to the EPBB database. There is a threshold set by GRID under which revisions are not made to the EPBB database.

Table 55 EPBB and Program Tracking Data Discrepancies

EPBB-Tracking Energy Generation Diff. [kWh]	Project Quantity	GRID Field Verification Quantity
0	46	3
25	0	0
50	2	1
100	2	2
650	3	3
TOTAL	53	9

Table 56 describes the total difference in annual energy generation values for the sampled projects as recorded in the tracking database and the EPBB files. The total difference between the two sources is 0.2 percent.

Table 56: File and Program Tracking Estimated Total Annual Generation Difference

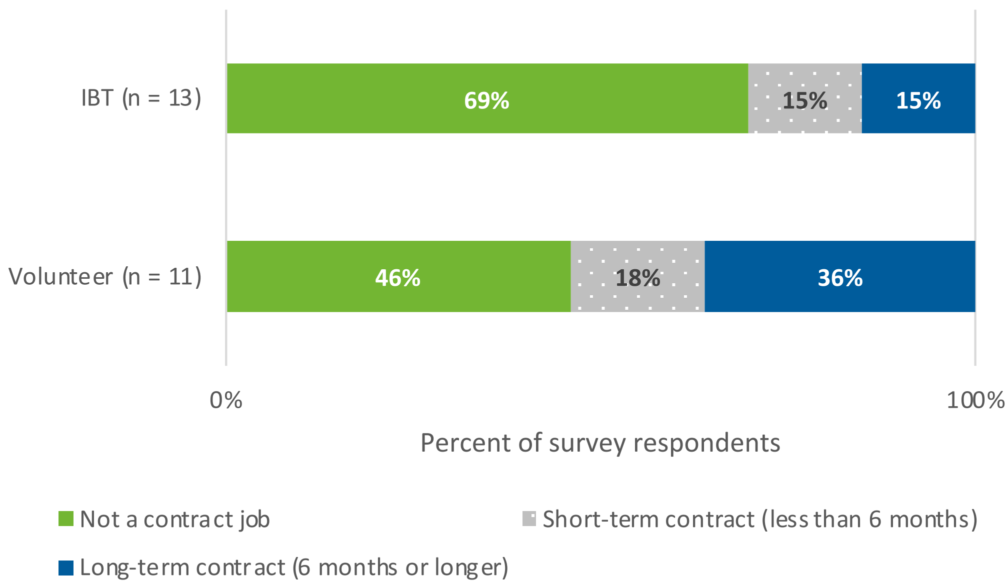
Tracking [MWh]	EPBB [MWh]	Difference [MWh]	Percent Difference [%]
276.5	276.0	0.5	0.2%

Design Factor (DF): The DF is used by the CPUC to determine if a project is eligible for program incentives. Calculation of the DF is the product of the design correction factor and the installation correction factor. The method used to calculate DF is inconsistent between the EPBB file and the tracking database for 26 projects out of 53 sampled. A subset of five projects report a DF that does not correspond to known methods in the tracking database. It is unlikely a coincidence that eight of the nine projects verified by GRID have a tracking DF that does not identify with calculation methodology. This suggests that EPBB files may have been updated to reflect the field verification while the tracking database remained unchanged. The tracking database has one DF recorded for any given project; however, there is a calculation required to determine this value when a project has multiple orientations. An EPBB file is provided for each orientation subarray making comparison of them challenging, due to an opaque method of combining the subarray DFs into a single factor.

6.7 Other Outcomes from the Training Program

For trainees who were working part time before participating with GRID, the majority of the IBT participants (69%) said that the work that they did was not contractually based, as shown in Figure 48. For the volunteers, almost half (46%) reported that their work was not a contract job.

Figure 48: Part-Time Job Type Before Participation



Of the 10 IBT participants who reported having a part-time job after participation, most reported that it was not a contract job (63%). Fewer (12%) said they had a short-term contract, and the remainder (25%) had a long-term contract.

