

SOLAR ON MULTIFAMILY AFFORDABLE HOUSING (SOMAH) PROGRAM SECOND TRIENNIAL EVALUATION RESEARCH PLAN

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Verdant Associates (Verdant) and Illume Advising (Illume) have been contracted by San Diego Gas and Electric (SDG&E) on behalf of the California Public Utilities Commission (CPUC) to evaluate the Solar on Multifamily Affordable Housing (SOMAH) program, as directed by CPUC Decision (D.) 17-12-022.¹ This document summarizes the approach for the second triennial evaluation of the SOMAH program.

1 PROGRAM BACKGROUND AND CURRENT STATUS

California State Assembly Bill (AB) 693 directed the CPUC to institute a new program intended to make qualifying solar energy systems more accessible to low-income and disadvantaged communities (DACs).² In December 2017, the CPUC issued Decision (D.) 17-12-022 creating the SOMAH Program and establishing program goals and eligibility requirements. The primary goals of this program are to install solar energy systems that have a generating capacity equivalent to at least 300 MW (CEC-AC) on qualified multifamily affordable housing properties through December 31, 2030³ and to promote local economic development through job training requirements and hiring practices.

The SOMAH Program provides significant subsidies for the installation of solar photovoltaic (PV) systems on qualifying multifamily affordable housing properties (i.e., multifamily housing financed with low-income housing tax credits, tax-exempt mortgage revenue bonds, general obligation bonds, or local, state, or federal loans or grants). To qualify for SOMAH incentives, properties must be existing deed restricted properties, have at least five units, and separately metered tenant units. They must also satisfy either A) have 80% of their total tenant households with incomes at or below 60% of the area median income or B) be located in a DAC that scores in the top 25% of census tracts statewide in the CalEnviroScreen⁴ or C) be located on a federally recognized tribal land or be under tribal control.

On the first day of accepting applications (July 1, 2019), SOMAH was nearly fully subscribed, having received more than 240 applications representing over 74 MW of solar generating capacity and \$163 million in reserved funding. In the three years since the program's launch, the total number of SOMAH

¹ CPUC (D.) 17-12-022 Adopting Implementation Framework for Assembly Bill 693 and creating the Solar on Multifamily Affordable Housing Program. December 14, 2017.

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M201/K940/201940057.pdf>

² https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB693

³ This program is funded by Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas and Electric (SDG&E), Liberty Utilities, and PacifiCorp, collectively the investor-owned utilities or IOUs.

⁴ CalEnviroScreen is a screening methodology that helps to identify California communities that are disproportionately burdened by multiple sources of pollution developed by the Office of Environmental Health Hazard Assessment (OEHHA) on behalf of the California Environmental Protection Agency (CalEPA).



applications has nearly tripled.⁵ Figure 1 below shows the recent number of active and completed (“Incentive Paid”) SOMAH applications.⁶

FIGURE 1: SOMAH ACTIVE APPLICATIONS BY APPLICATION STATUS

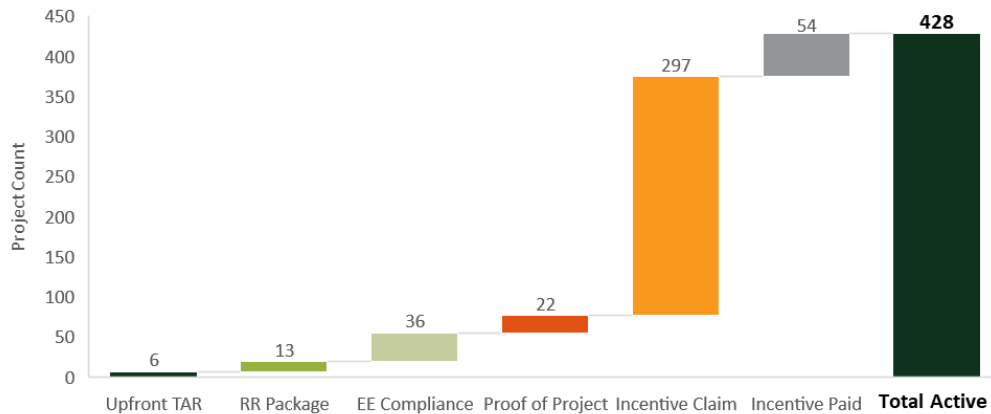


Table 1 below presents the number of SOMAH applications that have been submitted, cancelled or withdrawn, and paid annually since the program’s inception in 2019. It also provides the cumulative number of active and paid projects by year. As this figure shows, currently 262 of the 690 submitted applications have been cancelled or withdrawn (38%) and 54 out of the 690 submitted applications have been completed and received their SOMAH incentive (8%).

TABLE 1: ANNUAL SUBMITTED AND CANCELLED/WITHDRAWN APPLICATIONS, PAID PROJECTS, AND CUMULATIVE ACTIVE AND PAID PROJECTS

Calendar Year	Submitted Applications	Cancelled or Withdrawn Applications	Paid Projects	Cumulative Active and Paid Projects
2019	316	20	0	296
2020	183	74	0	405
2021	171	100	14	476
2022	20	68	40	428
Total	690	262 (38%)	54 (8%)	428 (62%)

Figure 2 below shows the 10-year forecast of installed capacity as of mid-September 2022. This forecast includes 10-year projections assuming participation continued at the same pace as the program’s first year (July 2019 – June 2020), second year (July 2020 - June 2021), third year (July 2021 – June 2022), and

