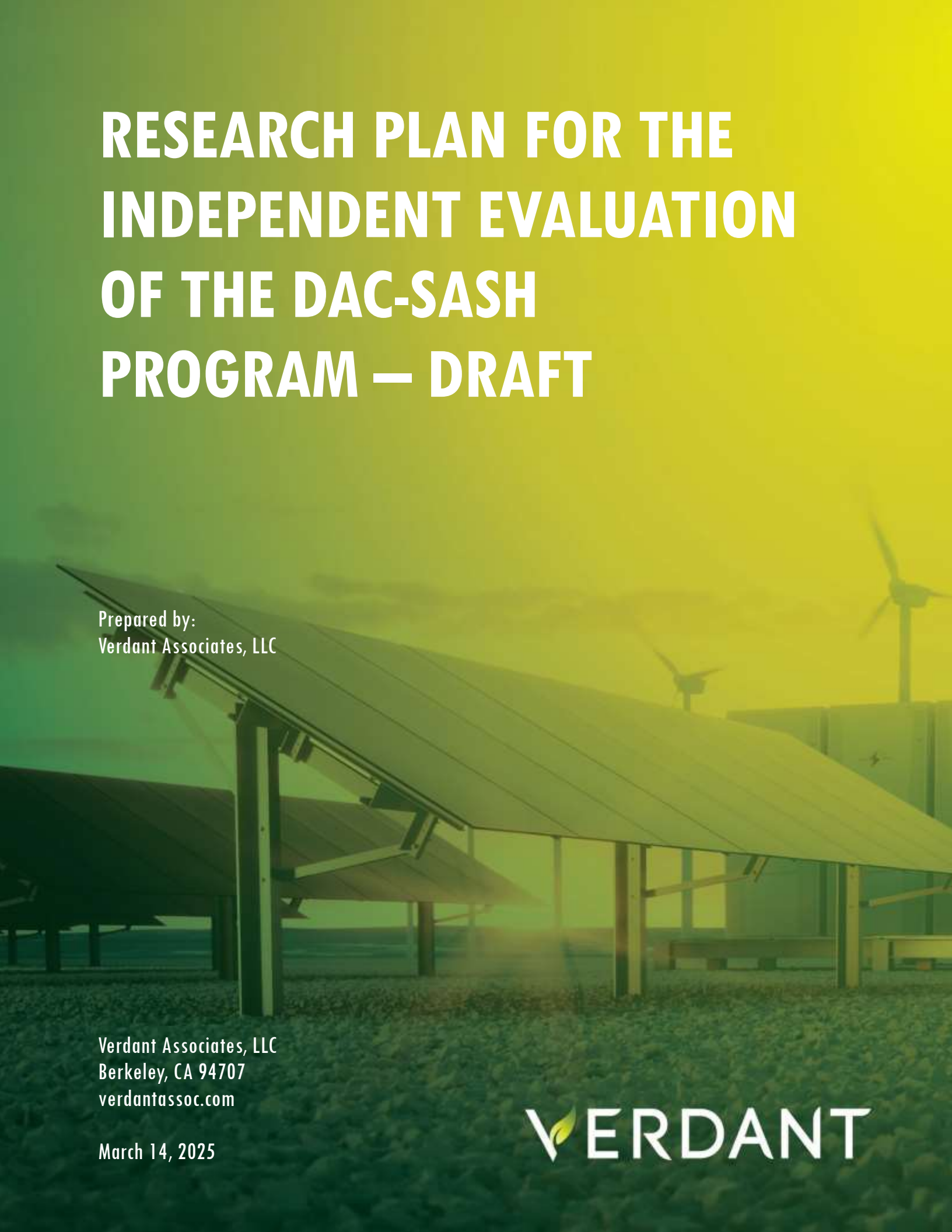
RESEARCH PLAN FOR THE INDEPENDENT EVALUATION OF THE DAC-SASH PROGRAM – DRAFT



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1 INTRODUCTION

California Assembly Bill (AB) 327 (Perea, 2013) directed the California Public Utilities Commission (CPUC) to develop a standard contract or tariff applicable to customer-generators with renewable electrical generation, as a successor to then-existing Net Energy Metering (NEM) tariffs, and, as a part of this mandate, required the CPUC to develop specific alternatives designed to increase adoption of renewable generation in disadvantaged communities (DACs).[1] As directed by AB 327, CPUC Decision (D.) 18-06-027 created the DAC-Single-family Solar Homes (DAC-SASH) program.[2] The DAC-SASH program, modeled after the Single-family Affordable Solar Homes (SASH) Program, provides assistance in the form of financial incentives towards the installation of solar generating systems on the homes of low-income homeowners. The DAC-SASH program is available to low-income customers who are resident-owners of single-family homes in DACs. The incentives provided through DAC-SASH are meant to assist low-income customers in overcoming barriers to the installation of solar energy, such as a lack of up-front capital or credit needed to finance solar installation. The DAC-SASH program also incorporates job training objectives to promote green-collar jobs in low-income communities and to develop a trained workforce that will foster a sustainable solar industry in California. GRID Alternatives (GRID) was selected to serve as the statewide program administrator (PA) for the DAC-SASH program.

As ordered by D.18-06-027, every three years beginning in 2021, the CPUC Energy Division shall select an independent evaluator to assess the effectiveness and efficiency of both the PA and the DAC-SASH program overall. This research plan, developed in consultation with the Energy Division, describes the desired outcomes and research activities that will be conducted as part of the second triennial evaluation of the DAC-SASH program. Table 1-1 summarizes the research activities and their alignment with the Energy Division's research objectives. Section 2 of this research plan describes the various research activities in greater detail.

TABLE 1-1: SUMMARY OF RESEARCH ACTIVITIES AND OBJECTIVES

Research Activity	Research Objective(s)
Review project application data	Summarize geographic distribution of DAC-SASH participants. Identify which projects are leveraging IRA incentives, the storage attachment rate, and completed vs. pending installations.
DAC-SASH participant surveys	Assess customer satisfaction with the program and effectiveness of ME&O activities.

