FINAL IMPACT EVALUATION

Residential Energy Efficiency

Program Year 2021

MAY 5, 2023

Submitted to:
California Public Utilities Commission

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DNV·GL

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SECTION 1:

EXECUTIVE SUMMARY

1.1 OVERVIEW

This report presents the results of an evaluation of energy savings from Southern California Gas Company's (SCG's) Residential Energy Efficiency Program (SCG3702) administered in program year 2021 (PY21). The Residential Energy Efficiency Program (REEP) offers incentives to single-family and multifamily customers, as well as to new construction residential projects. REEP encourages the installation of the most efficient gas appliances[1] available and consists of three separate subprograms: the Home Energy Efficiency Rebate Program (HEER), the Multifamily Energy Efficiency Rebate Program (MFEER), and the Energy Efficiency New Homes Program (EENHP). The California Public Utility Commission (CPUC) requested this study because the REEP was one of the most successful programs with respect to the amount of therm savings it claimed in PY21, representing 27% of the savings among all rebate programs across California's energy efficiency portfolio[2].

Key findings and recommendations from this evaluation include the following:

- **The evaluation team has found:**
  - **Higher savings than claimed for tankless water heaters installed through the EENHP subprogram, and savings equal to claimed savings among tankless water heaters for the HEER subprogram. Tankless water heaters represent 82% of PY2021 lifecycle savings in the REEP program.**
    - *Primarily caused by differences in UEFs[3] between claimed and evaluated tankless water heaters.*

[1] We refer to each energy efficiency technology offered under the program as a "measure".

[2] This includes programs offering fixed, per unit rebate amounts for energy efficiency measures, but does not include programs that have customized rebate (or incentive) values, typically for more complex installations and measures.

[3] UEF or uniform energy factor is a Department of Energy-based efficiency rating applicable to water heating equipment.

- Largest percentage of hard to reach (HTR) customers and disadvantaged communities (DAC) found within multi-family segments.

- The evaluation team recommends:
  - Changing the hot water temperature setpoint in the assumptions used to estimate program-based savings for all house types.
  - That SCG conduct a more thorough verification that incorporates improved tracking of the efficiency levels of installed tankless water heaters.
  - Increasing program marketing and outreach to multi-family building markets to reach HTR/DAC more effectively.
  - Conducting a market study to determine the share of tankless water heaters among recently installed water heaters for both the replacement and new construction market.

1.2 RESEARCH OBJECTIVES

The focus of this evaluation was to evaluate tankless water heater (TWH) savings and to conduct research to develop revised estimates of savings. Furthermore, we characterized the types of participants in each sub-program, including hard-to-reach (HTR)[4] and those in disadvantaged communities (DAC)[5]. We also analyzed other participant factors, such as fuel-substitution practices, depth of retrofit, analysis of participation and savings targets, and the total system benefit (TSB) of the program.

1.3 REEP SAVINGS CLAIMS

Most of the reported savings for the program come from TWHs, but the program also offers other measures. Table 1-1 summarizes the measures and savings SCG reported for REEP. The table shows "net" and "gross" savings for both the first year after installation, as well as for the lifetime of the measures installed otherwise known as lifecycle savings. Net savings examine how successful REEP

[4] https://static1.squarespace.com/static/53c96e16e4b003bdba4f4fee/t/6100a9d65429cb3846a417a3/1627433432394/SW+Deemed+WP+Rulebook+Interim+v4.0+Final.pdf

[5] https://oehha.ca.gov/calenviroscreen/sb535

was at influencing customers to install energy efficiency technologies that they would not have installed without the program. We refer to customers who would have installed the same energy efficiency equipment in the absence of the program as free riders because they receive incentives for actions they would have undertaken without the program's existence. Our evaluation examined the total amount of savings derived among all participants, referred to as gross savings, but did not examine the level of free ridership in the program[6], which results in net savings. We refer to the ratio between the net and gross levels of savings as the net-to-gross ratio. For this evaluation, we developed evaluation estimates of gross savings but used SCG's reported net-to-gross ratios to generate evaluation estimates of net savings by applying the NTGRs to the evaluation's estimate of gross savings.

The majority of SCG-reported savings, about 70% first-year gross and net, and 82% lifecycle net therm savings are from the tankless water heaters offered by the program. Nearly all (over 99%) of the tankless water heater savings were generated by the HEER and EENHP sub-programs. Because such a large majority of savings is concentrated in the tankless water heater measure in the HEER and EENHP sub-programs, tankless water heaters are the focus of the gross impact portion of this evaluation. For the other measures with substantial savings, we reviewed the reported savings parameters in the program tracking data[7] to ensure they are consistent with the relevant measure package documentation.

[6] As part of the PY2019 Residential Impact Evaluation, a comprehensive NTG analysis was conducted on the tankless water heater measure, including over 700 participant interviews. The results of this analysis are currently being incorporated into the 2023 DEER. As a result, we have only conducted a gross analysis of tankless water heaters. We did not undertake a NTG study to understand program attribution for PY2021.

[7] The program tracking data contains customer level information of installations of rebated measures.

Table 1-1: Residential Energy Efficiency Program-Based Savings

Measure Group	No. of Installs	First Year kWh		Lifecycle kWh	First Year Therm		Lifecycle Therm	% Lifecycle Net Savings
		Gross	Net	Net	Gross	Net	Net	
Water Heating Tankless Water Heater	19,570	-71,779	-43,067	-861,348	1,801,521	1,080,913	21,618,253	82%
HVAC Duct Sealing	5,774	4,266	3,166	56,983	121,088	82,329	1,346,358	5%
Water Heating Controls	435	0	0	0	270,753	162,452	812,258	3%
Water Heating Boiler	101	0	0	0	69,032	41,419	828,387	3%
HVAC Controls Smart Thermostat	7,735	218,258	132,129	1,202,370	60,265	54,455	495,540	2%
HVAC Furnace	2,558	81,832	49,099	981,989	42,669	25,601	512,030	2%
Pool Heater	4,417	0	0	0	46,157	31,418	304,765	1%
Appliance Clothes Dryer	12,183	-9,456	-5,673	-60,080	40,659	24,396	292,746	1%
Water Heating Storage Water Heater	1,206	0	0	0	30,522	18,313	208,637	1%
HVAC Gas Fireplace	168	0	0	0	2,386	1,647	32,942	0%
Food Service	841	0	0	0	2,020	1,515	19,696	0%
Appliance Clothes Washer	70	4,475	2,580	28,381	302	166	1,830	0%
Water Heating Showerhead	3	0	0	0	25	15	148	0%
Non-Resource	2,479	0	0	0	0	0	0	0%
Total	**57,558**	**227,597**	**138,233**	**1,340,295**	**2,487,399**	**1,524,639**	**26,473,589**	**100%**

1.4 APPROACH

The evaluation team conducted original research to verify the energy savings reported by SCG and/or developed revised estimates of savings for the tankless water heaters studied. The primary mechanism

for collecting data included telephone surveys, which we conducted among a sample of HEER customers and EENHP builders who installed tankless water heaters.

In addition to surveys, we leveraged make and model information from a variety of other sources, including inspection data from the EENHP program, make/model/efficiency (uniform energy factor, or UEF) data from the HEER program, and compliance forms for EENHP builders in the program.

The data we collected as part of these activities includes information on how the measure was installed and how the measure affected each customer's energy consumption. We then compared the savings estimates developed using data collected from customers who participated in the programs with the energy savings estimates reported by SCG. The ratio of the evaluation results to SCG's reported savings estimate is referred to as the realization rate and is the fraction of reported savings realized at the conclusion of our evaluation.

For the participant characterization study, we utilized information from the program tracking data, SCG customer billing data, CalEnviroScreen, and survey data to gain insights on the demographic distribution, DACs, HTR customers, depth of retrofit, and other areas of focus for the study. The participant characterization portion assesses all three subprograms – HEER, EENHP, and MFEER. However, we only conducted surveys for single-family HEER participants due to the difficulties in surveying EENHP and MFEER occupants who are not program participants. Because the participants of EENHP are builders, and the participants of the MFEER program have a large portion of property managers, we found difficulties in identifying the occupants for those programs, and therefore did not utilize billing data and/or conduct surveys for those programs.

1.5 RESULTS

Table 1-2 presents the net lifecycle savings results of this evaluation. For each subprogram and measure group, we show the evaluated and reported net lifecycle savings values (Therms), and the net realization rates. For both HEER and EENHP tankless water heaters, the net realization rate was 1.01, which means that the evaluation found more program-based net lifecycle savings (101%) than what was claimed by the HEER and EENHP subprograms. These realization rates are primarily driven by the difference in

what the evaluation used for tankless water heater UEFs by tier, relative to what was reported. Overall, the HEER and EENHP program level net realization rates were 1.00 and 1.03, respectively. We did not evaluate the MFEER program or non-tankless water heating measures, so the net realization rates are 1.0 since we passed through savings. Values shown in italics are those that were not evaluated and were entirely passed through. Overall, the program achieved a net realization rate of 1.01, meaning that the evaluation could verify that 101% of the net lifecycle savings were caused by the program. Note that 18% of the program's net lifecycle savings claim was not evaluated and received a 100% realization rate. Therefore, the 101% is entirely driven by the realization rate associated with the tankless water heating evaluation results.

Table 1-2: Net Therm Realization Rates by Subprogram & Measure Group

Subprogram	Measure Group	Lifecycle Net Therm Savings		
		Claimed	Evaluated	NRR
HEER	WATER HEATING TANKLESS WATER HEATER	15,844,542	15,811,285	1.00
	OTHER	2,811,241	2,811,241	1.00
	TOTAL	18,655,783	18,622,526	1.00
MFEER	WATER HEATING TANKLESS WATER HEATER	62,418	62,418	1.00
	OTHER	1,558,656	1,558,656	1.00
	TOTAL	1,621,074	1,621,074	1.00
EENHP	WATER HEATING TANKLESS WATER HEATER	5,711,293	5,885,548	1.03
	OTHER	485,439	485,439	1.00
	TOTAL	6,196,732	6,370,987	1.03
TOTALS	WATER HEATING TANKLESS WATER HEATER	21,618,253	21,759,251	1.01
	OTHER	4,855,336	4,855,336	1.00
	TOTAL	**26,473,589**	26,614,587	1.01

1.6 KEY EVALUATION FINDINGS

This section provides high-level findings and recommendations based on our evaluation. More details can be found in Section 8 of the main report.

1.6.1 Tankless Water Heaters

- Based on surveys, we found the temperature setpoints to be closer to 120° F, instead of 135 °F used in the reported savings.
- A portion of the tankless water heaters was miscategorized in the program tracking data as being either higher or lower in efficiency than they were. This led to a slight reduction in evaluated savings for the HEER program and a slight increase in evaluated savings for EENHP.
- Surveyed HEER participants and EENHP participating builders indicate a strong likelihood of installing tankless water heaters in the absence of the program.
  - Based on the survey responses with 100 HEER participants, 69% claim they would have installed a tankless water heater in the absence of the program, and only 17% responded that they would have installed a storage water heater without the program.
  - For EENHP, we analyzed compliance runs for 103 EENHP homes, and found that 37/103 (36%) of homes would not have passed compliance if a minimally compliant tankless water heater was installed. Furthermore, among the 15 EENHP participating builders that were surveyed, 13 said they would have installed a tankless water heater in the absence of the program, and the other 2 were uncertain what they would have done.

1.6.2 Participant Characterization

- We found that 19% of the program is in a DAC, where 18% of HEER, 39% of MFEER, and 20% of EENHP are in DACs.
- Ten percent of the population is HTR, with MFEER serving the largest amount of HTR customers at 41%. Only 8% of the surveyed HEER participants were classified as HTR.
  - The vast majority of HEER respondents live in a single-family detached home (92%), own their own home (96%) and primarily speak English within their household (90%).

- Of those responding, 17% of HEER respondents have incomes below $50k and 57% have incomes above $100k.

- Thirty percent of all participants installed more than one energy efficiency offering. EENHP has the highest percentage of sites installing more than one efficiency offering, which was 76% of sites.
  - HVAC Controls Smart Thermostats (HEER, MFEER, EENHP), Duct Sealing (HEER, MFEER), and HVAC Furnaces (EENHP) are popular measure groups installed in conjunction with other measures.

1.6.3 Total System Benefit (TSB)

- Total system benefit is the "sum of the benefit that a measure provides to the electric and natural gas systems".[8] TSB expresses, in dollars, the lifecycle energy, ancillary services, generation capacity, transmission and distribution capacity, and GHG benefits of energy efficiency activities, on an annual basis.[9] Table 1-3 presents the total system benefits claimed by subprogram.

Table 1-3: Total System Benefit by Subprogram

Subprogram	Total System Benefit Claimed
HEER	13,530,067
MFEER	1,301,473
EENHP	4,752,810

[8] Decision Adopting Energy Efficiency Goals for 2022-2032 (2021) Decision (D.) 21-09-037.

[9] Assessment of Energy Efficiency Potential and Goals and Modification of Portfolio Approval and Oversight Process (2021) Decision (D.) 21-05-031, p. 9.

1.7 RECOMMENDATIONS

1.7.1 Tankless Water Heaters

- We recommend updating the measure package with the program's current temperature setpoint parameter (used to estimate program-based savings) of 120°F.
- The application process should require that tankless water heater nameplate information to be provided. In addition, the HEER/EENHP teams should check that the UEF provided in the application is appropriate for the make and model of the tankless water heater.
- SCG should also check that the claimed efficiency levels align with what is found in inspection data when available; otherwise, the efficiency should align with the make and model included with each application.
- A market study should be conducted to determine the share of tankless water heaters among recently installed water heaters for both the replacement and new construction market.
- A net-to-gross study should be conducted for the new construction measure application type for tankless water heaters, based on the high incidence of builders stating they would have installed a tankless water heater in the absence of the program, and the fact that the revised net-to-gross ratio for tankless water heaters is based on a study that did not include new construction.

1.7.2 Participant Characterization

- SCG should continue to promote multifamily participation in MFEER and EENHP. MFEER is 41% HTR which has a positive effect to the overall percentage of HTR customers in the program.
- SCG should continue to offer an array of energy efficiency offerings per subprogram, as we see this encourages the installation of multiple offerings by participating customers, increasing the program's depth of retrofit.

1.8 CONTACT INFORMATION

The California Public Utilities Commission (CPUC) Project Manager for this study was Mr. Peter Franzese. Mr. John Cavalli of Quantum Energy Analytics served as the manager of this impact evaluation.

Table 1-4: Contact Information

Firm	Lead	Contact Info
CPUC 505 Van Ness Avenue San Francisco, CA 94102	Peter Franzese Energy Division	Phone: (415) 703-1926 Email: peter.franzese@cpuc.ca.gov
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SECTION 2:

INTRODUCTION AND OVERVIEW

This report documents the activities and results of the 2021 Residential Energy Efficiency Program (REEP) Impact Evaluation implemented by the Southern California Gas Company (SCG). The overall goal of this study is to address research questions covering gross savings, baseline determination, participant characterization, depth of retrofit, and the program's prevalence in the hard-to-reach customer segment.

We evaluated tankless water heaters due to their high contribution of overall program lifecycle net savings (82%). As part of the Program Year (PY) 2019 Residential Impact Evaluation, a comprehensive Net-to-Gross (NTG) analysis was conducted on the tankless water heater measure, including over 700 participant interviews. The results of that analysis are currently being incorporated into the 2023 Database for Energy Efficient Resources (DEER). As a result, we did not undertake a NTG study to understand program attribution for PY2021.

Furthermore, for the other measures with substantial savings, we reviewed the ex ante savings parameters in the tracking data to ensure they are consistent with the values documented in the relevant measure package.

In addition to this gross analysis, we also conducted a participant analysis to understand the type of customers that the program reached, with a focus on the Hard-to-Reach (HTR) customer segment.

2.1 RESIDENTIAL ENERGY EFFICIENCY PROGRAM MEASURE OFFERINGS

One objective of this study is to perform an impact evaluation – utilizing new primary evaluation data – to update claimed (ex ante) gross savings estimates and inform future savings values for measures offered in the program. Most of the claimed savings for the program come from tankless water heaters,

but the program also offers other measures. Table 2-1 summarizes the measures and savings claims for this program.

- **The majority of the savings, about 70% first year gross and net, and 80% lifecycle net therm savings are from the tankless water heaters offered by the program.**
- **Nearly all (over 99%) of the tankless water heater savings were generated by the Home Energy Efficiency Rebate (HEER) and Energy Efficiency New Home Program (EENHP) sub-programs.**

Because such a large majority of savings are concentrated in the tankless water heater measure in the HEER and EENHP sub-programs, as seen in Table 2-2, the gross impact evaluation activities are focused on those segments.

Table 2-1: PY2021 SCG Residential Energy Efficiency Program Savings Claims

Measure Group	No. of Claims	First Year kW		First Year kWh		Lifecycle kWh	First Year Therm		Lifecycle Therm
		Gross	Net	Gross	Net	Net	Gross	Net	Net
Water Heating Tankless Water Heater	19,570	-10	-6	-71,779	-43,067	-861,348	1,801,521	1,080,913	21,618,253
HVAC Duct Sealing	5,774	5	4	4,266	3,166	56,983	121,088	82,329	1,346,358
Water Heating Controls	435	0	0	0	0	0	270,753	162,452	812,258
Water Heating Boiler	101	0	0	0	0	0	69,032	41,419	828,387
HVAC Controls Smart Thermostat	7,753	0	0	218,258	132,129	1,202,370	60,265	54,455	495,540
HVAC Furnace	2,558	94	56	81,832	49,099	981,989	42,669	25,601	512,030
Pool Heater	4,417	0	0	0	0	0	46,157	31,418	304,765
Appliance Clothes Dryer	12,183	0	0	-9,456	-5,673	-60,080	40,659	24,396	292,746
Water Heating Storage Water Heater	1,206	0	0	0	0	0	30,522	18,313	208,637
HVAC Gas Fireplace	168	0	0	0	0	0	2,386	1,647	32,942
Food Service	841	0	0	0	0	0	2,020	1,515	19,696
Appliance Clothes Washer	70	1	0	4,475	2,580	28,381	302	166	1,830
Water Heating Showerhead	3	0	0	0	0	0	25	15	148
Non-Resource	2,479	0	0	0	0	0	0	0	0
Total	**57,558**	**89**	**54**	**227,597**	**138,233**	**1,340,295**	**2,487,399**	**1,524,639**	**26,473,589**

Table 2-2: PY2021 SCG Tankless Water Heater Savings Claims by Subprogram

Sub-Program	No. of Claims	First Year kW		First Year kWh		Lifecycle kWh	First Year Therm		Lifecycle Therm
		Gross	Net	Gross	Net	Net	Gross	Net	Net
HEER	14,087	-8	-5	-54,651	-32,791	-655,218	1,320,378	792,227	15,844,542
MFEER	65	0	0	-196	-117	-2,348	5,202	3,121	62,418
EENHP	5,418	-2	-1	-16,932	-10,159	-203,184	475,941	285,656	5,711,293
Total	**19,570**	**-10**	**-6**	**-71,779**	**-43,067**	**-861,348**	**1,801,521**	**1,080,913**	**21,618,253**

2.2 RESEARCH OBJECTIVES

Table 2-3 below summarizes the research objectives for this evaluation.

Table 2-3: PY2021 SCG Residential Energy Efficiency Program Research Questions

Research Question	Evaluation Method
What are the gross savings of tankless water heaters?	Engineering analysis based on remote data collection using telephone surveys with participating customers, and telephone surveys with participating builders
What is the appropriate baseline for new construction and normal replacement? How do estimated savings change under alternative baseline assumptions?	Title 24 code requirements
Are the unit savings for the other key measures, correct?	For the other measures with substantial savings, review the ex ante savings parameters in the tracking data to ensure they are consistent with the relevant measure package documentation.
What is the demographic distribution of participants?	Participation analysis using tracking data, program staff interviews, customer surveys and secondary data sources.
Who are the program's participants? What proportion of these are HTR?	Participation analysis using tracking data, program staff interviews, customer surveys and secondary data sources.
Are participants aware of the option to fuel switch to an electric water heater (e.g., heat pump water heater)? Why didn't participants select this option?	Analysis of customer surveys.
Is the program achieving deep savings?	Analysis of tracking and billing data to assess the depth of retrofit.
How does the program's performance compare to peer programs?	Conduct a benchmarking analysis comparing demographic distributions, disadvantaged communities (DACs), and depth of retrofit.

Research Question	Evaluation Method
How did the program do in reaching participation and savings targets?	Comparison of program tracking data to program goals.
What is the total system benefit (TSB) for the program?	Calculate the TSB based on program tracking data.

2.3 STUDIED MEASURES

Table 2-4 presents the measures studied under this evaluation for each research objective. The majority of the gross focus is on single family, tankless water heating projects under HEER and EENHP. The non-gross impact research focus was on single family normal replacement[10] (NR) projects under HEER.

Table 2-4: PY2021 SCG Studied Measures

Measure Group	Gross Savings/ Baseline Study	Ex Ante Review	Demographic Distribution/ HTR	Fuel Substitution Awareness	Depth of Retrofit	TSB
Water Heating Tankless Water Heater	X		X	X	X	X
HVAC Duct Sealing		X	X		X	X
Water Heating Controls		X			X	X
Water Heating Boiler		X			X	X
HVAC Controls Smart Thermostat		X	X		X	X
HVAC Furnace		X	X		X	X
Pool Heater		X	X		X	X
Appliance Clothes Dryer		X	X		X	X
Water Heating Storage Water Heater			X		X	X
HVAC Gas Fireplace			X		X	X

[10] Normal replacement measure installations are where the existing equipment has either failed, no longer meets current needs, or is being replaced due to remodeling, upgrading, or replacement undertaken in the normal course of business.

Measure Group	Gross Savings/ Baseline Study	Ex Ante Review	Demographic Distribution/ HTR	Fuel Substitution Awareness	Depth of Retrofit	TSB
Food Service			X		X	X
Appliance Clothes Washer					X	X
Water Heating Showerhead					X	X

2.4 OVERVIEW OF IMPACT EVALUATION METHODOLOGY

Our study group includes both single-family tankless water heater replacements and installations in new single-family homes, as rebated by SCG under the Residential Energy Efficiency Program. The tankless water heater measure in single-family homes accounts for 16% of the net lifecycle natural gas savings across all group A measures in PY2021.

For the NR measures, we virtually verified the tankless water heater installation and operation at 100 sampled homes that received Program Administrator (PA) rebated tankless water heaters in 2021. During each virtual verification, our staff confirmed measure installation and operability and collected information on the installed make and model, house type, nameplate information, number of occupants/bedrooms, assessment of program influence in the adoption of a tankless water heater versus storage water heater (and Uniform Energy Factor (UEF) chosen), and pre-existing conditions (water heater type, age). We also collected information on remaining useful life (RUL) and operating condition of the pre-existing water heater(s). Finally, during data collection our staff requested that the home occupant read out the digital or analog temperature display or analog gauge to determine the water temperature exiting the tankless water heater system. The inlet water temperature is based on climate zone-specific temperatures by month, supported by DEER sources. Change in temperature is a key component of tankless water heater savings as described in the below equation.

A key secondary source of information that is leveraged is the annual hot water usage estimate imbedded in the DEER water heater calculator. The DEER hot water heater modeling effort is discussed in greater detail in Section 5.

The remainder of this report includes the following:

- Section 3 discusses the data sources used to estimate each of the individual measure parameters
- Section 4 discusses the sample design for measures subject to ex post evaluation
- Section 5 discusses the tankless water heater impact modeling effort, development of tankless water heater gross impact parameters, and ex ante review activities completed
- Section 6 discusses the participant characterization analysis
- Section 7 presents the final study results including a discussion of the gross realization rate
- Section 8 presents the conclusions and recommendations.
- Appendix AA presents the standardized high-level savings for both gross and net first year and lifecycle.
- Appendix AB presents the standardized per unit savings for both gross and net first year and lifecycle.
- Appendix AC presents the summary of recommendations for the Response to Recommendations (RTR).
- Appendix A presents the program manager interview guide.
- Appendix B presents the HEER tankless water heater participant survey instrument.
- Appendix C presents the EENHP builder telephone survey instrument.
- Appendix D presents the HEER demographic web survey instrument.
- Appendix E presents the detailed methodology for Ex Ante review of non-tankless water heater measures.
- Appendix F presents the evaluators responses to public comment.

SECTION 3

DATA SOURCES

The evaluation team used a variety of data sources to support the research topics under this evaluation. We obtained these data using a combination of secondary literature review and new primary data collection. We list each data source below and describe the specifics of each data source in greater detail throughout this subsection:

- **Primary data sources:**
  - Telephone interviews supporting gross impact objectives
  - Telephone and web surveys supporting the participant characterization
  - In-depth interviews with PA program staff
- **Secondary data sources:**
  - Program tracking data and CIS billing data
  - PA Measure Packages and DEER
  - Industry sources
  - Utility inspection data
  - Title 24 CF1R and CF2R compliance forms

Table 3-1 presents the key primary and secondary data sources used for the research topics in this evaluation.

Table 3-1: PY2021 SCG Key Primary & Secondary Data Sources Used for Research Topics

Research Topic	Primary Data Sources		Secondary Data Sources		
	Telephone / Web Surveys	In-depth PA Interviews	Program Tracking Data/ CIS Billing	PA Measure Packages & DEER and Other Industry Sources	Utility Inspection & CF1R/CF2R Data
Gross Savings/Verify Baseline	X	X	X	X	X
Customer Awareness Fuel Substitution	X				
Participant Characterization/ HTR and DAC Assessment[11]	X		X	X	
Depth of Retrofit Analysis			X		
Program Performance Assessment	X	X	X		
Participation and Savings Targets	X	X	X	X	

3.1 TELEPHONE & WEB SURVEYS

For this evaluation, we conducted a variety of surveys. To support water heating gross impacts, we conducted surveys for replacement water heaters under the HEER subprogram, and new water heaters under the EENHP subprogram. Our gross data collection for tankless water heaters under HEER were obtained by customer interviews, where data collection for tankless water heaters under EENHP were obtained by builder interviews. In addition to this, we conducted demographic web surveys for a sample of projects and a variety of other measures within REEP to support the participant characterization.

One purpose of the surveys is to gather demographic data, installation and operational characteristics, and data relevant to specific parameters that support the estimation of impacts. Surveys also support an awareness and willingness to purchase heat pump water heaters, as well as demographic data used in support of the participant characterization. Table 3-2 provides the details of the data that we collected.

[11] Participant characterization includes a hard to reach (HTR) and disadvantaged communities (DAC) assessment.

Table 3-2: PY2021 SCG Summary of Parameters of Interest in Data Collection Efforts

Research Topic Covered	Data Collected
Tankless Water Heater Gross Impacts	Equipment Nameplate: Our staff guided participants to provide us with key information obtained from their water heater's nameplate, which included make, model number and efficiency rating (UEF). Operating Characteristics: Our staff collected water heating set-point temperature. Premise Information: Building type, square footage, number of bedrooms
Customer Fuel Substitution Awareness	Awareness of heat pump water heaters, and likelihood of installation with further knowledge and/or financing
Participant Characterization	Demographics: income, household language, education, ethnicity

3.2 IN-DEPTH SCG INTERVIEWS

Our evaluation team conducted in-depth interviews with SCG staff that support HEER and EENHP. We learned more about how each sub-program operates, including the participation process, outreach strategies, how participants encounter the program, availability of utility inspection data, and the impact that tankless water heaters have on the program. This information was critical in developing the survey instruments.

3.3 PROGRAM TRACKING AND CIS BILLING DATA

Our evaluation team utilized program tracking from a centralized server; each PA uploads that data following CPUC requests to do so. We analyzed, cleaned, re-categorized, reformatted, and merged these separate datasets into one integrated program tracking database. The purpose of this exercise was to gain insight into the number of program participants receiving rebates for program year 2021 measures, understand the portfolio-level savings attributable to those rebated measures, and inform the sampling plan for ex post evaluation.

We also used the CIS (Customer Information System) & billing data[12] to examine usage for our depth of retrofit calculation, which we used as an indicator of program performance.

3.4 SCG Measure Packages and DEER

Our evaluation team also conducted a comparative analysis using ex ante parameter estimates from the following sources: SCG measure packages, data received directly from SCG, data downloaded from DEER and the gross ex post impacts developed using evaluation data sources. The ex ante gross impacts for deemed measures are populated in the tracking system using unit energy savings values that are derived using these ex ante sources.

Lifecycle savings are calculated by multiplying the annual unit energy savings by the effective useful life of the measure. Where feasible, we compared the ex ante to the ex post estimates for each of the measure-parameters to better understand which parameters are driving the gross realization rates for selected measures with high savings.

3.5 Industry Sources

Our evaluation team used industry sources to supplement other evaluation data sources, especially in cases where it was impractical for the evaluation to independently collect data and establish comparable results due to time and budget limitations, or where industry sources have already adequately established a given parameter or result. Industry sources that we used to establish robust methods for estimating savings include some of the following:

- **Use of DEER methods, augmented for site-specific conditions, to derive saving estimates**
- **Use of manufacturer equipment specifications to establish parameters**
- **Use of theoretical hot water usage estimates by house type and climate**

[12] The CIS Billing data contains the customer's name, address, and monthly consumption.

3.6 UTILITY INSPECTION DATA & CF1R/CF2R FORMS

To verify the installed tankless water heater, we relied on a combination of inspection data provided by the utility, and for EENHP, we also relied on CF1R and CF2R forms. The data team from SCG's HEER program was able to provide a complete list of verified make and models for their tankless water heater population. The EENHP data team inspects 5-6% of their total tankless water heater projects. In addition to the 5-6% of inspected make/models from EENHP's data team, we supplemented the installed name plate data by using CF1R and CF2R forms provided by CalCERTS.

SECTION 4

SAMPLE DESIGN

We conducted three separate surveys of home owners and builders to support evaluation objectives:

- HEER SF Tankless Water Heater Customer Survey
- EENHP SF Tankless Water Heater Builder Survey
- Demographic Survey

We used these data to derive independent estimates of ex post gross impact estimates and to inform improvements needed to ex ante impact, EUL and load shape estimates, as well as improvements that can be made to the programs themselves.

4.1 HEER SINGLE-FAMILY (SF) TANKLESS WATER HEATER CUSTOMER SURVEY

The HEER SF Tankless Water Heater Customer Survey involved contacting participants in single family homes with normal replacement tankless water heating measures under HEER. These participants are an important contributor to therm savings within the overall REEP program, contributing 53% of program savings. The HEER program includes participation from single family and mobile home housing types. Single family homes make up 99.9% of therm savings, while mobile homes contribute just a small minority of savings. Therefore, we only sampled and conducted interviews among single family tankless water heater participants. The tankless water heater measure descriptions include three efficiency tiers, with different efficiency requirements as a function of uniform energy factor (UEF). The Tier 1 tankless water heater s range from a code compliant UEF of 0.81[13] to 0.86. The Tier 2 tankless water heater range from a UEF of 0.87 to 0.94. Tier 3 tankless water heaters have a UEF ≥ 0.95. Tier 1 makes up 5% of single family HEER tankless water heater savings and 6% of records, Tier 2 makes up 25% of HEER

[13] Equipment with an 0.81 UEF are eligible and also set equal to the Title 20-based minimum code allowable efficiency level. There are two different measure descriptions associated with the tier 1 offering – one indicates >= 0.81 UEF and the other lists the range 0.82 – 0.86.

tankless water heater savings and 25% of records, and Tier 3 makes up 70% of HEER tankless water heater savings and 69% of records. Our sampling approach for our HEER customer surveys was to stratify by tier, targeting 70 Tier 3, 25 Tier 2, and 5 Tier 1 interview completes, for a total of 100 completes. We completed 70 Tier 3 surveys, 26 tier 2 surveys, and 5 tier 1 surveys.