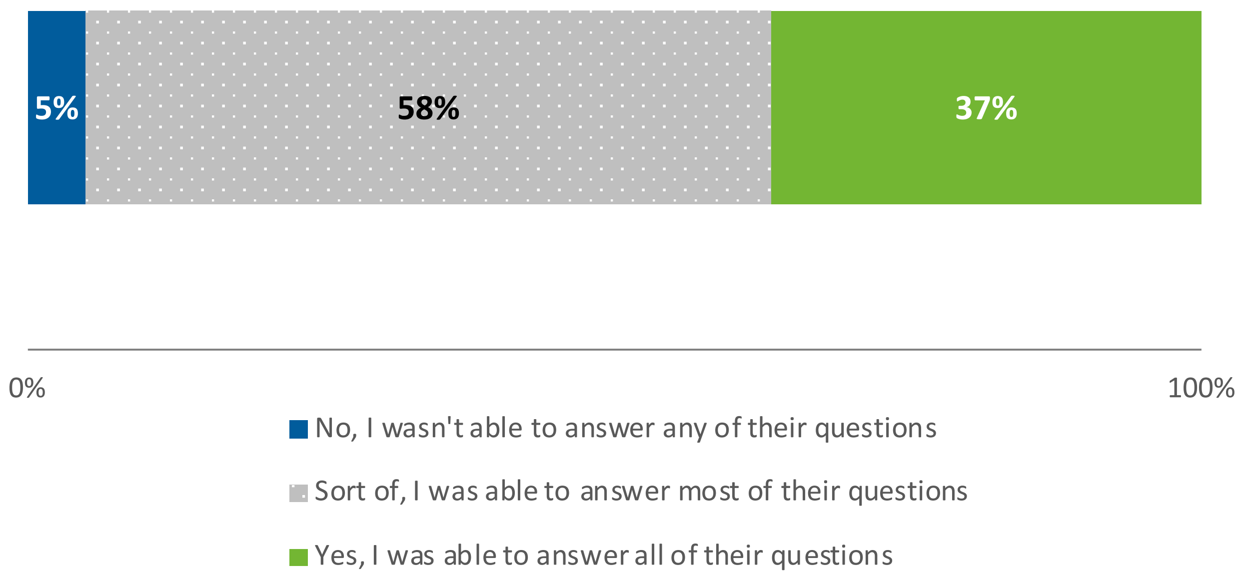
6.7.1 Professional Certifications

Forty-five percent of the IBT respondents said they received some professional certification, while 55 percent reported that they did not. Of those who received a certification, over half (58%) received both the OSHA 10 and CPR certifications. A little over a third (38%) received Design, Forklift, Auditing, Inverter, or PV 1-3 certifications, and the remainder (33%) stated that they received a Certificate of Completion from the GRID training course. Most respondents (55%) have pursued or plan to pursue other professional certifications in the solar industry outside of what was received in the GRID training course.

6.7.2 Interactions with Residents

Most respondents (81%) had the opportunity to interact with residents of the homes that were getting solar installed. Many trainees (73%) reported that residents had questions about the installation or process. Of the participants who encountered residents with questions, only 5 percent were not able to answer their questions at all. Figure 49 captures participant confidence levels in fielding resident questions.

Figure 49: Confidence Answering Resident Questions (n = 60)



6.8 Value of Training Courses

IBT respondents were asked whether they felt that the training that they received on-site and in the classroom provided them with the knowledge and skills necessary to be successful in the solar industry. Participants mostly reported that both modes prepared them well enough to get a job in the solar industry. However, there were some respondents who reported not feeling prepared (Figure 50).