[1] California Assembly Bill No. 327 (Perea, 2013). http://www.leginfo.ca.gov/pub/13-14/bill/asm/ab_0301-0350/ab_327_bill_20131007_chaptered.htm

[2] CPUC D.18-06-027. Alternate Decision Adopting Alternatives to Promote Solar Distributed Generation in Disadvantaged Communities. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M216/K789/216789285.PDF

Research Activity	Research Objective(s)
Interviews with GRID, subcontractor partnership program (SPP) participants, and participants with cancelled projects	Understand factors in application cancellation, the program's effectiveness in addressing barriers, and the effectiveness of the SPP program.
Solar and storage impact assessment	Estimate the program's energy and environmental impacts.
Web surveys with job trainees	Evaluate skills and knowledge gained through the job training, determine the ways in which the job training has supported trainees' careers, and conduct a wage comparison of trainees within the field to measure the economic benefits of the job training.
Utility data analytics	Determine the number and location of eligible customers not served, the number of participants enrolled in CARE/FERA/SGIP/ESA or other clean energy programs, the monthly bill reductions, and the changes in consumption post-installation of solar/solar and storage.
Program cost-benefit analysis	Quantify the program's cost effectiveness using the three SPM tests (RIM, TRC, and SCT) and provide incentive level-setting support.
Vendor assessment, program documentation review	Conduct a comparison of forecasted vs. actual expenses, PA costs, program management costs, information technology costs, regulatory compliance, implementation costs, and ME&O costs.

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2 EVALUATION APPROACH

We have grouped the evaluation objectives into eight primary assessment areas listed below:

1. **Review project application data.** We will request this information from GRID and identify the need to supplement with other sources such as interconnection data or Self-Generation Incentive Program (SGIP) application data. We will summarize geographic distribution of DAC-SASH participants and identify which projects are leveraging Inflation Reduction Act (IRA) incentives, the fraction of customers on the Net Billing Tariff (NBT) vs. NEM 2.0, the storage attachment rate, and completed vs. pending installations.
2. **DAC-SASH participant surveys.** To assess customer satisfaction with the program and the effectiveness of marketing, education, and outreach (ME&O) activities.
3. **Interviews with GRID, subcontractors, and participants with cancelled projects.** To understand factors in application cancellation, the program's effectiveness in addressing barriers, and the effectiveness of the Subcontractor Partnership Program (SPP) program.
4. **Solar and storage impact assessment.** Estimate program energy, peak demand, environmental, and grid impacts.
5. **Web surveys with job trainees.** Assess job training program experiences and job outcomes resulting from the program.
6. **Utility data analytics.** Quantify number and location of eligible customers not served, number of participants enrolled in the California Alternate Rates for Energy (CARE)/Family Electric Rate Assistance (FERA)/SGIP/Energy Saving Assistance (ESA) programs or other clean energy programs, quantify monthly bill reductions, and determine changes in consumption post-installation of solar photovoltaic (PV) or PV paired with storage.
7. **Program cost-benefit analysis.** Using Verdant's proven suite of modeling tools, quantify ratepayer/societal benefits and costs and propose changes to incentive levels as appropriate.
8. **Vendor assessment, program documentation review.** Review and analyze program documentation to understand forecasted vs. actual costs, expenditures and uncommitted balances, total program administration costs, information technology costs, regulatory compliance costs, implementation costs, and ME&O expenditures.

Within each of these research areas we will also document progress toward program metrics and goals, assess any progress that has been made by the DAC-SASH PA to address recommendations stemming

from prior evaluation research, and identify areas where further program improvements are needed to help increase program participation and achieve its goals.

2.1 DATA SOURCES AND PRIMARY DATA COLLECTION ACTIVITIES

The DAC-SASH program evaluation will rely upon many data sources and primary data collection activities that will gather the data necessary to support the eight primary assessment areas.

Project Application Data

A fundamental component for all aspects of the evaluation is the PA's customer database that houses key applicant and system information for all DAC-SASH projects. This database will be requested from the PA and will provide the following key elements necessary for the DAC-SASH evaluation:

- **DAC-SASH project information** such as application status (including the dates various project milestones were completed), project specifications (system size, azimuth, tilt, etc.), system costs and DAC-SASH incentive amount, additional project funding (e.g., Investment Tax Credit (ITC), IRA), ownership type, and solar contractor information. These data will be used to assess program metrics and key performance indicators (KPIs) and to develop estimates of PV system energy production.
- **Applicant information** such as the applicant's name and contact information (address, email, and phone) and property address that will be used to develop participating survey samples and assess geographic distributions of participants.

Program Materials

We will review publicly available information on the DAC-SASH program. We will also work with the Energy Division project manager (PM) and the DAC-SASH PA to obtain any **additional** program documentation that may not be publicly available to ensure our evaluation is informed by all available Program materials. We do not expect the program material review to result in any standalone deliverables. Instead, the program material review will inform the development of the Detailed Research Plan and Schedule and the evaluation's data collection instruments.

In-Depth Interviews and Surveys

To better understand current DAC-SASH program participation experiences, the effectiveness of current ME&O and job training activities, and the SPP, the Verdant team will complete a number of data collection efforts with key participants and stakeholders. Table 2-1 below provides an overview of the in-depth interview (IDI) and web survey data collection activities and the primary research objectives for each effort. The sample sizes were estimated by Verdant based on data from the California Distributed Generation Statistics website (DG Stats), the DAC-SASH Semi-annual Progress Report for July 2024, and

the 2024 ME&O Plan whenever possible. The sample sizes for some of the interviews and surveys are listed as to be determined (TBD) due to a lack of publicly available data. They will be determined as part of the study and in collaboration with the CPUC and GRID. The available sample and number of completes may change based on analysis of DAC-SASH program tracking data and information from the PA, with final numbers being determined shortly after receiving program tracking data and conducting the PA interviews. For all primary research activities, Verdant will increase the cultural competency of our research by seeking feedback from a member or organization from the target audience and ensuring the data collection instruments are offered in the primary languages of these audiences.