Table 4-1 below shows this sampling approach in detail. The survey data collected helped support the estimates of key parameters that are inputs to estimating gross savings, such as UEF and temperature set points. Based on the data collected, we expected to estimate these key parameters with relative precision estimates in the range of ±10-15% at the 90% confidence interval.

Table 4-1: PY2021 SCG HEER Single Family Tankless Water Heater M&V Sample Design

Strata	PY2021 Population		Sample	
	Records	Ex Ante Lifecycle Net Therms	Targets	Completes
Tier 1	804	753,896	5	5
Tier 2	3,569	3,935,587	25	26
Tier 3	9,700	11,139,350	70	70
Total	**14,073**	**15,828,834**	**100**	**101**

4.2 EENHP SF TANKLESS WATER HEATER BUILDER SURVEY

The EENHP SF Tankless Water Heater Builder survey involved contacting participating new home builders that installed tankless water heaters in single family homes. The new construction tankless water heating measure under EENHP contributes 26% of program savings. The EENHP program includes participation from single family and multifamily housing types. Single family homes make up 97.6% of therm savings, while multifamily homes contribute 2.4% of savings. Therefore, we only sampled and conducted interviews with single family tankless water heater participants.

The EENHP program offers three different tiers under the program. Tier 1 is offered, with a UEF of 0.81[14] to 0.86. Tier 2, at a higher efficiency, is offered with a UEF between 0.87 to 0.94. Lastly, Tier 3 is offered with the highest efficiency of 0.95 or higher. Tier 1 makes up 22% of single family EENHP tankless water heater savings and 26% of records, Tier 2 makes up 76% of EENHP tankless water heater savings and 73% of records, and Tier 3 makes up 2% of EENHP tankless water heater savings and 2% of records.

The single family tankless water heater population for EENHP consists of a total of 38 builders, and a total of 5,262 claims. On average, each builder has 138 claims, where each claim represents a single address of a home. Our sampling approach for our builder surveys was to perform a census of all 38 builders, and sample 1 address per builder. We then asked if their responses apply to another two-to-four addresses belonging to the same application. We chose addresses based on what was available in CF2R data, or inspection form data. SCG inspects 5-6% of their total projects, and verifies the make and model of the equipment. In addition to this, as a part of building code requirements, a Home Energy Rating System (HERS) rater also verifies the equipment and documents this in CF2R forms. Therefore, using a combination of CF2R forms and inspection forms, we leveraged the make and model data available in developing our sample frame. 21 of the 38 builders had projects listed in the CalCERTS CF1R and CF2R compliance database. Another 13 builders had projects that were inspected by SCG. Only four builders did not have projects listed in the CF1R/CF2R database and did not have any projects inspected by SCG. For those four builders, we randomly selected one address from the largest application with the most homes to verify the make and model of the installed equipment. Table 4-2: below shows the availability of inspection and CalCERTS data for each builder along with the number of completed surveys. We completed a total of 15 builder surveys from the population of 38 builders[15].

The compliance documents along with the survey data collected from builders helped support the estimates of key parameters that are inputs to estimating gross savings, such as UEF and temperature set

[14] Equipment with an 0.81 UEF are eligible and also set equal to the Title 20-based minimum code allowable efficiency level. There are two different measure descriptions associated with the tier 1 offering – one indicates >= 0.81 UEF and the other lists the range 0.82 – 0.86.

[15] These 15 builders that completed a survey represent 55% of EEHP's net lifecycle savings.

points. Based on the data collected, we expected to estimate these key parameters with relative precision estimates in the range of ±10-15% at the 90% confidence interval.

Table 4-2: PY2021 SCG EENHP Single Family Tankless Water Heater Builders Sample Availability & Completes

Inspection Data Available	CalCERTS Data Available	PY2021 Builders	Lifecycle Net Therms of Proposed Sample (Assuming just one address per builder)	Survey Completes
Yes	Yes	19	20,306.40	8
Yes	No	13	15,391.20	5
No	Yes	2	2,184.00	0
No	No	4	5,605.20	2
NA	NA	38	43,486	15

4.3 PARTICIPANT CHARACTERIZATION SAMPLE DESIGN

We conducted a web survey to gather additional information to support the participant characterization and program benchmarking activities. Whereas the gross savings analysis was focused solely on the tankless water heater measure, this supplemental web survey sample included all HEER participants. We chose to only focus on HEER for participant characterization because the HEER subprogram contributes 70% of overall savings, and the participants are the customers.

For measures where contact information was available on the end user residing in the participating premise where the equipment was installed, we conducted a web survey. Our target was to complete 300 surveys with customers installing tankless water heaters. For non-tankless water heating measures with sufficient sample size (over 300), we attempted to complete at least 30 web surveys with customers. For all other measures with lower levels of participation, we attempted a census of customers. Customer emails for the HEER population are very well populated, with 99% containing valid emails. Table 4-3 shows the resulting sample breakdown by measure, and the resulting completes. In total, we expected to have 515 surveys, and we completed 670 surveys. We exceeded our target for each measure, with the exception of the two measures with lower population counts, HVAC Furnace and HVAC Gas Fireplace.

Table 4-3: PY2021 SCG HEER Single Family Participant Characterization Sample Design

Measure	Population		Sample	
	Records	Ex Ante Lifecycle Net Therms	Targets	Completes[16]
APPLIANCE CLOTHES DRYER	11,956	289,950	30	143
FOOD SERVICE	835	19,646	30	40
HVAC CONTROLS SMART THERMOSTAT	4,655	448,878	30	49
HVAC DUCT SEALING	4,905	1,330,194	30	36
HVAC FURNACE	217	67,268	20	11
HVAC GAS FIREPLACE	167	32,942	15	11
POOL HEATER	4,401	295,352	30	63
WATER HEATING STORAGE WATER HEATER	1,192	181,038	30	34
WATER HEATING TANKLESS WATER HEATER	14,152	15,906,960	300	366
Total	**42,480**	**18,572,228**	**515**	**670**

[16] Some participants installed more than one measure; therefore total survey completes does not equal the sum of survey completes by measure.

SECTION 5

GROSS IMPACT PARAMETER ANALYSIS

This section of the report details the parameter assessment and gross impact analysis for the tankless water heater measure under the single family HEER and single family EENHP programs. We also discuss the appropriate baseline for both normal replacement and new construction programs. In addition, for other measures with substantial savings we have reviewed the ex ante savings in the tracking data to ensure they are consistent with measure package documentation.

The gross impact approach utilizes the following DEER hot water heating model to generate hourly ex post gross impacts[17]. Our approach is to update default DEER parameters to best reflect program participating homes, and participating equipment/settings. This model accounts for the water heater's recovery or thermal efficiency, which is the effectiveness of converting fuel energy into hot water, as well as other supplemental energy uses to estimate the total energy use. We then aggregated the hourly impacts to develop an annual ex post gross therm savings estimate. Our evaluation engineers leveraged default hot water usage profiles within DEER prototype models as a function of house type and climate zone, as follows.

$$\Delta Therm = \Delta UES(\Delta T, \Delta \mathrm{RE}, CZ, Bldg)$$

$where$,

$\Delta Therm$ = Annual hourly water heating savings (Therms)

UES = Unit energy savings as modeled by DEER simulations among prototypes by climate zone, adjusted by our evaluation-based parameters

ΔT = Increase in DHW temperature between tankless water heater inlet and outlet (°F)

$\Delta \mathrm{RE}$ = Recovery Efficiency - The baseline is the minimum compliant storage water heater, and the efficient unit reflects the manufacturer's RE. The recovery efficiency increases as the UEF (uniform energy factor) increases. UEF is a measure of water heater efficiency.

CZ = Climate zone of the facility receiving the rebated tankless water heater

[17] https://www.caetrm.com/measure/SWWH013/02/

$Bldg$ = Classification of the house type receiving the rebated tankless water heater

We calculate lifecycle therms as follows:

$$WH_{lifecycle\ therm} = \Delta Therm * EU$$

EUL = Effective useful life (estimated years that the equipment is still operable)

The default parameters that we changed to reflect the program include the uniform energy factor (UEF) and recovery efficiency (RE). The default parameters that we did not change includes the effective useful life (EUL), where we used the ex ante value of 20 years, the water mains temperatures, and the hot water temperature setpoint. We developed ex post impacts by tier (Tier 1, 2, or 3), climate zone, and program (HEER or EENHP). The ratio of these impacts to the ex ante claimed savings represent a gross realization rate – the gross savings realized as a result of the ex post evaluation. Below we discuss the parameters obtained from the telephone survey data collection, and the summaries developed through data analysis.

5.1 GROSS IMPACTS & PARAMETERS

We employed a gross realization rate approach for this evaluation. We used the average parameter estimates corresponding to each tier and subprogram to develop specific ex post savings estimates by tier, subprogram, and climate zone. Below is a discussion of the parameter estimates along with summaries from the telephone survey sample.

5.1.1 Baseline Determination

For this evaluation, we have elected to use the ex ante/eTRM baseline, which is a storage water heater with a UEF of 0.59.

For the HEER program, the tankless water heater measure was installed as a "normal replacement" measure (as opposed to an accelerated replacement). Under normal replacement, the baseline is set as either a minimum required by code, or as an industry standard practice (ISP). For existing homes, there are separate code requirements for storage water heaters and for tankless water heaters. The ex

ante/eTRM baseline is defined as a 40-gallon storage water heater for single family installations, with an efficiency specification that has a UEF of 0.59. This is consistent with the Code of Federal Regulations minimum efficiency standards and emission limits set forth in California Appliance Efficiency Regulations (Title 20), Building Energy Efficiency Standards (Title 24) and emissions regulations.

It is important to note that the code for tankless water heaters, based on Title 24, prescribes a UEF of 0.81. Therefore, there is a significant difference in baseline efficiency using a storage water heater versus a tankless water heater in the base case.

Although we are electing to use a baseline consistent with eTRM which utilizes the code requirements for storage water heaters, there is evidence that the market for water heaters may be moving towards a tankless water heater. Because there is not an ISP study that has been conducted for water heaters, we did not attempt to utilize an ISP baseline for this evaluation. However, it is worthy to note that based on the survey responses with 100 HEER participants, the large majority claim they would have installed a tankless water heater in the absence of the program. As shown in Table 5-1, 69% of participants responded that they would have installed a tankless water heater without the program, and only 17% responded that they would have installed a storage water heater without the program.

Similarly, for EENHP, the tankless water heater baseline utilized the code based storage water heater with a UEF of 0.59. The EENHP installations are installed as new construction (NC) measures. While there is nothing precluding a builder from installing a storage water heater with a UEF of 0.59, the overall home is required to comply with Title 24. We analyzed compliance runs for 103 EENHP homes, and found that 37/103 (36%) of homes would not have passed compliance if a minimally compliant tankless water heater was installed (implying that even more would likely not have passed with a storage water heater). Furthermore, among the 15 EENHP participating builders that were surveyed, 13 said they would have installed a tankless water heater in the absence of the program, and the other 2 were uncertain what they would have done. Therefore, there is also evidence that a tankless water heater may be a more appropriate baseline to consider in the future for the EENHP. It is also important to note that the revised net-to-gross ratio for tankless water heaters in the 2023 DEER was based on a study that only include natural replacements. Based on the high incidence of builders stating they would have installed a

tankless water heater in the absence of the program, we recommend a net-to-gross study be completed for the new construction measure application type for tankless water heaters.

Table 5-1 ummarizes these results from our surveys with HEER customers and EENHP builders. Although these participants may not be representative of the entire water heating market, there is some evidence that the market may be moving towards tankless water heaters, as mentioned above. Therefore, we would recommend that an market share study be conducted to determine the penetration of tankless water heaters in the both the water heater replacement market as well as in the new construction market. It is important to note that if the baseline were to change from a storage to a tankless water heater, imposing a baseline efficiency of 0.81 or higher (which is the 2019 Residential Compliance Manual minimum federal UEF requirements for instantaneous gas fired water heaters[18]) would also require the program to change eligibility to be a higher minimum efficiency tankless water heater than current program eligibility requirements. It is likely that moving eligibility to a more efficient tankless water heater would also reduce free ridership in the program. Therefore, if the baseline was to be changed to a tankless water heater, we would also recommend that a net-to-gross study also be conducted where the net-to-gross ratio is measured against a new tankless water heater base case.

[18] https://www.energy.ca.gov/sites/default/files/2021-03/2019_Chapter%205%20-%20Water%20Heating_ADA.pdf

Table 5-1: PY2021 SCG HEER & EENHP Water Heater Action Absent of Program Survey Response

Water heaters come in a variety or technologies and fuel types, such as traditional storage water heaters, heat pump water heaters, condensing water heaters and tankless water heaters; and can use either gas or electricity. You installed a tankless water heater through the program that uses gas. Without the rebate would you have purchased a gas tankless water heater, a unit that is a different technology or fuel type, or would not have purchased one at all?	# Participants
HEER	101
Different technology or different fuel type	21
Gas tankless water heater	70
Would not have purchased a water heater	4
Don't Know	5
EENHP	15
Different technology or different fuel type	0
Gas tankless water heater	13
Would not have purchased a water heater	0
Don't Know	2
All	**116**

5.1.2 Acquiring Installed Hot Water Equipment Information

Our evaluation team used nameplate information provided by survey data, SCG inspection data, and CF1R/CF2R forms to estimate equipment gross impact parameters by tier. For the HEER program, SCG had provided the make, model, and UEF of all 14k tankless water heater claims. We reviewed this data and compared it to the make and model given to us by the participant. As described in Table 5-2, out of 101 survey completes, 71 participants were willing to read their nameplate information from their water heater. Only two participants read a make and model that differed from what SCG provided us, and the remaining 97% matched. Therefore, we felt confident in using the population's make and model information provided by SCG for our analysis.

Table 5-2: PY2021 SCG HEER Make & Model Survey Data Collection

Participant Willing to Verify Make & Model	# Participants	Make & Model Match SCG
Yes	71	97%
No	30	NA
All	101	97%

For EENHP, SCG instead verifies 5-6% of projects. We used this inspection data provided by SCG, in addition to CF1R and CF2R forms verified by HERS raters and provided by CalCERTS to gather nameplate information. Of the 38 builders in the EENHP population, we had CalCERTS data for 21 builders, and inspection data for 32 builders. There were 4 builders where we did not have CalCERTS or inspection data. Nonetheless, we still collected make and model information for all builders that we surveyed. We completed 15 interviews with builders, and only 2 builders reported a different model water heater than what was documented in either the inspection or CF2R forms. We used a combination of inspection forms, CF2R, and survey responses for the nameplate information used in our analysis.

5.1.3 Hot Water Temperature Setpoint

Hot water temperature setpoints were acquired from survey responses. Table 5-3 demonstrates the average hot water temperature setpoints from HEER and EENHP surveys. Although the surveys suggest that the hot water temperature setpoint is closer to 120, we ultimately used the ex ante temperature setpoint value of 135. This is because using a temperature setpoint of 120 would require adjusting hot water usage profiles in the DEER water heater calculator (that we are not able to accurately estimate). Adjusting the hot water profiles would require a thorough understanding of use cases in the home, and where usage is unmixed hot water versus mixed water of a given temperature. For instance, the mixed water temperature for showering is not consistent with hot water use for dishwashers.

Table 5-3: PY2021 SCG Average Hot Water Temperature Setpoints

Survey	# Survey Completes	# Survey Completes w/ Hot Water Temp. Setpoint Response	Average Hot Water Temp. Setpoint (°F)	RP
HEER	101	61	122	1.11 %
EENHP	15	10	120	0.26 %

5.1.4 UEF & Recovery Efficiency (RE)

For HEER and EENHP, we looked up the parameters provided by each manufacturer using the California Energy Commission's appliance lookup database[19]. For HEER, we found lookups for 188 tankless water heaters, covering 13,456 claims or 96% of the HEER single family population. Based on these lookups, we averaged the measure case parameters such as UEF, and recovery efficiency (RE) by tier. In Table 5-4, we show that we used the same UEF and RE for the ex ante and ex post baseline case. In addition, Table 5-5 to Table 5-6 presents the HEER ex ante and ex post measure case parameters used, as well as the relative precisions.

Table 5-4: PY2021 SCG HEER/EENHP Baseline Case Parameters

Parameter	Ex Ante Baseline Case	Ex Post Baseline Case
UEF	0.59	0.59
Recovery Efficiency	0.76	0.76

Table 5-5: PY2021 SCG HEER Measure Case UEF, Ex Ante & Ex Post

Tier	Ex Ante Measure Case UEF	Ex Post Measure Case UEF	# Customers Sampled	RP
Tier 1	0.81	0.82	537	0.03%
Tier 2	0.87	0.92	3,377	0.00%
Tier 3	0.95	0.96	9,542	0.00%

[19] MAEDBS Advanced Search (ca.gov)

Table 5-6: PY2021 SCG HEER Measure Case Recovery Efficiency, Ex Ante & Ex Post

Tier	Ex Ante Recovery Efficiency	Ex Post Recovery Efficiency	# Customers Sampled	RP
Tier 1	0.84	0.85	537	0.03%
Tier 2	0.95	0.95	3,377	0.00%
Tier 3	0.99	0.98	9,542	0.00%

For EENHP, we found lookups for 48 water heaters, covering 528 claims or 10% of the EENHP single family population. Based on these lookups, we averaged measure case parameters such as UEF, and recovery efficiency (RE) by tier. Table 5-7 to Table 5-8 shows the ex ante and ex post measure case parameters used, as well as the relative precisions.

Table 5-7: PY2021 SCG EENHP Measure Case UEF, Ex Ante and Ex Post

Tier	Ex Ante Measure Case UEF	Ex Post Measure Case UEF	# Builders Sampled	RP
Tier 1	0.81	0.85	9	0.05%
Tier 2	0.87	0.93	29	0.02%
Tier 3	0.95	0.96	3	1.02%

Table 5-8: PY2021 SCG EENHP Measure Case Recovery Efficiency, Ex Ante & Ex Post

Tier	Ex Ante Recovery Efficiency	Ex Post Recovery Efficiency	# Builders Sampled	RP
Tier 1	0.84	0.87	9	0.88%
Tier 2	0.95	0.97	29	0.15%
Tier 3	0.99	0.99	3	7.93%

5.2 GROSS EVALUATION RESULTS

Table 5-9 presents the evaluation results for first year (FY) and lifecycle (LC) GRRs. We do not have a relative precision for the overall GRRs since a single savings value is generated for each segment

(Subprogram and Tier) using the DEER model, based on the average parameter values provided above. The EUL used for ex post lifecycle savings is the ex ante EUL of 20 years.

Table 5-9: PY2021 SCG Gross Realization Rates for Single Family Tankless Water Heaters by Tier, Subprogram

Subprogram	Tier	FY Therms			LC Therms		
		Ex Ante Therms	Ex Post Therms	GRR	Ex Ante Therms	Ex Post Therms	GRR
HEER Single Family	1	62,825	64,301	1.02	1,256,494	1,286,012	1.02
	2	327,966	329,940	1.01	6,559,312	6,598,797	1.01
	3	928,279	922,058	0.99	18,565,584	18,441,152	0.99
HEER SF Total		1,319,069	**1,316,298**	**1.00**	26,381,390	**26,325,961**	**1.00**
EENHP Single Family	1	102,433	102,433	108,730	2,048,668	2,174,608	1.06
	2	354,096	354,096	362,317	7,081,914	7,246,350	1.02
	3	7,886	7,886	7,888	157,720	157,769	1.00
EENHP SF Total		464,415	**478,936**	**1.03**	9,288,302	**9,578,727**	**1.03**
ALL SF		**1,783,485**	**1,795,234**	**1.01**	**35,669,692**	**35,904,688**	**1.01**

The main impact was the difference in UEFs and recovery efficiencies used in ex ante and ex post savings. The overall measure case UEF that we used in ex post calculations is slightly higher than the ex ante measure case UEF that was used for EENHP, and slightly lower than the overall ex ante UEF for HEER, resulting in a slightly higher impact for EENHP, and a slightly lower impact for HEER. For HEER, 7% of Tier 2 tankless water heaters were mislabeled in the tracking data and verified to be Tier 3 tankless water heaters. This had an upward impact on calculated ex post savings for Tier 1 and Tier 2, but overall for all tiers had a slight downward impact. For EENHP, 64% of Tier 1 tankless water heaters were mislabeled in the tracking data and verified to be Tier 2 tankless water heaters. 17% of Tier 2 EENHP tankless water heaters were mislabeled in the tracking data and verified to be Tier 3 tankless water heaters. This had an upward impact on calculated ex post savings. This has resulted in ex post measure case UEFs being higher than the ex ante measure case UEFs. We also found cases where the tracking tier matched the verified tier, but the UEF of the installed tankless water heater was higher than the claimed UEF. For those cases, we still saw a positive impact on calculated ex post savings. Figure

5-1 shows this depicted in a waterfall chart for HEER and Figure 5-2 shows this depicted in a waterfall chart for EENHP.

Figure 5-1: PY2021 SCG Single Family HEER Ex Ante to Ex Post Waterfall Chart

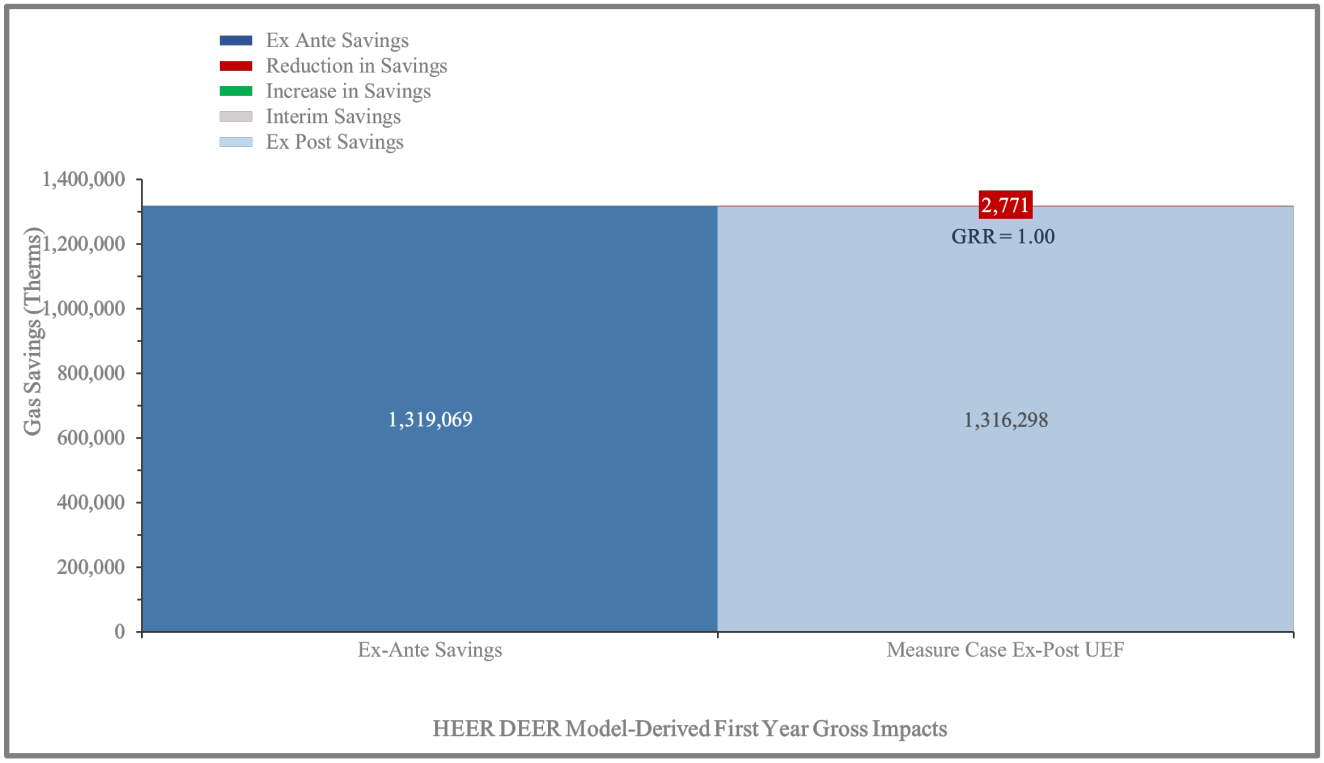
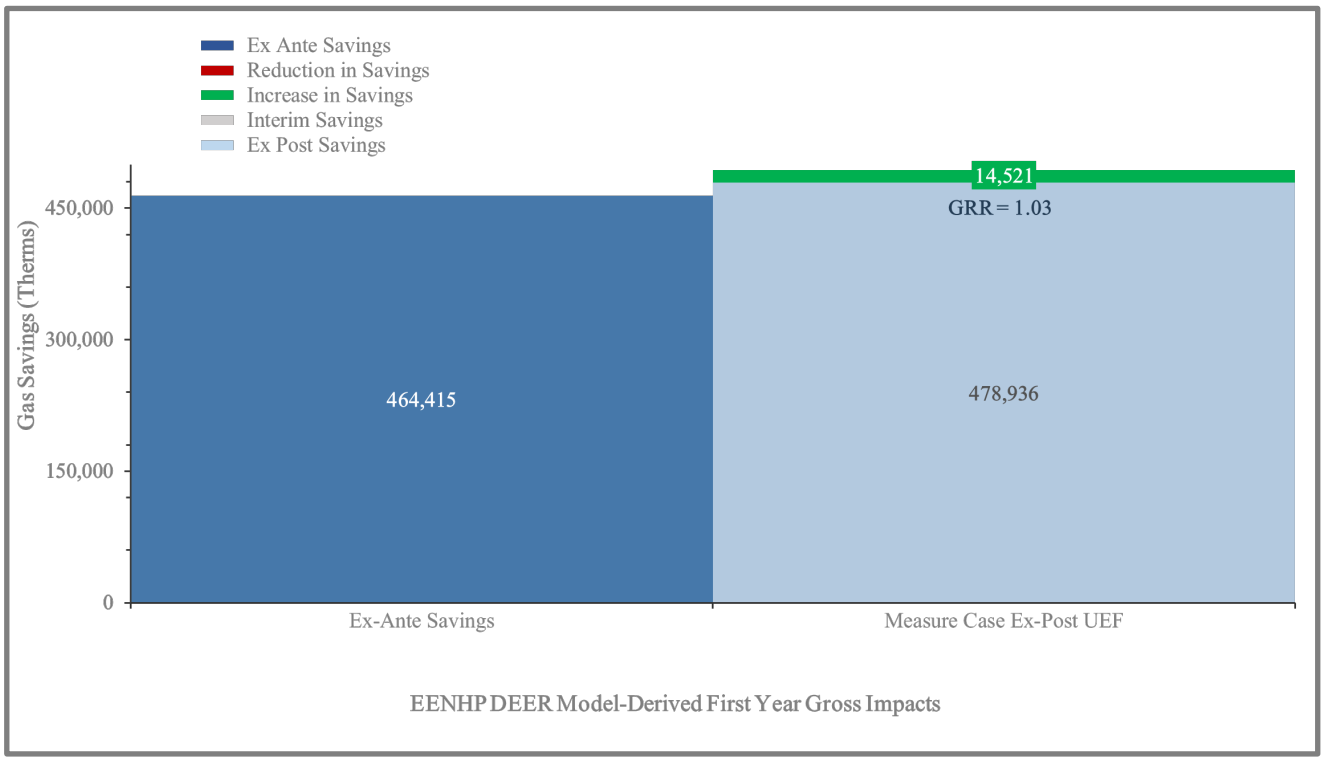


Figure 5-2: PY2021 SCG Single Family EENHP Ex Ante to Ex Post Waterfall Chart



5.3 REVIEW OF EX ANTE SAVINGS FOR OTHER MEASURES

This section presents the findings of the Ex Ante Review task, which provides a review of deemed measure claims in the Residential Energy Efficiency Program. This task focuses on the measures that fall outside of the tankless water heater full evaluation, but still represent significant therm savings to the program.

For this task, the evaluation team reviewed the 2021 energy savings claim submission to the California Energy Data and Reporting System (CEDARS) and compared the selected Claim measures against the approved values in the eTRM. This task included systematically assigning each selected Claim record to its corresponding record in the eTRM, performing a comparison of the two, and tracking any differences or issues encountered throughout the process.

In Table 5-10, we have included definitions of key fields used throughout this document. For additional detailed data definitions, please reference the *CEDARS Claims data specification* or the *eTRM user guide*.

5.3.1 Measure Selection

The 2021 SCG32702 Claims were assigned to measure groups and summarized to show the relative contribution of each measure group to lifecycle therm savings. Aside from tankless water heaters, which are receiving a full evaluation, any measure group representing more than 1% of lifecycle net therm savings were included in the ex ante review, as shown in Table 5-10: below. Accordingly, the measures representing 99% of the program's lifecycle net therm savings were covered by either 1) the full evaluation or 2) the ex ante review.

Table 5-10: PY2021 SCG The Residential Energy Efficiency Program Measure Selection for Ex Ante Review

Measure Group	# Claims	Therm Savings			Selected for Ex Ante Review?
		Lifecycle Net	%	Cumulative %	
Water Heating Tankless Water Heater	19,570	21,618,253	81.7%	81.7%	No-full evaluation
HVAC Duct Sealing	5,774	1,346,358	5.1%	86.7%	Yes
Water Heating Controls	435	812,258	3.1%	89.8%	Yes
Water Heating Boiler	101	828,387	3.1%	92.9%	Yes
HVAC Controls Smart Thermostat	7,735	495,540	1.9%	94.8%	Yes
HVAC Furnace	2,558	512,030	1.9%	96.7%	Yes
Pool Heater	4,417	304,765	1.2%	97.9%	Yes
Appliance Clothes Dryer	12,183	292,746	1.1%	99.0%	Yes
Water Heating Storage Water Heater	1,206	208,637	0.8%	99.8%	No
HVAC Gas Fireplace	168	32,942	0.1%	99.9%	No
Food Service	841	19,696	0.1%	100.0%	No
Appliance Clothes Washer	70	1,830	0.0%	100.0%	No
Water Heating Showerhead	3	148	0.0%	100.0%	No
Non-Resource	2,479	0	0.0%	100.0%	No
Total	74,825	26,473,589			

5.3.2 Research Objective

The purpose of this evaluation task was to examine how the Residential Energy Efficiency Program claimed savings values (ex ante savings) for measure groups with significant therm savings compare to approved ex ante values (eTRM data) by reviewing items such as:

- unit energy savings (UES) by building type, HVAC, vintage, and/or climate zone;
- net-to-gross (NTG);

- effective useful life (EUL)/remaining useful life (RUL); and
- measure application type (accelerated vs. normal replacement vs. new construction, commonly abbreviated as AR, NR and NC, respectively).