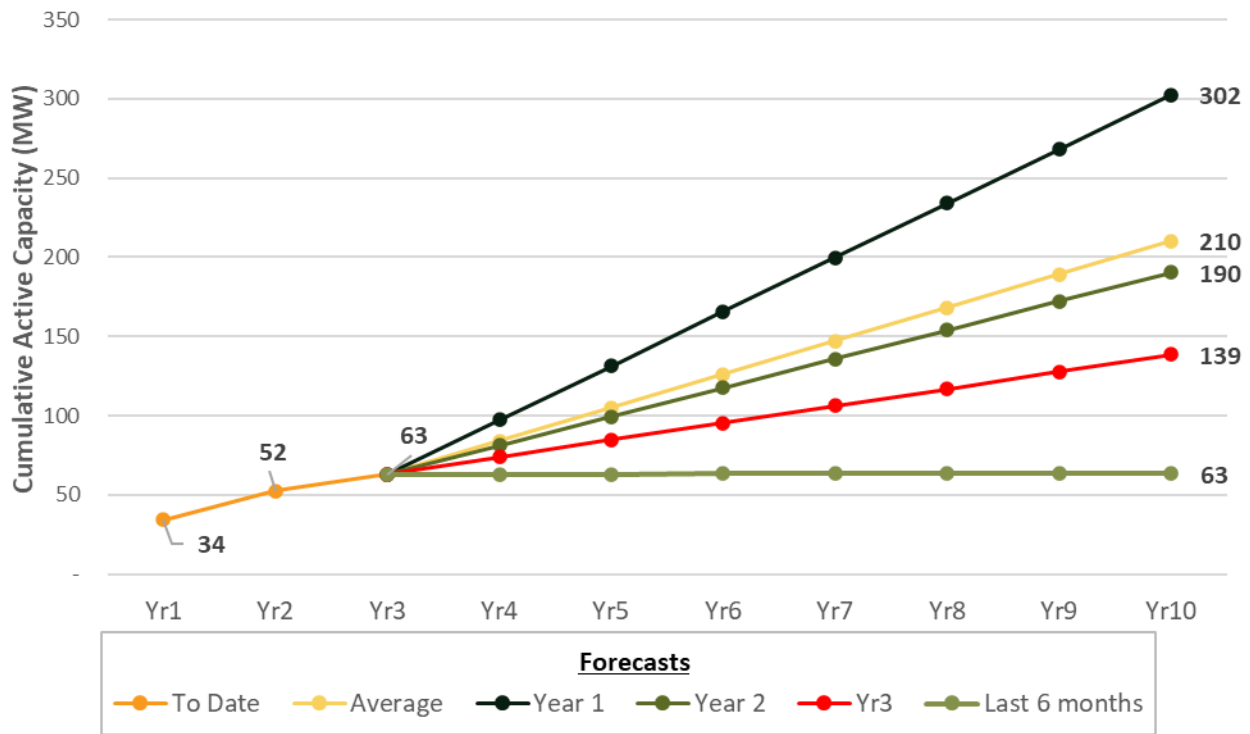
⁵ According to SOMAH Program participation data pulled from DGStats.com on September 19, 2022, a total of 690 applications have been submitted to date.

⁶ As of September 19, 2022.



the past six months. As Figure 2 shows, the only scenario in which the program achieves its 10-year goal of installing 300 MW of solar is if program participation returned to the level it experienced in the first year of the program and remains at that level for the final seven years of the program. The alternative forecasts (which are likely more realistic if significant changes are not made to the program), show the program falling short of its 300 MW goal.

FIGURE 2: SOMAH 10-YEAR FORECAST OF INSTALLED CAPACITY



2 EVALUATION OBJECTIVES AND OVERVIEW OF APPROACH

The SOMAH Program’s second triennial evaluation will serve to provide an update on the program’s progress towards meeting its goals. This progress will be measured via an assessment of the program’s **metrics and KPIs** (developed in the first SOMAH evaluation) and the **M&V requirements** (as outlined in D.17-12-022 and PU Code 2870(j) and 913.8). The number of projects that will have received Permission to Operate (PTO) as of December 31, 2022, will allow us to calculate and compare metered and simulated impacts of completed SOMAH projects, to improve the estimated impacts for the hundreds of active applications that are in progress. This evaluation will also include a cost-effectiveness assessment using



the Standard Practice Manual tests to determine the costs and benefits of the SOMAH Program to society (SCT), the combined utilities and beneficiaries⁷ (TRC), and ratepayers (RIM). Lastly, this evaluation will assess the **progress made by the SOMAH PA and IOUs to implement the recommendations** that from the first SOMAH evaluation and identify additional recommendations to help the program achieve its goals.

The evaluation objectives are grouped into four primary assessment areas. These assessment areas include:

1. A **Participation Assessment** to quantify program participation using metrics such as the number and size of installed projects, the location of homes served and eligible homes not served, the geographic coverage of participants and eligible non-participants, an accounting of program and project costs by project ownership type.
2. A **Process Assessment** to assess progress made towards minimizing identified contractor and property owner barriers to participation and the effectiveness of SOMAH's recent ME&O and workforce development activities, and to possibly identify other areas where continued improvements are needed to help the SOMAH Program achieve its goals.
3. An **Impact Assessment** to estimate PV production and the per-household change in electricity consumption as inputs to the quantification of SOMAH's energy (kWh and kW), environmental (GHG and criteria pollutants), and economic (tenant and common area bill savings, changes to tenant arrearages, and CARE subsidy reductions) impacts.
4. A **Cost-Effectiveness Assessment** to determine the cost-effectiveness of the SOMAH Program using three California Standard Practice Manual tests.

3 EVALUATION APPROACH

The following subsections describe the evaluation approach for the second triennial SOMAH evaluation.

3.1 DATA SOURCES AND PRIMARY DATA COLLECTION ACTIVITIES

The study approach relies upon many data sources and primary data collection activities that will serve to gather the data necessary to support the four assessment areas described above. Table 2 below presents the data needs for each of the assessment areas.

⁷ "Beneficiaries" refer to the tenants and property owners that receive SOMAH PV system benefits via their assigned VNEM allocations.



TABLE 2: SOMAH EVALUATION DATA NEEDS

Data Collection Activity	Participation Assessment	Process Assessment	Impact Assessment	Cost-Effectiveness Assessment
SOMAH Program Tracking Data (PowerClerk)	X	X	X	X
Job Trainee and Opportunity Data	X	X		
Cross-Program Participation Data Process		X		
Eligible Contractor and Property Owner Data	X	X		
Project Cost Data	X			X
In-Depth Interviews	X	X	X	
PA Surveys of Tenants and Job Trainees	X	X	X	
PV Performance, Energy Bills, and AMI Data		X	X	X
SOMAH Semi-Annual Expenditure Reports and Administrative Cost Data		X	X	X

The remainder of this section provides an overview of these data collection activities. Complete details on the objectives and methodologies for each of the assessment areas are provided below.