Verdant will coordinate with the DAC-SASH program PA on the status, timing, and objectives of the DAC-SASH PA's research activities to ensure research activities are complementary, not redundant, and are considerate of respondent survey fatigue.

TABLE 2-1: SUMMARY OF IN-DEPTH INTERVIEWS AND SURVEYS

Program Actor	Group	Type	Sample*	Completes
DAC-SASH PA	GRID Alternatives	IDI	1	1
Participants	Active & Completed Applications	Web Surveys	3,306	150
	Cancelled Applications	IDIs	TBD	5
Non-Participants	GRID Cold Leads and Households Directly Marketed to	Web Surveys	~19,000	100
Sub-Contractors in the SPP	Participants	IDI	7	4
Job Trainees	Completed DAC-SASH job training opportunity	Web Surveys	151	100
CBOs and IOUs	Participants	IDI	36 CBOs 3 IOUs	6 CBOs 3 IOUs
Tribal Contacts	Employees that coordinate with GRID	IDI	TBD	3

*Participant sample size was based on data from DG Stats for all projects beyond the Reservation Request Review stage. Non-participant data comes from the DAC-SASH Semiannual Progress Report for July 2024 from their Q1 & Q2 mailing campaign. Job trainee and subcontractor sample sizes were estimated based on data included in the Semi-annual Progress Report for July 2024. Community based organization (CBO) sample size was based on the 2024 DAC-SASH ME&O Plan, investor-owned utility (IOU) sample size based on participating utilities.

For each of the data collection efforts shown in the table above Verdant will carefully develop an interview guide or survey instrument that is clear, concise, not overly burdensome, and can efficiently collect data that will assist Verdant with our assessment of the primary research objectives. The in-depth interview

guides will take a semi-structured format to ensure we capture the key themes and metrics of interest to DAC-SASH stakeholders, while allowing room to explore unexpected—yet pertinent, details associated with the program's implementation. In many cases, these unplanned threads of conversation prove to be the most insightful. Where possible, we will work to apply learnings from one interview to enhance our inquiry in the next. We will provide each of the interview guides and survey instruments to the Energy Division PM for review and comment prior to commencing data collection. All in-depth interviews will be conducted by professional Verdant staff and recorded (if the interviewee provides their consent). Following the completion of each interview we will document the key findings in an Interview Findings Log that can be shared with the Energy Division PM during regularly scheduled meetings.

Participant Surveys

The DAC-SASH Participant surveys will assess the impact of DAC-SASH's ME&O activities, quantify satisfaction with the program, and gauge any shifts in energy usage or engagement with other energy efficiency initiatives following solar implementation. These surveys will provide valuable insights into customers' awareness and understanding of their participation in the program, their energy bills, bill savings, as well as their satisfaction with the information and education provided.

Verdant recognizes potential barriers faced by DAC-SASH participants when responding to surveys—including distrust towards unfamiliar entities, limited access to technology, and language challenges—and we are committed to employing strategies that effectively address these issues. Our proven methodology is designed specifically for maximizing survey response rates among low-income customers. This includes offering a $25 incentive for participants who complete the short survey in its entirety.

Our data collection will employ a multi-modal outreach approach to ensure broad participation. We will initiate a web survey distributed via email and SMS (text) and will follow up with non-respondents using postcards featuring QR codes as needed. All survey outreach materials will prominently feature the $25 incentive being offered for survey completion. The survey will be available in both English and Spanish, with plans to investigate whether another non-English language is prevalent enough among participants to warrant a second translation. To further encourage participation, we will follow up with phone calls whenever necessary.

Participants with Cancelled Projects Interviews

To gather additional information on barriers and program effectiveness, we will conduct 30-minute interviews with customers that have cancelled applications to better understand why they cancelled and how well or poorly the DAC-SASH program is addressing specific barriers to solar adoption for low-income customers and customers located in DACs. Interviewees will receive a $25 incentive as thanks for completing the interview.

Non-participant Surveys

We will also conduct web surveys with DAC-SASH non-participants. This could include GRID "cold leads" (homeowners they connected with that did not apply) as well as customers who received direct marketing materials (TBD based on information gathered about GRID's marketing activities). These non-participant surveys will focus on gathering data to improve our understanding of how the program's ME&O initiatives are carried out and received by those who do not choose to participate in the program. Specifically, they will focus on determining non-participants' level of familiarity with the DAC-SASH program, exploring the persuasiveness of current marketing materials (including if any marketing materials are counter-productive and discourage participation), and gathering feedback on how DAC-SASH marketing materials could be improved to better resonate with customers.

Web surveys will be initiated via email and SMS (text) and will follow up with non-respondents using postcards featuring QR codes as needed. All survey outreach materials will prominently feature the $10 incentive being offered for survey completion. The survey will be available in both English and Spanish, with plans to investigate whether another non-English language is prevalent enough among participants to warrant a second translation. To further encourage participation, we will follow up with phone calls whenever necessary.

DAC-SASH PA Interviews

We will conduct an initial one-hour interview with the DAC-SASH PA (GRID) to discuss current program status, program changes, their assessment of the effectiveness of these changes, and other program implementation successes and challenges. We will also ask GRID what they perceive to be the major barriers to program adoption, major pain points in program implementation, and dig into the strategies GRID is using to address these challenges. This and any follow-up interviews needed will also provide us with an opportunity to discuss planned or ongoing DAC-SASH PA research efforts to identify overlaps that may exist with our evaluation activities and understand the coordination that will be necessary to minimize respondent burden. Prior to the interview we will send the interview guide to GRID to help them prepare.