5.3.3 Methods

Checking the accuracy of SCG's 2021 Residential Energy Efficiency Program claim data entailed matching each claim record to a record in the eTRM measure permutation data. The Residential Energy Efficiency Program is a deemed program, and all parameters claimed in CEDARS should match the parameters associated with a corresponding approved deemed measure stored in the eTRM. Matching the SCG claim data with the eTRM data was not a straightforward exercise and required the evaluation team's deep experience with program administrator (PA) claim data.

The methods and detailed steps required to match the included measure group claims with the eTRM measures are provided in Appendix E but summarized here. After iteratively adjusting and matching primary keys, we were able to successfully align all claims included in this exercise with the eTRM, allowing for the direct comparison of the Claim and eTRM data that provided the results discussed in the next section. Starting in 2022, a new field[20] was added to the Claim data which should make alignment to the eTRM much more straightforward. The long-term plan of the DEER ex ante team is to have CEDARS check the claims versus eTRM measure permutations, and adding this field is a first step towards that goal.

5.3.4 Comparison Results

After matching an eTRM measure permutation with each claim associated with the included measure groups for the Residential Energy Efficiency Program, we carried out a series of checks based on our deep knowledge of both claim and eTRM data. We also filtered the data in various ways to look for outliers. As noted below, we found only the few issues/errors in the claims data.

[20] New Claim field 'MeasDetailID' was added to the 2022 CEDARS Claim data specification.

Claims versus eTRM Data

The 2021 Annual Claims data studied in this deliverable are limited to the 7 measure groups shown in Table 5-10:, and listed below for clarity.

- HVAC Duct Sealing
- Water Heating Controls
- Water Heating Boiler
- HVAC Controls Smart Thermostat
- HVAC Furnace
- Pool Heater
- Appliance Clothes Dryer

Table 5-11 below shows the SCG-claimed first-year gross therm savings compared to the eTRM-mapped savings for 2021 included measure groups. SCG-claimed therm savings were within 0.1% of the eTRM-mapped approved measures, and any differences between the approved values and SCG-claimed values are attributable to rounding.

Table 5-11: PY2021 SCG Total Annual Claimed vs. eTRM-Mapped, First-Year Gross Therm Savings

Energy Savings Unit	Quarterly Claims Data 2021 Annual	eTRM Mapped	Difference
Therms	650,623	651,297	0.1%

kW and kWh Differences

While the SCG-claimed therm savings for the included measures were within 0.1% of the approved eTRM savings values, SCG's reporting of electric savings was sporadic, with kW and kWh savings frequently zeroed out or not reported. After dialog with SCG, we learned that SCG frequently does not claim electric savings since SCG does not have electric savings goals. For example, for HVAC Duct Sealing and HVAC Furnace measure groups, the eTRM provides small kW savings, but the Claim frequently provides zero savings. With no electric savings goals and generally sporadic reporting of kW and kWh savings, an electric savings comparison was excluded from the scope of this analysis.

Other Ancillary Issues

After we mapped each Claim record to a corresponding eTRM permutation record, we inspected additional parameters with differences between the Claim and approved eTRM values that can frequently lead to various discrepancies with savings or cost effectiveness, as well as other categorization issues:

- **Net To Gross (NTG):** The Claim included NTG_ID's referencing the Hard to Reach (HTR) values, which are not available in the eTRM, as the eTRM only permutes out standard NTG values. After discussion with SCG, it appears the SCG is properly claiming the HTR NTG using criteria outlined in Decision 18-05-041 to justify the higher NTG of 0.85. We did not perform a formal NTG verification for the claims using the HTR NTG.

- **Measure Application Type (MAT):** The measure package with Source Description "SWHC039-03" does not have any New Construction offerings in the eTRM—the eTRM only contains 'Normal Replacement' MATs for this measure. However, SCG frequently claims MAT = 'New Construction' for this measure package.

- **Building Type:** The measure package with Source Description "SWWH010-01" is a multifamily boiler measure in the eTRM. However, in the claim, SCG only claims single family and mobile home building types for this measure.

5.3.5 Claims to eTRM Measure Permutation Matching Issues

Matching the SCG claim records with corresponding eTRM records was involved. However, this exercise should be seamless beginning with 2022 claims, with the implementation of a new MeasDetailID field in the Claim. This field will provide a unique value for every measure premutation in the eTRM. The following parameter/field-level issues contributed to the difficulty we experienced aligning the claim to the eTRM:

- **BldgVint (Standard ExAnte Building Vintage)**
  - eTRM uses "Ex" and "Old".
  - Since there are several options for claiming BldgVint ('Ex', 'New', 'Old', 'Rec'), there are likely cases where the eTRM should have additional options available; there should be a dialog to discuss all options needed in the eTRM. This could also be related to how BldgVint is specified in the specific measure package.

- SCG data incorrectly uses 'Ex' where eTRM uses 'Old'.

- DeliveryType
  - Frequent differences between Claim and eTRM: 'DnDeemed' vs 'DnDeemedDI'.
  - For example, eTRM only offers 'DnDeemed' for a measure, but SCG claims 'DnDeemedDI', or vice versa.
  - Since there are several options for claiming DeliveryType, there are likely cases where the eTRM should have additional options available; there should be a dialog to discuss all options needed in the eTRM. This could also be related to how DeliveryType is specified in the specific measure package.
  - Further research is needed to understand these discrepancies.

- NormUnit
  - NormUnit is the basis for the Quantity of a measure being reported
  - For the HVAC Controls Smart Thermostat measure, the eTRM used NormUnit = 'Household', while the Claim used 'Each'.
  - SCG should use the NormUnit provided in the eTRM permutation record

5.3.6 Conclusions and Next Steps

At this point in time, aside from those issues/observations listed above, the evaluation team has not found any other significant data gaps or errors. Those issues listed above should be alleviated in the future by tighter integration between Claims and the eTRM. SCG appears to be claiming the appropriate therm savings values for the measure groups included in this analysis. The following are some specific recommendations for future work that could help address some of the issues presented in this report.

- SCG should continue to work with the Deemed Ex Ante and eTRM teams
  - To ensure that measure permutation data stored in the eTRM match the measure packages/workpapers narratives. Some SCG claim parameters sometimes do not align with the permutation data stored in the eTRM.

- **Monitor 2022 SCG Claims to verify the new MeasDetailID field alleviates some of the matching issues.**
  - **The MeasDetailID will likely solve some matching issues and help uncover some of the issues laid out in this report.**
  - **For those issues which still exist, SCG should work with the eTRM team to ensure that the appropriate values exist in the eTRM.**

Beyond the MeasDetailID addition, the CPUC announced plans to more tightly integrate the eTRM data with Claims. Since the PAs would not actually be providing any of the parameters addressed by this memo (eg. UES, NTG, GSIA) in the Claim itself, tight integration could alleviate some of the issues laid out in this memo, although Energy Division should continue to verify the total savings being claimed.

SECTION 6

PARTICIPANT CHARACTERIZATION

We utilized information from the tracking data, CIS/billing data, CalEnviroScreen, and survey data to gain insights on the demographic distribution, disadvantaged communities, hard-to-reach customers, depth of retrofit, and other areas of focus in this evaluation's participant characterization study. The participant characterization portion assesses all three subprograms – HEER, EENHP, and MFEER. However, we only conducted surveys for single family HEER participants due to the difficulties in surveying EENHP and MFEER occupants who are not participants of the program. The HEER program consists of 99.9% single family records, and a small portion of mobile homes. In total, there are 45,527 single family HEER records, which is 79% of the entire SCG Residential Energy Efficiency Program.

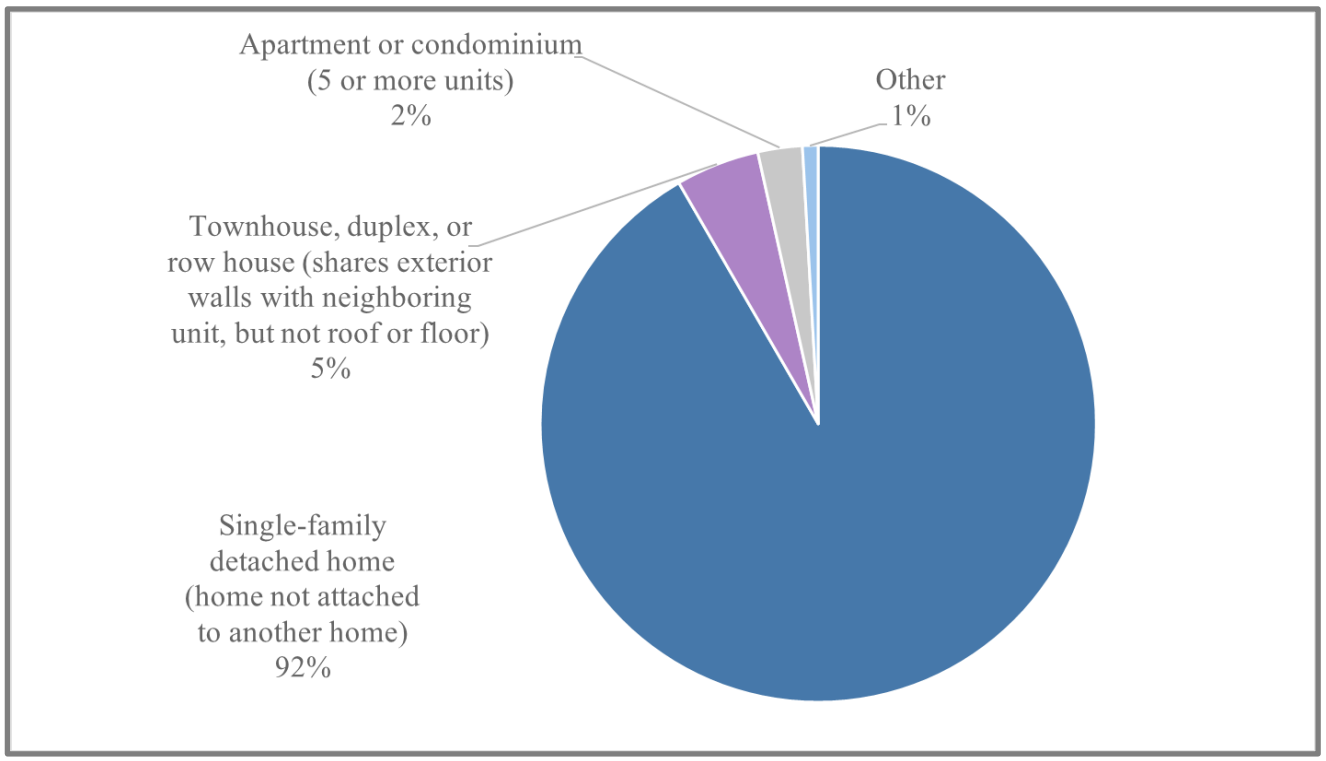
6.1 DEMOGRAPHIC DISTRIBUTION

The HEER surveys assessed a variety of demographic segments, such as education, employment status, cultural background, etc. We interviewed a total of 670 HEER participants. Below we list a summary of key survey findings.

6.1.1 Home Type, Size and Ownership

- **92% of respondents live in a single-family detached home.**
  - **8% live in either a townhouse, apartment/condominium, or mobile home.**
- **1,500-2,500 square feet is the most frequent household square footage of HEER respondents.**
- **96% of respondents own their home.**
  - **3% rent and 1% refused to respond.**

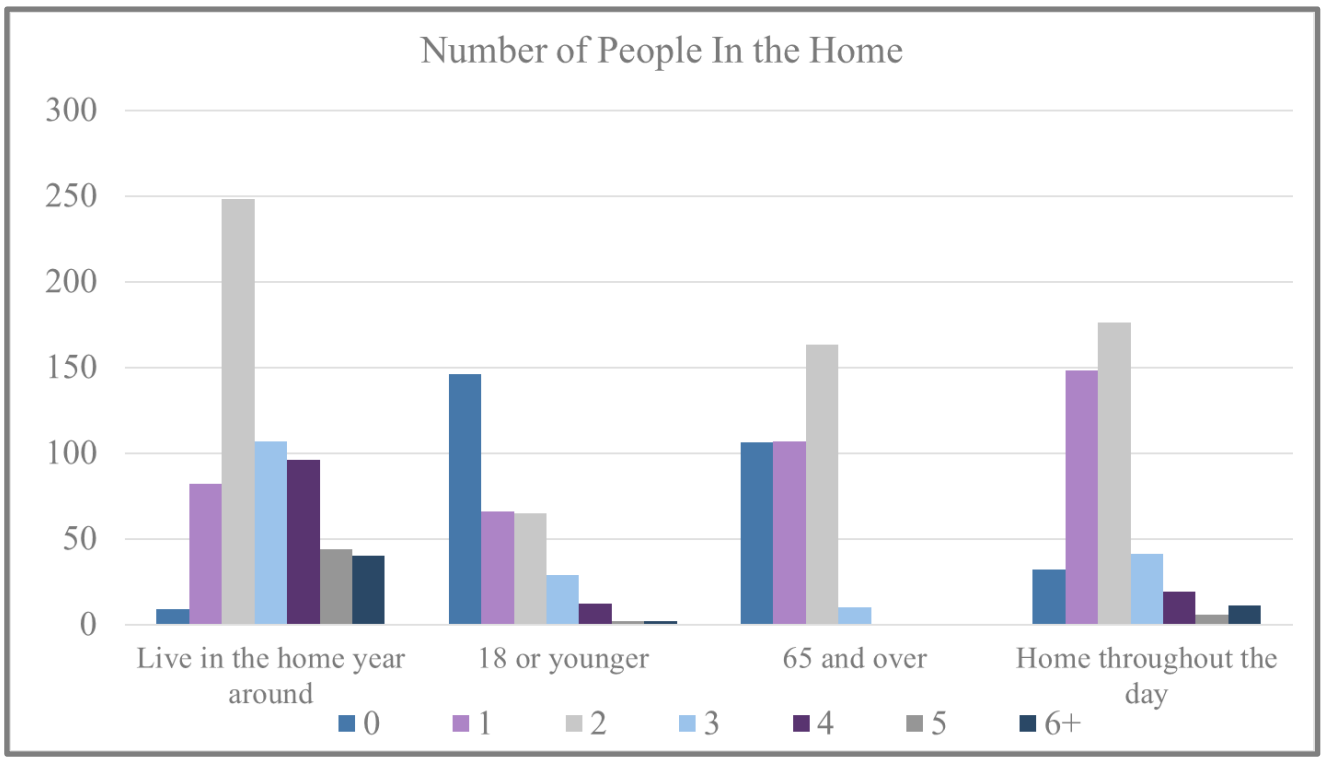
Figure 6-1: PY2021 SCG HEER Housing Type



6.1.2 Home Occupants

- An average of 2.8 people live in the home year-round.
  - 1.1 people living in the home are 18 or younger.
  - 1.2 people living in the home are 65 or older.
- An average of 1.8 people are home throughout the day.

Figure 6-2: PY2021 SCG HEER Number of People in the Home



6.1.3 Home Occupant Language, Origin and Race

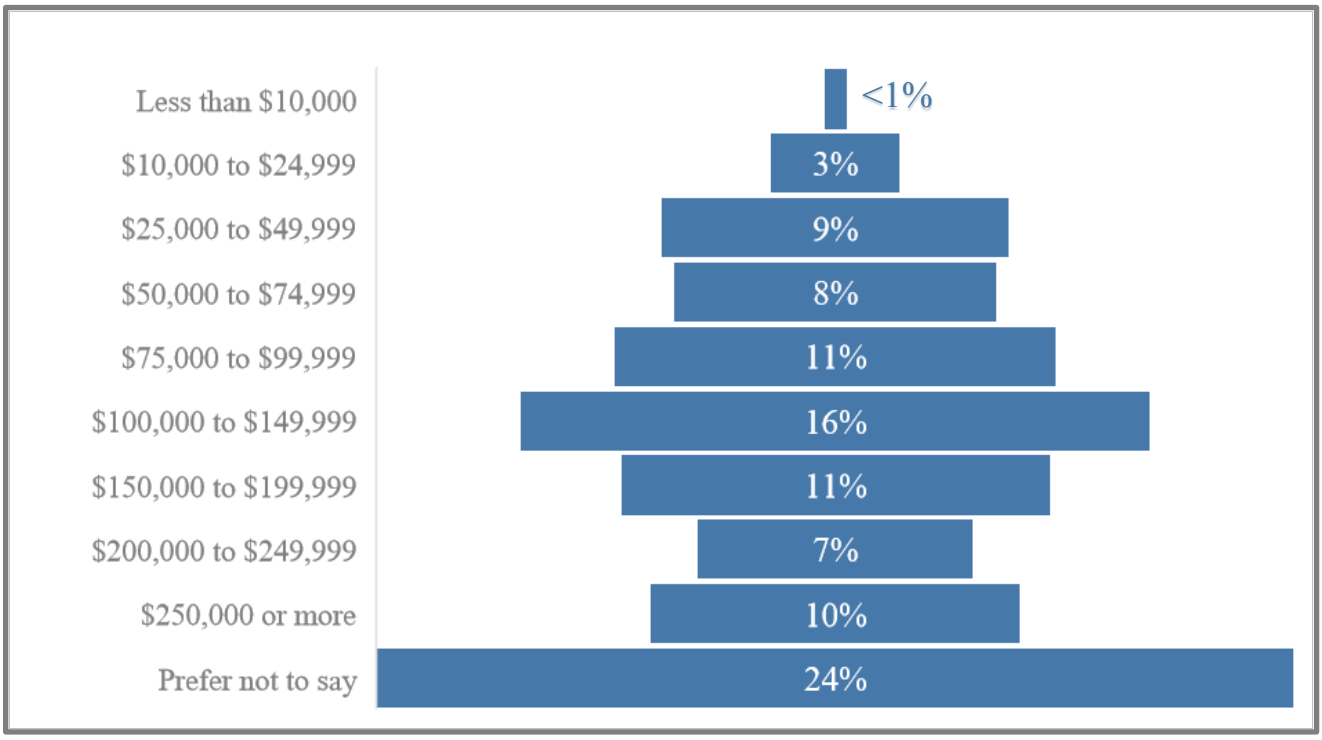
- 90% of respondents primarily speak English within their household.
  - 3% primarily speak Spanish.
  - 1% primarily speak Korean, 1% Vietnamese, and 1% Mandarin or Cantonese.
  - 2% primarily speak another language than that listed above.
  - 2% declined to respond.
- 77% of respondents are not of Hispanic, Latino, or Spanish origin
  - 9% are Mexican, Mexican American, or Chicano.
  - 1% are Puerto Rican.
  - 5% are another Hispanic, Latino, or Spanish origin.
  - 8% declined to respond.

- 66% of respondents are White.
  - 13% are Asian.
  - 3% are Black or African American.
  - 1% are American Indian or Alaska Native.
  - 1% are Pacific Islander.
  - 5% are some other race.
  - 12% declined to respond.

6.1.4 Home Occupant Education, Employment and Income

- 69% of respondents have either a bachelor's degree or higher.
- 46% of respondents are employed full time.
  - 44% are retired.
  - 5% are employed part time.
  - 4% are not employed.
- 57% of respondents have incomes of $100k or more, among those that provided their income.
  - 26% have incomes between $50k-$100k.
  - 17% have incomes less than $50k.

Figure 6-3: PY2021 SCG HEER Income



6.1.5 Disadvantaged Communities

We also assessed the disadvantaged communities (DAC) within SCG's territory that overlap with the end use customers of the HEER, EENHP, and MFEER programs. Disadvantaged communities suffer from economic, health, and environmental burdens such as poverty, unemployment, air and water pollution, hazardous wastes, and increased incidence of asthma and heart disease[21]. These communities are determined by the California Environmental Protection Agency using a tool called CalEnviroScreen, which maps pollution burdens for California census tracts.

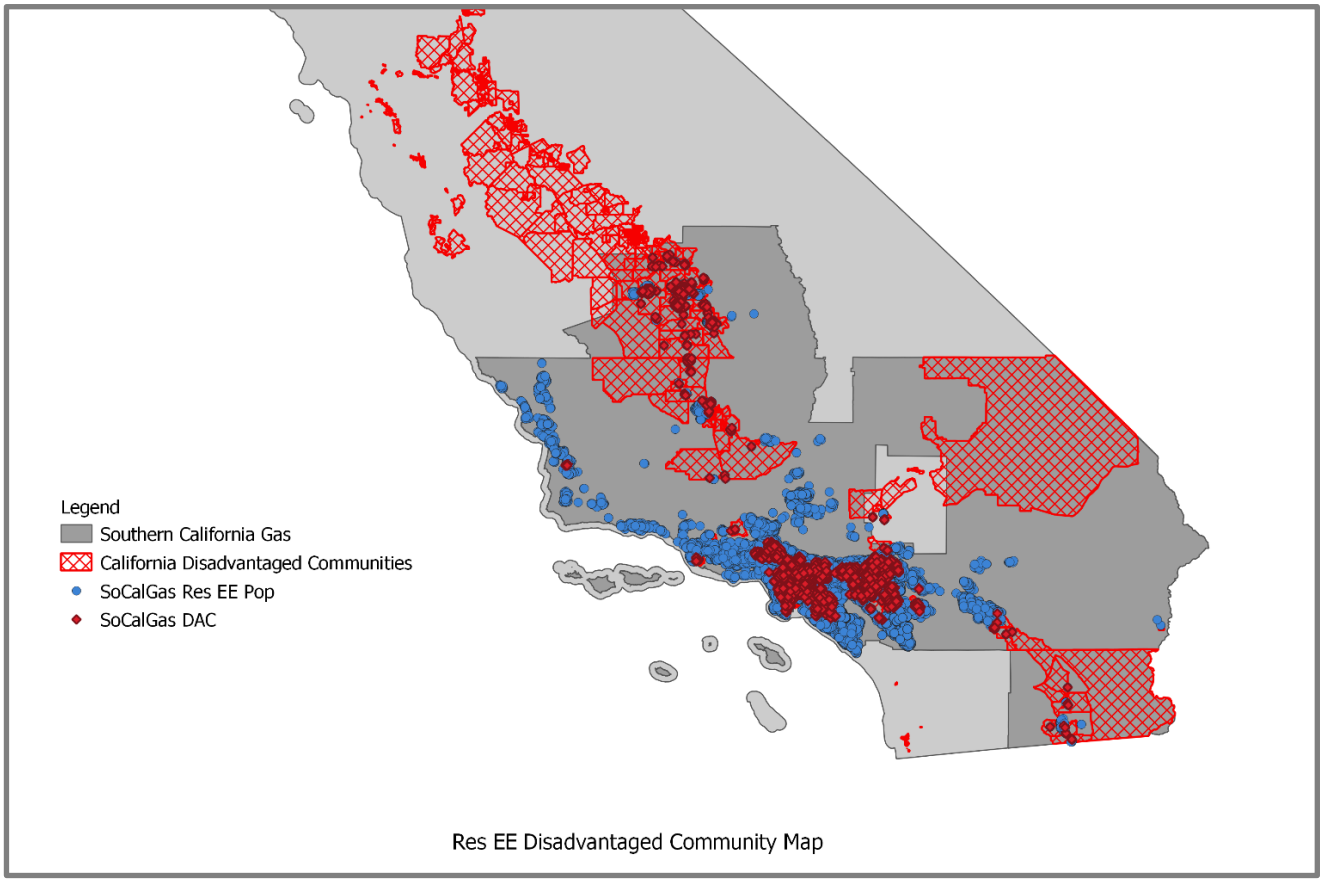
Figure 6-4 below shows a map of the customers located in a DAC, where the blue dots represent all households in the program, and the red dots are the households located in a DAC.

- **We found that 19% of the program is in a DAC, where 18% of HEER, 39% of MFEER, and 20% of EENHP are in DACs.**

[21] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/disadvantaged-communities

- **Census tracts in Ontario, Los Angeles, Visalia, and Riverside, CA are the most populated DACs of the program.**

Figure 6-4: PY2021 SCG Residential Energy Efficiency Program Disadvantaged Communities



6.2 HARD-TO-REACH CUSTOMERS

We are using the hard-to-reach (HTR) definition defined by the Statewide Deemed Workpaper Rulebook Version 4.0[22] to classify the HTR population of HEER, MFEER, and EENHP. The rulebook states that HTR customers fall under a geographic region outside of the US Office of Management and Budget Combined statistical areas of the SF Bay Area, greater LA area, greater Sacramento area, or in a DAC.

22 https://static1.squarespace.com/static/53c96e16e4b003bdba4f4fee/t/6100a9d65429cb3846a417a3/1627433432394/SW+Deemed+WP+Rulebook+Interim+v4.0+Final.pdf

In addition to this, HTR customers either primarily speak a non-English language, qualify for California Alternative Rates for Energy (CARE) / Family Electric Rate Assistance Program (FERA), or their housing type falls under multifamily, mobile home, or are renting their home. If the geography criteria is not met, customers are considered HTR if the language, income (CARE qualification), and housing type criteria are all met. Table 6-1 below shows the criteria that make up HTR, as well as the data source we are using for each criteria.

Table 6-1: PY2021 SCG HTR Definition and Data Sources

HTR definition: Geography + 1 more, OR Income, Housing Type, & Language	
Criteria	**Data Source**
Geography	
DAC ***OR***	CalEnviroScreen
Outside Greater LA	US Office of Management and Budget Combined statistical areas
Income	
Flagged in CARE in billing data ***OR***	Billing Data
Survey question shows income requirements for CARE	Survey
Housing Type	
Tracking Data Housing Type is MF or MH ***OR***	Tracking Data
Survey response is mobile home, multifamily, or renter (if survey differs from tracking data, use survey)	Survey
Language	
Survey response says primary language is not English	Survey

6.2.1 Geography Criteria

As stated in the Deemed Workpaper rulebook, customers outside of the combined statistical areas of Los Angeles, the SF Bay Area, and Sacramento, or customers located in a DAC are geographically in a region that is hard-to-reach. We referenced the US Office of Management and Budget[23] to identify counties outside the Greater LA area. We also referenced CalEnviroScreen to identify DACs. As shown in Table 6-2, 24% of customers in the HEER program, 41% of customers in the MFEER program, and

[23] https://www.census.gov/geographies/reference-files/time-series/demo/metro-micro/delineation-files.html

25% of customers in the EENHP program are in HTR geographies, and overall 25% of the Res EE Program is in an HTR geography.

Table 6-2: PY2021 SCG HTR Geographies by Subprogram

Subprogram	Geographic HTR Criteria	N	%
HEER	No	34,532	76%
	Yes	11,031	24%
MFEER	No	801	59%
	Yes	568	41%
EENHP	No	7,923	75%
	Yes	2,703	25%
ALL		**57,558**	**25%**

6.2.2 Income Criteria

To meet the HTR income criteria, customers must qualify for the California Alternative Rates for Energy (CARE) or the Family Electric Rate Assistance Program (FERA). Customers qualify for CARE/FERA if they belong to either Medical, Medicaid, Food Stamps, or other public assistance programs, or if they meet specific income criteria[24]. For the HEER program, we used a combination of survey responses and the CARE flag provided to us by SCG's residential billing data. Table 6-3 is a heatmap showing the percentage of HEER sampled participants who qualify for CARE/FERA based on their income and household size, or are already enrolled in CARE according to SCG. The average eligible CARE customer in HEER, based on the sample, has an income of $56k and an average of 3.1 household residents. In addition, 24% of HEER surveyed customers meet the income HTR requirement, while 26% of the non-surveyed customers meet the income HTR requirement (based on the SCG CARE flag alone). Because the participants of EENHP are builders, and the participants of the MFEER program have a large portion of property managers, we found difficulties in identifying the occupants for those programs, and therefore did not utilize billing data and/or conduct surveys to identify customers in CARE for those programs.

[24] https://www.socalgas.com/save-money-and-energy/assistance-programs/california-alternate-rates-for-energy

Table 6-3: PY2021 SCG Percent of HEER Sampled Participants Eligible or Enrolled in CARE by Income & Household Size

	Income									
#Household Residents	Less than $10,000	$10,000 to $24,999	$25,000 to $49,999	$50,000 to $74,999	$75,000 to $99,999	$100,000 to $149,999	$150,000 to $199,999	$200,000 to $249,999	$250,000 or more	Prefer not to say
6+	NA	NA	100%	100%	33%	17%	0%	NA	33%	75%
5	NA	NA	NA	100%	44%	13%	0%	0%	0%	36%
4	NA	100%	100%	100%	11%	12%	5%	0%	20%	10%
3	NA	100%	100%	40%	27%	8%	0%	8%	0%	24%
2	NA	100%	100%	8%	10%	0%	5%	0%	0%	3%
1	100%	100%	100%	14%	0%	5%	0%	0%	0%	33%
0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2.3 Housing Type Criteria

Customers who live in multifamily and mobile home residences satisfy the housing type HTR criteria. We determined housing type from a combination of tracking data and HEER survey responses. From the 670 HEER survey completes, 98% of respondents reported a housing type that matched the single family housing type claimed in the tracking data, and the other 2% of respondents reported that they live in an apartment or condominium with 5 or more units, or that they live in a mobile home. In addition, 96% of HEER respondents own their homes, and 3% rent their homes. In Table 6-4 we show the housing types by program, for surveyed homes, and un-surveyed homes represented by the tracking data. We can see that 0.18% of HEER, 100% of MFEER, and 3.61% of EENHP meet the housing type criteria, which is 0.81% overall for the program.

Table 6-4: PY2021 SCG Housing Type by Subprogram

Subprogram	Housing Type	Tracking Data Claims	Surveyed Claims	% Meeting Housing Type Criteria
HEER	Single Family	44,728	773	0.18%
	Multifamily	NA	3	
	Mobile Home	34	20	
MFEER	Multifamily	1,369	NA	100%
EENHP	Single Family	10,242	NA	3.61%
	Multifamily	384	NA	
ALL		**56,757**	**796**	**0.81%**

6.2.4 Language Criteria

Customers who primarily speak a non-English language within their household fulfill the language HTR criteria. We derived this information from the HEER surveys, and found that out of 670 survey completes, 52 (7.8%) responded that they primarily speak a non-English language within their household.

6.2.5 Final HTR Assessment

Geographically, 41% of multifamily customers in MFEER are located in an HTR region (either a DAC or outside of the Greater LA Area), which is higher than the percentage of HEER and EENHP customers living in an HTR region. In addition, since MFEER is a multifamily program, all customers satisfy the housing type HTR criteria, therefore making the percentage of HTR customers in MFEER larger than the other two programs. Because we had difficulties in identifying the occupants of the MFEER program, we were unable to utilize survey data and billing data to determine the income, CARE eligibility, and primary household language of the MFEER customers. Therefore, it could be likely that more than 41% of MFEER customers are HTR. Note that the only additional customers that would be classified as HTR are those that were outside of the DAC/Geographic area (because all those inside are HTR due to also meeting the housing criteria), and met both the language and income criteria.