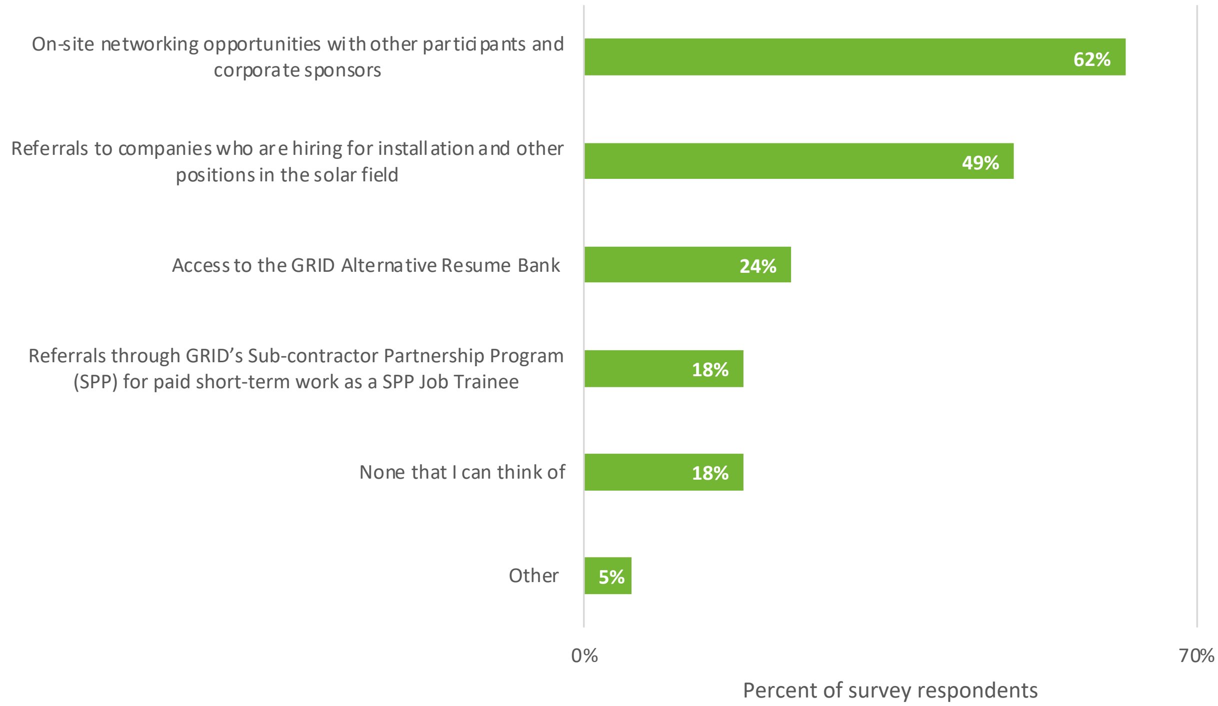
Figure 50: Preparation by Mode of Learning

The participants who reported feeling that the training they received was not enough for them to get a job in the solar industry were asked what they felt that they needed to be successful. Their suggestions included:

- Greater training and experience (9)
- Improvement in the quality of education received (more classes with a lot more variety and better student-teacher ratio) and greater accessibility to hands-on opportunities (5)
- Greater access to networking and employment opportunities (2)

Respondents were then asked to select the types of networking and employment opportunities received during GRID training, with multiple selections allowed (Figure 51). Sixty-two percent of the IBT participants chose 'on-site networking opportunities with other participants and corporate sponsors' as the most frequent opportunity among those provided by the GRID training course, closely followed by 'referrals to companies who were hiring for installation and other positions in the solar field' (49%).

Figure 51: Opportunities Received During Training (n = 55, multiple responses allowed)



Most IBT respondents reported that GRID's training course provided them with the opportunities and resources needed to obtain a job in the solar industry extremely well or very well (76%). Those who reported that the course did not do very well in providing them the necessary resources were asked about what the training course could have provided that would have helped them obtain employment in the solar industry Their suggestions included:

- More hands-on training (4);
- More classes that would help improve their technical knowledge (2);
- Uniformity in the quality of the training program (1);
- Availability of unconditional support (1); and
- More opportunities (1).

The respondents were also asked whether they would have known how to seek the skills necessary for employment in the solar industry if they had not participated in the GRID training course, to which the majority (76%) said 'no,' indicating that the training course is instrumental in helping people enter the solar industry.