Subcontractor Interviews

The Verdant team plans to complete up to four 30-minute interviews with subcontractors in the SPP, with a goal of conducting at least one interview with a DAC-SASH subcontractor who has installation experience with California tribal communities. These interviews will provide an opportunity to identify and understand lessons that can be applied to improving the feasibility, economic benefit, and cost-effectiveness of the program, including its job training elements that apply to subcontractors.

Job Trainee Surveys

Verdant will conduct surveys with individuals who have fulfilled a DAC-SASH job training opportunity to measure economic benefits of the DAC-SASH program.

Outreach will follow a similar approach to what we described above for the participant surveys. We will begin outreach using email and SMS (text) survey invitations and will follow up with postcards containing a quick response (QR) code for the survey to unresponsive job trainees. Phone calls will also be used to achieve our desired number of completes, if needed. Surveys will be offered in both English and Spanish, and a third language if the translation is warranted. We will provide a $25 incentive to each respondent who completes the job trainee survey.

CBO and IOU Interviews

The DAC-SASH CBO and IOU interviews will explore the role the CBOs and IOUs play in terms of marketing and any costs associated with these marketing efforts. We plan to conduct 30-minute interviews with CBOs in the DAC-SASH network, at least one of which will aim to be with a CBO with DAC-SASH marketing experience in California Indian Country; and 30-minute interviews with the IOUs. We will make a $100 donation to each CBO organization that participates in the interview in appreciation for their time.

Tribal Contact Interviews

Tribal contact interviews will be conducted with tribal employees with whom GRID frequently interacts. We will conduct up to three 30-minute interviews that focus on any specific barriers that impact tribal projects and how the program could better support its tribal applicants. We will provide each interview respondent with a $100 gift card as thanks for their participation in our research effort.

Written Data Requests

We will work with GRID to obtain any additional information necessary for evaluation purposes that is not publicly available, is not located in the project application data, and cannot be obtained from in-depth interviews or surveys. This includes (but is not limited to):

- Information from GRID that can easily be provided via email rather than during an interview to help decrease interview fatigue
- Job training program data
- Information on third party ownership

Solar PV and Storage Impact Assessment

Solar production and interval usage data will be used to quantify energy, environmental, and bill impacts. Our review of the DG Stats public dataset suggests that as of March 6, 2025, there were 2,995 completed DAC-SASH applications. Table 2-2 summarizes completed project counts by IOU service territory.

TABLE 2-2: DAC-SASH COMPLETED PROJECT COUNTS BY IOU

IOU	Project Count
PG&E	1,745
SCE	97
SDG&E	1,153
Grand Total	***2,995***

Distributed energy resource (DER) data collection is a schedule and budget risk. However, solar PV is a mature technology and the prior DAC-SASH evaluation observed meter performance that closely matched expected performance. Therefore, we plan to request solar PV generation data that are readily available from entities involved in many DAC-SASH projects, such as Sunrun, rather than creating a stratified sample design (e.g., setting minimum quotas by parameters of interest like climate zone, utility, and equipment manufacturer) that would require data collection from more varied, harder to reach manufacturers. We will compare these solar PV generation data to PV generation simulations that use actual weather data from California Measurement Advisory Council (CALMAC) to simulate performance of the systems[3] (see section 2.2.4 for details on methodology). Results will help us understand how systems are performing relative to expectations and inform the simulation estimates for projects where data are not available.

For projects paired with battery storage, we will attempt to obtain battery storage charge/discharge data from the equipment manufacturer. If storage data are not available, Verdant will leverage internally developed battery dispatch models to simulate storage behavior.

Environmental Impacts

Environmental impacts will be determined based on the energy impacts calculated via the methods described above. We will use the marginal carbon dioxide (CO_2) emissions data developed by WattTime as part of the SGIP greenhouse gas (GHG) signal (http://sgipsignal.com) to estimate the avoided CO_2 emissions using data from each year (2022, 2023, and 2024). We will also estimate reductions in sulfur oxides (SO_X), nitrogen oxide (NO_X), and particulate matter emissions (see Section 2.2.4 for details on methodology).

[3] CALMAC contains historical and typical weather files for 127 California weather stations.

Utility Data

Verdant will work with the California Energy Commission (CEC, which is currently collecting electric usage data from all load serving entities on a regular basis) or the three large electric IOUs to obtain the necessary utility data to conduct this analysis. The analysis we plan to do focuses on two main aspects:

- **Changes in Electricity Consumption** In previous research we have found that customer energy consumption often increases following the installation of solar with the largest increase in the later afternoon (during peak hours) in the third quarter.[4] If DAC-SASH participants increase their energy consumption following the installation of PV or PV and storage systems, there will be a reduction in energy, environmental, and bill savings impacts relative to the assumption of no change in customer energy consumption. We will evaluate customer energy usage pre- and post-installation to analyze the behavior of customers with installed systems and determine what changes, if any, can be expected in energy consumption of future beneficiaries after their systems are installed. We will also create a control group to understand how the increase in consumption compares to non-solar customers who may also be electrifying their homes or increasing use of air conditioning. We will stratify results by NEM 2.0 vs. NBT, solar-only vs. solar paired with storage, and any other parameters we may deem useful.
- **Customer Bill Impacts** Verdant will compare the pre- and post-installation utility bills for each DAC-SASH customer. The utility bill analysis requires a full year of pre- and post- installation utility bills, limiting the application of this approach to projects that are installed and where participants have been receiving NEM/NBT credits for a full year. Where possible, bill impacts will be reported by IOU, climate zone, and system ownership (see Section 2.2.6 for details on methodology).