For the EENHP, only 4% were found to be HTR as we could only use the geographic and housing criteria as we did not survey these customers, and nearly all of these customers live in single family residences. Because we were unable to determine the income, CARE eligibility, and primary household language, it could be possible that more than 4% of households under the EENHP are HTR.. However, it is unlikely that many more customers would have been classified as HTR because:

- **Those not meeting the geographic criteria, which is known, must have met the remaining three criteria, which is unlikely because we also know they are mostly single-family residences.**
- **Those meeting the geographic criteria (only 25%) need to meet one additional criterion, but it's unlikely the housing type would have been met. Also, since these are new home buyers, meeting the income criteria is also less likely.**

For HEER, we identified that 8% of surveyed customers are HTR. This was ultimately close to the 11% identified for the rest of the population, based just on the geographic HTR criteria and income HTR criteria provided by the CARE flag in the billing data. Table 6-5 shows the % of HTR customers for the surveyed HEER sample, unsurveyed remaining HEER population, unsurveyed MFEER population, and unsurveyed EENHP population. Using just the geographic and housing type criteria, which is available for every claim, 1.7% of the population is HTR. When adding in the CARE requirement for HEER, based on HEER billing data, we then classify 10.0% of the population as HTR. Lastly, when adding survey responses, such as income and language information, we still find that 10% of the population is HTR.

Table 6-5: PY2021 SCG Final HTR Assessment by Program

Program	Surveyed	N Sites	% Geographic	% Income	% Housing Type	% Language	% HTR
HEER	1	670	20%	24%	3%	8%	8%
HEER	0	38,204	24%	26%	0%	NA	11%
MFEER	0	787	41%	NA	100%	NA	41%
EENHP	0	5,416	25%	NA	4%	NA	4%

6.3 DEPTH OF RETROFIT

We looked at the number of measures installed per premise, as well as the savings achieved per premise to determine depth of retrofit for the program. Table 6-6 below helps understand the types and distribution of measures in the Res EE Program. HEER tankless water heaters make up 24% of records, and 60% of total program ex ante savings. EENHP tankless water heaters make up 9% of records and 22% of total program ex ante savings.

Table 6-6: PY2021 SCG Distribution of Records and Savings by Program and Measure Group

Measure Group	Program	N	Exante Lifecycle Net Therms	% Records	% Savings
WATER HEATING TANKLESS WATER HEATER	HEER	14,087	15,844,542	24%	60%
WATER HEATING TANKLESS WATER HEATER	MFEER	65	62,418	0%	0%
WATER HEATING TANKLESS WATER HEATER	EENHP	5,418	5,711,293	9%	22%
APPLIANCE CLOTHES DRYER	HEER	12,066	289,950	21%	1%
APPLIANCE CLOTHES DRYER	MFEER	47	1,132	0%	0%
APPLIANCE CLOTHES DRYER	EENHP	70	1,665	0%	0%
HVAC CONTROLS SMART THERMOSTAT	HEER	4,723	448,878	8%	2%
HVAC CONTROLS SMART THERMOSTAT	MFEER	286	9,382	0%	0%
HVAC CONTROLS SMART THERMOSTAT	EENHP	2,744	37,281	5%	0%
HVAC DUCT SEALING	HEER	5,485	1,330,194	10%	5%
HVAC DUCT SEALING	MFEER	289	16,164	1%	0%
POOL HEATER	HEER	4,413	295,352	8%	1%
POOL HEATER	MFEER	4	9,413	0%	0%
HVAC FURNACE	HEER	227	67,268	0%	0%
HVAC FURNACE	EENHP	2,331	444,762	4%	2%
WATER HEATING STORAGE WATER HEATER	HEER	1,196	181,038	2%	1%
WATER HEATING STORAGE WATER HEATER	MFEER	10	27,599	0%	0%
FOOD SERVICE	HEER	839	19,646	1%	0%

Measure Group	Program	N	Exante Lifecycle Net Therms	% Records	% Savings
FOOD SERVICE	MFEER	2	49	0%	0%
WATER HEATING CONTROLS	MFEER	435	812,258	1%	3%
HVAC GAS FIREPLACE	HEER	168	32,942	0%	0%
WATER HEATING BOILER	HEER	20	145,728	0%	1%
WATER HEATING BOILER	MFEER	81	682,659	0%	3%
APPLIANCE CLOTHES WASHER	HEER	10	246	0%	0%
APPLIANCE CLOTHES WASHER	EENHP	60	1,584	0%	0%
WATER HEATING SHOWERHEAD	EENHP	3	148	0%	0%

For the HEER program, we looked at the total ex ante first year gross savings for each measure group[25], and divided this by the total yearly usage for sites in 2021 to analyze savings over usage by measure group. As shown in Table 6-7, the savings over usage for the entire HEER program, based on ex ante savings, is 8%, with water heating being the biggest contributor to savings. The sites in this table represent the customers we were able to find in the billing data, which is 98% of HEER customers. Since we had difficulties in identifying occupants from MFEER and EENHP, we were only able to calculate usage for HEER sites.

[25] Note that we are using ex ante savings values and not ex post for consistency, as only the tankless water heater measure was evaluated for HEER and EENHP.

Table 6-7: P2021 SCG HEER Program Ex Ante Savings Over Usage

Measure Group	# Sites[26]	Ex Ante First Year Gross Savings	2021 Usage[27]	Savings Over Usage
APPLIANCE CLOTHES DRYER	12,047	40,217	5,713,695	1%
APPLIANCE CLOTHES WASHER	10	62	873	7%
FOOD SERVICE	838	2,013	293,538	1%
HVAC CONTROLS SMART THERMOSTAT	4,269	46,924	1,751,144	3%
HVAC DUCT SEALING	4,298	103,764	1,742,787	6%
HVAC FURNACE	218	5,606	112,289	5%
HVAC GAS FIREPLACE	166	2,369	78,205	3%
POOL HEATER	4,399	42,901	3,571,711	1%
WATER HEATING BOILER[28]	5	12,144	73,205	17%
WATER HEATING STORAGE WATER HEATER	1,191	27,339	462,030	6%
WATER HEATING TANKLESS WATER HEATER	13,893	1,315,152	7,287,256	18%
TOTAL	**37,750**	**1,598,492**	**19,574,295**	**8%**

We also analyzed the percentage of the Res EE population that installed more than one measure under the program. 30% of sites installed more than one measure. In particular, 80% of sites installing HVAC Controls Smart Thermostats, 63% of sites installing HVAC Duct Sealing, and 93% of sites installing an HVAC Furnace also installed another program measure, shown in Table 6-8.

[26] Because some sites installed multiple measures, the sum total sites across measure groups will not add up to total sites.

[27] Because some sites installed multiple measures, measure level usage will not add up to the total usage.

[28] These 5 boiler sites are multifamily, so multiple boilers are installed per meter. Therefore the savings over usage may be skewed.

Table 6-8: PY2021 SCG Res EE Multiple Measure Installs by Measure Group

Measure Group	Percent Sites Install More Than 1 Measure	# Sites[29]
APPLIANCE CLOTHES DRYER	5%	12,179
APPLIANCE CLOTHES WASHER	100%	70
FOOD SERVICE	10%	841
HVAC CONTROLS SMART THERMOSTAT	80%	7,742
HVAC DUCT SEALING	63%	5,272
HVAC FURNACE	93%	2,543
HVAC GAS FIREPLACE	8%	167
POOL HEATER	4%	4,415
WATER HEATING BOILER	21%	39
WATER HEATING CONTROLS	3%	301
WATER HEATING SHOWERHEAD	100%	3
WATER HEATING STORAGE WATER HEATER	4%	1,205
WATER HEATING TANKLESS WATER HEATER	18%	19,416
ALL	**30%**	**44,803**

When broken down by subprogram, we found that EENHP had the highest percentage of sites that installed more than one measure, which was 76%, shown in Table 6-11. All EENHP sites installed tankless water heaters, and 53% of sites also installed one or more measures, with HVAC furnaces or HVAC Controls Smart Thermostats being the most popular measures. MFEER had the second highest percentage of sites installing more than one measure, which was 45%, shown in Table 6-10. Popular measure groups installed in conjunction with other measures are HVAC Controls Smart Thermostats (78%) and HVAC Duct Sealing (77%). Lastly, 18% of HEER sites installed more than one measure, shown in Table 6-9, with HVAC Controls Smart Thermostats (68%) and HVAC Duct Sealing (62%) being popular measures.

[29] Summing the sites for each measure group does not equal the total sites in the program, since many sites installed more than 1 measure.

Table 6-9: PY2021 SCG HEER Subprogram Multiple Measure Installs by Measure Group

Measure Group	Percent Sites Install More Than 1 Measure	# Sites[30]
APPLIANCE CLOTHES DRYER	5%	12,063
APPLIANCE CLOTHES WASHER	100%	10
FOOD SERVICE	10%	839
HVAC CONTROLS SMART THERMOSTAT	68%	4,718
HVAC DUCT SEALING	62%	4,989
HVAC FURNACE	20%	218
HVAC GAS FIREPLACE	8%	167
POOL HEATER	4%	4411
WATER HEATING BOILER	20%	5
WATER HEATING STORAGE WATER HEATER	4%	11,96
WATER HEATING TANKLESS WATER HEATER	4%	13,947
ALL	**18%**	**38,615**

Table 6-10: PY2021 SCG MFEER Subprogram Multiple Measure Installs by Measure Group

Measure Group	Percent Sites Install More Than 1 Measure	# Sites[31]
APPLIANCE CLOTHES DRYER	4%	46
FOOD SERVICE	0%	2
HVAC CONTROLS SMART THERMOSTAT	78%	281
HVAC DUCT SEALING	77%	283
POOL HEATER	0%	4
WATER HEATING BOILER	21%	34
WATER HEATING CONTROLS	3%	301
WATER HEATING STORAGE WATER HEATER	22%	9
WATER HEATING TANKLESS WATER HEATER	6%	53
ALL	**45%**	**787**

[30] Summing the sites for each measure group does not equal the total sites in the program, since many sites installed more than 1 measure.

[31] Summing the sites for each measure group does not equal the total sites in the program, since many sites installed more than 1 measure.

Table 6-11: PY2021 SCG EENHP Subprogram Multiple Measure Installs by Measure Group

Measure Group	Percent Sites Install More Than 1 Measure	# Sites[32]
APPLIANCE CLOTHES DRYER	100%	70
APPLIANCE CLOTHES WASHER	100%	60
HVAC CONTROLS SMART THERMOSTAT	100%	2,743
HVAC FURNACE	100%	2,325
WATER HEATING SHOWERHEAD	100%	3
WATER HEATING TANKLESS WATER HEATER	53%	5,416
ALL	**76%**	**5,416**

6.4 FUEL-SUBSTITUTION ANALYSIS

We interviewed two different groups, including HEER tankless water heating customers, and EENHP builders, to gain more insights on fuel switching practices and heat pump water heaters (HPWHs). When interviewing HEER tankless water participants, we asked them a variety of questions on their awareness of heat pump water heaters, and if they would ever consider installing one. We found that out of 101 respondents, 79% replied that they were not familiar with heat pump water heaters. Of the 21% of customers that were familiar with heat pump water heaters, 52% (13 customers) of these customers replied that they did not consider installing heat pump water heaters. The 8 respondents who did consider installing a heat pump water heater ultimately decided against it for various reasons, such as higher purchase price (23%), structural limitations (23%), electrical panel upgrade costs (15%), and other factors. The other 13 customers who are familiar with the equipment did not consider installing a heat pump water heater due to higher costs to operate (29%), preference for gas instead of electricity (25%), and other factors. Of the 21% of participants that were aware of heat pump water heaters, 16 (76%) responded that it is very unlikely, 1 (5%) responded that it is somewhat unlikely, 3 (14%) responded that it would be a 50/50 chance, and 1 (5%) responded that it is somewhat likely that that they would have purchased the heat pump water heater if financing were available.

[32] Summing the sites for each measure group does not equal the total sites in the program, since many sites installed more than 1 measure.

We also asked the 80 customers who were unaware of heat pump water heaters the likelihood of purchasing an electric heat pump water heater if they were aware of the technology and it could be financed. Of those customers, 61% said it would be very unlikely or somewhat unlikely that they would install the equipment, 25% said there would be a 50/50 chance, and 14% said they would somewhat likely or very likely purchase a heat pump water heater with financing. Table 6-12 below summarizes these findings. Of the customers who responded that it is very unlikely they would install without financing, 3% (1 customer) responded that with financing they would be somewhat likely to install a HPWH. All customers who responded that they are somewhat unlikely to install a HPWH without financing, remain with their decision of being somewhat unlikely to install a HPWH with financing. Of the customers who responded that there would be a 50/50 chance of installing without financing, 15% (3 customers) respond that with financing they would be somewhat likely, and 5% (1 customer) responded that it would be very unlikely they would be installing a HPWH with financing. Of the customers who responded that they would be somewhat likely of installing a HPWH without financing, 25% (1 customer) respond that with financing they would be very likely to be installing a HPWH with financing, and 25% (1 customer) responded that with financing there would be a 50/50 chance of installing a HPWH with financing. Overall, offering financing would make 5/80 (6%) customers more likely to install HPWHs.

Table 6-12: PY2021 SCG HEER Participants Unaware of HPWHs Decision to Install with & without Financing

Response	# Cust. Likelihood of HPWH installation w/o financing	# Cust. Likelihood of HPWH installation w/ financing
Very unlikely	38	38
Somewhat unlikely	11	11
50/50 chance	20	17
Somewhat likely	4	6
Very likely	7	8
ALL	**80**	**80**

We also see in Table 6-13 below the percentage of HEER tankless water heater participants, who are unaware of heat pump water heaters, and their likelihood of installing a HPWH by tier. We see that 16%

of Tier 3 participants are very likely or somewhat likely to install a HPWH, and 60% very unlikely or somewhat unlikely to install a HPWH. Five percent of Tier 2 participants are very likely or somewhat likely to install a HPWH, and 65% very unlikely or somewhat unlikely to install a HPWH. With only 3 sample points from Tier 1, we see 33% of Tier 1 participants very likely or somewhat likely to install a HPWH, and 67% are very unlikely or somewhat unlikely to install a HPWH.

Table 6-13: PY2021 SCG HEER Participants Unaware of HPWHs Decision to Install without Financing by Tier

The costs of an electric heat pump water heater may be $500-$1,000 more than a tankless water heater, but can save you money long term by switching to electricity instead of gas. Furthermore, there are environmental benefits by using electricity instead of gas. Had you been aware of this technology, what is the likelihood that you would have purchased the electric heat pump water heater instead of the gas tankless water heater?			
Tier	**Response**	**n**	**% of Tier**
Tier 1	Very unlikely	2	67%
	Somewhat unlikely	0	0%
	50/50 chance	0	0%
	Somewhat likely	0	0%
	Very likely	1	33%
Tier 2	Very unlikely	12	60%
	Somewhat unlikely	1	5%
	50/50 chance	6	30%
	Somewhat likely	1	5%
	Very likely	0	0%
Tier 3	Very unlikely	24	42%
	Somewhat unlikely	10	18%
	50/50 chance	14	25%
	Somewhat likely	3	5%
	Very likely	6	11%
ALL		**80**	**NA**

We interviewed 14 builders from EENHP, and asked them questions about heat pump water heaters. We found that 71% (10 builders) of builders are familiar with heat pump water heaters, and of those builders,

only 10% (1 builder) considered installing a heat pump water heater. The builder who considered installing the HPWH gave reasons against installing the HPWH, like compliance with title 24, and that tankless water heaters utilize less space than HPWHs. This builder who considered installing the HPWH also said that factors that may lead them to purchase a HPWH would be compliance benefits, or cost benefits. When asking the 9 builders who are familiar with HPWHs but never considered installing HPWHs their reasons for not considering HPWHs, 38% said high purchase price, 25% said structural limitations, 19% said preference for gas instead of electricity, and 6% had other reasons for not implementing HPWHs. Ultimately, 93% (13 builders) of builders stated that it is very unlikely or somewhat unlikely that they would install a heat pump water heater in their new construction sites, while the other 7% (1 builder) said there would be a 50/50 chance.

6.5 PROGRAM COMPARISON

The Res EE program we are evaluating consists largely of tankless water heating savings, in addition to other gas measures. We investigated other programs that offered similar measures, and found only one, SCG's Residential Advanced Clean Energy Program, with measure similarities. The Res EE program is a prescriptive rebate program, with some direct install measures, whereas the Residential Advanced Clean Energy Program is direct install. Also, the Res EE program is an IOU Core program, while the Residential Advanced Clean Energy Program is a Third/Local Party program. The Res EE program first started in 2016, while the Residential Advanced Clean Energy Program first started in 2021. The Residential Advanced Clean Energy Program installs a handful of free measures like showerheads and aerators, along with a much smaller number of tankless water heaters and some other measures. While they both offer some similar measures, the program design (deemed/DI mix vs. DI) is different.

We found the Residential Advanced Clean Energy Program's total first year ex ante savings over the annual usage for 2021 to be 5%, compared to the 8% we found for Res EE's HEER program. Note that this analysis could only be done for single family claims, since it is easy to identify bills for those customers. We found that the median usage is comparable for both programs, where the Residential Advanced Clean Energy Program's median usage per customer is 372 therms annually, and the Res EE program's median usage per customer is 381 therms annually. The mean first year gross ex ante savings

per customer for the single family Residential Advanced Clean Energy Program is 24 therms, while the mean first year gross ex ante savings per customer for the single-family HEER program is 43 therms. The Res EE program has more participation and variation of measures with higher savings.

We also compared the percentage of each population that installed more than one measure. We found that 66% of the Residential Advanced Clean Energy Program installed more than one measure, while 30% of the Res EE customers installed more than one measure. The direct install delivery approach for the Residential Advanced Clean Energy Program allows for many free measures to be installed, contributing to more a higher depth of retrofit in terms of the number of measures per premise.

In addition, we compared the percentage of each population in DACs, and found that 34% of the Residential Advanced Clean Energy Program is in a DAC, while 19% of the Res EE program is in a DAC. Again, this difference is due to the program delivery, where direct install programs are able to target DACs more effectively.

We compared the TRC of both the Res EE and Residential Advanced Clean Energy Programs, and found the TRCs to be 0.56 and 1.47 respectively, for PY2021. Budgets for PY2021 of both the Res EE and Residential Advanced Clean Energy Programs are $26,004,453 and $ 3,526,676 respectively. The budget divided by ex ante lifecycle net savings for Res EE is $0.98/Therm, and for the Residential Advanced Clean Energy Program it is $1.43/Therm. So while the Residential Advanced Clean Energy Program is more cost effective from a TRC standpoint, the Res EE program is more effective in using its budget from a dollar per therm standpoint. This is a common finding when comparing prescriptive programs to direct install program. Because the direct install programs pay for 100% of the retrofit, they require higher program budgets to achieve similar savings to programs that pay incentives that are only a fraction of cost of the retrofit. However, because incentives are not considered a “cost” in the TRC cost-benefit ratio, direct install programs tend to have higher TRCs because they are often more successful in installing more than one measure since they pay 100% of the cost. This is exactly what we are seeing in this program comparison.

6.6 PARTICIPATION & SAVINGS TARGETS

We compared the participation and savings targets in the Res EE program implementation plan[33] to what was completed in PY2021. Table 6-14 lists the ex ante first year net savings targets and what was achieved for PY2021. All three subprograms exceeded their savings goals, and together the program more than doubled its savings goals.

Table 6-14: PY2021 SCG Res EE Savings Targets and Achieved Savings

Program	Net Savings Target	Achieved Ex Ante Net First Year Savings
HEER	717,746	1,625,565
MFEER	306,794	341,505
EENHP	210,111	520,328
ALL	**1,234,651**	**2,487,399**

For the HEER program, as shown in Table 6-15, the program far exceeded its targets for most of the measures in the implementation plan. In addition, new measures were offered in PY2021 that were not originally in the plan. The only measures that did not meet participation targets are insulation measures, furnaces, and smart thermostats, where other measures like clothes dryers, pool heaters, and water heaters, far exceeded the targets. We also see measures such as duct sealing, food service, and gas fireplaces that were popular measures in the program that were not originally in the implementation plan.

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Table 6-15: PY2021 SCG HEER Measure Targets and PY2021 Installs[3435]

Measure Group	Measure Name	Target	Actual
APPLIANCE CLOTHES WASHER	Clothes Washers	-	10
APPLIANCE CLOTHES DRYER	Energy Star Dryer	5,000	12,066
INSULATION	Attic Insulation >=R-38	3,500,000	-
INSULATION	Wall Blow-In R-0 to R-13 Insulation	1,500,000	-
WATER HEATING BOILER	CENTRAL SYSTEM GAS BOILER TIER I (>=84%TE)	-	14
WATER HEATING BOILER	CENTRAL SYSTEM TANKLESS WATER HEATER TIER II (>=90%TE)	-	6
HVAC DUCT SEALING	DUCT SEAL AND TEST, RESIDENTIAL, HIGH (40% TO 12%) SFM & MFM POST 2006	-	464
HVAC DUCT SEALING	DUCT SEAL AND TEST, RESIDENTIAL, HIGH (40% TO 12%) SFM & MFM PRE 2006	-	5,021
FOOD SERVICE	EFFICIENT RESIDENTIAL GAS OVEN	-	839
HVAC FURNACE	Gravity Wall Furnace 70% AFUE	10	-
HVAC FURNACE	Central Gas Furnace Tier 1 92% AFUE	200	5
HVAC FURNACE	Central Gas Furnace Tier 2 95% AFUE	750	125
HVAC FURNACE	Central Gas Furnace Tier 3 97% AFUE	-	97
HVAC GAS FIREPLACE	NATURAL GAS FIREPLACE INSERT - TIER 1 (NR) - (70-74.9 FE)	-	150
HVAC GAS FIREPLACE	NATURAL GAS FIREPLACE INSERT - TIER 2 (NR) - (75 FE OR GREATER)	-	18
POOL HEATER	Pool & Spa Heaters in Res Bldgs - 84% TE	500	4,399
POOL HEATER	Pool & Spa Heaters in Res Bldgs - 90% TE	10	14
HVAC CONTROLS SMART THERMOSTAT	SmartThermostat	5,000	4,723
WATER HEATING TANKLESS WATER HEATER	Tankless Water Heater Tier I (UEF=0.81-0.86)	100	804
WATER HEATING TANKLESS WATER HEATER	Tankless Water Heater Tier II (UEF>=0.87)	100	3,577
WATER HEATING TANKLESS WATER HEATER	SMALL TANKLESS WATER HEATER, TIER 3 (UEF>=0.95), MEDIUM DRAW	-	9,706
WATER HEATING STORAGE WATER HEATER	Natural Gas Storage Water Heater Tier II (UEF>= 0.64 medium draw)	50	765
WATER HEATING STORAGE WATER HEATER	Natural Gas Storage Water Heater Tier II (UEF>= 0.68 high draw)	50	431

The implementation plan has no mention of its measure targets for MFEER, however we saw in Table 6-14 that savings targets were achieved.

For EENHP, we list below in Table 6-16 and Table 6-17 the single and multifamily measure targets and PY2021 installs. Although the multifamily portion did not achieve its measure targets, the single family portion readily exceeded in its measure targets, with the exception of clothes washers, clothes dryers, and water heating showerheads.

Table 6-16: PY2021 SCG EENHP Single Family Measure Targets and PY2021 Installs[36]

Measure Group	Measure Name	Target	Actual
APPLIANCE CLOTHES WASHER	Clothes Washers	140	-
APPLIANCE CLOTHES DRYER	Energy Star Dryer	140	10
HVAC FURNACE	Central Gas Furnace Tier 1 92% AFUE	900	270
HVAC FURNACE	Central Gas Furnace Tier 2 95% AFUE	300	1,999
HVAC FURNACE	Central Gas Furnace Tier 3 97% AFUE	200	8
HVAC CONTROLS SMART THERMOSTAT	SmartThermostat	1,400	2,690
WATER HEATING TANKLESS WATER HEATER	Tankless Water Heater Tier I (UEF=0.81-0.86)	1,000	1,347
WATER HEATING TANKLESS WATER HEATER	Tankless Water Heater Tier II (UEF>=0.87)	400	3,833
WATER HEATING TANKLESS WATER HEATER	SMALL TANKLESS WATER HEATER, TIER 3 (UEF>=0.95), MEDIUM DRAW	-	82
WATER HEATING SHOWERHEAD	Thermostatic Valve - Shower	500	-
WATER HEATING SHOWERHEAD	Thermostatic Valve - Shower/Bath Combo	200	3

[36] Target and actual values are the number of units installed, with the exception of insulation, which is the square footage of insulation installed.

Table 6-17: PY2021 SCG EENHP Multifamily Measure Targets and PY2021 Installs[37]

Measure Group	Measure Name	Target	Actual
APPLIANCE CLOTHES WASHER	Clothes Washers	140	60
APPLIANCE CLOTHES DRYER	Energy Star Dryer	140	60
HVAC FURNACE	Gravity Wall Furnace 70% AFUE	500	-
HVAC FURNACE	Gravity Wall Furnace w/ Intermittent Pilot	400	-
HVAC FURNACE	Central Gas Furnace Tier 1 92% AFUE	1,000	-
HVAC FURNACE	Central Gas Furnace Tier 2 95% AFUE	300	54
HVAC FURNACE	Central Gas Furnace Tier 3 97% AFUE	300	-
HVAC CONTROLS SMART THERMOSTAT	SmartThermostat	2,500	54
WATER HEATING TANKLESS WATER HEATER	Tankless Water Heater Tier I (UEF=0.81-0.86)	40	96
WATER HEATING TANKLESS WATER HEATER	Tankless Water Heater Tier II (UEF>=0.87)	10	60
WATER HEATING TANKLESS WATER HEATER	SMALL TANKLESS WATER HEATER, TIER 3 (UEF>=0.95), MEDIUM DRAW	-	-
WATER HEATING SHOWERHEAD	Thermostatic Valve - Shower	500	-
WATER HEATING SHOWERHEAD	Thermostatic Valve - Shower/Bath Combo	200	-

6.7 TOTAL SYSTEM BENEFIT (TSB)

Total system benefit is the "sum of the benefit that a measure provides to the electric and natural gas systems".[38] TSB expresses, in dollars, the lifecycle energy, ancillary services, generation capacity,

[37] Target and actual values are the number of units installed, with the exception of insulation, which is the square footage of insulation installed.

[38] Decision Adopting Energy Efficiency Goals for 2022-2032 (2021) Decision (D.) 21-09-037.

transmission and distribution capacity, and GHG benefits of energy efficiency activities, on an annual basis.[39] We calculate TSB as follows, using ex ante lifecycle savings:

$$Total\ System\ Benefit^{40} = NTG\ Ratio\ (Sum\ of\ All\ Benefits - Sum\ of\ All\ Increased\ Supply\ Costs)$$

where

$$Sum\ of\ All\ Benefits = (ElecBen + GasBen + NumUnits * (NTGRkWh + MarketEffectsBenefits) * RefrigBens + NumUnits * (NTGRkWh + MarketEffectsBenefits) * GasInfraBens)$$

$$Sum\ of\ All\ Increased\ Supply\ Costs = (ElecSupplyCost + GasSupplyCost + NumUnits * (NTGRkWh + MarketEffectsCosts) * UnitRefrigCosts$$

Table 6-18 and Table 6-19 present the total system benefits by subprogram, and measure respectively.

Table 6-18: PY2021 SCG Total System Benefit by Subprogram

Subprogram	TSB Claimed ($)
HEER	13,530,067
MFEER	1,301,473
EENHP	4,752,810

[39] Assessment of Energy Efficiency Potential and Goals and Modification of Portfolio Approval and Oversight Process (2021) Decision (D.) 21-05-031, p. 9.

[40] FINAL TSB Tech Guidance 102521.pdf (energydataweb.com)

Table 6-19: PY2021 SCG Res EE Program Total System Benefit by Measure

Measure Group	TSB Claimed ($)
APPLIANCE CLOTHES DRYER	226,223
APPLIANCE CLOTHES WASHER	6,586
FOOD SERVICE	15,821
HVAC CONTROLS SMART THERMOSTAT	651,250
HVAC DUCT SEALING	1,004,645
HVAC FURNACE	545,278
HVAC GAS FIREPLACE	23,701
POOL HEATER	255,626
WATER HEATING BOILER	591,760
WATER HEATING CONTROLS	718,367
WATER HEATING SHOWERHEAD	123
WATER HEATING STORAGE WATER HEATER	171,437
WATER HEATING TANKLESS WATER HEATER	15,373,532

SECTION 7

EVALUATION RESULTS

This section of the report presents the gross and net realization rates for the PY2021 Residential Energy Efficiency Program report. We evaluated tankless water heaters, and did an ex ante review of other pertinent measures in the program. Evaluation updates are only applied for gross tankless water heater results. Table 7-1 presents the measures for PY2021 along with the measure types ultimately evaluated.

Table 7-1: PY2021 SCG Ex Post Update for Res EE Measures

Measure Group	Evaluation Update		
	HEER	EENHP	MFEER
APPLIANCE CLOTHES WASHER	Gross & Net Pass Through	Gross & Net Pass Through	
WATER HEATING BOILER	Gross & Net Pass Through		Gross & Net Pass Through
WATER HEATING STORAGE WATER HEATER	Gross & Net Pass Through		Gross & Net Pass Through
WATER HEATING CONTROLS			Gross & Net Pass Through
HVAC DUCT SEALING	Gross & Net Pass Through		Gross & Net Pass Through
FOOD SERVICE	Gross & Net Pass Through		Gross & Net Pass Through
APPLIANCE CLOTHES DRYER	Gross & Net Pass Through	Gross & Net Pass Through	Gross & Net Pass Through
HVAC FURNACE	Gross & Net Pass Through	Gross & Net Pass Through	
NON-RESOURCE	Gross & Net Pass Through		Gross & Net Pass Through
HVAC GAS FIREPLACE	Gross & Net Pass Through		
POOL HEATER	Gross & Net Pass Through		Gross & Net Pass Through
HVAC CONTROLS SMART THERMOSTAT	Gross & Net Pass Through	Gross & Net Pass Through	Gross & Net Pass Through

Measure Group	Evaluation Update		
	HEER	EENHP	MFEER
WATER HEATING TANKLESS WATER HEATER	Gross Only Evaluation, Net Pass Through	Gross Only Evaluation, Net Pass Through	Gross & Net Pass Through
WATER HEATING SHOWERHEAD		Gross & Net Pass Through	

7.1 GROSS FIRST YEAR REALIZATION RATES

The evaluation team estimated gross realization rates (GRR) by examining the ratio of the aggregate evaluated gross savings to the aggregated ex ante gross savings. The evaluation team utilized the following algorithm to develop GRRs:

$$Gross\_Realization\_Rate_m = \frac{\sum_{i,m=1}^{n} Gross\_Ex\_Post\_Impact_{i,m}}{\sum_{i,m=1}^{n} Gross\_Ex\_Ante\_Impact_{i,m}}$$

Where:

Gross_Ex_Post_Impact$_{i,m}$ = the gross ex post impact estimate for claim$_i$ of measure$_m$ in the population.

Gross_Ex_Ante_Impact$_{i,m}$ = the gross ex ante impact estimate claim$_i$ of measure$_m$ in the population.