SOMAH Program Tracking Data

A fundamental component for all aspects of this evaluation will be the PowerClerk database that houses key applicant and system information for all SOMAH projects. The PowerClerk database will provide the following key elements necessary for the SOMAH evaluation:

- **SOMAH project information** such as application status (including the dates various project milestones were completed), project specs (system size, azimuth, tilt, etc.), system costs (both estimated and verified, if available) and SOMAH incentive, additional project funding (ITC, LIHTC), ownership type, and solar contractor information.
- **Applicant information** such as the applicant’s name and contact information (address, email, and phone) and property address that will be used to develop samples and assess geographic distributions of participants.
- **Tenant beneficiary information** such as tenant name, address and account/meter number, Virtual Net Energy Metering (VNEM) allocation, and utility rate (pre- and post-SOMAH). These data will allow our team to allocate generation credits and evaluate bill savings.

This data will be used to assess program metrics and KPIs and to develop estimates of PV system energy production that can be compared to actual metered production for installed systems.

If the SOMAH PA can provide participant utility account or meter numbers from the IOU data received during the Reservation Request stage of the application process, this data could facilitate merging of program tracking and application data with customer billing and usage information. If these data are not



available, Verdant will combine solar program application data with customer billing and usage data using both account numbers, where available, and participant contact information, where necessary.

Job Trainee and Opportunity Data

The Incentive Claim Package requires each project to submit a Job Training Affidavit which includes job trainee contact information, the types of tasks completed by the trainee(s), the hours worked, the wages paid, and the job training program the trainee attended (if applicable⁸). This data, along with data on the number of job training opportunities created by the SOMAH Program, will be used to assess the effectiveness of SOMAH's Workforce Development (WFD) activities, track the progress they have made towards accomplishing their stated job training goals, and report on the metrics and KPIs related to job training.

Cross-Program Participation Data

SOMAH is a key program in the CPUC's integration effort for programs supporting low-income and disadvantaged communities. D.17-12-022 includes the requirement for SOMAH projects to undergo energy efficiency audits and notify tenants about the availability of the Energy Savings Assistance (ESA) energy efficiency program.

To support the future estimation of cross-program participation levels, the Verdant team will review the data being requested by the SOMAH PA and process by which it is requested to identify any changes necessary to ensure this data will be available for future evaluations. As part of the Reservation Request Package, SOMAH applicants are required to submit a list of all tenant addresses that can be shared with the IOUs and used for ESA Program referrals. The last SOMAH evaluation was unable to verify the IOUs had acted upon this data as no ESA referral data had been provided by the IOUs to the SOMAH PA (this data can only be requested by the SOMAH PA annually). It is our understanding that at this time the SOMAH PA has still not received any data to verify cross-program participation.

SOMAH-Eligible Contractor and Property Owner Data

Contractors who desire to participate in the SOMAH Program are required to attend an introductory workshop (Contractor Eligibility Workshop). The SOMAH PA tracks contractors who have completed this requirement and are authorized to participate in the program. This data also includes contractor attributes such as their diversity status, their size (number of employees), and the number of solar installations they have completed. As of the last SOMAH evaluation, there were 118 unique contractors eligible to participate in the SOMAH Program, however only 10 contractors had an active application in the program at the time of reporting. According to the SOMAH PA's most recent Semi-Annual Progress

⁸ SOMAH tenants are not required to attend a job training program.



Report (SAPR) the number of SOMAH-eligible contractors as of June 30, 2022, has increased to 143, but less than 20 contractors have active SOMAH applications.⁹ The Verdant team will request an update of this data from the SOMAH PA to assess the program’s progress increasing the number, location, and diversity of participating contractors. This data will also be used to identify eligible contractors who have not yet participated in SOMAH for the contractor interviews described in the section below.

The SOMAH PA maintains a database of SOMAH-eligible properties which feeds the SOMAH Eligible Properties Map available on the SOMAH website. This database includes multifamily affordable properties located within SOMAH service territories and tracks other property attributes such as the number of units per property, whether the property has an active SOMAH application, and whether the property is located within a DAC. The Verdant team will request this data to identify whether discrepancies exist between SOMAH eligible and participating properties. The PA also maintains a list of properties who have indicated interest in the program but have not yet participated (SOMAH email subscriber list). Both databases will be used to develop a sample frame for the non-participating property owner interviews described in the section below.

Project Cost Data

The SOMAH PA reserves the right to conduct audits to verify project costs, as reflected in final invoices and/or a copy of the final agreement, matches the cost information identified in the Incentive Claim. The Verdant team will request invoices from contractors for a sample of completed projects to verify project costs. Understanding system costs is important for calculation of the societal cost test and total resource cost test that will be part of the cost effectiveness assessment. To better understand how SOMAH system costs compare to non-SOMAH systems, the Verdant team will research system cost information from non-SOMAH projects as part of the participant assessment. The non-SOMAH project cost information may come from other programs including the Multifamily Affordable Solar Homes (MASH) program that concluded installation in 2021. Verdant will work with the CPUC and the MASH PAs and evaluator to determine if MASH system cost data can be made available for a comparison to SOMAH system costs data. This comparison helps assess whether the cost of PV systems designed to benefit low-income multi-family customers is similar under different public programs.

In-Depth Interviews

To better understand current SOMAH Program participation experiences, the impact program changes have had on reducing application burden and barriers to participation, and the effectiveness of current ME&O and WFD activities, the Verdant team will implement data collection efforts with key participants and stakeholders. Table 3 below provides an overview of the planned in-depth interviews (IDIs) and the

⁹ Based on DGStats data as of September 19, 2022.



primary research objectives for each effort. The sample sizes were estimated based on recently obtained publicly available data or data included in the SOMAH Phase II report. The available sample and number of completes may change based on analysis of program tracking data.