Vendor Assessment Data

The data needed to complete the vendor assessment will include a mix of pre-existing resources and primary data that will be collected as part of this evaluation (these are further described in the In-Depth Interviews and Surveys section below). Some of the necessary pre-existing data elements are publicly available (such as DAC-SASH's Semi-Annual Progress Reports). Other necessary data includes the DAC-SASH PA's forecast and actual invoices from program inception through December 2024, which will be requested from GRID. These data will be used to assess the primary administrative cost drivers for the DAC-SASH PA, how the spending to date compares to the originally proposed DAC-SASH PA implementation plan, how effective spending to date has been on addressing barriers faced by

[4] California Solar Initiative Final Impact Evaluation. January 2021. https://www.calmac.org/publications/CSI_Evaluation_Report-2.pdf

participants, and the effectiveness of the ME&O efforts and invoicing process, and to identify future areas for analysis.

Independently Acquired Data

The development of energy, economic, and environmental impact estimates will also require the acquisition of additional data. These data include the following:

- Weather data (typical year and actual) from the CALMAC[5]
- Identification of the top 100 hours of electricity demand for each IOU and the California Independent System Operator (CAISO) from CAISO's Open Access Same-Time Information System (OASIS),[6] in order to evaluate the program's contribution to reducing demand during utility and system peak hours.
- GHG emissions information from WattTime,[7] the California Air Resource Board (CARB), and the most recently approved CPUC Avoided Cost Calculator[8]

[5] California Measurement and Advisory Council – California Weather Files. https://www.calmac.org/weather.asp

[6] California ISO Open Access Same-time Information System. http://oasis.caiso.com/mrioasis/logon.do

[7] California Self-Generation Incentive Program Greenhouse Gas Signal. https://sgipsignal.com

[8] California Public Utilities Commission Avoided Cost Calculator. https://www.cpuc.ca.gov/dercosteffectiveness

2.2 DATA ANALYSES AND KEY DELIVERABLES

Below we present each of the eight primary research areas with their corresponding assessment areas and key deliverables.

2.2.1 Project Application Data Review

- **Assessment of Metrics, KPIs, and Measurement & Verification Reporting Requirements**
  - Analyze customer data to determine the number and installed capacity of solar and storage, project characteristics such as application status, location, system ownership type (host customer vs. third-party), project costs and incentives, and resiliency capabilities.
  - Analyze customer data to characterize participant and non-participant income level, household size, annual pre-solar energy use, education level, and other demographic characteristics that could contribute to differences in participation.
  - Characterize cancelled or withdrawn applications, including their location, system size, estimated incentive, and reasons for cancellation based on customer data and interviews.
  - Analyze DAC-SASH tracking data (PA customer database) and subcontractor data (collected by the DAC-SASH PA for the SPP) to provide recommendations on the feasibility, economic benefit, and cost-effectiveness of the SPP.
  - Conduct a geographical distribution analysis of DAC-SASH participants and eligible customers not served as they relate to DACs, IOU service territories, and GRID office locations.
  - Determine whether participating households have performed an energy efficiency audit or enrolled in the Energy Savings Assistance Program.
  - Determine the average system costs broken out by equipment, installation, and/or other customer acquisition costs.

2.2.2 DAC-SASH Participant Surveys

- **Assessment of Metrics, KPIs, and Measurement & Verification Reporting Requirements**
  - Analyze DAC-SASH participant survey responses to understand awareness of participation in DAC-SASH, impact on energy bills, effectiveness of ME&O activities, satisfaction with the program (including customer experience, savings, information, and education provided), changes in energy patterns, whether participants have purchased other non-solar energy saving measures, if participants have installed electrification measures, and participation in other energy efficiency or utility programs.
  - Analyze DAC-SASH tracking data and participant survey and interview responses to determine specific barriers to participation such as lack of in-native language support, distance to GRID and/or subcontractor offices, utility rates, NBT impacts and battery availability.

2.2.3 Interviews with GRID, Subcontractors and Participants with Cancelled Projects

- **Assessment of Metrics & KPIs**
  - Document barriers and successes of the SPP to determine how to improve the feasibility, economic benefit, and cost-effectiveness of the program.
  - Measure applicant satisfaction and barriers to solar adoption for low-income customers located in DACs through in-depth interviews with cancelled project applicants.
  - Assess awareness levels among subcontractors and participants about the DAC-SASH program and recent program changes and assistance.
  - Verify through interviews with the PA the implementation of minimum consumer protection standards for systems served by approved third-party operators.
- **Assessment of Program Organizational Structure**.
  - Conduct interviews/surveys with key stakeholders including subcontractors, participants who have cancelled their applications, tribal contacts, and the DAC-SASH PA, to understand their experiences with the current organizational setup. Focus on identifying strengths and weaknesses within the organization structure and assessing perceptions of changes made since the previous evaluation.
  - Determine how well the program aligns with the CPUC goals as outlined in the Environmental and Social Justice (ESJ) Action Plan and Resiliency Workshop Series Summary Report.
- **Documentation of Program Experiences and Barriers**
  - Utilize surveys and interviews with various program actors—including participants (active and cancelled applications) and subcontractors. Gather actionable recommendations aimed at overcoming these barriers.
- **Assessment of Progress Made Towards Prior Evaluation Recommendations**
  - Review actions taken by the DAC-SASH PA to address prior evaluation recommendations. Determine if/how prior recommendations have been implemented and whether the implementation of these recommendations has had the desired impact on the program.

2.2.4 Solar PV and Storage Impact Assessment

The key objectives of the impact assessment are to estimate the energy (kWh, kW), environmental (GHG), and economic (bill savings) impacts of DAC-SASH projects installed in 2022 to 2024. To calculate these impacts, we will first estimate each PV system's production as well as the change in beneficiary customer energy consumption and the change in utility energy load after system installation. The results of these estimates will be used as inputs to calculate the demand impacts, GHG impacts, and bill savings for non-cancelled and non-withdrawn DAC-SASH projects (where data are readily available) since the program's

inception. We will stratify results by NEM 2.0 vs. NBT, solar-only vs. solar paired with storage, and any other parameters we may deem useful.