Table 7-2 presents the population level first year gross therm realization rates by measure group and subprogram, along with the aggregate ex ante and ex post first year therm savings for SCG. Realization rates that are *italicized* signify the ex ante savings were passed through.

Table 7-2: PY2021 SCG First Year Gross Therm Realization Rates

Measure Group	Subprogram	First Year Gross Therm Savings		
		Ex Ante	Ex Post	GRR
APPLIANCE CLOTHES DRYER	HEER	*40,271*	*40,271*	*1.0*
	MFEER	*157*	*157*	*1.0*
	EENHP	*231*	*231*	*1.0*
APPLIANCE CLOTHES WASHER	HEER	*62*	*62*	*1.0*
	EENHP	*240*	*240*	*1.0*
FOOD SERVICE	HEER	*2,015*	*2,015*	*1.0*
	MFEER	*5*	*5*	*1.0*
HVAC CONTROLS SMART THERMOSTAT	HEER	*52,346*	*52,346*	*1.0*
	MFEER	*1,091*	*1,091*	*1.0*
	EENHP	*6,828*	*6,828*	*1.0*
HVAC DUCT SEALING	HEER	*119,908*	*119,908*	*1.0*
	MFEER	*1,180*	*1,180*	*1.0*
HVAC FURNACE	HEER	*5,606*	*5,606*	*1.0*
	EENHP	*37,063*	*37,063*	*1.0*
HVAC GAS FIREPLACE	HEER	*2,386*	*2,386*	*1.0*
POOL HEATER	MFEER	*3,138*	*3,138*	*1.0*
	HEER	*43,019*	*43,019*	*1.0*
WATER HEATING BOILER	MFEER	*56,888*	*56,888*	*1.0*
	HEER	*12,144*	*12,144*	*1.0*
WATER HEATING CONTROLS	MFEER	*270,753*	*270,753*	*1.0*
WATER HEATING SHOWERHEAD	EENHP	*25*	*25*	*1.0*
WATER HEATING STORAGE WATER HEATER	MFEER	*3,092*	*3,092*	*1.0*
	HEER	*27,430*	*27,430*	*1.0*
WATER HEATING TANKLESS WATER HEATER	HEER	1,320,378	1,317,607	1.00
	MFEER	*5,202*	*5,202*	*1.0*
	EENHP	475,941	490,462	1.03
TOTALS	HEER	1,625,565	**1,622,794**	**1.00**
	MFEER	*341,505*	*341,505*	*1.0*
	EENHP	520,328	**534,850**	**1.03**
	ALL	**2,487,399**	**2,499,149**	**1.00**

7.2 GROSS LIFECYCLE REALIZATION RATES

Table 7-3 presents the population level gross lifecycle therm realization rates by measure group and subprogram, along with the aggregate ex ante and ex post first year therm savings for SCG. Realization rates that are *italicized* signify the ex ante savings were passed through.

Table 7-3: PY2021 SCG Lifecycle Gross Therm Realization Rates

Measure Group	Subprogram	Lifecycle Gross Therm Savings		
		Ex Ante	Ex Post	GRR
APPLIANCE CLOTHES DRYER	HEER	*483,249*	*483,249*	*1.0*
	MFEER	*1,886*	*1,886*	*1.0*
	EENHP	*2,775*	*2,775*	*1.0*
APPLIANCE CLOTHES WASHER	HEER	*682*	*682*	*1.0*
	EENHP	*2,640*	*2,640*	*1.0*
FOOD SERVICE	HEER	*26,195*	*26,195*	*1.0*
	MFEER	*66*	*66*	*1.0*
HVAC CONTROLS SMART THERMOSTAT	HEER	*476,349*	*476,349*	*1.0*
	MFEER	*9,929*	*9,929*	*1.0*
	EENHP	*62,135*	*62,135*	*1.0*
HVAC DUCT SEALING	HEER	*1,949,184*	*1,949,184*	*1.0*
	MFEER	*20,940*	*20,940*	*1.0*
HVAC FURNACE	HEER	*112,113*	*112,113*	*1.0*
	EENHP	*741,270*	*741,270*	*1.0*
HVAC GAS FIREPLACE	HEER	*47,723*	*47,723*	*1.0*
POOL HEATER	MFEER	*15,689*	*15,689*	*1.0*
	HEER	*430,190*	*430,190*	*1.0*
WATER HEATING BOILER	MFEER	*1,137,764*	*1,137,764*	*1.0*
	HEER	*242,880*	*242,880*	*1.0*
WATER HEATING CONTROLS	MFEER	*1,353,764*	*1,353,764*	*1.0*
WATER HEATING SHOWERHEAD	EENHP	*246*	*246*	*1.0*
WATER HEATING STORAGE WATER HEATER	MFEER	*45,998*	*45,998*	*1.0*
	HEER	*301,730*	*301,730*	*1.0*
WATER HEATING TANKLESS WATER HEATER	HEER	26,407,570	26,352,141	1.00
	MFEER	*104,030*	104,030	1.0
	EENHP	9,518,822	9,809,247	1.03

Measure Group	Subprogram	Lifecycle Gross Therm Savings		
		Ex Ante	Ex Post	GRR
TOTALS	HEER	30,477,865	**30,422,436**	**1.00**
	MFEER	*2,690,066*	2,690,066	**1.0**
	EENHP	10,327,887	**10,618,312**	**1.03**
	ALL	**43,495,818**	**43,730,814**	**1.01**

7.3 NET FIRST YEAR REALIZATION RATES

The evaluation team estimated the net ex post impacts in a similar manner as the gross impacts, however, the NTG ratios were multiplied by the gross impacts. The resulting net realization rates (NRR) represent the ratio of aggregated evaluated net savings to the aggregated ex ante net savings. The evaluation team utilized the following formula to develop customer specific NRRs:

$$Net\_Realization\_Rate_m = \frac{\sum_{i,m=1}^{n} Net\_Ex\_Post\_Impact_{i,m}}{\sum_{i,m=1}^{n} Net\_Ex\_Ante\_Impact_{i,m}}$$

Where:

$Net\_Ex\_Post\_Impact_{i,m}$ = the net ex post impact estimate for $claim_i$ of $measure_m$ in the population

$Net\_Ex\_Ante\_Impact_{i,m}$ = the net ex ante impact estimate for $claim_i$ of $measure_m$ in the population

Table 7-4 presents the ex ante and ex post NTG ratios, plus the 0.05 market adder. Remember that we did not undertake a NTG study to understand program attribution for PY2021. As part of the Program Year (PY) 2019 Residential Impact Evaluation, a comprehensive Net-to-Gross (NTG) analysis was conducted on the tankless water heater measure, including over 700 participant interviews. The results of that analysis are currently being incorporated into the 2023 Database for Energy Efficient Resources (DEER). We italicized all ex post NTG values, indicating that they were passed through.

Table 7-4: PY2021 Ex Ante and Ex Post Net-to-Gross Ratios[41]

Measure Group	Subprogram	NTGR	
		Ex Ante	Ex Post
APPLIANCE CLOTHES DRYER	HEER	*0.60*	*0.60*
	MFEER	*0.60*	*0.60*
	EENHP	*0.60*	*0.60*
APPLIANCE CLOTHES WASHER	HEER	*0.36*	*0.36*
	EENHP	*0.60*	*0.60*
FOOD SERVICE	HEER	*0.75*	*0.75*
	MFEER	*0.75*	*0.75*
HVAC CONTROLS SMART THERMOSTAT	HEER	*0.94*	*0.94*
	MFEER	*0.94*	*0.94*
	EENHP	*0.60*	*0.60*
HVAC DUCT SEALING	HEER	*0.68*	*0.68*
	MFEER	*0.77*	*0.77*
HVAC FURNACE	HEER	*0.60*	*0.60*
	EENHP	*0.60*	*0.60*
HVAC GAS FIREPLACE	HEER	*0.69*	*0.69*
POOL HEATER	MFEER	*0.60*	*0.60*
	HEER	*0.69*	*0.69*
WATER HEATING BOILER	MFEER	*0.60*	*0.60*
	HEER	*0.60*	*0.60*
WATER HEATING CONTROLS	MFEER	*0.60*	*0.60*
WATER HEATING SHOWERHEAD	EENHP	*0.60*	*0.60*
WATER HEATING STORAGE WATER HEATER	MFEER	*0.60*	*0.60*
	HEER	*0.60*	*0.60*
WATER HEATING TANKLESS WATER HEATER	HEER	*0.60*	*0.60*
	MFEER	*0.60*	*0.60*
	EENHP	*0.60*	*0.60*

Table 7-5 below presents the population level first year therm net realization rates for along with the aggregate ex ante and ex post first year net therm savings. The net realization rate is impacted by the difference in ex ante and ex post gross savings since all NTGRs are passed through. Realization rates that are *italicized* signify the ex ante savings were passed through.

[41] Note that these NTGRs include the 0.05 market effects adder.

Table 7-5: PY2021 SCG First Year Net Therm Realization Rates

Measure Group	Subprogram	First Year Net Therm Savings		
		Ex Ante	Ex Post	NRR
APPLIANCE CLOTHES DRYER	HEER	*24,162*	*24,162*	*1.0*
	MFEER	*94*	*94*	*1.0*
	EENHP	*139*	*139*	*1.0*
APPLIANCE CLOTHES WASHER	HEER	*22*	*22*	*1.0*
	EENHP	*144*	*144*	*1.0*
FOOD SERVICE	HEER	*1,511*	*1,511*	*1.0*
	MFEER	*4*	*4*	*1.0*
HVAC CONTROLS SMART THERMOSTAT	HEER	*49,327*	*49,327*	*1.0*
	MFEER	*1,031*	*1,031*	*1.0*
	EENHP	*4,097*	*4,097*	*1.0*
HVAC DUCT SEALING	HEER	*81,419*	*81,419*	*1.0*
	MFEER	*910*	*910*	*1.0*
HVAC FURNACE	HEER	*3,363*	*3,363*	*1.0*
	EENHP	*22,238*	*22,238*	*1.0*
HVAC GAS FIREPLACE	HEER	*1,647*	*1,647*	*1.0*
POOL HEATER	MFEER	*1,883*	*1,883*	*1.0*
	HEER	*29,535*	*29,535*	*1.0*
WATER HEATING BOILER	MFEER	*34,133*	*34,133*	*1.0*
	HEER	*7,286*	*7,286*	*1.0*
WATER HEATING CONTROLS	MFEER	*162,452*	*162,452*	*1.0*
WATER HEATING SHOWERHEAD	EENHP	*15*	*15*	*1.0*
WATER HEATING STORAGE WATER HEATER	MFEER	*1,855*	*1,855*	*1.0*
	HEER	*16,458*	*16,458*	*1.0*
WATER HEATING TANKLESS WATER HEATER	HEER	792,227	790,564	1.00
	MFEER	*3,121*	*3,121*	*1.0*
	EENHP	285,565	294,277	1.03
TOTALS	HEER	1,006,959	**1,005,296**	**1.00**
	MFEER	*205,482*	*205,482*	*1.0*
	EENHP	312,197	**320,910**	**1.03**
	ALL	**1,524,639**	**1,531,689**	**1.00**

7.4 NET LIFECYCLE REALIZATION RATES

Table 7-6 present the population lifecycle therm net realization rates along with the aggregate ex ante and ex post lifecycle net therm savings. Rows that are *italicized* signify the ex ante savings were passed through.

Table 7-6: PY2021 SCG Lifecycle Net Therm Realization Rates for Evaluated Measures

Measure Group	Subprogram	Lifecycle Net Therm Savings		
		Ex Ante	Ex Post	NRR
APPLIANCE CLOTHES DRYER	HEER	*289,950*	*289,950*	*1.0*
	MFEER	*1,132*	*1,132*	*1.0*
	EENHP	*1,665*	*1,665*	*1.0*
APPLIANCE CLOTHES WASHER	HEER	*246*	*246*	*1.0*
	EENHP	*1,584*	*1,584*	*1.0*
FOOD SERVICE	HEER	*19,646*	*19,646*	*1.0*
	MFEER	*49*	*49*	*1.0*
HVAC CONTROLS SMART THERMOSTAT	HEER	*448,878*	*448,878*	*1.0*
	MFEER	*9,382*	*9,382*	*1.0*
	EENHP	*37,281*	*37,281*	*1.0*
HVAC DUCT SEALING	HEER	*1,330,194*	*1,330,194*	*1.0*
	MFEER	*16,164*	*16,164*	*1.0*
HVAC FURNACE	HEER	*67,268*	*67,268*	*1.0*
	EENHP	*444,762*	*444,762*	*1.0*
HVAC GAS FIREPLACE	HEER	*32,942*	*32,942*	*1.0*
POOL HEATER	MFEER	*9,413*	*9,413*	*1.0*
	HEER	*295,352*	*295,352*	*1.0*
WATER HEATING BOILER	MFEER	*682,659*	*682,659*	*1.0*
	HEER	*145,728*	*145,728*	*1.0*
WATER HEATING CONTROLS	MFEER	*812,258*	*812,258*	*1.0*
WATER HEATING SHOWERHEAD	EENHP	*148*	*148*	*1.0*
WATER HEATING STORAGE WATER HEATER	MFEER	*27,599*	*27,599*	*1.0*
	HEER	*181,038*	*181,038*	*1.0*
WATER HEATING TANKLESS WATER HEATER	HEER	15,844,542	15,811,285	1.00
	MFEER	*62,418*	*62,418*	*1.0*
	EENHP	5,711,293	5,885,548	1.03
TOTALS	HEER	18,655,783	**18,622,526**	**1.00**
	MFEER	*1,621,074*	*1,621,074*	*1.0*
	EENHP	6,196,732	**6,370,987**	**1.03**
	ALL	**26,473,589**	**26,614,587**	**1.01**

SECTION 8
CONCLUSIONS AND RECOMMENDATIONS

This section of the report highlights conclusions and recommendations related to the findings that we developed based on this evaluation. We tie each conclusion to the relevant section of the report.

Conclusions and recommendations are numbered below. Appendix AC summarizes these corresponding conclusions and provides the numbering scheme for easy reference.

Participant Characterization:

- **Conclusion 1 [Section 6]: Overall, the Res EE program had limited reach serving hard-to-reach customers, and more success with disadvantaged communities.** 10% of SCG's Res EE program are HTR, and 19% are DAC. Because the HEER and EENHP programs are focused on single family residences, it is more challenging to meet the HTR criteria for these subprograms. However, the MFEER program, which serves multifamily residences, was 41% HTR.
  - **Recommendation 1: SCG should continue to promote multifamily participation in MFEER and EENHP.** MFEER is 41% HTR which has a positive effect to the overall percentage of HTR customers in the program.
- **Conclusion 2 [Section 6]: For the Res EE Program overall, 30% of sites installed more than one measure. EENHP has the largest percentage of sites installing multiple measures, at 76%, followed by MFEER at 45%, and HEER at 18%.** Over two-thirds of the HEER participants installed tankless water heaters, storage water heaters or clothes dryers; and only 4-5% of these participants installed more than one measure. Because of the prescriptive nature of the HEER program, it can be challenging to encourage multi-measure participation, whereas MFEER and EENHP are designed to achieve better depth of retrofit metrics.

HVAC Controls Smart Thermostats (HEER, MFEER, EENHP), Duct Sealing (HEER, MFEER), and HVAC Furnaces (EENHP) are popular measure groups installed in conjunction with other measures.

- **Recommendation 2: SCG should continue to offer a varietal measure mix per subprogram, as we see this encourages participation in more than a single measure, and thereby increasing the program's depth of retrofit.**

Tracking Data

- **Conclusion 3 [Section 5]: The evaluation team found multifamily projects claimed as single family.** When interviewing HEER single family participants, we found that 92% of respondents live in a single-family detached home, 5% are in a townhouse, duplex or row house, and 2% are in an apartment or condominium with 5 or more units, while the remaining 1% are in mobile homes or refused to respond.
  - **Recommendation 3: SCG should carefully review the claimed BldgType field, to ensure that it is correct for each subprogram.**
- **Conclusion 4 [Section 5 – HEER, EENHP]: We found that the reported tier for HEER and EENHP water heaters were incorrect for a large portion of claims.** For HEER, 7% of Tier 2 tankless water heaters were mislabeled in the tracking data, and verified to be Tier 3 tankless water heaters. This had a positive impact on calculated ex post savings for Tier 1 and Tier 2, but overall for all tiers had a slight negative impact. For EENHP, 64% of Tier 1 tankless water heaters were mislabeled in the tracking data and verified to be Tier 2 tankless water heaters. 17% of Tier 2 EENHP tankless water heaters were mislabeled in the tracking data, and verified to be Tier 3 tankless water heaters. This had a positive impact on calculated ex post savings. This has resulted in ex post measure case UEFs being higher than the ex ante measure case UEFs. We also found cases where the tracking tier matched the verified tier, but the UEF of the installed tankless water heater was higher than the claimed UEF. For those cases, we still saw a positive impact on calculated ex post savings.

Table 8-1: PY2021 SCG HEER & EENHP Tier Verification

Tier	# HEER Records Verified	% HEER Tracking Tier Match Verified Tier	HEER Ex Post Impact of Measure Case UEF	# EENHP Records Verified	% EENHP Tracking Tier Match Verified Tier	EENHP Ex Post Impact of Measure Case UEF
Tier 1	537	99.8%	Positive	192	36.5%	Positive
Tier 2	7,401	92.5%	Positive	456	82.5%	Positive
Tier 3	9,782	99.6%	Negative	17	100%	Positive

- Recommendation 4-1: We suggest that the application process requires tankless water heater nameplate information to be provided. In addition, the HEER/EENHP teams should check that the UEF provided in the application is appropriate for the make and model of the tankless water heater.
- Recommendation 4-2: SCG should also check that the claimed tier levels align with what is found in inspection data when available, otherwise, it should align with the make and model tier found in the application.

Savings & Measure Package Updates:

- **Conclusion 5 [Section 5 – HEER, EENHP]: Surveyed HEER participants and EENHP participating builders indicate a strong likelihood of installing tankless water heaters in the absence of the program.**

  Based on the survey responses with 100 HEER participants, 69% claim they would have installed a tankless water heater in the absence of the program, and only 17% responded that they would have installed a storage water heater without the program.

  For EENHP, we analyzed compliance runs for 103 EENHP homes, and found that 37/103 (36%) of homes would not have passed compliance if a minimally compliant tankless water heater was installed. Furthermore, among the 15 EENHP participating builders that were surveyed, 13 said they would have installed a tankless water heater in the absence of the program, and the other 2 were uncertain what they would have done.

- Recommendation 5a: A market study should be conducted to determine the share of tankless water heaters among recently installed water heaters for both the replacement and new construction market.
- Recommendation 5b: A net-to-gross study should be conducted for the new construction measure application type for tankless water heaters, based on the high incidence of builders stating they would have installed a tankless water heater in the absence of the program, and the fact that the revised net-to-gross ratio for tankless water heaters in the 2023 DEER is based on a study that only included natural replacements.

- **Conclusion 6 [Section 5 – HEER, EENHP]: While surveying HEER customers and EENHP builders about temperature setpoint, we learned that water heaters are set at 120/122 degrees F, instead of the assumed 135 degrees F.**
  - Recommendation 6: We recommend updating the measure package temperature setpoint parameter to 120 degrees.

- **Conclusion 7 [Section 5 – All Programs]: Measure packages do not align with what SCG is claiming for a handful of cases.**

  Measure Application Type (MAT): The measure package with Source Description "SWHC039-03" does not have any New Construction offerings in the eTRM—the eTRM only contains 'Normal Replacement' MATs for this measure. However, SCG frequently claims MAT = 'New Construction' for this measure package.

  Building Type: The measure package with Source Description "SWWH010-01" is a multifamily boiler measure in the eTRM. However, in the claim, SCG only claims single family and mobile home building types for this measure.
  - Recommendation 7: SCG should verify the measure application type and building type and choose a valid measure package accordingly.

Fuel-Substitution:

- **Conclusion 8 [Section 6 – HEER]: While surveying HEER tankless water heater customers, we found that 79% were unaware of heat pump water heaters. Of the 21% of participants that were**

aware of heat pump water heaters, 16 (76%) responded that it is very unlikely, 1 (5%) responded that it is somewhat unlikely, 3 (14%) responded that it would be a 50/50 chance, and 1 (5%) responded that it is somewhat likely that that they would have purchased the heat pump water heater if financing were available.

- Recommendation 8: If SCG or the CPUC is interested in increasing the market penetration of heat pump water heaters, they should consider a campaign to increase awareness of the technology given the low rate of awareness (21%) we experienced among our tankless water heater participant population.

APPENDIX AA:

STANDARDIZED REPORTING TABLES

Gross Lifecycle Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	-339	-339	1.00	1.2%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	-1,093	-1,093	1.00	0.1%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	-4	-4	1.00	100.0%	
ResEE_Evaluation	**SCG**	**Total**	**-1,436**	**-1,436**	**1.00**	**0.6%**	**1.00**
ResEE_Evaluation		***Statewide***	***-1,436***	***-1,436***	***1.00***	***0.6%***	***1.00***
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	-1	-1	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	-112	-112	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	44	44	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	5	5	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0	0			
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	1,608	1,608	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	375	375	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	3	3	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	74	74	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	3	3	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	1,415	1,415	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	222	222	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0	0			
ResEE_PassThrough	SCG	POOL HEATER-HEER	0	0			
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0	0			
ResEE_PassThrough	**SCG**	**Total**	**3,635**	**3,635**	**1.00**	**100.0%**	
ResEE_PassThrough		***Statewide***	***3,635***	***3,635***	***1.00***	***100.0%***	

Net Lifecycle Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	-203	-203	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	-656	-656	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	-2	-2	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	**SCG**	**Total**	**-861**	**-861**	**1.00**	**100.0%**	**0.60**	**0.60**		
ResEE_Evaluation		***Statewide***	***-861***	***-861***	***1.00***	***100.0%***	***0.60***	***0.60***		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	-67	-67	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	27	27	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	2	2	1.00	100.0%	0.36	0.36		
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0	0						
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	965	965	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	235	235	1.00	100.0%	0.63	0.63		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	2	2	1.00	100.0%	0.71	0.71		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	55	55	1.00	100.0%	0.75	0.75		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	2	2	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	849	849	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	133	133	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0	0						
ResEE_PassThrough	SCG	POOL HEATER-HEER	0	0						
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0	0						
ResEE_PassThrough	**SCG**	**Total**	**2,202**	**2,202**	**1.00**	**100.0%**	**0.61**	**0.61**		
ResEE_PassThrough		***Statewide***	***2,202***	***2,202***	***1.00***	***100.0%***	***0.61***	***0.61***		

Gross Lifecycle Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	0.0	0.0	1.00	1.2%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	-0.2	-0.2	1.00	0.1%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	0.0	0.0	1.00	100.0%	
ResEE_Evaluation	**SCG**	**Total**	**-0.2**	**-0.2**	**1.00**	**0.6%**	**1.00**
ResEE_Evaluation		***Statewide***	***-0.2***	***-0.2***	***1.00***	***0.6%***	***1.00***
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0.0	0.0			
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0.0	0.0			
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	0.0	0.0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	0.0	0.0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	0.1	0.1	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	1.6	1.6	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	0.2	0.2	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0.0	0.0			
ResEE_PassThrough	SCG	POOL HEATER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0.0	0.0			
ResEE_PassThrough	**SCG**	**Total**	**2.0**	**2.0**	**1.00**	**100.0%**	
ResEE_PassThrough		***Statewide***	***2.0***	***2.0***	***1.00***	***100.0%***	

Net Lifecycle Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	-0.1	-0.1	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	**SCG**	**Total**	**-0.1**	**-0.1**	**1.00**	**100.0%**	**0.60**	**0.60**		
ResEE_Evaluation		***Statewide***	***-0.1***	***-0.1***	***1.00***	***100.0%***	***0.60***	***0.60***		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0.0	0.0						
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0.0	0.0	1.00	100.0%	0.36	0.36		
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0.0	0.0						
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	0.0	0.0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	0.0	0.0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	0.1	0.1	1.00	100.0%	0.74	0.74		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	1.0	1.0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	0.1	0.1	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0.0	0.0						
ResEE_PassThrough	SCG	POOL HEATER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0.0	0.0						
ResEE_PassThrough	**SCG**	**Total**	**1.2**	**1.2**	**1.00**	**100.0%**	**0.61**	**0.61**		
ResEE_PassThrough		***Statewide***	***1.2***	***1.2***	***1.00***	***100.0%***	***0.61***	***0.61***		

Gross Lifecycle Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	9,519	9,809	1.03	2.4%	1.03
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	26,408	26,352	1.00	0.1%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	104	104	1.00	100.0%	
ResEE_Evaluation	**SCG**	**Total**	**36,030**	**36,265**	**1.01**	**1.0%**	**1.01**
ResEE_Evaluation		***Statewide***	***36,030***	***36,265***	***1.01***	***1.0%***	***1.01***
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	3	3	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	483	483	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	2	2	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	3	3	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	1	1	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	26	26	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	62	62	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	476	476	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	10	10	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	1,949	1,949	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	21	21	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	741	741	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	112	112	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	48	48	1.00	100.0%	
ResEE_PassThrough	SCG	POOL HEATER-HEER	430	430	1.00	100.0%	
ResEE_PassThrough	SCG	POOL HEATER-MFEER	16	16	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	243	243	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	1,138	1,138	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	1,354	1,354	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	302	302	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	46	46	1.00	100.0%	
ResEE_PassThrough	**SCG**	**Total**	**7,465**	**7,465**	**1.00**	**100.0%**	
ResEE_PassThrough		***Statewide***	***7,465***	***7,465***	***1.00***	***100.0%***	

Net Lifecycle Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	5,711	5,886	1.03	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	15,845	15,811	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	62	62	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	**SCG**	**Total**	**21,618**	**21,759**	**1.01**	**100.0%**	**0.60**	**0.60**		
ResEE_Evaluation		***Statewide***	***21,618***	***21,759***	***1.01***	***100.0%***	***0.60***	***0.60***		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	2	2	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	290	290	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	1	1	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	2	2	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0	0	1.00	100.0%	0.36	0.36		
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	20	20	1.00	100.0%	0.75	0.75		
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0	1.00	100.0%	0.75	0.75		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	37	37	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	449	449	1.00	100.0%	0.94	0.94		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	9	9	1.00	100.0%	0.94	0.94		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	1,330	1,330	1.00	100.0%	0.68	0.68		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	16	16	1.00	100.0%	0.77	0.77		
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	445	445	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	67	67	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	33	33	1.00	100.0%	0.69	0.69		
ResEE_PassThrough	SCG	POOL HEATER-HEER	295	295	1.00	100.0%	0.69	0.69		
ResEE_PassThrough	SCG	POOL HEATER-MFEER	9	9	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	146	146	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	683	683	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	812	812	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	181	181	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	28	28	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	**SCG**	**Total**	**4,855**	**4,855**	**1.00**	**100.0%**	**0.65**	**0.65**		
ResEE_PassThrough		***Statewide***	***4,855***	***4,855***	***1.00***	***100.0%***	***0.65***	***0.65***		

Gross First Year Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	-17	-17	1.00	1.2%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	-55	-55	1.00	0.1%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	0	0	1.00	100.0%	
ResEE_Evaluation	**SCG**	**Total**	**-72**	**-72**	**1.00**	**0.6%**	**1.00**
ResEE_Evaluation		***Statewide***	***-72***	***-72***	***1.00***	***0.6%***	***1.00***
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	-9	-9	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	4	4	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0	0			
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	177	177	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	41	41	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	4	4	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	71	71	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	11	11	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0	0			
ResEE_PassThrough	SCG	POOL HEATER-HEER	0	0			
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0	0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0	0			
ResEE_PassThrough	**SCG**	**Total**	**299**	**299**	**1.00**	**100.0%**	
ResEE_PassThrough		***Statewide***	***299***	***299***	***1.00***	***100.0%***	

Net First Year Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	-10	-10	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	-33	-33	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	0	0	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	**SCG**	**Total**	**-43**	**-43**	**1.00**	**100.0%**	**0.60**	**0.60**		
ResEE_Evaluation		***Statewide***	***-43***	***-43***	***1.00***	***100.0%***	***0.60***	***0.60***		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	-6	-6	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	2	2	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0	0	1.00	100.0%	0.36	0.36		
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0	0						
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	106	106	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	26	26	1.00	100.0%	0.63	0.63		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	0	0	1.00	100.0%	0.71	0.71		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	3	3	1.00	100.0%	0.75	0.75		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	42	42	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	7	7	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0	0						
ResEE_PassThrough	SCG	POOL HEATER-HEER	0	0						
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0	0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0	0						
ResEE_PassThrough	**SCG**	**Total**	**181**	**181**	**1.00**	**100.0%**	**0.61**	**0.61**		
ResEE_PassThrough		***Statewide***	***181***	***181***	***1.00***	***100.0%***	***0.61***	***0.61***		

Gross First Year Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	0.0	0.0	1.00	1.2%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	0.0	0.0	1.00	0.1%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	0.0	0.0	1.00	100.0%	
ResEE_Evaluation	**SCG**	**Total**	**0.0**	**0.0**	**1.00**	**0.6%**	**1.00**
ResEE_Evaluation		***Statewide***	***0.0***	***0.0***	***1.00***	***0.6%***	***1.00***
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0.0	0.0			
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0.0	0.0			
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	0.0	0.0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	0.0	0.0			
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	0.1	0.1	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	0.0	0.0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0.0	0.0			
ResEE_PassThrough	SCG	POOL HEATER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0.0	0.0			
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0.0	0.0			
ResEE_PassThrough	**SCG**	**Total**	**0.1**	**0.1**	**1.00**	**100.0%**	
ResEE_PassThrough		***Statewide***	***0.1***	***0.1***	***1.00***	***100.0%***	

Net First Year Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	**SCG**	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	**0.60**	**0.60**		
ResEE_Evaluation		***Statewide***	***0.0***	***0.0***	***1.00***	***100.0%***	***0.60***	***0.60***		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0.0	0.0						
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0.0	0.0	1.00	100.0%	0.36	0.36		
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	0.0	0.0						
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	0.0	0.0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	0.0	0.0						
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	0.0	0.0	1.00	100.0%	0.74	0.74		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	0.0	0.0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	0.0	0.0						
ResEE_PassThrough	SCG	POOL HEATER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	POOL HEATER-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	0.0	0.0						
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	0.0	0.0						
ResEE_PassThrough	**SCG**	**Total**	**0.1**	**0.1**	**1.00**	**100.0%**	**0.61**	**0.61**		
ResEE_PassThrough		***Statewide***	***0.1***	***0.1***	***1.00***	***100.0%***	***0.61***	***0.61***		

Gross First Year Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	476	490	1.03	2.4%	1.03
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	1,320	1,318	1.00	0.1%	1.00
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	5	5	1.00	100.0%	
ResEE_Evaluation	**SCG**	**Total**	**1,802**	**1,813**	**1.01**	**1.0%**	**1.01**
ResEE_Evaluation		***Statewide***	***1,802***	***1,813***	***1.01***	***1.0%***	***1.01***
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	40	40	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	2	2	1.00	100.0%	
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	7	7	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	52	52	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	1	1	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	120	120	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	1	1	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	37	37	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	6	6	1.00	100.0%	
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	2	2	1.00	100.0%	
ResEE_PassThrough	SCG	POOL HEATER-HEER	43	43	1.00	100.0%	
ResEE_PassThrough	SCG	POOL HEATER-MFEER	3	3	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	12	12	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	57	57	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	271	271	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	27	27	1.00	100.0%	
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	3	3	1.00	100.0%	
ResEE_PassThrough	**SCG**	**Total**	**686**	**686**	**1.00**	**100.0%**	
ResEE_PassThrough		***Statewide***	***686***	***686***	***1.00***	***100.0%***	