TABLE 3: SUMMARY OF IN-DEPTH INTERVIEWS

Program Actor	Group	Sample*	Completes	Research Objectives
SOMAH Program Administrator	CSE	1	1	Identify program changes made to reduce application burden and reduce barriers to participation, areas of ME&O success and in need of improvement, current project pipeline outlook, current challenges impeding program goals, cross-program marketing and coordination efforts and results (ESA, LIWP, SGIP), assessment of current incentive levels, measurement, and effectiveness of WFD activities
	GRID Alternatives	1	1	
	AEA	1	1	
	CHPC	1	1	
IOUs	PG&E, SCE, SDG&E, PacifiCorp, and Liberty	5	5	Assess challenges within their role in SOMAH and identify potential improvements and future involvement in program delivery
Contractors	Participating	17	6	Program participation experience and satisfaction, impact of recent program changes, areas in need of improvement, and likelihood of future participation
	Non-Participating	~100	6	Barriers to participation, awareness/impact of recent program changes, areas in need of improvement, and likelihood of future participation
Property Owners	Participating (including cancelled or withdrawn)	~80	15	Program participation experience and satisfaction (including with solar PV installation and Track A technical support), drivers and barriers to participation, cross program awareness and participation, installed system performance, observed bill savings and other system benefits, reason for project cancellation/withdrawal, likelihood of future program participation, areas for additional support or program improvement
	Non-Participating	~3,400	15	Level of program awareness, effectiveness of ME&O efforts, reasons for non-participation, likelihood and timing of future program participation, barriers to solar adoption, and recommendations for program improvement
CBOs	Participating	8	8	Role and effectiveness in SOMAH ME&O and WFD activities, perception on property owner's barriers to participation, recommendation for program improvement
Financing Partners	Participating	1	1	Description of SOMAH bridge financing offer and qualification, interaction with third-party system ownership, uptake of financing amongst SOMAH participants, recommendations for program improvement

* Contractor sample sizes were determined based on analysis of SOMAH participation found in DGStats (7/11/2022). Property owner sample sizes were estimated based on SOMAH Phase II participation data.

For each of the data collection efforts shown in the table above the Verdant team will develop an interview guide that is clear, concise, not overly burdensome, and can efficiently collect data that will inform the assessment of the primary research objectives. The in-depth interview guides will take a semi-structured format to ensure they capture the key themes and metrics of interest to SOMAH stakeholders, while allowing room for the interviews to explore unexpected yet pertinent details associated with the program's implementation. We will provide each interview guide to the CPUC project manager for review



and comment prior to commencing any of the data collection. All IDIs will be conducted by Verdant or ILLUME professional evaluation staff and recorded (assuming 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 CPUC project manager during regularly scheduled check-in meetings.

SOMAH PA Interviews

All four SOMAH PA members were interviewed as part of the first SOMAH evaluation. These initial interviews served to gather data essential to developing a Program Theory and Logic Model for the SOMAH Program, as well as the program metrics and KPIs that are to be assessed as part of this evaluation. For this second SOMAH evaluation, we will conduct follow-up interviews with each member of SOMAH PA to discuss recent or planned program changes, their assessment of the effectiveness of these changes, and other program implementation successes achieved or challenges faced.

IOU Interviews

As part of the first SOMAH evaluation, the Verdant team interviewed the five SOMAH IOUs. These interviews helped to better understand their role in program design and delivery, inventory their activities and responsibilities, and understand the difficulties they have had within their role in SOMAH. For this evaluation, we will conduct follow-up interviews with the IOUs to discuss successes or challenges within their current role and SOMAH overall, and to discuss potential improvements and future involvement in program delivery.

Participating and Non-Participating Contractor Interviews

As part of the SOMAH Phase II evaluation, the Verdant team completed IDIs with 6 participating and 6 non-participating contractors (12 in total). The contractor interviews planned for the second triennial evaluation will discuss their recent program participation including whether program changes have been effective in reducing the application burden and barriers to participation faced by contractors, their experiences with job trainees and fulfilling the program's job training requirements, opportunities and challenges with identifying future SOMAH projects and working with property owners to submit additional SOMAH applications, and their likelihood of future SOMAH participation. We will discuss whether the SOMAH Program is helping to incubate, build, and cultivate new businesses and solar installers in the communities that the program aims to serve.

Participating and Non-Participating Property Owner Interviews

As part of the SOMAH Phase II evaluation, the Verdant team completed IDIs and web surveys with 19 participating and non-participating property owners. These interviews collected extremely valuable data regarding the drivers and barriers affordable housing developers faced to SOMAH participation, as well as their experience with the program and their plans for future participation. At the time of the last study most property owners were not very far along in the SOMAH application process (only one SOMAH project



has been completed and no Track A applicants had moved beyond the Reservation Request Approval stage) and so were unable to provide feedback on the later stages of SOMAH participation. To better understand property owners' experiences with the entire SOMAH Program (including PV installation and installed system performance and realized benefits), whether recent program changes have helped to decrease barriers faced to participation, and to identify additional or continued support needed to encourage SOMAH participation, the Verdant team will conduct 30-minute interviews with participating property owners interviewed during the first SOMAH evaluation or those who have completed one or more SOMAH project or Track A applicants with an active SOMAH projects. These interviews will also assess awareness of and participation in other LIMF and DER programs (such as ESA or SGIP) resulting from SOMAH participation. We will also conduct short interviews with eligible non-participating property owners to discuss awareness of, and likely future participation in the SOMAH Program, and to identify recommendations to increasing the number of eligible SOMAH properties submitting program applications.

The sample frame for the property owner interviews will be developed based on the property owners interviewed as part of the first SOMAH evaluation, SOMAH active or completed projects included in the PowerClerk database, and properties identified in the Eligible SOMAH properties map.

Partnering Organization (CBOs and Bridge Financing) Interviews

As part of the SOMAH Vendor Assessment, the Verdant team completed IDIs with four participating Community Based Organizations (CBOs). These CBOs primarily were responsible for assisting and supporting the SOMAH PA's ME&O and WFD activities. These interviews identified several challenges the CBOs faced in their SOMAH roles which led to the development of recommendations for additional CBO support. The Verdant team will again conduct interviews with these four participating CBOs; The IDIs will be used to determine whether progress has been made on implementing these recommendations and if the effectiveness of the CBOs has increased as a result. Interviews will also be completed with three newly brought on CBOs and an organization who is assisting SOMAH applicants with bridge financing support to assess their roles in the program and identify areas where program changes may be needed to improve their effectiveness.