PV Production

We will compare metered performance data from projects whose PV data are readily available to simulated PV generation data that uses actual weather data. Results will inform the simulation estimates for the other projects installed during the study period. The PV production analysis will utilize the following steps:

- **Simulations of installed system performance** will be developed using system characteristics from the customer data and weather data. The simulation will use *pvlib python,* a python-based, community-developed toolbox that provides a set of functions for simulating the performance of PV energy systems and accomplishing related tasks.[9] Verdant will use historical weather data available from CALMAC to simulate performance of the systems.[10]
- **Develop PV performance ratios** using the actual metered PV generation compared to the simulated generation based on actual weather. The PV-ratio, defined as hourly metered PV generation divided by hourly simulated PV generation using observed weather conditions, accounts for the differences between observed generation and simulated results. Careful analysis of the performance ratio can provide actionable insights into the drivers of performance. Variances in configuration and system availability can lead to performance that deviates from expectations. These comparisons will provide a more reliable audit of system performance than a site visit and have the benefit of being substantially more cost-effective.
- **Calculate forecasted performance of both installed and planned systems.** We will use the *pvlib python* model with typical weather produced by CALMAC. To estimate expected production in a typical year, the simulated production for all systems will be adjusted by the performance ratios described above. This will ensure that the typical year simulations for installed and planned systems better match evaluated real-world generation.

Storage Dispatch Data

For systems paired with storage we will request dispatch data from the equipment manufacturer and leverage it for impact analyses. If data are unavailable we will use internal dispatch models to simulate battery storage based on our knowledge of battery behavior and system characteristics.

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9 Anderson, K., Hansen, C., Holmgren, W., Jensen, A., Mikofski, M., and Driesse, A. "pvlib python: 2023 project update." Journal of Open-Source Software, 8(92), 5994, (2023). DOI: 10.21105/joss.05994.

10 CALMAC contains historical and typical weather files for 127 California weather stations.

Environmental Impacts

The program's environmental impacts will be assessed based on the evaluated energy impacts described above.

- We will use the marginal CO_2 emissions data developed by WattTime as part of the SGIP GHG signal (http://sgipsignal.com) to **e**stimate the avoided carbon emissions**.** CO_2 emission impacts will be calculated as the avoided emissions that would have occurred in the absence of the program. The hourly marginal emissions rates and the hourly utility electrical load reduction estimates will be combined to estimate avoided emissions in metric tons of carbon dioxide.
- The monetary value of the change in emissions will be calculated applying the value of GHGs from the California avoided cost calculator.
- We will estimate the lifetime GHG emissions reductions attributable to the program during 2025 using the CARB GHG benefits estimation tool.
- The SOx, NOx, and PM emissions will be calculated using marginal criteria pollution emissions rates developed as part of Verdant's evaluations of the SGIP. These hourly emissions factors will be multiplied by the solar PV generation and behavioral change in consumption to arrive at the program impact.

2.2.5 Web Surveys with Job Trainees

Data collected during surveys of job trainees will enable us to assess trainees' experiences working on DAC-SASH projects, both in terms of skills or knowledge gained and ease of participation, and whether the DAC-SASH job training helped them secure longer-term employment within a clean energy field.

- **Assessment of Metrics & KPIs**
  - Characterize the job trainee population in terms of demographics and specific skills or knowledge they gain through the training opportunity
  - Survey job trainees to assess the effectiveness of DAC-SASH-sponsored job training activities and the impact DAC-SASH's work force development activities have had on promoting economic development in DACs and expanding solar job outcomes, to document their experiences with the program and identify barriers they face to program participation
  - Analyze DAC-SASH job training survey responses to evaluate the types of training offered to participants (e.g., battery storage training), the number of trainees participating in the training programs, the wages training graduates are earning in the solar industry as compared to other solar industry wages across the state (or comparable industries), and the wages GRID/SPP contractors provide during their training.

2.2.6 Utility Data Analysis

Utility Energy Impacts

Verdant will calculate customer's change in utility load using the PV performance ratio adjusted PV production and weather normalized estimate of energy consumption change due to the participation in DAC-SASH.

$$\Delta Utility\ kWh_i = PVR_{IOU_{mo}} * kWhPV_i + \Delta kWh_i$$

Where,

$\Delta Utility\ kWh_i$	Is the change in utility load for customer *i*
PVR_{IOUmo}	Is the PV performance ratio that adjusts simulated performance to account for evaluated performance results. This ratio would vary by IOU and by month.
$kWhPV_i$	Is the simulated typical performance for the PV system associated with customer *i*
ΔkWh_i	Is the change in customer *i*'s electricity consumption following the system installation[11]

The annual utility electrical load reduction will be reported, at a minimum, by IOU. Verdant will collaborate with the CPUC PM to determine additional levels of reporting.

The estimated utility electrical load reduction 8760 will be used to calculate **demand impacts** during hours of CAISO and IOU peak demands. We will analyze peak demand over the top 100 peak hours[12] to provide insight into how DAC-SASH projects impact the grid during the hours of highest load. The top hours will be obtained from the CAISO OASIS website.