Net First Year Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	286	294	1.03	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	792	791	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	3	3	1.00	100.0%	0.60	0.60		
ResEE_Evaluation	**SCG**	**Total**	**1,081**	**1,088**	**1.01**	**100.0%**	**0.60**	**0.60**		
ResEE_Evaluation		***Statewide***	***1,081***	***1,088***	***1.01***	***100.0%***	***0.60***	***0.60***		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	24	24	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	0	0	1.00	100.0%	0.36	0.36		
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	2	2	1.00	100.0%	0.75	0.75		
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	0	0	1.00	100.0%	0.75	0.75		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	4	4	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	49	49	1.00	100.0%	0.94	0.94		
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	1	1	1.00	100.0%	0.94	0.94		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	81	81	1.00	100.0%	0.68	0.68		
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	1	1	1.00	100.0%	0.77	0.77		
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	22	22	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	3	3	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	2	2	1.00	100.0%	0.69	0.69		
ResEE_PassThrough	SCG	POOL HEATER-HEER	30	30	1.00	100.0%	0.69	0.69		
ResEE_PassThrough	SCG	POOL HEATER-MFEER	2	2	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	7	7	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	34	34	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	162	162	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	0	0	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	16	16	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	2	2	1.00	100.0%	0.60	0.60		
ResEE_PassThrough	**SCG**	**Total**	**444**	**444**	**1.00**	**100.0%**	**0.65**	**0.65**		
ResEE_PassThrough		***Statewide***	***444***	***444***	***1.00***	***100.0%***	***0.65***	***0.65***		

APPENDIX AB:

STANDARDIZED PER UNIT SAVINGS

Per Unit (Quantity) Gross Energy Savings (kWh)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	0	0.0%	0.0%	20.0	-63.0	-3.2	-3.2
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	0	0.0%	0.0%	20.0	-77.6	-3.9	-3.9
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	1	0.0%		20.0	-26.8	-1.3	-1.3
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	1	0.0%		20.0	-66.4	-3.3	-3.3
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	1	0.0%		20.0	-60.2	-3.0	-3.0
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	1	0.0%		12.0	-9.6	-0.8	-0.8
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	1	0.0%		12.0	-9.3	-0.8	-0.8
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	1	0.0%		12.0	-8.4	-0.7	-0.7
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	1	0.0%		11.0	740.3	67.3	67.3
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	1	0.0%		11.0	480.7	43.7	43.7
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	1	0.0%		13.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	1	0.0%		13.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	1	0.0%		9.1	573.9	63.1	63.1
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	1	0.0%		9.1	79.3	8.7	8.7
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	1	0.0%		9.1	11.8	1.3	1.3
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	1	0.0%		16.6	3.9	0.2	0.2
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	1	0.0%		17.7	3.0	0.2	0.2
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	1	0.0%		20.0	594.1	29.7	29.7
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	1	0.0%		20.0	965.5	48.3	48.3
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	1	0.0%		20.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	POOL HEATER-HEER	1	0.0%		10.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	POOL HEATER-MFEER	1	0.0%		5.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	1	0.0%		20.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	1	0.0%		20.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	1	0.0%		5.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	1	0.0%		10.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	1	0.0%		11.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	1	0.0%		15.0	0.0	0.0	0.0

Per Unit (Quantity) Gross Energy Savings (Therms)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	0	0.0%	0.0%	20.0	1,805.6	90.3	90.3
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	0	0.0%	0.0%	20.0	1,870.5	93.5	93.5
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	1	0.0%		20.0	1,477.7	73.9	73.9
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	1	0.0%		20.0	1,745.3	87.3	87.3
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	1	0.0%		20.0	1,600.5	80.0	80.0
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	1	0.0%		12.0	39.6	3.3	3.3
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	1	0.0%		12.0	40.1	3.3	3.3
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	1	0.0%		12.0	40.1	3.3	3.3
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	1	0.0%		11.0	44.0	4.0	4.0
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	1	0.0%		11.0	68.2	6.2	6.2
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	1	0.0%		13.0	31.2	2.4	2.4
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	1	0.0%		13.0	32.9	2.5	2.5
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	1	0.0%		9.1	22.2	2.4	2.4
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	1	0.0%		9.1	100.8	11.1	11.1
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	1	0.0%		9.1	34.7	3.8	3.8
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	1	0.0%		16.6	102.1	6.3	6.3
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	1	0.0%		17.7	25.1	1.4	1.4
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	1	0.0%		20.0	311.3	15.6	15.6
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	1	0.0%		20.0	487.4	24.4	24.4
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	1	0.0%		20.0	284.1	14.2	14.2
ResEE_PassThrough	SCG	POOL HEATER-HEER	1	0.0%		10.0	97.5	9.7	9.7
ResEE_PassThrough	SCG	POOL HEATER-MFEER	1	0.0%		5.0	10.8	2.2	2.2
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	1	0.0%		20.0	33.8	1.7	1.7
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	1	0.0%		20.0	45.3	2.3	2.3
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	1	0.0%		5.0	92.3	18.5	18.5
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	1	0.0%		10.0	82.1	8.2	8.2
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	1	0.0%		11.0	252.3	22.9	22.9
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	1	0.0%		15.0	30.6	2.1	2.1

Per Unit (Quantity) Net Energy Savings (kWh)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	1	0.0%		20.0	-37.2	-1.9	-1.9
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	1	0.0%		20.0	-46.5	-2.3	-2.3
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	1	0.0%		20.0	-36.1	-1.8	-1.8
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	1	0.0%		12.0	-5.8	-0.5	-0.5
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	1	0.0%		12.0	-5.6	-0.5	-0.5
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	1	0.0%		12.0	-5.0	-0.4	-0.4
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	1	0.0%		11.0	444.2	40.4	40.4
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	1	0.0%		11.0	173.1	15.7	15.7
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	1	0.0%		13.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	1	0.0%		13.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	1	0.0%		9.1	344.3	37.8	37.8
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	1	0.0%		9.1	49.8	5.5	5.5
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	1	0.0%		9.1	8.4	0.9	0.9
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	1	0.0%		16.6	2.9	0.2	0.2
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	1	0.0%		17.7	1.8	0.1	0.1
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	1	0.0%		20.0	356.5	17.8	17.8
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	1	0.0%		20.0	579.3	29.0	29.0
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	1	0.0%		20.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	POOL HEATER-HEER	1	0.0%		10.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	POOL HEATER-MFEER	1	0.0%		5.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	1	0.0%		20.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	1	0.0%		20.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	1	0.0%		5.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	1	0.0%		10.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	1	0.0%		11.0	0.0	0.0	0.0
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	1	0.0%		15.0	0.0	0.0	0.0

Per Unit (Quantity) Net Energy Savings (Therms)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-EENHP	1	0.0%		20.0	1,077.7	53.9	53.9
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-HEER	1	0.0%		20.0	1,122.2	56.1	56.1
ResEE_Evaluation	SCG	WATER HEATING TANKLESS WATER HEATER-MFEER	1	0.0%		20.0	960.3	48.0	48.0
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-EENHP	1	0.0%		12.0	23.8	2.0	2.0
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-HEER	1	0.0%		12.0	24.0	2.0	2.0
ResEE_PassThrough	SCG	APPLIANCE CLOTHES DRYER-MFEER	1	0.0%		12.0	24.1	2.0	2.0
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-EENHP	1	0.0%		11.0	26.4	2.4	2.4
ResEE_PassThrough	SCG	APPLIANCE CLOTHES WASHER-HEER	1	0.0%		11.0	24.6	2.2	2.2
ResEE_PassThrough	SCG	FOOD SERVICE-HEER	1	0.0%		13.0	23.4	1.8	1.8
ResEE_PassThrough	SCG	FOOD SERVICE-MFEER	1	0.0%		13.0	24.7	1.9	1.9
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-EENHP	1	0.0%		9.1	13.3	1.5	1.5
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-HEER	1	0.0%		9.1	95.0	10.4	10.4
ResEE_PassThrough	SCG	HVAC CONTROLS SMART THERMOSTAT-MFEER	1	0.0%		9.1	32.8	3.6	3.6
ResEE_PassThrough	SCG	HVAC DUCT SEALING-HEER	1	0.0%		16.6	69.7	4.3	4.3
ResEE_PassThrough	SCG	HVAC DUCT SEALING-MFEER	1	0.0%		17.7	19.3	1.1	1.1
ResEE_PassThrough	SCG	HVAC FURNACE-EENHP	1	0.0%		20.0	186.8	9.3	9.3
ResEE_PassThrough	SCG	HVAC FURNACE-HEER	1	0.0%		20.0	292.5	14.6	14.6
ResEE_PassThrough	SCG	HVAC GAS FIREPLACE-HEER	1	0.0%		20.0	196.1	9.8	9.8
ResEE_PassThrough	SCG	POOL HEATER-HEER	1	0.0%		10.0	66.9	6.7	6.7
ResEE_PassThrough	SCG	POOL HEATER-MFEER	1	0.0%		5.0	6.5	1.3	1.3
ResEE_PassThrough	SCG	WATER HEATING BOILER-HEER	1	0.0%		20.0	20.3	1.0	1.0
ResEE_PassThrough	SCG	WATER HEATING BOILER-MFEER	1	0.0%		20.0	27.2	1.4	1.4
ResEE_PassThrough	SCG	WATER HEATING CONTROLS-MFEER	1	0.0%		5.0	55.4	11.1	11.1
ResEE_PassThrough	SCG	WATER HEATING SHOWERHEAD-EENHP	1	0.0%		10.0	49.3	4.9	4.9
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-HEER	1	0.0%		11.0	151.4	13.8	13.8
ResEE_PassThrough	SCG	WATER HEATING STORAGE WATER HEATER-MFEER	1	0.0%		15.0	18.4	1.2	1.2

APPENDIX AC:

RESPONSE TO RECOMMENDATIONS

EM&V Impact Study Recommendations

Study Title: PY2021 RESIDENTIAL ENERGY EFFICIENCY IMPACT REPORT

Study Manager: CPUC

ID		Section	Conclusion	Recommendation	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of specific program change or Reason for rejection or Under further review)
1	SCG	6	Overall, the Res EE program had limited reach serving hard-to-reach customers, and more success with disadvantaged communities. 10% of SCG's Res EE program are HTR, and 19% are DAC. However, the MFEER program, which serves multifamily residences, was 41% HTR.	SCG should continue to promote multifamily participation in MFEER and EENHP. MFEER is 41% HTR which has a positive effect to the overall percentage of HTR customers in the program.		
2	SCG	6	For the Res EE Program overall, 30% of sites installed more than one measure. EENHP has the largest percentage of sites installing multiple measures, at 76%, followed by MFEER at 45%, and HEER at 18%. HVAC Controls Smart Thermostats, Duct Sealing, and HVAC Furnaces are popular measure groups installed in conjunction with other measures.	SCG should continue to offer a varietal measure mix per subprogram, as we see this encourages participation in more than a single measure, and thereby increasing the program's depth of retrofit.		

ID		Section	Conclusion	Recommendation	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of specific program change or Reason for rejection or Under further review)
3	SCG	5	The evaluation team found multifamily projects claimed as single family. When interviewing HEER single family participants, we found that 92% of respondents live in a single-family detached home, 5% are in a townhouse, duplex or row house, and 2% are in an apartment or condominium with 5 or more units, while the remaining 1% are in mobile homes or refused to respond.	SCG should carefully review the claimed BldgType field, to ensure that it is correct for each subprogram.		
4	SCG	5		We suggest that the application process requires tankless water heater nameplate information to be provided. In addition, the HEER/EENHP teams should check that the UEF provided in the application is appropriate for the make and model of the tankless water heater.		

ID		Section	Conclusion	Recommendation	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of specific program change or Reason for rejection or Under further review)
4	SCG	5	We found that the reported tier for HEER and EENHP water heaters were incorrect for a large portion of claims. For HEER, 55% of Tier 2 tankless water heaters were mislabeled in the tracking data and verified to be Tier 3. For EENHP, 64% of Tier 1 tankless water heaters were mislabeled in the tracking data and verified to be Tier 2. 17% of Tier 2 EENHP tankless water heaters were mislabeled in the tracking data and verified to be Tier 3. We also found cases where the tracking tier matched the verified tier, but the UEF of the installed tankless water heater was higher than the claimed UEF	SCG should also check that the claimed tier levels align with what is found in inspection data when available, otherwise, it should align with the make and model tier found in the application.		
5	SCG/ CPUC/ eTRM	5		A market study should be conducted to determine the share of tankless water heaters among recently installed water heaters for both the replacement and new construction market.		

ID		Section	Conclusion	Recommendation	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of specific program change or Reason for rejection or Under further review)
5	SCG/ CPUC/ eTRM	5	Surveyed HEER participants and EENHP participating builders indicate a strong likelihood of installing tankless water heaters in the absence of the program. Based on the survey responses with 100 HEER participants, 69% claim they would have installed a tankless water heater in the absence of the program, and only 17% responded that they would have installed a storage water heater. For EENHP, we analyzed compliance runs for 103 EENHP homes, and found that 37/103 (36%) of homes would not have passed compliance if a minimally compliant tankless water heater was installed. Furthermore, among the 15 EENHP participating builders that were surveyed, 13 said they would have installed a tankless water heater in the absence of the program, and the other 2 were uncertain what they would have done.	A net-to-gross study should be conducted for the new construction measure application type for tankless water heaters, based on the high incidence of builders stating they would have installed a tankless water heater in the absence of the program, and the fact that the revised net-to-gross ratio for tankless water heaters in the 2023 DEER is based on a study that only included natural replacements.		

ID		Section	Conclusion	Recommendation	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of specific program change or Reason for rejection or Under further review)
6	SCG/ CPUC/ eTRM	5	While surveying HEER customers and EENHP builders about temperature setpoint, we learned that water heaters are set at 120/122 degrees F, instead of the assumed 135 degrees F.	We recommend updating the measure package temperature setpoint parameter to 120 degrees.		
7	SCG	5	Measure packages do not align with what SCG is claiming for a handful of cases. Measure Application Type (MAT): The measure package with Source Description "SWHC039-03" does not have any New Construction offerings in the eTRM—the eTRM only contains 'Normal Replacement' MATs for this measure. However, SCG frequently claims MAT = 'New Construction' for this measure package. Building Type: The measure package with Source Description "SWWH010-01" is a multifamily boiler measure in the eTRM. However, in the claim, SCG only claims single family and mobile home building types for this measure.	SCG should verify the measure application type and building type and choose a valid measure package accordingly.		

ID		Section	Conclusion	Recommendation	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of specific program change or Reason for rejection or Under further review)
8	SCG/ CPUC	6	While surveying HEER tankless water heater customers, we found that 79% were unaware of heat pump water heaters. Of the 21% of participants that were aware of heat pump water heaters, 16 (76%) responded that it is very unlikely, 1 (5%) responded that it is somewhat unlikely, 3 (14%) responded that it would be a 50/50 chance, and 1 (5%) responded that it is somewhat likely that that they would have purchased the heat pump water heater if financing were available.	If SCG or the CPUC is interested in increasing the market penetration of heat pump water heaters, they should consider a campaign to increase awareness of the technology given the low rate of awareness (21%) we experienced among our tankless water heater participant population.		

APPENDIX A:

PROGRAM MANAGER INTERVIEW GUIDE

This appendix includes the program manager interview guides used for the following programs in this evaluation:

- HEER Program Manager Interview Guide
- EENHP Program Manager Interview Guide

A-1 HEER PROGRAM MANAGER INTERVIEW GUIDE

HEER PROGRAM MANAGER INTERVIEW GUIDE

1. Can you briefly describe the process for participation in the SoCalGas HEER Program? [what are the participation steps for the customer?

2. How do customers typically come to the SoCalGas HEER Program? Are they brought in via their equipment vendor, do they self-enroll, does the program implementer bring them in via audit or direct install processes, or is there some other variant?

3. Can you talk about other outreach strategies the program is offering, for example, training courses, case studies, marketing materials, demonstration facilities?

4. Please describe the outreach approach for customers. What about for trade allies?

5. Is there an outreach approach for hard-to-reach customers (HTR)? Any efforts being made to reach participating customers in disadvantaged communities (DACs)?

6. Please comment on the maturity stage of the Tankless Water Heating (TWH) measure tiers (high efficiency, higher and very high UEF ratings). Segments targeted (such as house type), etc. Are any of the measures still ramping up? Are any planned to be sunsetted?

7. What considerations are there among participants and vendors for heat pump water heaters (HPWHs) as an alternative to TWHs, and have HPWH had any influence on the program?

8. For each of the Tankless Water Heating measures, is there a target market you are trying to reach? Why do you say that?

9. We see that you more than exceeded your participation target goals for tankless water heaters, originally targeting 100 tier 1 and 100 tier 2 units, and achieving 14k participants. What is the reason for this?

10. What do you see as priorities across the SCG HEER Program that focus on this group of Tankless Water Heating measures? What do you see as the priorities within the SCG HEER Program serving the residential sector? (This will help inform the Program Assessment effort.)

11. Is your program tracking system collecting make/model, UEF and any other information on the installed Tankless Water Heating equipment offered under the HEER program? If so, would you be able to provide us with that database?

12. The program requires that the new Tankless Water Heating equipment replace an old storage water heater, is that correct? Are you doing anything to verify that the replaced equipment was a storage water heater?

13. The program classifying all of the installed equipment as natural replacement, as opposed to accelerated replacement. Why is that? Are a substantial number of installations actually accelerated replacements but simply not tracked that way? Are you are able to estimate the fraction of HEER participants for which the program has induced accelerate replacement of existing water heating equipment?

14. Outside of the program are you seeing that the market is moving towards the installation of new tankless water heaters, or are most residences installing storage water heaters?

15. The measure package information that documents the energy savings is claiming a baseline unit that is a storage water heater. Do you think this is appropriate and why?

16. One parameter used in the measure package savings estimate is the draw of the unit – assumed to be medium. Do you have any evidence supporting medium as the predominant draw rate for water heaters in use?

17. In the tracking data we see some unique customers that have installed more than one TWH. Do you know why that might be the case?

Changes over time

18. Can you describe the changes in the SCG HEER Program between calendar year 2021 and 2022?

19. Do you feel that tankless water heaters are a major contributor to savings, and do you foresee it to continue in future program years?

IOU concerns and insights

20. What do you think it's important for the impact evaluation to consider? Are there uncertain parameters you would like us to focus our data collection on?

21. This impact evaluation focuses on calculating gross savings, as well as looking at participant characterization and program performance. We will be looking at types of participants in the program, including HTR/DAC customers, and will be looking at different metrics like depth of retrofit. Are there any other metrics you would like us to gather? Is there anything else you would like to share that you think would be helpful for our research?

22. Are there specific questions that you would want to add to data collection or other areas of research (in the future if we can't add now)?

23. What research have you done recently (and what research are you planning to do in the next year) that addresses these Tankless Water Heating measures and/or the HEER program that offers these measures?

24. In your experience is the program a key mechanism for converting existing storage water heaters to tankless, or might this already be happening in considerable numbers in the marketplace without program intervention?

Closing

We'd also like to confirm that SCG is the current program implementer for the HEER program and that you are the correct person that we should contact if we have additional questions.

A-2 EENHP PROGRAM MANAGER INTERVIEW GUIDE

EENHP PROGRAM MANAGER INTERVIEW GUIDE

1. Can you briefly describe the process for participation in the SoCalGas EENHP Program? [what are the participation steps for the builder?

2. How do builders typically come to the SoCalGas EENHP Program? Are they recruited by SCG, do they self-enroll, does the program implementer bring them in via marketing, or is there some other variant?

3. Can you talk about other outreach strategies the program is offering, for example, training courses, case studies, marketing materials, demonstration facilities?

4. Please describe the outreach approach for builders. Is there a role for any other trade allies?

5. Is there an outreach approach for hard-to-reach customers (HTR)? Any efforts being made to reach participating customers in disadvantaged communities (DACs)?

6. Please comment on the maturity stage of the Tankless Water Heating (TWH) measure tiers (high efficiency, higher and very high UEF ratings). Segments targeted (such as house type), etc. Are any of the measures still ramping up? Are any planned to be sunsetted?

7. What considerations are there among builders and vendors for heat pump water heaters (HPWHs) as an alternative to TWHs, and have HPWH had any influence on the program?

8. For each of the Tankless Water Heating measures, is there a target market you are trying to reach? Why do you say that?

9. We see that you more than exceeded your participation target goals for tankless water heaters, originally targeting 1000 tier 1 and 400 tier 2 units, and achieving 5k participants. What is the reason for this?

10. What do you see as priorities across the SCG EENHP Program that focus on this group of Tankless Water Heating measures? What do you see as the priorities within the SCG EENHP Program serving the residential sector? (This will help inform the Program Assessment effort.)

11. Is your program tracking system collecting make/model, UEF and any other information on the installed Tankless Water Heating equipment offered under the EENHP program? If so, would you be able to provide us with that database? Would you be able to provide us with CF-1R and CF-6R Title 24 compliance forms?

12. Do CF-1R forms include only storage, or a mix of storage and tankless?

13. What fraction of projects were already tankless before the program? How often do builders plan on installing storage water heaters, and instead the program encourages tankless?

14. Outside of the program are you seeing that the market is moving towards the installation of new tankless water heaters, or are most residences installing storage water heaters?

15. The measure package information that documents the energy savings is claiming a baseline unit that is a storage water heater. Do you think this is appropriate and why?

16. One parameter used in the measure package savings estimate is the draw of the unit – assumed to be medium. Do you have any evidence supporting medium as the predominant draw rate for water heaters in use?

17. In the tracking data we see some unique customers that have installed more than one TWH. Do you know why that might be the case?

Changes over time

18. Can you describe the changes in the SCG EENHP Program between calendar year 2021 and 2022?

19. Do you feel that tankless water heaters are a major contributor to savings, and do you foresee it to continue in future program years?

IOU concerns and insights

20. What do you think it's important for the impact evaluation to consider? Are there uncertain parameters you would like us to focus our data collection on?

21. This impact evaluation focuses on calculating gross savings, as well as looking at participant characterization and program performance. We will be looking at types of participants in the program, including HTR/DAC customers, and will be looking at different metrics like depth of retrofit. Are there any other metrics you would like us to gather? Is there anything else you would like to share that you think would be helpful for our research?

22. Are there specific questions that you would want to add to data collection or other areas of research (in the future if we can't add now)?

23. What research have you done recently (and what research are you planning to do in the next year) that addresses these Tankless Water Heating measures and/or the EENHP program that offers these measures?

24. In your experience is the program a key mechanism for converting planned storage water heaters to tankless, or might tankless already be happening in considerable numbers in the marketplace without program intervention?

Effective dialogue between builders and evaluators

25. We will attempt to interview each builder in the program about one production home development project. During that dialogue we want to be able to ask a few questions that are specific to homes in that project, using an address to identify each of three homes; a sample of 3 homes per project. Will builders likely be able to translate from an address to a particular new home model and Title 24 compliance run? We will want to know what water heater type, make and model they would have installed absent the program, how many bedrooms are in each home and what the hot water temperature setting was at the time of project completion.

Data requests for SCG

26. For each of the three homes described above we will also want to obtain hot water heater type, make, model and efficiency (UEF), and the Title 24 CF-1R compliance form that represents each home (as well as CF-6R form if available). Based on a new home address will you be able to locate the appropriate CF-1R forms and organize them by address? If not, what are our options – obtain all CF-1R forms for each given development project?

Closing

We'd also like to confirm that SCG is the current program implementer for the EENHP program and that you are the correct person that we should contact if we have additional questions, correct?

APPENDIX B:

HEER CUSTOMER SURVEY INSTRUMENT

INTRODUCTION AND FINDING CORRECT RESPONDENT

OUTCOME1

This is %n calling on behalf of the CPUC, from Quantum Energy Analytics. THIS IS NOT A SALES CALL NOR A SERVICE CALL. May I please speak with ...<%CONTACT> ...<%OLDCONTACT> ..... the person at your residence that is most knowledgeable about your participation in SoCalGas's Home Energy Efficiency Rebate Program

[IF NEEDED]...This is a fact-finding survey only, authorized by the California Public Utilities Commission.

XX	BEGIN THE INTERVIEW	Continue
101	NO ANSWER	Record response and attempt again at a later time
102	BUSY	Record response and attempt again at a later time
103	DIRECTED TO A NEW CONTACT	Q1B
111	CHANGED NUMBER	Record new number and attempt again
107	ANSWERING MACHINE / VOICE MAIL	Record response and attempt again at a later time
104	CALLBACK-Specific	Record response and schedule time to callback
105	CALLBACK-General	Record response and get best time to callback

5	NON-WORKING NUMBER	Record response and resolve record
14	OTHER PHONE PROBLEM / FAX / MODEM	Record response and resolve record
12	REFUSAL	Record response and T&T
19	ASKED TO BE PLACED ON DNC LIST	Record response and T&T
15	LANGUAGE/HEARING PROBLEM	Record response and T&T
10	CLAIMS TO HAVE BEEN PREVIOUSLY INTERVIEWED	Record response and T&T
94	MAXIMUM CALL ATTEMPTS	Record response and resolve record
900	DUPLICATE PHONE NUMBER	DO NOT LOAD - RESOLVE RECORD
901	ON DNC LIST	DO NOT LOAD - RESOLVE RECORD
999	INVALID PHONE NUMBER	DO NOT LOAD - RESOLVE RECORD
Thank & Terminate PBLOCK NO_ONE	On behalf of the California Public Utilities Commission, thank you for your time and cooperation.	END

[IF YOU ARE TRANSFERRED TO ANOTHER PERSON OTHER THAN THE BEST CONTACT]

Q1B

Who would be the person at your residence who is most familiar about participation in SoCalGas's Home Energy Efficiency Rebate Program? [ENTER NEW CONTACT NAME AND MOVE ON]

[IF NEEDED] This is not a sales call.

[IF NEEDED] This is a fact-finding survey only, and responses will not be connected with you in any way. The California Public Utilities Commission wants to better understand how residents think about and manage their energy consumption.

77	There is no one here who can help you	T&T
02	CALL BACK TO REACH PR0PER PARTY	Record response and get best time to callback
1	Continue Q1B until you find appropriate contact person, record as &NEW CONTACT NAME	Intro3:s

[IF BEST CONTACT IS AVAILABLE]
Hello, my name is _____%n_____ and I am calling on behalf of the California Public Utilities Commission from Quantum Energy Analytics. THIS IS NOT A SALES CALL. We are interested in speaking with the person at your residence most knowledgeable about participation in ... SoCalGas's Home Energy Efficiency Rebate Program during 2021...I was told that would be you.

Intro3:S

...You participated in SoCalGas's Home Energy Efficiency Rebate Program by installing a tankless water heater in 2021.

Through this program, you installed....

<%UNITS_1> ... <%MEASURE_1> on <MEASURE_1_DATE>

Are you the best person to speak to about your participation in this program?

[If you need to provide validation for this survey, provide the following contact name and number: Peter Franzese, California Public Utilities Commission -- peter.franzese@cpuc.ca.gov]

1	Yes	DISPLAY
2	No, there is someone else	PBLOCK Hi
3	No and I don't know who to refer you to	Thank&Terminate
99	Don’t know/refused	Thank&Terminate

PBLOCK Hi Who would be the person at this residence who is most knowledgeable about the installation of a new tankless water heater? [Enter New Contact Name and move on.]

77	Record Name, as &CONTACT	May_I
88	Refused	Thank&Terminate
99	Don’t know	Thank&Terminate

May_I May I speak with him/her?

77	Yes	Intro3:s
88	No (not available right now@, set cb)	Get best time to callback

Before we start, I would like to inform you that for quality control purposes, this call may be monitored by my supervisor.

Today we’re conducting a very important study on the energy needs and perceptions of household residents. We are interested in how residents like yourself think about and manage their energy consumption.

DISPLAY Your input will allow the California Public Utilities Commission to build and maintain better energy savings programs for customers like you. And we would like to remind you, your responses will not be connected with you in any way..

For the sake of expediency, I will refer to SoCalGas’s Home Energy Efficiency Rebate Program as the PROGRAM.

SCREENER

Scrn_Addr First, I'd like to confirm your address. Our records show your address is located at %ADDRESS in %CITY. Is that correct?

[CONTINUE IF ADDRESS REPORTED BY RESPONDENT IS SIMILAR ENOUGH]

1	Yes	V1
2	No	CORRECT
88	Refused	COMMENT
99	Don't Know	COMMENT

COMMENT We were attempting to reach SoCalGas's customer at <%ADDRESS> and since you cannot confirm this address, those are all the questions that we have for you today, on behalf of the California Public Utilities Commission, thank you for your time.

CORRECT May I have your correct address?

%CORRECT	Corrected Address	COMPARE

COMPARE Are these addresses similar or totally different?
Computer Address - %ADDRESS
Corrected Address - &CORRECT

1	Similar	V1
2	Totally Different	COMMENT2

COMMENT 2	We were attempting to reach the SoCalGas customer at <%ADDRESS> in <%CITY> and since that does not match your address, then we must have mis-dialed the telephone number. Those are all the questions that we have for you today, on behalf of the California Public Utilities Commission. Thank you for your time and cooperation.	Thank and Terminate

ROLE OF CONTRACTORS

V1 Did you use a contractor/vendor to install your tankless water heater that was purchased through the program?

1	Yes	V2
2	No	AP9
88	Refused	AP9
99	Don't Know	AP9

If V1 = 1 then ask; else skip to AP9

V2 In relation to this water heater equipment installation, how did you come into contact with the contractor/vendor?

1	They contacted you	V2aa
2	You contacted them	V2aa
3	You had worked with them before	V2a
77	OTHER - Record	V2aa
88	Refused	V2aa
99	Don't Know	V2aa

Ask if V2 = 3; else skip to V2aa

V2a In relation to this project, did the vendor/contractor approach you about your energy efficient equipment retrofit/installation?

1	Yes	V2aa
2	No	V2aa
88	Refused	V2aa
99	Don't Know	V2aa

Ask ALL

V2aa Did the vendor recommend a tankless or storage water heater?

1	Tankless	V2ab
2	Storage	V2ab
3	Other - RECORD	V2ab
88	Refused	V2ab
99	Don't Know	V2ab

V2ab Did the VENDOR recommend purchasing high efficiency equipment instead of standard efficiency equipment?

1	Yes	V2ac
2	No	V2ac
88	Refused	V2ac
99	Don't Know	V2ac

V2ac Did the VENDOR recommend purchasing an electric water heater?

1	Yes	V2b
2	No	V2b
88	Refused	V2b
99	Don't Know	V2b

Ask if V2 = 1 or V2a = 1; else skip to V3

V2b On a scale of 0 - 10, with 0 being NOT AT ALL LIKELY and 10 is VERY LIKELY, how likely is it that you would have installed this new equipment had the contractor/vendor not contacted you?