PA Surveys of Tenants and Job Trainees

The SOMAH PA's 2022 ME&O Plan and most recent SAPR outline numerous data collection activities planned or underway by the SOMAH PA. These efforts include surveys with SOMAH tenants and job trainees. To accomplish the objectives of this evaluation, gathering data from these parties is necessary. To limit redundancy of efforts, the evaluation team will work with the SOMAH PA to leverage the data they are collecting. The evaluation team will work collaboratively with the SOMAH PA to determine the status of each of these research activities and will review the data collection instruments and protocols



they have developed to ensure the data being collected effectively supports the assessment of program metrics and KPIs. If necessary, the evaluation team will propose minor modifications or adjustments to increase the value of the data being collected.

SOMAH Tenant Surveys

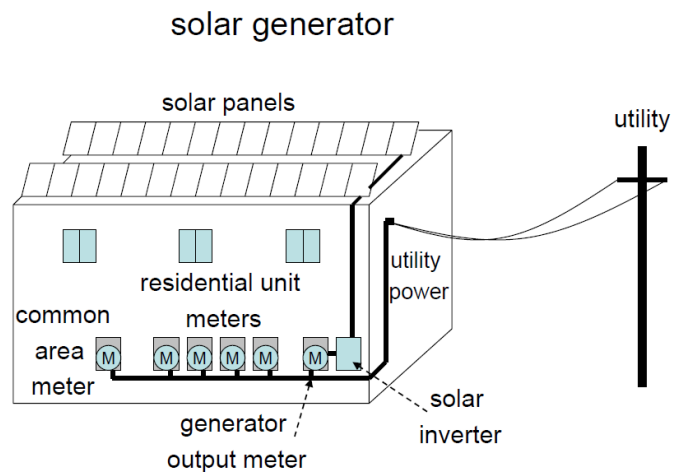
To maximize the SOMAH Program’s benefits to tenants residing in participating properties, the program requires property owners engage and educate tenants on how SOMAH projects are funded, the benefits SOMAH will provide to them, the changes they will observe on their energy bills, and the solar training opportunities available to tenants. Data collected during surveys with SOMAH tenants can be used to gauge the effectiveness of SOMAH’s tenant education activities, as well as to assess whether SOMAH tenants have changed the way they use energy or have participated in additional energy efficiency or demand response programs since the solar was installed.

Job Trainee Surveys

To ensure the successful and sustained economic benefits of SOMAH, policy makers need to understand the job creation benefits of the SOMAH Program. Data collected during surveys of job trainees (individuals who have fulfilled a SOMAH job training opportunity) can help to assess trainees’ experiences working on SOMAH projects, both in terms of skills or knowledge gained and ease of participation, and whether the SOMAH job training helped them secure longer-term employment within a clean energy field.

Performance (Generation) and AMI/Billing Data

Solar production and interval usage data will be needed to quantify energy, environmental, and bill impacts. The SOMAH handbook states that a performance monitoring and reporting service (PMRS) is required to meter generation for each project and that all PV equipment be wired to a net generation output meter (NGOM). The PMRS often uses meters built into the inverter and the NGOM is installed and operated by the utility. Verdant will request PV production data from the NGOM and PMRS meters and beneficiary (tenant and common area) energy consumption and billing information. The combination of metered generation, pre- and post-installation energy usage, and billing information will enable Verdant to determine how systems are operating, estimate if beneficiaries are changing their electricity usage, and calculate beneficiaries’ saving on their electricity bills (this includes common area and





tenants). These data will also be combined with grid information such as marginal emissions rates and utility / CAISO peak demand information to quantify environmental and grid benefits.

We will collect and validate the metered generation data of installed systems from the PMRS and NGOM data received. This will provide generation data to evaluate the performance of installed system relative to simulations of production that will be produced using information from the site level tracking and actual weather data. Verdant will also develop simulations of PV generation for installed and committed systems using typical meteorological year (TMY) weather data.

AMI data and billing information should be available for each customer and common area beneficiary. Verdant will request AMI and billing data for one year pre-and the post-installation period for beneficiaries living at sites with installed systems. These data will be used to determine if beneficiaries' electricity consumption changes following the installation of the VNEM PV systems.¹⁰

For beneficiaries at sites where the systems have yet to be installed, one year of AMI data will be requested to inform the development of energy, economic, grid, and environmental impacts. The IOUs may have difficulty identifying customers who are living in sites with planned, but uninstalled systems. As part of the SOMAH application process, however, the IOUs provide the SOMAH PA with historical consumption data. It may be necessary to sample the beneficiaries from the sites where the systems have yet to be installed due to the increased difficulty and burden identifying these customers. If sampling is necessary, a sampling plan will be developed based on utility and geographic location (climate zone). The Verdant team will work with the IOUs to determine the most effective way to identify beneficiary utility accounts.

Information on beneficiary customer utility rates (including CARE designation) and payment histories will also be requested for one year pre- and the post-installation period. The customer rate information will be used to develop estimates of customer utility bills and to determine how the installation of VNEM PV systems impacts their bills. Information on payment histories and potential arrearages will be analyzed to determine if SOMAH improves beneficiary utility bill payment and reduces arrearages.

The development of energy, economic, and environmental impacts will also require additional data that will either be requested from the utilities during the AMI/Billing data request or will be acquired independently. These data include the following:

- Weather data (TMY and actual) from the National Solar Radiation Database (NSRDB)

¹⁰ Verdant staff's 2021 evaluation of the California Solar Initiative found that residential electricity consumption increased by 7.2% in the first year following solar installation. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/csi-progress-reports/csi-2/csi_evaluation-report.pdf



- Identification of the top IOU and CAISO 200 hours from CAISO's OASIS system
- GHG emissions information from WattTime, CARB, and the E3 Avoided Cost Calculator.