Customer Electricity Consumption

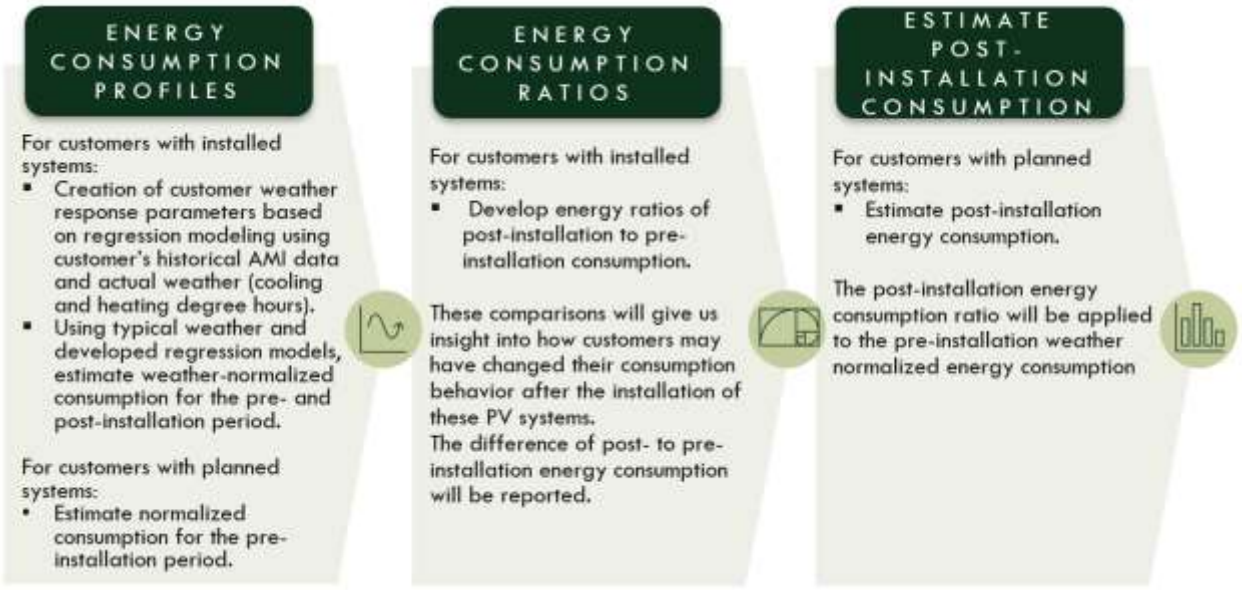
Verdant staff have found that customer energy consumption often increases following the installation of solar. If beneficiary customers increase their energy consumption following the installation of the PV systems, there will be a reduction in energy, environmental, and bill savings impacts relative to the assumption of no change in customer energy consumption. Our planned evaluation of customer energy usage pre- and post-installation will allow us to analyze the behavior of customers with installed systems

[11] For customers with installed systems, the change in energy consumption is the change in their weather normalized pre- and post-installed electricity consumption. For customers with planned systems, the change in energy consumption is their pre-installed weather normalized electricity consumption adjusted by the evaluated energy ratio.

[12] The Top 100 hours is a metric used by the CEC to reflect the System Net Peak Hours.

to determine what changes, if any, in energy consumption are observed after systems are installed. The customer energy consumption analysis will include the following steps in Figure 2-1.

FIGURE 2-1: CUSTOMER ENERGY ANALYSIS STEPS



If DAC-SASH customers with installed systems do not change their electricity consumption following the receipt of the bill credits, the evaluation will assume that customers with planned systems maintain their pre-installation energy consumption.

Economic Impacts

The program's economic impacts will be estimated using customer bill changes. The utility bill analysis will compare the pre- and post-installation utility bills. This approach will assess changes in pre and post installation bills using actual rates and holding rates constant at their pre-installation values.

2.2.7 Cost-effectiveness Assessment

The cost-effectiveness of the DAC-SASH program will be estimated using the format and content requirements of the 2001 CPUC California Standard Practice Manual (SPM) for performing Economic Analysis of Demand-Side Programs and Projects. Cost-effectiveness will be quantified using the total resource cost (TRC) test and the ratepayer impact measure (RIM) test. We will also calculate the societal cost test (SCT), adopted in CPUC D.24-07-015, which is a modified TRC. If there is interest we can also calculate the participant cost test but given the zero-cost nature of DAC-SASH, this would simply be the total present value of the customer's bill savings. The PA test is also complicated when analyzing costs and benefits of non-IOU administered non-ratepayer funded programs where the costs are accrued to the

administrator (GRID) and the benefits (electric avoided costs) accrue to the IOU. We will work with the Energy Division to determine the appropriate discount rates to use for these tests and to determine the non-energy impacts and GHG adders to include in the SCT.

TABLE 2-3: STANDARD PRACTICE MANUAL COST-EFFECTIVENESS TESTS

SPM Test	Cost	Benefit
TRC	Program Admin Costs, Measure Costs	Avoided Costs, Federal Tax Credits
SCT	Program Admin Costs, Measure Costs	Avoided Costs, Federal Tax Credits, GHG Adder, Non-Energy Impacts
RIM	Program Admin Costs, Reduced Revenue (bill savings – reduced CARE subsidy), Incentive Costs	Avoided Costs

The IRA, passed in 2022, has led to substantial changes to the Federal ITC for expenses invested in renewable energy. The IRA reinstated the 30% basic ITC for solar systems installed from 2022 to 2032. The ITC was also expanded to include several bonus credits and to allow for direct or elective pay for nonprofits and other tax-exempt entities (municipalities and tribal governments). The updated ITC includes six different bonus credits, four of which are associated with low-income communities. Projects can only apply for one of the four low-income community bonus credits. The other two bonus credits are stackable. The combination of the basic, low-income, and stackable credits could raise the value of the ITC up to 70% of the eligible costs of the project. The four low-income bonus ITC credits are:

- 10% bonus for projects located in a low-income community
- 10% bonus for projects located on tribal lands
- 20% bonus for projects classified as qualified low-income residential building projects where the financial benefits of solar production are allocated equitably among the residents
- 20% bonus for projects that are classified as qualified low-income economic benefit projects.

The two stackable bonus credits are:

- 10% bonus for projects located in an "energy community"[13]
- 10% bonus for projects meeting domestic content or manufacturer requirements.