1	0-10 response	V3
88	Refused	V3
99	Don't Know	V3

V3 Did the contractor/vendor tell you about or recommend the tankless water heater purchased through the program?

1	Yes	V3a
2	No	AP9
88	Refused	AP9
99	Don't Know	AP9

V3a Did you install what your VENDOR recommended?

1	Yes	V4
2	No	V4
88	Refused	V4
99	Don't Know	V4

Ask if V3 = 1; else skip to AP9

V4 Prior to coming into contact with the contractor/vendor, did you have plans to replace/install this equipment?

1	Yes	V4a
2	No	V4a
88	Refused	V4a
99	Don't Know	V4a

V4a What action would you have taken if the contractor/vendor did not recommend this tankless water heater you installed through the program?

1	Not replaced your water heater	V40
2	Installed a gas storage water heater	V40
3	Installed the same gas tankless water heater	V40
4	Installed a less efficient gas tankless water heater	V40
5	Installed an electric water heater	V4b
88	Refused	V40
99	Don't Know	V40

If V4a = 5 then ask, else skip:

V4b What type of electric water heater would you have installed?

1	Electric storage water heater	V40
2	Electric tankless water heater	V40
3	Electric heat pump water heater	V40
77	Other (please specify)	V4b
88	Refused	V40
99	Don't Know	V40

V40 On a scale of 0 - 10, with 0 being not at all important and 10 being very important, how important was the input from the contractor you worked with in deciding which specific equipment to install?

1	0-10 response	AP9
88	Refused	AP9
99	Don't Know	AP9

PROGRAM AWARENESS

Next, I'd like to ask you how you became aware of the Home Energy Efficiency Rebate Program.

How did you FIRST learn about SoCalGas's program? [DO NOT READ ANSWERS](SINGLE RESPONSE)

AP9		
1	Bill insert	AP9a
2	Program literature	AP9a
3	Program approved vendor	AP9a
4	Program representative	AP9a
5	Utility or program website	AP9a
6	Trade publication	AP9a
7	Conference	AP9a
8	Newspaper article	AP9a
9	Word of mouth	AP9a
10	Previous experience with it	AP9a
11	Contractor	AP9a
12	Result of an audit	AP9a
13	Part of a larger expansion or remodeling effort	AP9a
77	Other (RECORD VERBATIM)	AP9a
88	Refused	A3
99	Don’t know	A3

If AP9 in (1-77) then ask; else skip to [MEASURE]

AP9a How ELSE did you learn about SoCalGas's program? [DO NOT READ LIST, ACCEPT MULTIPLES]

1	Bill insert	A3
2	Program literature	A3
3	Program approved vendor	A3
4	Program representative	A3
5	Utility or program website	A3
6	Trade publication	A3
7	Conference	A3
8	Newspaper article	A3
9	Word of mouth	A3
10	Previous experience with it	A3
11	Contractor	A3
12	Result of an audit	A3
13	Part of a larger expansion or remodeling effort	A3
66	No other sources	A3
77	Other (RECORD VERBATIM)	A3
88	Refused	A3
99	Don't know	A3

PROGRAM TWH EQUIPMENT

Comment	We would like to ask you about the tankless water heater you installed under SoCalGas's program.	A3[A]

ASK IF TWH_QTY_x > 0; ELSE SKIP TO A3a[A-C]

A3[A-C] According to our records, you installed <%TWH_QTY_x> <%TWH_MEAS_x> through SoCalGas's program, is this correct?

1	Yes - Quantity is Correct	A4
2	Yes - Installed Different Quantity	A4
3	No, did not install	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY

ASK A3a[A-C] if TWH_QTY_x = 0

A3a[A-C] According to our records, you installed <%TWH_MEAS_x> through SoCalGas's program, is this correct?

1	Yes	A4
2	No, did not install	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY

DISPLAY **IF A3[A-C](3 - 99) OR A3a[A-C](2-99), READ: "We must conduct this study with someone that knows about the installation of this measure." and ABANDON USER. Else continue with A4.**

A4 Is the new water heater in place and operational at this home <address>?

1	Yes	A7
2	No	A5
88	Refused	A7
99	Don't know	A7

[Show if A4 = no] What did you do with the new water heater?

A5

1	Never installed	A6
2	Removed it	A6
3	Other	A7
88	Refused	A7
99	Don't know	A7

A6 [Show if never/removed] Why did you never install it/remove it?

1	Record	A7
88	Refused	A7
99	Don't know	A7

IF ^UNRECORDED(DEEM_INSTALL_DATEx)

A7 Our records indicate that you <installed> ...<%TWH_MEAS_x> on <%DEEM_INSTALL_DATEx>. _____Is this correct?

1	Yes	A9a
2	No	A8
88	Refused	A8
99	Don't know	A8

IF A7 in (2,88,99) | (UNRECORDED(DEEM_INSTALL_DATEx) & ^UNRECORDED(DEEM_PAID_DATEx))

A8 When did you install <%TWH_MEAS_x>? (PROBE FOR BEST GUESS)

1	RECORD:____	A9a
88	Refused	A9a
99	Don't know	A9a

A9a Our records show that you installed a gas tankless water heater and replaced a gas storage water heater. Is this correct?

1	Yes	A10
2	No	A9b
99	Don't know	A9b

A9b What type of water heater was removed and replaced when you installed the new tankless water heater through the program? [MULTIPLE RESPONSE]

1	Conventional storage tank fueled by gas	A10
2	Conventional storage tank fueled by electricity	A10
3	Tankless fueled by gas	A11
4	Heat pump (all electric)	A11
5	Solar water heater	A11
6	No previous water heater	A13
99	Don't know	A11
77	Other, please specify:	A11

A10 What size, in gallons, was the storage water heater?

1	Record Size in Gallons	A11
88	Refused	A11
99	Don't know	A11

A11 Approximately how old was the previous water heater that was removed and replaced? Would you say…

1	Less than 5 years old	A12
2	Between 5 and 10 years old	A12
3	Between 10 and 15 years old	A12
4	More than 15 years old	A12
88	Refused	A12
99	Don't know	A12

A12 How would you describe the removed equipment's condition? Would you say it was in…

1	Poor condition	A13
2	Fair condition	A13
3	Good condition	A13
88	Refused	A13
99	Don't know	A13

Heat pump water heaters or hybrid water heaters are an efficient way to heat water using electricity. Unlike a tankless water heater, they do require a storage tank and are not considered instantaneous. They are becoming more popular because of their environmental benefits, available rebates, lower operating costs, high efficiency, and decrease of gas usage.

A13 Are you familiar with electric heat pump water heaters?

1	Yes	A14
2	No	A18
88	Refused	A18
99	Don't know	A18

A14 Did you ever consider installing a heat pump water heater instead of the tankless water heater?

1	Yes	A15
2	No	A16
88	Refused	A16
99	Don't know	A16

A15 Why did you decide against it? (Accept Multiples)

1	Higher purchase price	A17
2	Higher cost to operate	A17
3	Structural limitations or installation space constraints	A17
4	Don’t plan on living in the home long enough to reap the benefits	A17
5	Cost to upgrade wiring, electrical panel, or plumbing	A17
6	I wouldn’t want to change water heater types	A17
7	Unfamiliar with the technology	A17
8	I prefer “tried and true” water heaters to newer water heater technologies	A17
9	Noisy	A17
10	Cools the room down	A17
11	Not good for large families	A17
12	Preference for gas vs electricity	A17
13	Downtime (absence of heat/hot water)	A17
77	Other (Please specify)	A17
88	Refused	A17
99	Don't know	A17

A16 Why was it not a consideration? (Accept Multiples)

1	Higher purchase price	A17
2	Higher cost to operate	A17
3	Structural limitations or installation space constraints	A17
4	Don’t plan on living in the home long enough to reap the benefits	A17
5	Cost to upgrade wiring, electrical panel, or plumbing	A17
6	I wouldn’t want to change water heater types	A17
7	Unfamiliar with the technology	A17
8	I prefer “tried and true” water heaters to newer water heater technologies	A17
9	Noisy	A17
10	Cools the room down	A17

11	Not good for large families	A17
12	Preference for gas vs electricity	A17
13	Downtime (absence of heat/hot water)	A17
77	Other (Please specify)	A17
88	Refused	A17
99	Don't know	A17

A17 What if the costs of the heat pump water heater were able to be financed? How likely would you have been to purchase the heat pump water heater instead of the tankless water heater you installed, if you could have financed the purchase of the heat pump?

1	Very likely	IWH0
2	Somewhat likely	IWH0
3	50/50 chance	IWH0
4	Somewhat unlikely	IWH0
5	Very unlikely	IWH0
88	Refused	IWH0
99	Don't Know	IWH0

Ask if A13 in (2, 88, 99):

A18 The costs of an electric heat pump water heater may be $500-$1,000 more than a tankless water heater, but can save you money long term by switching to electricity instead of gas. Furthermore, there are environmental benefits by using electricity instead of gas. Had you been aware of this technology, what is the likelihood that you would have purchased the electric heat pump water heater instead of the gas tankless water heater?

1	Very likely	IWH0
2	Somewhat likely	A19
3	50/50 chance	A19
4	Somewhat unlikely	A19
5	Very unlikely	A19
88	Refused	A19
99	Don't Know	A19

A19 What if the costs of the heat pump water heater could be financed, what is the likelihood that you would have purchased the electric heat pump water heater instead of the gas tankless water heater?

1	Very likely	IWH0
2	Somewhat likely	IWH0
3	50/50 chance	IWH0
4	Somewhat unlikely	IWH0
5	Very unlikely	IWH0
88	Refused	IWH0
99	Don’t Know	IWH0

INSTALLED TWHs

As part of our energy study, we are hoping to gather information about the installed 'tankless' water heaters.

IWH0 Would it be possible for you to help us with this task by verifying the make and model of your water heater along with a couple other pieces of important information. You can simply go over to your water heater and read this information off, or if its easier we can set up a video conference or you can text or email me photos of the information displayed on the water heater.

[If you choose to record the video conference; be sure to notify the contact and ask for their permission first. California is a two-party consent state for recording private or confidential conversations]

1	Yes	IWH1
2	No	NTG0
88	Refused	NTG0
99	Don't Know	NTG0

[Have the contact collect any necessary glasses and flashlight, go to the water heaters (recently installed in a new home; 2021) to visually inspect. Help them navigate to opening the panel on the front of the water heater, if needed.

A) Have them take photos of the water heater nameplate(s)

B) Have them get the hot water temperature (supply temperature) off the water heaters display (if it has one) or dial]

IWH1 What is the make and model of your water heater?

1	Make: _____	IWH2
2	Model: _____	IWH2
88	Refused	IWH2
99	Don't Know	IWH2

IWH2 What is the universal energy factor (UEF) or energy factor (EF)?

1	UEF: _____	IWH3
2	EF: _____	IWH3
88	Refused	IWH3
99	Don't Know	IWH3

IWH3 What is the hot water supply temp. setpoint (F)?

1	Water Supply Temp Setpoint: _____	NTG0
88	Refused	NTG0
99	Don't Know	NTG0

NET TO GROSS BATTERY

For the next set of questions, we would like to know about your decision to install the water heater and the role the utility program had (if any) on your decision.

There are usually a number of reasons why you would decide to participate in energy efficiency programs like this one. In your own words, can you tell me why you decided to participate in this program?

NTG0		
1	To replace old, outdated, or inoperable equipment	NTG1
2	As part of a home renovation	NTG1
3	To gain more control over how the equipment was used	NTG1
4	Maintenance downtime/associated expenses for old equipment were too high	NTG1
6	To improve equipment performance	NTG1
11	To get a rebate from the program	NTG1
12	To protect the environment	NTG1
13	To reduce energy costs	NTG1
14	To reduce energy use/power outages	NTG1
15	To update to the latest technology	NTG1
16	Comfort, health, or safety benefits	NTG1
77	RECORD VERBATIM	NTG1
88	Don't know	NTG1
99	Refused	NTG1

NTG1 What is the likelihood you would have purchased the same high efficiency water heater, if the rebate from SoCalGas had not been available?

1	Very likely	NTG2
2	Somewhat likely	NTG2
3	50/50 chance	NTG2
4	Somewhat unlikely	NTG2
5	Very unlikely	NTG2
88	Refused	NTG2
99	Don't Know	NTG2

NTG2 If SoCalGas hadn't offered a rebate program in 2021, when would you have purchased the water heater?

1	At the same time or sooner	NTG4
2	1 to 24 months later	NTG3
3	More than 24 months later	NTG4
4	Never	NTG4
88	Refused	NTG4
99	Don't Know	NTG4

NTG3 Please specify the number of months: [RECORD #]:

1	# Months: _____	NTG4
88	Refused	NTG4
99	Don't Know	NTG4

NTG4 Water heaters come in a variety or technologies and fuel types, such as traditional storage water heaters, heat pump water heaters, condensing water heaters and tankless water heaters; and can use either gas or electricity. You installed a tankless water heater through the program that uses gas. Without the rebate would you have purchased a gas tankless water heater, a unit that is a different technology or fuel type, or would not have purchased one at all?

1	Gas tankless water heater	NTG6
2	Different technology or different fuel type	NTG5
3	Would not have purchased a water heater	NTG7
88	Refused	NTG6
99	Don't Know	NTG6

NTG5 You said you would have purchased a different technology or fuel type, what type of water heater would you have purchased?

1	Conventional storage tank fueled by gas	NTG5aa
2	Conventional storage tank fueled by electricity	NTG5aa
3	Tankless fueled by electricity	NTG7
4	Heat pump (all-electric)	NTG7
5	Condensing water heater	NTG7
88	Refused	NTG7
99	Don't Know	NTG7

NTG5aa What size, in gallons, storage water heater would you have purchased?

1	Record Size in Gallons	NTG5a
88	Refused	NTG5a
99	Don't know	NTG5a

NTG5a What led you to switch to a tankless water heater?

1	Rebate	NTG7
2	Reduce energy use	NTG7
3	Reduce bill	NTG7
4	Interest in newer technologies	NTG7
5	Recommendation by contractor	NTG7
6	Recommendation by friends/family	NTG7
7	Other	NTG7
88	Refused	NTG7
99	Don't Know	NTG7

NTG6 If the SoCalGas program hadn't offered a rebate in 2021, would you have purchased the same higher efficiency tankless water heater at your own expense?

1	Would have purchased a minimum standard efficiency tankless water heater	NTG7
2	Would have purchased the same high efficiency tankless water heater	NTG7
3	Would NOT have purchased a tankless water heater at all	NTG7
88	Refused	NTG7
99	Don't Know	NTG7

NTG7 Did you make the decision to install the tankless water heater before, after, or at the same time as you became aware that the rebate was available through the program?

1	Before	NTG8
2	After	NTG8
3	Same time	NTG8
88	Refused	NTG8
99	Don't Know	NTG8

I'd like you to consider the importance of the program and all program related factors such as the program rebate; and the program information and recommendations you have received from your utility. We are interested in how these program related factors affected your decision about the tankless water heater you installed. That is, we are interested in what influenced you to choose the tankless water heater you did rather than a less efficient option.

NTG8 Using a scale of 0 to 10 where 0 means not at all important and 10 means extremely important, how would you rate the importance of these program related factors?

1	Record 0 to 10 score _____	NTG9
88	Refused	NTG9
99	Don't Know	NTG9

Now I'd like you to consider a number of factors I will call the "non-program factors". These include reasons unrelated to the program that may have influenced you to choose your tankless water heater rather than a less efficient option, such as …

[LIST ANYTHING THEY MENTIONED IN AA3, EXCEPT FOR REBATE, PLUS THESE:]

previous experience with similar equipment,

existing plans of installing the equipment regardless of the program,

or other reasons that were not related to the program

NTG9 Using the same scale of 0 to 10 where 0 means not at all important and 10 means extremely important, how would you rate the importance of these "non-program" factors?

1	Record 0 to 10 score _____	NTG10
88	Refused	NTG10
99	Don't Know	NTG10

Next, I would like you to compare the importance of the program related factors to the other Non-program factors that may have influenced your decision.

If you were given 10 points to award in total, how many points would you give to the importance of the program related factors such as the rebate, versus the other non-program factors in choosing the tankless water heater, rather than a less efficient option?

NTG10 Using the same scale of 0 to 10 where 0 means not at all important and 10 means extremely important, how would you rate the importance of these "program" factors?

1	Record 0 to 10 score _____	NTG11
88	Refused	NTG11
99	Don't Know	NTG11

NTG11 Using a likelihood scale from 0 to 10, where 0 is not at all likely and 10 is extremely likely, if THE PROGRAM had NOT BEEN AVAILABLE, what is the likelihood that you would have installed exactly the same program-qualifying tankless water heater that you did for this project, regardless of when you would have installed it?

1	Record 0 to 10 score _____	CC1a
88	Refused	CC1a
99	Don't Know	CC1a

CUSTOMER DEMOGRAPHICS

In order to ensure that energy efficiency programs serve all customer segments fairly, we would like to learn more about your dwelling and household demographics.

CC1a Which of the following dwelling types best describes your home at %ADDRESS? [READ RESPONSE CATEGORIES]

1	Single-family detached home (home not attached to another home)	CC2a
2	Townhouse, duplex, or row house (shares exterior walls with neighboring unit, but not roof or floor)	CC2a
3	Apartment or condominium (2–4 units)	CC2a
4	Apartment or condominium (5 or more units)	CC2a
5	Mobile home	CC2a
88	Refused	CC2a
99	Don't know	CC2a

CC2a Approximately how many square feet of living space is there in your home, including bathrooms, foyers and hallways? Exclude garages, basements or unheated porches.

1	Less than 250 SQFT	CC4
2	250–500	CC4
3	501–750	CC4
4	751–1,000	CC4
5	1,001 – 1,250	CC4
6	1,251 – 1,500	CC4
7	1,501 – 2,000	CC4
8	2,001 – 2,500	CC4
9	2,501 – 3,000	CC4
10	3,001 – 4,000	CC4
11	4,001 – 5,000	CC4
12	More than 5,000 SQFT	CC4

88	Refused	CC4
99	Don't know	CC4

CC4 Do your rent or own your home?

1	Own	C5
2	Rent	C5
3	Manage	C5
88	Refused	C5
99	Don't know	C5

C5 Approximately what year was this home built?

1	Before 1940	CC6
2	1940-1969	CC6
3	1970-1979	CC6
4	1980-1989	CC6
5	1990-1999	CC6
6	2000-2009	CC6
7	2010-2022	CC6
88	Refused	CC6
99	Don't know	CC6

CC6 In the year 2021, for each of the following age groups, how many people, including yourself, live in this home year-round? Please select one response for each age category.

1	5 and under #____	CC7
2	6-18 #____	CC7
3	19-64 #____	CC7
4	65 and over #____	CC7
88	Refused	CC7
99	Don't know	CC7

CC7 Has the number of occupants in your house increased, decreased or stayed the same since 2021?

1	Increased	CC11a
2	Decreased	CC11a
3	Stayed the same	CC11a
88	Prefer not to say	CC11a
99	Don't Know	CC11a

CC11a What is the highest degree or level of school you have completed? If you're currently enrolled in school, please indicate the highest degree you have received.

1	Less than a high school diploma	CC11b
2	High school degree or equivalent	CC11b
3	Vocational/trade school degree	CC11b
4	Bachelor's degree (e.g. BA, BS)	CC11b
5	Master's degree (e.g. MA, MS, MEd)	CC11b
6	Doctorate (e.g. PhD, MD, EdD)	CC11b
7	Other (please specify)	CC11b
88	Refused	CC11b
99	Don't know	CC11b

CC11b What is the primary household language?

1	English	CC12a
2	Spanish	CC12a
3	Chinese (including Mandarin and Cantonese)	CC12a
4	Tagalog	CC12a
5	Vietnamese	CC12a
6	Korean	CC12a
7	Other (please specify)	CC12a
99	Prefer not to say	CC12a

CC12a Are you of Hispanic, Latino, or Spanish origin? Please select all that apply.

1	No, not of Hispanic, Latino, or Spanish origin	CC12b
2	Yes, Mexican, Mexican American, Chicano	CC12b
3	Yes, Puerto Rican	CC12b
4	Yes, Cuban	CC12b
5	Yes, another Hispanic, Latino, or Spanish origin (please specify)	CC12b
99	Prefer not to say	CC12b

CC12b What is your race?

1	White	CC13
2	Black or African American	CC13
3	American Indian or Alaska Native	CC13
4	Chinese	CC13
5	Asian Indian	CC13
6	Japanese	CC13
7	Korean	CC13
8	Filipino	CC13
9	Vietnamese	CC13
10	Other Asian	CC13
11	Pacific Islander	CC13

12	Some Other Race (please describe)	CC13
99	Prefer not to say	CC13

CC13 This information is collected for internal purposes only and remains confidential. What range best describes your household's total 2021 annual income. [READ RESPONSE CATEGORIES]

1	Less than $10,000	Vendor_Name
2	$10,000 – $24,999	Vendor_Name
4	$25,000 – $49,999	Vendor_Name
5	$50,000 – $74,999	Vendor_Name
6	$75,000 – $99,999	Vendor_Name
7	$100,000 – $149,999	Vendor_Name
8	$150,000 – $199,999	Vendor_Name
10	$200,000 – $249,999	Vendor_Name
11	$250,000 or more	Vendor_Name
99	Prefer not to say	Vendor_Name

Vendor_Name

Ask if V1(1)

Earlier you stated that you had a vendor/contractor that helped you with the installation of the tankless water heater equipment that was installed through the program. Could you provide me with their name and phone number?

1	Cannot provide	**END**
77	Record Name, Phone Number, Email Address or any other information they can provide. More is better.	**END**
88	Refused	**END**
99	Don't know	**END**

END	Those are all the questions I have for you today. On behalf of the CPUC, I would like to thank you very much for your kind cooperation. Have a good day.

APPENDIX C:

EENHP BUILDER SURVEY INSTRUMENT

INTRODUCTION AND FINDING CORRECT RESPONDENT

OUTCOME1

This is %n calling on behalf of the CPUC, from Quantum Energy Analytics. THIS IS NOT A SALES CALL NOR A SERVICE CALL. May I please speak with ...<%CONTACT> ...<%OLDCONTACT> ..... the person with your company that is most knowledgeable about participating in SoCalGas's Energy Efficient Homes Program

[IF NEEDED]...This is a fact-finding survey only, authorized by the California Public Utilities Commission.

XX	BEGIN THE INTERVIEW	Continue
101	NO ANSWER	Record response and attempt again at a later time
102	BUSY	Record response and attempt again at a later time
103	DIRECTED TO A NEW CONTACT	Q1B
111	CHANGED NUMBER	Record new number and attempt again
107	ANSWERING MACHINE / VOICE MAIL	Record response and attempt again at a later time
104	CALLBACK-Specific	Record response and schedule time to callback
105	CALLBACK-General	Record response and

		get best time to callback
5	NON-WORKING NUMBER	Record response and resolve record
14	OTHER PHONE PROBLEM / FAX / MODEM	Record response and resolve record
12	REFUSAL	Record response and T&T
19	ASKED TO BE PLACED ON DNC LIST	Record response and T&T
15	LANGUAGE/HEARING PROBLEM	Record response and T&T
10	CLAIMS TO HAVE BEEN PREVIOUSLY INTERVIEWED	Record response and T&T
94	MAXIMUM CALL ATTEMPTS	Record response and resolve record
900	DUPLICATE PHONE NUMBER	DO NOT LOAD - RESOLVE RECORD
901	ON DNC LIST	DO NOT LOAD - RESOLVE RECORD
999	INVALID PHONE NUMBER	DO NOT LOAD - RESOLVE RECORD

[IF YOU ARE TRANSFERRED TO ANOTHER PERSON OTHER THAN THE BEST CONTACT]

Q1B Who would be the person at your company who is most familiar about participation in SoCalGas's Energy Efficient New Homes Program? [ENTER NEW CONTACT NAME AND MOVE ON]

[IF NEEDED] This is not a sales call.

[IF NEEDED] This is a fact-finding survey only, and responses will not be connected with you in any way. The California Public Utilities Commission wants to better understand how builders think about improvements to the energy efficiency of the new homes they build.

77	There is no one here who can help you	T&T
02	CALL BACK TO REACH PR0PER PARTY	Record response and get best time to callback
1	Continue Q1B until you find appropriate contact person, record as &NEW CONTACT NAME	Intro3:s

[IF BEST CONTACT IS AVAILABLE]

Intro3:S Hello, my name is _____%n_____ and I am calling on behalf of the California Public Utilities Commission from Quantum Energy Analytics. THIS IS NOT A SALES CALL. We are interested in speaking with the person at your company most knowledgeable about participation in ... SoCalGas's Energy Efficient New Homes Program during 2021...I was told that would be you.
...You participated in SoCalGas's Energy Efficient New Homes Program by installing a tankless water heater and other measures in 2021.

Through this program, you installed a number of tankless water heaters. Among these, you installed....

<%UNITS_1> ... <%MEASURE_1> on <MEASURE_1_DATE> at <%ADDRESS> under project <%PROJECT_NAME>

Are you the best person to speak to about your business' participation in this program?

[If you need to provide validation for this survey, provide the following contact name and number: Peter Franzese, California Public Utilities Commission -- peter.franzese@cpuc.ca.gov]

1	Yes	DISPLAY
2	No, there is someone else	PBLOCK Hi
3	No and I don't know who to refer you to	Thank&Terminate
99	Don't know/refused	Thank&Terminate

PBLOCK Hi Who would be the person at your company who is most knowledgeable about these tankless water heater installations through the Energy Efficient New Homes Program? [Enter New Contact Name and move on.]

77	Record Name, as &CONTACT	May_I
88	Refused	Thank&Terminate
99	Don't know	Thank&Terminate

May_I May I speak with him/her?

77	Yes	Intro3:s
88	No (not available right now@, set cb)	Get best time to callback

Before we start, I would like to inform you that for quality control purposes, this call may be monitored by my supervisor.

Today we're conducting a very important study on the energy needs and perceptions of builders. We are interested in how builders like yourself think about and manage energy consumption in the new homes they build.

DISPLAY

Your input will allow the California Public Utilities Commission to build and maintain better energy savings programs for customers like you. And we would like to remind you, your responses will not be connected with you in any way.

SCREENER

VERIFY For verification purposes only, may I please have your name?

77	Get name	Scrn_Addr
88	Refused	Scrn_Addr
99	Don't know	Scrn_Addr

DISPLAY For the sake of expediency, I will refer to SoCalGas's Energy Efficient New Homes Program as the PROGRAM.

Scrn_Addr First, I'd like to confirm the installation of one of the water heaters from our records. Our records show that you installed a water heater for project <%PROJECT_NAME> at %ADDRESS in %CITY. Is that correct?

[CONTINUE IF ADDRESS REPORTED BY RESPONDENT IS SIMILAR ENOUGH]

1	Yes	AP9
2	No	CORRECT
88	Refused	COMMENT
99	Don't Know	COMMENT

COMMENT We were attempting to reach the builder who participated in the program and project we described and since you cannot confirm the project, those are all the questions that we have for you today, on behalf of the California Public Utilities Commission, thank you for your time.

CORRECT May I have the corrected address for this project?

%CORRECT	Corrected Address	COMPARE

COMPARE

Are these addresses similar or totally different?
Computer Address - %ADDRESS
Corrected Address - &CORRECT

1	Similar	AP9
2	Totally Different	COMMENT2

COMMENT2

We were attempting to reach the builder who participated in the program for <%PROJECT_NAME> at <%ADDRESS> in <%CITY> and since that does not match your address, then we must have mis-dialed the telephone number. Those are all the questions that we have for you today, on behalf of the California Public Utilities Commission. Thank you for your time and cooperation.

Thank and Terminate

PROGRAM AWARENESS

Next, I'd like to ask you how you became aware of the Energy Efficient New Homes Program.

AP9 How did you FIRST learn about SoCalGas's program? [DO NOT READ ANSWERS](SINGLE RESPONSE)

1	Bill insert	AP9a
2	Program literature	AP9a
3	Program approved vendor	AP9a
4	Program representative	AP9a
5	Utility or program website	AP9a
6	Trade publication	AP9a
7	Conference	AP9a
8	Newspaper article	AP9a
9	Word of mouth	AP9a
10	Previous experience with it	AP9a
11	Contractor	AP9a
12	Result of an audit	AP9a
13	Part of a larger expansion or remodeling effort	AP9a
77	Other (RECORD VERBATIM)	AP9a
88	Refused	A13
99	Don’t know	A13

If AP9 in (1-77) then ask; else skip to [MEASURE]

AP9a How ELSE did you learn about SoCalGas's program? [DO NOT READ LIST, ACCEPT MULTIPLES]

1	Bill insert	A13
2	Program literature	A13
3	Program approved vendor	A13
4	Program representative	A13
5	Utility or program website	A13
6	Trade publication	A13
7	Conference	A13
8	Newspaper article	A13
9	Word of mouth	A13
10	Previous experience with it	A13
11	Contractor	A13
12	Result of an audit	A13
13	Part of a larger expansion or remodeling effort	A13
66	No other sources	A13
77	Other (RECORD VERBATIM)	A13
88	Refused	A13
99	Don't know	A13

PROGRAM TWH EQUIPMENT

Next we are going to ask you some questions about your familiarity with alternative water heating equipment.

A13 Are you familiar with electric heat pump water heaters?

1	Yes	A14
2	No	HPWH_Intro
88	Refused	HPWH_Intro
99	Don't know	HPWH_Intro

A14 Did your company ever consider installing a heat pump water heater instead of a tankless water heater?

1	Yes	A15
2	No	A16
88	Refused	A16
99	Don't know	A16

A15 For the project we are discussing today, why did you decide against it? (Accept Multiples)

1	Higher purchase price	A15a
2	Higher cost to operate	A15a
3	Structural limitations or installation space constraints	A15a
5	Cost to upgrade wiring, electrical panel, or plumbing	A15a
6	I wouldn’t want to change water heater types	A15a
7	Unfamiliar with the technology	A15a
8	I prefer “tried and true” water heaters to newer water heater technologies	A15a
9	Noisy	A15a
10	Cools the room down	A15a
11	Not good for large families	A15a
12	Preference for gas vs electricity	A15a

A15 For the project we are discussing today, why did you decide against it? (Accept Multiples)

13	Downtime (absence of heat/hot water)	A15a
77	Other (Please specify)	A15a
88	Refused	A15a
99	Don't know	A15a

A15a For the project we are discussing today, what factors might lead you to purchase a heat pump water heater? (Accept Multiples)

1	Cost benefits	A18
2	Lower gas usage	A18
3	Interest in latest technologies	A18
4	Environmental benefits	A18
5	Preference of electricity vs gas	A18
77	Other (Please specify)	A18
88	Refused	A18
99	Don't know	A18

A16 For the project we are discussing today, what factors might lead you to NOT purchase a heat pump water heater? (Accept Multiples)

1	Higher purchase price	A18
2	Higher cost to operate	A18
3	Structural limitations or installation space constraints	A18
5	Cost to upgrade wiring, electrical panel, or plumbing	A18
6	I wouldn’t want to change water heater types	A18
7	Unfamiliar with the technology	A18
8	I prefer “tried and true” water heaters to newer water heater technologies	A18
9	Noisy	A18
10	Cools the room down	A18
11	Not good for large families	A18

A16 For the project we are discussing today, what factors might lead you to NOT purchase a heat pump water heater? (Accept Multiples)

12	Preference for gas vs electricity	A18
13	Downtime (absence of heat/hot water)	A18
77	Other (Please specify)	A18
88	Refused	A18
99	Don't know	A18

HPWH_Intro Heat pump water heaters or hybrid water heaters are an efficient way to heat water using electricity. Unlike a tankless water heater, they do require a storage tank and are not considered instantaneous. They are becoming more popular because of their environmental benefits, available rebates, lower operating costs, high efficiency, and decrease of gas usage. A18

A18 The costs of an electric heat pump water heater may be $500-$1,000 more than a tankless water heater, but can save the occupants in your newly built homes money over the long term by switching to electricity instead of gas. Furthermore, there are environmental benefits by using electricity instead of gas. Had you been aware of this technology, what is the likelihood that you would have purchased an electric heat pump water heater instead of a gas tankless water heater?