The Verdant team will collaborate with the IOUs to determine if they have weather data mapped to IOU specific climate zones, requesting these data if available. If IOU climate zone specific weather data are not available, weather data will be mapped to the California climate zones.

Key Deliverables

- **In-depth Interviews:** Draft and final interview guides
- **Data Requests:** Data requests for AMI, billing, interconnection, and PV generation data (PMRS and NGOM)

3.2 PARTICIPATION ASSESSMENT

The key objectives of the participation assessment are to quantify program participation as of December 30, 2022, to document the program's progress towards achieving its goals via an assessment of SOMAH's metrics and KPIs (defined in the first SOMAH evaluation) and the M&V reporting requirements (established in PU Code 2870(j), PU Code 913.8, and D.17-12-022 Appendix B), and to evaluate progress made on the recommendations provided in the first triennial evaluation. Table 4 below summarizes the objectives of the participation assessment and the approaches to accomplish them.



TABLE 4: PARTICIPATION ASSESSMENT OBJECTIVES AND APPROACH

<i>Participation Assessment Objectives</i>	<i>Approach</i>
Assessment of Metrics and KPIs	
# of SOMAH Projects at each stage of the application process broken down by key characteristics such as incentive track (A or B), location (DAC/Non-DAC), IOU service territory, system capacity, VNEM allocations (tenant vs. common area), property type (HUD or USDA housing)	<i>Analysis of program tracking data</i>
MWs of installed solar capacity in MF Affordable Housing	<i>Analysis of program tracking data</i>
Number of job trainees who took advantage of SOMAH job training opportunities and were hired for Solar jobs	<i>Analysis of SOMAH job training data and PA's Surveys of Job Trainees</i>
Energy Savings Assistance (ESA) Program enrollment among SOMAH tenants/properties	<i>Property Owner IDs, PA's Surveys of Tenants, and ESA Program Tracking Data¹¹</i>
Assessment of M&V Reporting Requirements	
Dollar value of SOMAH incentives, average system costs, workforce development cost, and cost of the program (including expenditures, commitments, and uncommitted balances)	<i>Analysis of SOMAH Program tracking data, Project cost Data, Semi-Annual Expense Report data and administrative cost data</i>
Verification of SOMAH system costs and comparison to non-SOMAH system costs	<i>SOMAH and non-SOMAH Project Cost Data</i>
Non-solar EE and DER measures installed along with SOMAH solar PV	<i>Property Owner Interviews and PA's Surveys of Tenants</i>
Assessment of Progress made on Prior Evaluation Recommendations	
Diversity and expansion of participating eligible contractors	<i>Analysis of eligible contractor data and program tracking data</i>
Assess improvements to program tracking data (such as data completeness, enhanced cancellation reasons, BTM storage tracking)	<i>Analysis of program tracking data</i>

Key Deliverables

- Documentation of the program’s progress towards meeting its goals via an assessment of the program’s metrics and KPI’s
- Documentation of the results of the M&V conducted to meet SOMAH’s reporting requirements as established in PU Code 2870(j), PU Code 913.8, and D.17-12-022 Appendix B
- Recommendations for continued improvements to help the program meet its goals

3.3 PROCESS ASSESSMENT

The process assessment will evaluate the program’s progress meeting past evaluations’ recommendations and identify additional recommendations for improving the program going forward to meet its goals. The process assessment will also include a review of the SOMAH PA’s tenant and job trainee data collection

¹¹ Analysis of ESA program Tracking Data, if available.



efforts (surveys) to ensure they are collecting the data necessary to assess the program’s metrics and KPIs. Specifically, we will assess and provide insights on:

- **How to improve the effectiveness of the program’s ME&O activities.** Increasing the effectiveness of these activities is critical for building a pipeline of projects that will enable the program to overcome a current slowdown in the pipeline and meet its goals.
- **The program experience.** We will assess how contractors, property owners, tenants, and SOMAH job trainees are currently experiencing the program, particularly around what has changed since the last evaluation and how these stakeholders are experiencing those changes.
- **Barriers to participation.** The assessment will explore what barriers to participation persist and what the program can do to remove those barriers.
- **Implementation of evaluation recommendations.** We will assess progress made by the SOMAH PA towards implementing changes in response to recommendations resulting from the prior SOMAH Program evaluation.

The objectives of the process assessment and a brief description of the approaches to achieve them are presented in Table 5 below.



TABLE 5: PROCESS ASSESSMENT OBJECTIVES AND APPROACH

Process Assessment Objectives	Approach
Assessment of Metrics and KPIs	
Applicant satisfaction with technical assistance	<i>Contractor or Property Owner Interviews</i>
Awareness of SOMAH among targeted audience	<i>Contractor Interviews, Property Owner Interviews, and PA's Surveys of Tenants</i>
Number of Community Based Organizations (CBOs) actively participating in SOMAH and role/effectiveness	<i>Interviews with CBOs</i>
Assessment of M&V Reporting Requirements	
Impact of tenant education and bill credits on participation and tenant occupancy rates	<i>PA's Survey of Tenants and Property Owner Interviews</i>
Impact of Job Training Organization Taskforce in PA's effectiveness	<i>Interviews with CBOs and PA</i>
Assessment of Progress made on Prior Evaluation Recommendations	
Has program modified ME&O and co-marketing strategies and the effectiveness of those strategies on applications and project completion	<i>PA, Property Owner, Non-Participating Property Owner, and Contractor Interviews; ME&O Review</i>
Has program provided additional application or technical assistance, improvements to tools, maps, and handbooks, including what types of changes and effectiveness of the changes	<i>PA, Property Owner, and Contractor Interviews</i>
Effectiveness of steps taken to broaden the pool of small or diverse contractors and contractors serving DACs	<i>PA and Contractor Interviews</i>
Assess steps taken to reduce participant burden, increase participant eligibility, and augment participant staff capacity	<i>PA and Property Owner Interviews</i>
Effectiveness of program changes to address barriers due to financing and ownership models	<i>PA, Contractor, and Financing Partner Interviews</i>
Assess steps taken to support contractors with completing project documentation, permitting, data acquisition, generating leads, utility coordination, and sizing systems	<i>PA and Contractor Interviews</i>
Assess program changes to support workforce development efforts and goals and training/support for CBOs	<i>PA, Contractor, and CBO Interviews</i>

Key Deliverables

- Documentation of the awareness and effectiveness of recent program changes implemented
- Assessment of the effectiveness of the SOMAH's ME&O activities to build a future pipeline of SOMAH projects
- Assessment of the effectiveness of the SOMAH's Workforce Development activities to promote local economic development and expand solar job outcomes
- Recommendations for continued improvement to help the program meet its goals



3.4 IMPACT ASSESSMENT

The key objectives of the impact assessment are to estimate the energy (kWh, kW), environmental (GHG), and economic (bill savings) impacts of SOMAH projects. The impact assessment will also evaluate the impact of SOMAH on the CARE subsidy and customer arrearages. The evaluation objectives and a brief description of the approach to achieve them are presented in Table 6.