The updated ITC with bonus credits may have a substantial impact on project and program cost-effectiveness for the TRC and the SCT. It is critical to understand how the expanded ITC is being utilized by DAC-SASH market actors. In-depth interviews with these stakeholders will inform how these new

[13] There are multiple approaches for a facility being qualified as an "energy community" including being in a metropolitan or non-metropolitan statistical area which has an unemployment rate above the national average in the previous year.

benefits are incorporated into the cost-effectiveness analysis. The avoided cost benefits will be calculated using the DAC-SASH program's estimated energy impacts and the CPUC Avoided Cost Calculator.

2.2.8 Vendor Assessment

The research objectives of the vendor assessment are to document the performance of the DAC-SASH PA (GRID) from the perspective of DAC-SASH participants, conduct a longitudinal summary of the program implementation costs by program task and key milestones, and provide recommendations for areas of improvement based on a best practice review and benchmarking assessment of the program administration activities.

To meet the study's research objectives, we propose the following research questions:

1. To date, what have been the DAC-SASH PA's primary administrative cost drivers?
    - What are the allocations of DAC-SASH program spending?
    - Are there any areas of spending that have not been proportional to the anticipated output?
    - What percentage of the budget is being outsourced to subcontractors, how is their effectiveness being measured, and should any of these tasks be completed in-house by the DAC-SASH PA?
    - What is the administrative cost trend over time?
2. How effective has the DAC-SASH PA spending to date been at addressing the barriers faced by participants?
    - Should PA spending be shifted or refocused to areas that will help to alleviate participation barriers or burdens reported by contractors and property owners?
3. How effective have the DAC-SASH PA's ME&O efforts been to date? Are they successfully building awareness for a pipeline of future projects?
4. Identify areas for future analysis or auditing.

- **Evaluation of Marketing, Education & Outreach Efforts**
    - Verify the languages in which the program is being marketed and assess whether this makes sense for the eligible population
    - Conduct participant surveys to gauge awareness of and satisfaction with the DAC-SASH program.
    - Leverage participant surveys and non-participant surveys to assess if the outreach channels used for marketing are appropriate or could be improved.

- Assess whether the DAC-SASH PA has made changes to ME&O approaches that have increased program awareness and participation since the previous evaluation.
- Interview CBOs and IOUs to discuss their role in marketing and the costs associated with their efforts.
- Determine a 'participants per dollar metric' of each lead generation method to evaluate cost effectiveness of different strategies employed by each marketing group (PA, IOU, CBO)
- Survey non-participants to assist with evaluating the content of DAC-SASH marketing (including languages it's offered in, customer perception of the messaging, instilling trust in the program offering, or identifying out of touch or counterproductive messages), determine its effectiveness as well as what could be changed to entice more participants, and document their identification of barriers to program participation

- **Spending Assessment**
  - Determine the primary administrative cost drivers, evaluate spending compared to the initial proposed plan, evaluate how effective PA spending has been at reducing barriers, evaluate the effectiveness of the invoice process.
  - Compare the total cost of the GRID administration as compared to GRID installations.
  - Depending on the level of detail available in the data provided by GRID: we will evaluate how installed cost components compare to those reported by EnergySage, Lawrence Berkeley National Laboratory, the National Renewable Energy Laboratory, and/or other relevant sources.

3 PROJECT DELIVERABLES AND TIMELINES

Once a month, Verdant will provide Energy Division PM and IOU Contract Manager with a written monthly status report and invoice. The status report will provide an update on the status of work planned for the reporting month, any significant issues encountered or preliminary findings stemming from the performed work, work planned for the upcoming month, and status of the budget relative to the work accomplished (% complete).

The Verdant PM will also hold bi-weekly check-in meetings with the Energy Division PM. The purpose of these calls will be to provide an update on the status of ongoing work, pending deliverables, and the remaining budget. These calls will serve to not only coordinate work on the project but provide a forum to discuss interim results before formal deliverables. Once all milestones for a task have been completed, Verdant will submit an Interim Draft for that task to the Energy Division PM.

Verdant will prepare draft and final versions of the DAC-SASH program evaluation report. The report will consist of, at a minimum, an executive summary, an introduction, a discussion of the methodologies used

to answer the research questions, thoroughly documented analysis findings, and actionable recommendations for continued program improvements to help the DAC-SASH program meet its goals. The executive summary will be short and to the point, summarizing key findings for policymakers or legislators, in compliance with the Energy Division's guidelines. After the report has been finalized, the Verdant team will also prepare a Response to Recommendations (RTR) document. This RTR will include a table listing all recommendations from the final report and include columns for the DAC-SASH PA to provide a disposition and disposition notes for each recommendation.

Below we provide an overview of the timeline for completing the primary project tasks and deliverables associated with various tasks. In general, the research timeline is driven by the RFP and the desire to complete the study by March 31, 2026. Dates recorded here are subject to change based on data availability.

Deliverable/Activity	Completion Deadline
Draft Research Plan to Public	March 17th, 2025
Public webinar on Draft Research Plan	March 28th, 2025
Public comments on Draft Research Plan	April 11th, 2025
Final Research Plan to Public	April 21st, 2025
Project application data collection	May 5th, 2025
PA interviews	May 23rd, 2025
Program material collection	May 30th, 2025
Data to support Vendor Assessment	May 30th, 2025
Subcontractor interviews	June 20th, 2025
PV generation and storage dispatch data collection	June 30th, 2025
CBO and IOU interviews	July 7th, 2025
Tribal contact interviews	July 11th, 2025
Participants with cancelled projects interviews	July 25th, 2025
Utility data collection	July 31st, 2025
Participant surveys	August 1st, 2025
Non-participant surveys	August 8th, 2025
Job trainee surveys	August 15th, 2025
Data collection complete	August 29th, 2025
Data analysis complete	November 30th, 2025
Draft Report to CPUC Energy Division	December 31st, 2025
Draft Report to Public	January 30th, 2026
Public webinar on Draft Report	February 13th, 2026
Final Report	March 15th, 2026