1	Very likely	NTG0
2	Somewhat likely	NTG0
3	50/50 chance	NTG0
4	Somewhat unlikely	NTG0
5	Very unlikely	NTG0
88	Refused	NTG0
99	Don’t Know	NTG0

NET TO GROSS BATTERY

For the next set of questions, we would like to know about your decision to install the tankless water heater(s) at <ADDRESS> in <CITY> and the role the utility program had (if any) on your decision.

There are usually a number of reasons why you would decide to participate in energy efficiency programs like this one. In your own words, can you tell me why you decided to participate in this program?

NTG0		
1	The program helped our project to pass compliance	NTG1
2	To differentiate the homes we build from other homes being sold	NTG1
3	To get a rebate from the program	NTG1
4	To protect the environment	NTG1
6	To reduce energy use/power outages	NTG1
7	To update to the latest technology	NTG1
8	Comfort, health, or safety benefits	NTG1
77	RECORD VERBATIM	NTG1
88	Don't know	NTG1
99	Refused	NTG1

What is the likelihood you would have installed the same high efficiency water heater, if the rebate from SoCalGas had not been available?

NTG1		
1	Very likely	NTG4
2	Somewhat likely	NTG4
3	50/50 chance	NTG4
4	Somewhat unlikely	NTG4
5	Very unlikely	NTG4
88	Refused	NTG4
99	Don't Know	NTG4

NTG4 Water heaters come in a variety or technologies and fuel types, such as traditional storage water heaters, heat pump water heaters, condensing water heaters and tankless water heaters; and can use either gas or electricity. You installed a tankless water heater through the program that uses gas. Without the rebate would you have purchased a gas tankless water heater, or a unit that is a different technology or fuel type?

1	Gas tankless water heater	NTG6
2	Different technology or different fuel type	NTG5
88	Refused	NTG6
99	Don't Know	NTG6

NTG5 You said you would have purchased a different technology or fuel type, what type of water heater would you have purchased?

1	Conventional storage tank fueled by gas	NTG5a
2	Conventional storage tank fueled by electricity	NTG5a
3	Tankless fueled by electricity	NTG7
4	Heat pump (all-electric)	NTG7
5	Condensing water heater	NTG5a
88	Refused	NTG7
99	Don't Know	NTG7

NTG5a What led you to choose a tankless water heater instead of the conventional storage water heater?

1	Rebate	NTG7
2	Reduce energy use	NTG7
3	Reduce bill	NTG7
4	Interest in newer technologies	NTG7
5	Meet compliance	NTG7
7	Other	NTG7
88	Refused	NTG7
99	Don't Know	NTG7

NTG6 If the SoCalGas program hadn't offered a rebate in 2021, would you have purchased the same higher efficiency tankless water heater at your own expense?

1	Would have purchased a minimum standard efficiency tankless water heater	NTG7
2	Would have purchased the same high efficiency tankless water heater	NTG7
3	Would NOT have purchased a tankless water heater at all	NTG7
88	Refused	NTG7
99	Don't Know	NTG7

NTG7 Did you make the decision to install the tankless water heater before, after, or at the same time as you became aware that the rebate was available through the program?

1	Before	NTG8
2	After	NTG8
3	Same time	NTG8
88	Refused	NTG8
99	Don't Know	NTG8

I'd like you to consider the importance of the program and all program related factors such as the program rebate; and the program information and recommendations you have received from your utility. We are interested in how these program related factors affected your decision about the tankless water heater you installed. That is, we are interested in what influenced you to choose the tankless water heater you did rather than a less efficient option.

NTG8 Using a scale of 0 to 10 where 0 means not at all important and 10 means extremely important, how would you rate the importance of these program related factors?

1	Record 0 to 10 score _____	NTG9
88	Refused	NTG9
99	Don't Know	NTG9

Now I'd like you to consider a number of factors I will call the "non-program factors". These include reasons unrelated to the program that may have influenced you to choose a tankless water heater rather than a less efficient option, such as …

[LIST ANYTHING THEY MENTIONED IN NTG0, EXCEPT FOR REBATE, PLUS THESE:]

previous experience with similar equipment,

existing plans of installing the equipment regardless of the program,

or other reasons that were not related to the program

NTG9 Using the same scale of 0 to 10 where 0 means not at all important and 10 means extremely important, how would you rate the importance of these "non-program" factors?

1	Record 0 to 10 score _____	NTG10
88	Refused	NTG10
99	Don't Know	NTG10

Next, I would like you to compare the importance of the program related factors to the other Non-program factors that may have influenced your decision.

NTG10 If you were given 10 points to award in total, how many points would you give to the importance of the program related factors such as the rebate, versus the other non-program factors in choosing the tankless water heater, rather than a less efficient option?

1	Record 0 to 10 score _____	NTG11
88	Refused	NTG11
99	Don't Know	NTG11

NTG11 If the Title 24 compliance run for this project did not initially pass, what efficiency improvements would you likely have made in order to achieve compliance? [Ask open ended, do not read responses]

1	Water Heating Efficiency	CC1a
2	Cooling Equipment Efficiency	CC1a
3	Heating Equipment Efficiency	CC1a
4	Windows/Fenestration Efficiency	CC1a
5	Additional Attic Insulation	CC1a
6	Additional Wall Insulation	CC1a
7	Additional Floor Insulation	CC1a
8	Other 1 Record Verbatim _____	CC1a
9	Other 2 Record Verbatim _____	CC1a
10	PV	CC1a
88	Refused	CC1a
99	Don't Know	CC1a

DEMOGRAPHICS

[ASK DEMOGRAPHIC SECTION FOR ALL]

Finally, we would like to find out some information about the home you built at &ADDRESS.

Which of the following dwelling types best describes the home at %ADDRESS? [READ RESPONSE CATEGORIES]

CC1a

1	Single-family detached home (home not attached to another home)	CC2a
2	Townhouse, duplex, or row house (shares exterior walls with neighboring unit, but not roof or floor)	CC2a
3	Apartment or condominium (2–4 units)	CC2a
4	Apartment or condominium (5 or more units)	CC2a
5	Mobile home	CC2a
88	Refused	CC2a
99	Don't know	CC2a

Approximately how many square feet of living space is there in the home, including bathrooms, foyers and hallways? Exclude garages, basements or unheated porches.

CC2a

1	Less than 250 SQFT	CC3
2	250–500	CC3
3	501–750	CC3
4	751–1,000	CC3
5	1,001 – 1,250	CC3
6	1,251 – 1,500	CC3
7	1,501 – 2,000	CC3
8	2,001 – 2,500	CC3
9	2,501 – 3,000	CC3
10	3,001 – 4,000	CC3
11	4,001 – 5,000	CC3

CC2a Approximately how many square feet of living space is there in the home, including bathrooms, foyers and hallways? Exclude garages, basements or unheated porches.

12	More than 5,000 SQFT	CC3
88	Refused	CC3
99	Don't know	CC3

CC3 How many bedrooms are in the home?

1	1	IWH1
2	2	IWH1
3	3	IWH1
4	4	IWH1
5	5	IWH1
6	6+	IWH1
88	Refused	IWH1
99	Don't know	IWH1

INSTALLED TWHs

As part of our energy study, we are hoping to gather information about the installed 'tankless' water heaters.

[ASK ALL]

IWH1 What is the make and model of the water heater installed at <%ADDRESS>?

1	Make: _____	IWH2
2	Model: _____	IWH2
88	Refused	IWH2
99	Don't Know	IWH2

IWH2 What is the UEF or EF installed at <%ADDRESS>?

1	UEF: _____	IWH3
2	EF: _____	IWH3
88	Refused	IWH3
99	Don't Know	IWH3

[ASK ALL]

IWH3 What is the hot water supply temp. setpoint (F) that you typically set the water heaters to when you complete a project?

1	Water Supply Temp Setpoint: _____	MULTIPLE
88	Refused	MULTIPLE
99	Don't Know	MULTIPLE

MULTIPLE

MULTIPLE For the responses to questions that you've already provided today, do those answers also apply to the following addresses? [SELECT MUTIPLE FOR YES]

1	<%ADDRESS_2> in <%CITY_2>	END
2	<%ADDRESS_3> in <%CITY_3>	END
3	<%ADDRESS_4> in <%CITY_4>	END
4	<%ADDRESS_5> in <%CITY_5>	END
88	Refused	END
99	Don't Know	END

END	Those are all the questions I have for you today. On behalf of the CPUC, I would like to thank you very much for your kind cooperation. Have a good day.

APPENDIX D:

HEER DEMOGRAPHIC WEB SURVEY INSTRUMENT

This section presents the email invite issued to participants (customers will see the following):

From: QEASurvey
<survey@quantum-ea.com>

Subject line: Tell us about your experience with SoCalGas's Residential Energy Efficiency Program

Dear SoCalGas Customer,

How was your recent experience with SoCalGas's energy efficiency program? We are requesting customers provide feedback on their experience with the SoCalGas sponsored residential equipment rebate program. As a participant in SoCalGas's 2021 program, your opinions are important. SoCalGas and the California Public Utilities Commission (CPUC) would like your input and perspectives to understand how to best structure future energy efficiency programs designed to serve customers like you.

We're requesting your participation today in a 10-minute survey. The information gathered will be used solely for research purposes and your individual responses will be kept completely confidential.

To get started click on this link: [ST]:

Quantum Energy Analytics is the research provider retained by the CPUC to help administer this survey. If you'd like to validate the legitimacy of this survey, visit the CPUC website for a listing of this and other CPUC approved research efforts underway: http://cpuc.ca.gov/validsurvey

Thank you for helping to improve energy efficiency programs in California.

Peter Franzese
California Public Utilities Commission
505 Van Ness Ave.
San Francisco, CA 94102

If you would like to unsubscribe from this survey request, please click on this link: [remove]

SURVEY INTRODUCTION

Survey Instructions

Hello,

This 10-minute survey is being conducted by an independent research organization with households that that participated in the SoCalGas sponsored Residential Energy Efficiency Program to install energy efficiency equipment and services.

While completing the survey, please provide responses that reflect not just yourself but rather all household members that share the same gas bill. Do your best to answer all questions.
This study is sponsored by the California Public Utilities Commission (CPUC) and will be used to help plan programs to benefit homeowners and save energy. Responses to this survey will be kept strictly confidential and reported only in the aggregate.

Need Help? Quantum Energy Analytics has been hired to manage this study supported by SoCalGas and the California Public Utilities Commission. Quantum Energy Analytics support representatives can be reached by emailing us at: hollyf@quantum-ea.com

www.QuantumEnergyAnalytics.com

SURVEY QUESTIONS

Q1 According to SoCalGas's records, in 2021 your household received a rebate from SoCalGas for a %MEASURE. Are you aware of this purchase?

1	Yes	Q2
2	No	Q2

In order to ensure that energy efficiency programs serve all customer segments fairly, we would like to learn more about your dwelling and household demographics.

Q2 Which of the following dwelling types best describes your home at %ADDRESS? [READ RESPONSE CATEGORIES]

1	Single-family detached home (home not attached to another home)	Q3
2	Townhouse, duplex, or row house (shares exterior walls with neighboring unit, but not roof or floor)	Q3
3	Apartment or condominium (2–4 units)	Q3
4	Apartment or condominium (5 or more units)	Q3
5	Mobile home	Q3
88	Refused	Q3
99	Don't know	Q3

Q3 Approximately how many square feet of living space is there in your home, including bathrooms, foyers and hallways? Exclude garages, basements or unheated porches.

1	Less than 250 SQFT	Q4
2	250–500	Q4
3	501–750	Q4
4	751–1,000	Q4

Q3 Approximately how many square feet of living space is there in your home, including bathrooms, foyers and hallways? Exclude garages, basements or unheated porches.

5	1,001 – 1,250	Q4
6	1,251 – 1,500	Q4
7	1,501 – 2,000	Q4
8	2,001 – 2,500	Q4
9	2,501 – 3,000	Q4
10	3,001 – 4,000	Q4
11	4,001 – 5,000	Q4
12	More than 5,000 SQFT	Q4
88	Refused	Q4
99	Don't know	Q4

Q4 Do your rent or own your home?

1	Own	Q5
2	Rent	Q5
3	Manage	Q5
88	Refused	Q5
99	Don't know	Q5

Q5 Approximately what year was this home built?

1	Before 1940	Q6
2	1940-1969	Q6
3	1970-1979	Q6
4	1980-1989	Q6
5	1990-1999	Q6
6	2000-2009	Q6
7	2010-2022	Q6
88	Refused	Q6
99	Don't know	Q6

Q6 How many people currently live in your home?

1	Live in the home year around #____	Q7
2	18 or younger #____	Q7
3	65 and over #____	Q7
4	Home throughout the day #____	Q7
88	Refused	Q7
99	Don't know	Q7

Q7 What is the highest degree or level of school you have completed? If you're currently enrolled in school, please indicate the highest degree you have received.

1	Less than a high school diploma	Q8
2	High school degree or equivalent	Q8
3	Vocational/trade school degree	Q8
4	Bachelor's degree (e.g. BA, BS)	Q8
5	Master's degree (e.g. MA, MS, MEd)	Q8
6	Doctorate (e.g. PhD, MD, EdD)	Q8
7	Other (please specify)	Q8
88	Refused	Q8
99	Don't know	Q8

Q8 What is the primary household language?

1	English	Q9
2	Spanish	Q9
3	Chinese (including Mandarin and Cantonese)	Q9
4	Tagalog	Q9
5	Vietnamese	Q9
6	Korean	Q9
7	Other (please specify)	Q9
99	Prefer not to say	Q9

Q9 Are you of Hispanic, Latino, or Spanish origin?

1	No, not of Hispanic, Latino, or Spanish origin	Q10
2	Yes, Mexican, Mexican American, Chicano	Q10
3	Yes, Puerto Rican	Q10
4	Yes, Cuban	Q10
5	Yes, another Hispanic, Latino, or Spanish origin (please specify)	Q10
99	Prefer not to say	Q10

Q10 What is your race?

1	White	Q11
2	Black or African American	Q11
3	American Indian or Alaska Native	Q11
4	Chinese	Q11
5	Asian Indian	Q11
6	Japanese	Q11
7	Korean	Q11
8	Filipino	Q11
9	Vietnamese	Q11
10	Other Asian	Q11
11	Pacific Islander	Q11
12	Some Other Race (please describe)	Q11
99	Prefer not to say	Q11

Q11 This information is collected for internal purposes only and remains confidential. What range best describes your household's total 2021 annual income. [READ RESPONSE CATEGORIES]

1	Less than $10,000	Q12
2	$10,000 – $24,999	Q12
4	$25,000 – $49,999	Q12
5	$50,000 – $74,999	Q12
6	$75,000 – $99,999	Q12
7	$100,000 – $149,999	Q12
8	$150,000 – $199,999	Q12
10	$200,000 – $249,999	Q12
11	$250,000 or more	Q12
99	Prefer not to say	Q12

Q12 Which of the following products will you consider or purchase in the next two years?

1	Smart appliances	1. Use currently 2. Would consider/purchase in the next two years 3. Would NOT consider/purchase in the next two years	Q13
2	Heat pump heating/cooling		Q13
3	Heat pump water heater		Q13
4	Solar panels		Q13
5	Battery storage		Q13
6	Electric vehicles		Q13

Q13 Which of the following changes, if any, have you made in your home since 2021? Please select all changes that apply, or if none, please scroll down and select "no changes made."

1	Increased living area/square footage of your home (finished basement to add media room or bedroom, for example)	Q14
2	Decreased living area/square footage of your home (converted a bedroom to a storage room, for example)	Q14
3	Using more lighting	Q14
4	Using less lighting	Q14
5	Using an additional refrigerator	Q14
6	Got rid of/recycled/stopped using an additional refrigerator	Q14
7	Added a pool/pump	Q14
8	Eliminated/stopped using your pool/pump	Q14
9	Added electric vehicle charging to the home	Q14
10	No longer charge electric vehicle at the home	Q14
11	Added a spa	Q14
12	Eliminated/stopped using your spa	Q14
13	Household size increased	Q14
14	Household size decreased	Q14
15	Replaced heating or cooling unit	Q14
16	Added heating or cooling unit	Q14
17	NO CHANGES	Q14

Q14 The following questions are about challenges your household may have had paying energy bills or heating and cooling your home adequately. In the last 12 months, how many months did your household experience the following? How many months did your household…

1	Need to reduce or forego expenses for basic household necessities, such as medicine or food, in order to pay for your energy bill?	1. Almost every month 2. Some months 3. 1 or 2 months 4. Never	Q15
2	Keep your home at a temperature you felt was unsafe or unhealthy?		Q15
3	Unable to pay for energy bill or unable to pay the full bill amount?		Q15
4	Receive a disconnection notice, shut off notice, or non-delivery notice for an energy bill?		Q15

Q15 Which best describes your current employment status?

1	Employed full-time	Q16
2	Employed part-time	Q16
3	Retired	Q16
4	Not employed	Q16

[Ask if %MEASURE NOT 'WATER HEATING TANKLESS WATER HEATER']

Q16 If you were making the decision to install a new water heater, which water heater would you consider installing?

1	Conventional storage tank fueled by gas	END
2	Conventional storage tank fueled by electricity	END
3	Tankless fueled by gas	END
4	Heat pump (all electric)	END
5	Solar water heater	END
99	Don't know	END
77	Other, please specify:	END

END	Those are all the questions I have for you today. On behalf of the CPUC, I would like to thank you very much for your kind cooperation. Have a good day.

APPENDIX E:

EX ANTE REVIEW SUPPORTING INFORMATION

Key Data Field Definitions

For clarity, we have included data definitions for key fields used throughout this section in Table 1 below. For additional detailed data definitions, please reference the CEDARS Claims data specification or the eTRM user guide.

Table 1 : Key Data Field Definitions

TableName	FieldName	FieldDescription
Claim	BldgHVAC	Standard ExAnte Building HVAC Type
Claim	BldgLoc	Standard ExAnte Building Location/Climate Zone
Claim	BldgType	From DEER. Text codes which identify the building type/use and other paramters speific to that building use. For example, "Com" = Commercial buildings.
Claim	BldgVint	Standard ExAnte Building Vintage
Claim	ClaimID	Unique and persistant identifier of each claim record; Please include the Upload PA code and Claim Year at the beginning of the ClaimID (ex. PGE-2020-152645)
Claim	DeliveryType	From DEER. Identifies program implementation stategy / method of delivering a measure to a customer (eg. direct install)
Claim	EUC_Flag	Flag to identify Energy Upgrade California claims
Claim	MeasAppType	From DEER. The measure application identifies the context for the measure's installation. (e.g. accelerated replacement, new construction or behavioral)
Claim	MeasImpactType	From DEER. Describes how the savings impact was determined (eg. Deemed-DEER, Deemed-Workpaper, Site-specific calculation, etc)

TableName	FieldName	FieldDescription
Claim	NormUnit	Type of normalizing units, or basis of NumUnits or quantity used by the cost effectiveness calculation (eg. 'Lamp', 'hp', 'tons', 'facility', etc)
Claim	NTG_ID	From DEER. The Ex Ante NTG_ID associated with the NTG values being claimed.
Claim	NumUnits	Number of units or quantity. NumUnits must work in conjunction with the NormUnit value for the claim. Cross reference NormUnit and NumUnits before interpreting quantities of measures installed.
Claim	PrgID	Links Claim to Program table; Must exist in EEGA; (eg. PGE21041)
Claim	TotalFirstYearGrosskW	Total first year gross kW savings to be claimed
Claim	TotalFirstYearGrosskWh	Total first year gross kWh savings to be claimed
Claim	TotalFirstYearGrossTherm	Total first year gross therm savings to be claimed
Measure	EUL_ID	Specifies a row in EUL table that specifies the estimated useful life of the measure technology.
Measure	EUL_Yrs	Effective useful life of EE measure in years
Measure	GSIA_ID	Reference to the Ex Ante Gross Savings and Installation Adjustment table.
Measure	MeasAppType	Standard ExAnte Measure application type (eg. ROB)
Measure	MeasImpactType	MeasImpactType
Measure	MeasureID	Unique and persistent measure identifier
Measure	NormUnit	Type of normalizing units, or basis of NumUnits or quantity used by the cost effectiveness calculation (eg. 'Lamp')
Measure	NTG_ID	Claimed ExAnte NTG_ID, if different than the default NTG_ID associated with the implementation being claimed
Measure	NumUnits	Number of units or quantity associated with this claim (eg. 206)
Measure	RUL_ID	Specifies a row in ExAnte EUL table that identifies the remaining useful life of the existing technology.
Measure	RUL_Yrs	Remaining useful life of pre-existing measure in years
Measure	Sector	Standard ExAnte sector (eg. Ind)
Measure	SourceDesc	Description of the specific source for the data; The workpaper or DEER ID including revision (eg. PGE3PHVC149r0)
Measure	UnitkW1stBaseline	The first baseline kW savings per Unit
Measure	UnitkW2ndBaseline	The second baseline kW savings per Unit.
Measure	UnitkWh1stBaseline	The first baseline kWh savings per Unit
Measure	UnitkWh2ndBaseline	The second baseline kWh savings per Unit

TableName	FieldName	FieldDescription
Measure	UnitTherm1stBaseline	The first baseline therm savings per Unit
Measure	UnitTherm2ndBaseline	The second baseline therm savings per Unit

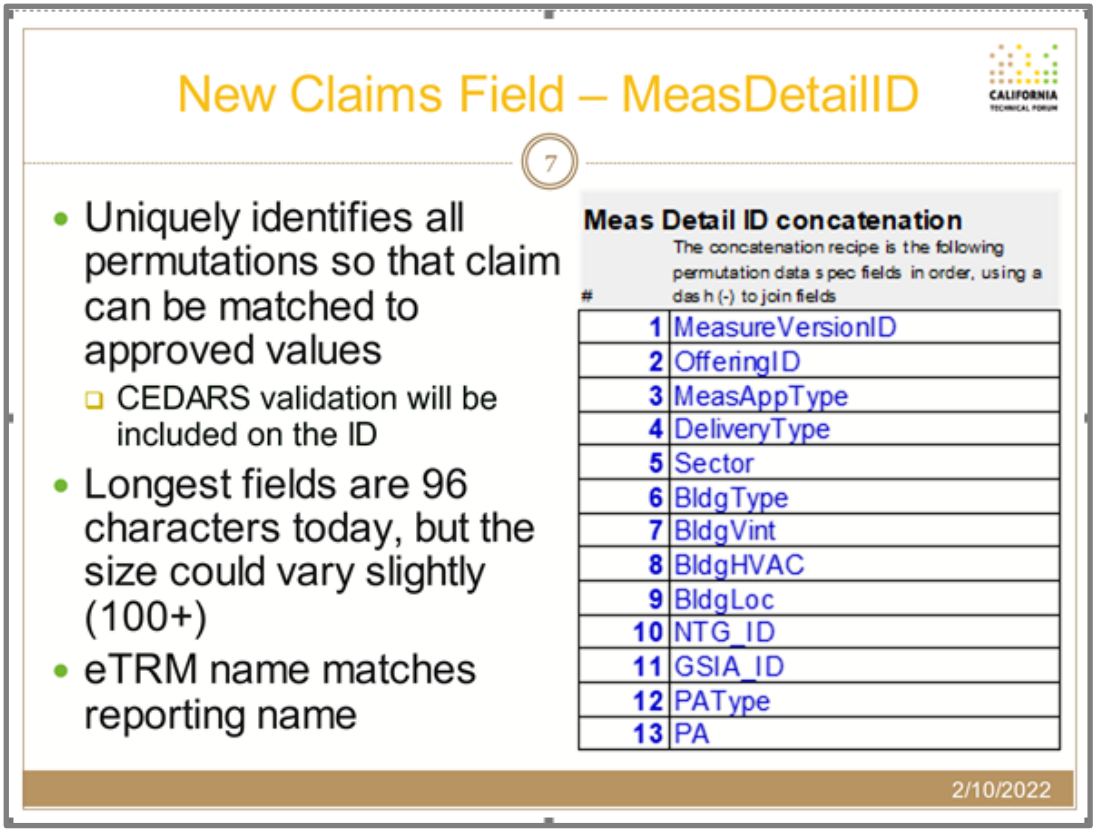
Figure Source: CEDARS Metadata

Methods for Matching CEDARS Claim to eTRM

The following details the steps the evaluation team took to match the 2021 SCG Claim data with corresponding measures in the eTRM.

We first downloaded the most recent 2021 Annual SCG Claim record-level data from CEDARS, along with the most recent measure permutation data from the eTRM. Since these are large datasets, each was filtered appropriately such that we were only handling SCG deemed, residential data based on CPUC-approved measure packages. After filtering the claim and eTRM data, we implemented a primary key in the Claim data, the details of which were provided by the eTRM team. Figure 1 below shows the eTRM primary key which is intended to align directly with Claims.

Figure 1: eTRM MeasDetailID



The intent of the primary key was to combine a series of Claim fields into a single field which, in theory, should match the 'MeasDetailID' field in the eTRM. Unfortunately, that match was unsuccessful using the key we were provided; however, starting in 2022, MeasDetailID was added to the Claim data, which should make the alignment to the eTRM much more straightforward.

Since there was not an easy match using the provided key, the evaluation team applied its deep knowledge of the claim data to systematically adjust the key based on differences we inferred from the data and iteratively match with the eTRM MeasDetailID, adding matches with each iteration. The mismatches were largely a result of either 1) combinations of parameters that were Claimed but were not available in the eTRM or 2) SCG is claiming invalid combinations of parameters that are intentionally excluded from the eTRM so they cannot be offered. We outlined some of the main contributors to mismatching/misalignment between the Claim and eTRM in the report. After 7 iterations

of adjusting the key and matching, we were able to successfully match all claims included in this exercise, allowing for the direct comparison of the Claim and eTRM. The bullets below represent the iterations required to successfully match the Claim with the eTRM.

- **Match 1: Modify MeasDetailID to leverage the last letter of the MeasureID, Remove OfferingID**
- **Match 2: Modify BldgType to 'Res' to handle mismatch with eTRM BldgType**
- **Match 3: Handle BldgVint = 'Old' vs 'Ex'**
- **Match 4: Modify BldgVint to handle 'Any'**
- **Match 5: Combine Match 4+Handle MeasAppType where 'NC' is not offered in eTRM**
- **Match 6: Modify BldgLoc to handle 'Any'**
- **Match 7: Handle BldgType mismatches where eTRM only offers MfM but Claim uses SFm / DMo**

APPENDIX F:

RESPONSE TO COMMENTS

Comment #	PA	Location	Page	Topic	Question/Comment	Evaluator Response
1	SDG&E	Recommendation #6	8-4	Recommendations	During the webinar it was stated that dropping the setpoint from 135F to 120F could have potentially negative impacts on the hot water draw. Will the recommendation to decrease the setpoint from 135F to 120F still be included in the final report?	The recommendation to change the setpoint in the measure package to 120 deg F is still included in the final version of the report. However, we agree that any such change will also require a change to DEER water heater calculator hot water usage profiles -- see comments below.
2	SCG	Key Evaluation Findings 3a	1-7	Recommendations	Program participation does not reflect the water heater market as a whole, only a subset of customers who are participating in SoCalGas rebate programs. SoCalGas typically recommends looking for EnergyStar Unit Shipment Data to support market assessment, however in the EnergyStar data the market penetration of tankless water heaters is unknown. In order to determine market share of tankless installations for HEER program participants, the first step should be a market study to determine the California sales splits between storage and tankless water heaters in order to gather more information and inform whether a full Industry Standard Practice (ISP) study is appropriate.	We will clarify in the report that we did not look at nonparticipant installations and that participants may not be representative of the overall market. We also agree that a market study is a good first step and have modified our recommendation accordingly.
3	SCG	Key Evaluation Findings 3b	1-7	Recommendations	Compliance of a new build project is not dependent on the installation of a tankless water heater. Many other installation factors contribute to a home being Title 24 compliant. In addition, the EENH program only provides incentives for above code measure installations. The minimum UEF eligible for the program is 0.82, so a minimally compliant tankless water heater with a UEF of 0.81 is not eligible for the program. Builders participating in the EENH program have long-standing relationships with SoCalGas Account Executives whose influence over many years has led to builders adopting higher energy efficient equipment as their choice. This is not reflective of all builders, builders not participating in the EENH program, or the water heater market as a whole.	We will clarify in the report that we did not speak with nonparticipant builders, and that the participant builders may not be representative of the overall market. We will recommend that a suvey of nonparticipant builders be conducted to better understand the water heating market for residential new construction. We will also recommend that a net-to-gross analysis be conducted for the EENHP program, as the current NTGRs being used for tankless water heaters are based on a study that only examined natural replacement and not new construction.
4	SCG	Recommendation #1	1-9	Recommendations	If the setpoint temperature is updated, the hot water load profile data needs to be updated as well. Lower setpoint will require higher hot water draw to meet hot water demand. DEER hot water load curves are built around assumptions of 135 F setpoint likely because they were established with assumptions for storage water heaters which have higher setpoint to increase thermal storage. Changing gross savings claims due to lower water heater setpoint without regard for how the lower setpoint temperature affects the draw profiles is likely not a reasonable assumption as they are codependent variables in the savings calculation. If this gross savings adjustment methodology is adopted, a new draw profile will need to be created specific to Tankless Water Heaters with lower setpoint.	Thank you for this feedback. We have updated the savings estimates and reported results to reflect a 135 deg F hot water temperature setpoint.
5	SCG	Recommendation #4	1-9	Recommendations	Though tankless gas water heaters market share has increased in recent years, the market has not transitioned to tankless water heaters as standard practice. The majority of water heater installations are emergency replacements due to existing equipment failure. In these instances, the quickest way to restore hot water service is through a like for like replacement. Surveys of SoCalGas program participants reflects participant only data, not market data. We do not believe that a survey of participant data supports the recommendation that an Industry Standard Practice (ISP) should be done. ISP studies are lengthy and costly processes and should be conducted when appropriate. Instead, a market study should be done first to gather information on California sales data between storage and tankless water heaters to better reflect the decision process of customers in the California water heater market as a whole, including non-program participants.	See response to comment #2