To develop these impacts, we will first estimate the SOMAH system’s PV 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.

TABLE 6: IMPACT ASSESSMENT OBJECTIVES AND APPROACH

<i>Impact Assessment Objectives</i>	<i>Approach</i>
Energy and demand impacts: Annual PV production, annual utility energy impacts, and CAISO and IOU peak impacts	PV simulation adjusted by estimated performance ratios, customer energy consumption adjusted by estimated change in pre- and post-installation weather-normalized energy consumptions, calculate annual utility energy impacts using adjusted PV production and change in energy consumption
Environmental impacts: Carbon and GHG emissions reductions	Using the estimated change in utility load and GHG and other emission impact information.
Economic impacts: Bill savings, reduced bill arrearages, CARE budget impacts	Bill modeling using Verdant’s NEM Model, estimated change in utility load, and customer rate information; And comparison of beneficiary arrearages against planned beneficiaries’ arrearages

PV Production

We anticipate that at least 50 projects will be installed at the time of evaluation, with many of those having a full year of metered PV performance data. For these projects we will compare metered performance data to simulated PV generation data that uses actual weather. Results will inform the simulation estimates for the other planned projects not yet installed. The PV production analysis will include the following steps:

- **Simulations of installed system performance will be developed** using system characteristics from the program tracking data and actual weather. The simulation will use NREL’s PVWatts model through the pvlib package in Python. Verdant will use weather data available from the National Solar Resource Database (NSRDB).¹²

¹² <https://nsrdb.nrel.gov/>



- **Develop PV performance ratios using** the actual metered PV generation compared to the simulated generation based on actual weather. Careful analysis of the performance ratio (metered/simulated generation) 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 produce a single annual performance ratio for systems with at least a year of data available. For systems without a full year of data, these comparisons will be done monthly
- **Simulate the typical performance of both installed and planned systems.** This simulation will mirror the simulations that the Verdant team performed for the inaugural SOMAH evaluation. The Verdant team will use NREL's PVWatts model with typical meteorological year (TMY) weather produced by NSRDB. 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.

Key Results: Performance ratios comparing actual to expected generation; Adjusted PV production estimates for all SOMAH projects.

Customer Electricity Consumption

In the Phase II evaluation, there were no installed projects, therefore the simplifying assumption was made in the impact analysis that beneficiary customers would not change their energy consumption following the installation of the PV systems. Verdant staff's evaluation of customer energy consumption in other studies, however, has found that many customers in single-family homes increase their energy consumption following the installation of solar. It is unclear, however, if SOMAH beneficiaries will behave similarly to single-family PV customers. SOMAH beneficiaries receive their benefits through the VNEM structure; therefore, they are less directly involved in the project's development and their economic situation likely differs from those of the typical PG&E residential PV owner. On the other hand, SOMAH does provide PV bill credits that could lead beneficiaries to increase their energy consumption.

If beneficiary customers increase their energy consumption once the PV systems are installed, 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 refine our impact estimates. Therefore, we will analyze the behavior of those customers with installed systems to determine what changes, if any, can be expected in the energy consumption of future beneficiaries after their systems are installed. The customer energy consumption analysis will include the following steps:

- **Create weather normalized energy consumption for customers with planned and installed systems.** Using customer's historical AMI data and actual weather, we will regress electricity consumption on cooling and heating degree hours to create customer weather response parameters. We will then use



typical weather to estimate weather-normalized energy consumption. For customers with installed systems, we will estimate normalized consumption for the pre- and post-installation period. For customers with planned systems, we will estimate normalized consumption for the pre-installation period.

- **For customers with installed systems, we will develop energy ratios of post-installation to pre-installation energy consumption.** These comparisons will give us insight into how customers may have changed their consumption behavior after the installation of these PV systems. The difference of post- to pre-installation energy consumption will be reported.
- **Estimate post-installation energy consumption for customers with planned systems.** The post-installation energy consumption ratio will be applied to the pre-installation weather normalized energy consumption for customers with planned systems.

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

Key results: Comparison of pre- to post-installation electricity consumption; Adjusted customer consumption estimates for all customers with SOMAH planned and installed projects.

Utility Energy Impacts

The customer’s change in utility load will be calculated using the PV performance ratio adjusted PV production, VNEM allocations from program tracking data, and weather normalized estimate of energy consumption change due to the participation in VNEM.

$$\Delta Utility kWh_i = VNEM_i * PVR * kWhPV_i + \Delta kWh_i$$

Where,

$\Delta Utility kWh_i$	Is the change in utility load for customer i
$VNEM_i$	Is the VNEM allocation share for customer i
PVR	Is the PV performance ratio that adjusts simulated performance to account for evaluated performance results
$kWhPV_i$	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 ¹³

¹³ 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



The annual utility electrical load reduction will be reported, at a minimum by IOU. The team will collaborate with the CPUC PM and SOMAH PAs 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 200 peak hours to provide insight into how SOMAH projects impact the grid during the hours of highest load. The top hours will be obtained from the CAISO OASIS website.

Key results: annual utility load reduction, peak demand impact

Environmental Impacts

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

- The team will use the marginal carbon dioxide emissions data developed by **WattTime** as part of the Self-Generation Incentive Program (SGIP) GHG signal (<http://sgipsignal.com>) to **estimate the avoided carbon emissions**. Carbon dioxide 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, with 2022 as the reference year.
- The **monetary value of the change in emissions** will be calculated applying the value of GHGs from the California avoided cost calculator.
- **The estimate of the lifetime GHG emissions reductions attributable to proceeds used in 2022** will rely on the California Air Resource Board (CARB) GHG benefits estimation tool.

Key results: estimates of the first year avoided carbon emissions, the lifetime GHG emissions reductions, and the monetary value of emission reductions.

Economic Impacts

The program's economic impacts will be estimated in a number of different ways, including customer bill changes, impact on bill arrearages, and CARE budget impacts.

- There will be three measurements of **bill impacts for customers with installed systems**.¹⁴ (1) The first bill impact will compare actual pre- and post-installation utility bills. (2) The second estimate of bill

energy consumption is their pre-installed weather normalized electricity consumption adjusted by the evaluated energy ratio.

¹⁴ Verdant will also review the timing from SOMAH systems physical installation to when beneficiaries receive bill credits, based on dates present in the program tracking data, PV metered data, and the beneficiary's bills.



impacts will use the calculated energy impacts (which include simulated typical energy production, performance ratio, VNEM allocation, and weather normalized change in electricity consumption) and tariff selections to estimate bill reductions. This analysis will use the customer bill calculator in Verdant’s cost-effectiveness model which can estimate customer bills while accounting for all VNEM tariff provisions.¹⁵ (3) The final measurement of customer bill impacts will use the simulated typical energy production from the PV system to estimate the customer’s reduction in bills if the system produced the anticipated level of energy and the customer maintained their pre-installation energy consumption.

- These three estimates of bill reductions will illustrate how bills can be impacted by actual weather relative to typical weather (measurement 1 versus 2), how or if changes occur in customer behavior following installation impacts customer bills (measurement 2 versus 3), and how weather and behavior can influence bills (measurement 1 versus 3).
- For customers with planned, but not yet installed system, the bill impacts will focus on the second and third measurement of bill impacts described above. For these customers it is not possible to compare actual pre- and post-installation utility bills. Bill impacts will be reported in both dollars saved and kwh of energy reduced. Where possible, bill impacts will be reported by IOU, climate zone, property size, DAC property status, CARE participation, and system ownership.
- Verdant will **assess the impact of program participation on customer arrearages** using two approaches. First, for beneficiaries with installed systems, we will compare customers’ bill arrearages in the pre- and post-installation period. The COVID-19 pandemic, California’s moratorium on utility disconnections, and the California Arrearage Payment Program, however, are likely to make the identification of the impact of SOMAH on customers’ pre- and post-installation arrearages difficult to estimate. Therefore, we will compare the arrearages for customers with installed systems to arrearages for customers with planned, but not yet installed systems, over the same time period. In this scenario, the customers with planned systems are akin to “non-participants” who are similar to the SOMAH beneficiaries with installed systems.
- We will calculate the program’s impacts on the **California Alternative Rates for Energy (CARE) program budget**. For customers on CARE, the estimated bill savings (from the second measurement described above) will be used to calculate the reduction in the CARE program subsidy for the customer. The reduction in customer usage due to SOMAH should reduce the total bill, and thereby the needed CARE budget for the 30-35% reduction applied to their electrical bill.

¹⁵ Verdant’s cost-effectiveness model was publicly vetted during the NEM 2.0 Lookback Study.



Key Deliverables

- **Energy Impacts:** Estimates of PV production, changes in energy consumption and utility energy and demand impacts.
- **Environmental Impacts:** Estimates of the first year, life-cycle, and monetary value of emissions reductions.
- **Economics Impacts:** Estimates of customer bill impacts, observed changes in arrearages, and reductions in the CARE subsidy.

3.5 COST-EFFECTIVENESS ASSESSMENT

The cost-effectiveness of the SOMAH Program will be estimated using the format and content requirements of the 2001 CPUC California Standard Practice Manual for performing Economic Analysis of Demand-Side Programs and Projects. Cost-effectiveness will be quantified using the total resource cost test (TRC), the societal cost test (SCT), and the ratepayer impact measure test (RIM). Verdant will use their publicly vetted cost-effectiveness model to estimate the program cost-effectiveness. We will work with the CPUC to determine the appropriate discount rates to use for these tests and to determine the non-energy impacts (NEI) and GHG adders to include in the SCT.

TABLE 7: 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, NEI
RIM	Program Admin Costs, Reduced Revenue (bill savings – reduced CARE subsidy), Incentive Costs	Avoided Costs

The avoided cost benefits will be calculated using the program’s estimated energy impact and the California avoided costs. The estimate of reduced utility revenue will use the estimated beneficiary tenant and common area bill savings and the estimate of the reduction in CARE subsidy attributable to SOMAH. The measure costs will be taken from the SOMAH program tracking data, a sample of these measure costs will be verified by a review of customer’s final invoices and/or final agreement.

Key results: Cost and benefits from multiple points of view and cost-effectiveness values.



Key Deliverables

- Cost-Effectiveness Metrics: Costs and benefits from multiple points of view and three of the Standard Practice Manual tests (TRC, RIM, and SCT).

4 PROJECT TIMELINE

The SOMAH evaluation study will be completed and delivered to the CPUC Energy Division by June 1, 2023. Below we provide an overview of the interim milestones leading up to the conclusion of the evaluation.

- Research Plan and Webinar:
 - Draft research plan released to public on September 30, 2022
 - Public webinar on research plan, October 4, 2022
 - Comments due on research plan, October 14, 2022
 - Final research plan release to public, October 21, 2022
- Data Collection:
 - IDIs - November through January 2023
 - AMI, Billing, and PV Data – frozen as of December 31, 2022
 - Program Tracking Data – frozen as of December 31, 2022
- Analysis:
 - Participation, Process, and Impact Assessments – January through March 2023
 - Cost Effectiveness Assessment – Mid-February through March 2023
- Draft Report release to public, late April 2023
- Public webinar on draft report, early May 2023
- Final Report, June 1, 2023