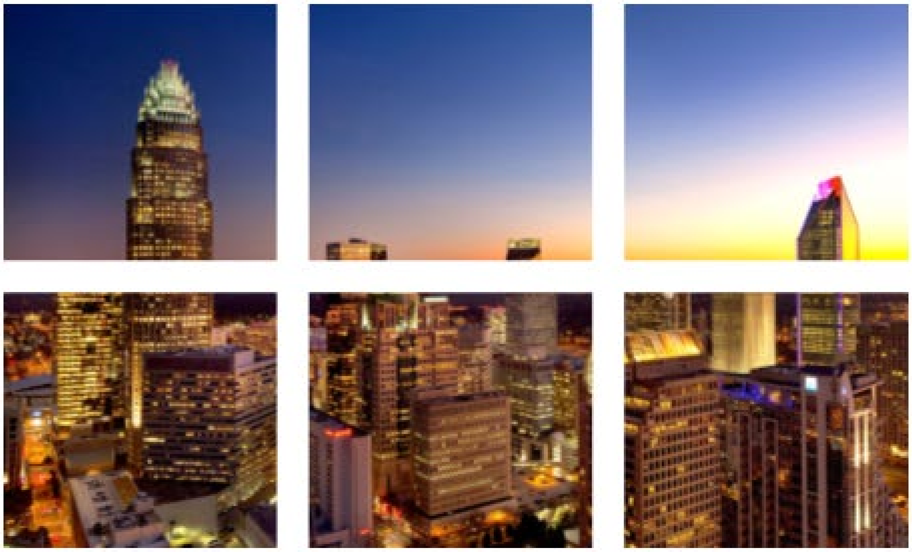

2017 SMALL/MEDIUM COMMERCIAL SECTOR ESPI IMPACT EVALUATION

Final Report

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California Public Utilities Commission

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 EXECUTIVE SUMMARY

1.1 NEED FOR THE STUDY

The overall goal of this study is to evaluate energy savings from selected technologies in the investor owned utilities' (IOUs') 2017 energy efficiency programs in the non-residential sector including small and medium commercial buildings and industrial and agricultural applications. This study focuses on technologies that have an assumed savings for that technology, as opposed to projects where the savings are calculated and very specific to a particular site. The results of this study address CPUC regulatory reporting requirements. The results are also used to inform decision makers if our energy efficiency programs are meeting savings goals or helping to meet the state's climate goals.

1.2 ENERGY EFFICIENCY TECHNOLOGIES STUDIED

This study evaluates a number of commercial, industrial or agricultural energy efficiency technologies for which the Commission cannot forecast, with a high level of certainty, the expected energy savings. These technologies include the following:

- Food Service Technologies –commercial cooking equipment
- Industrial Boilers – water heating and steam boilers used mostly in industrial applications
- Pipe Insulation, Hot Application – addition of pipe insulation to pipes holding a hot liquid/vapor
- Water Heater Boilers – water heating boilers used mostly in commercial applications, providing hot tap water
- Refrigeration Case Lighting – replacement of lighting in store refrigeration displays that hold cold retail shelf products for sale
- Agricultural Irrigation – drip irrigation solutions applied in agriculture

1.3 APPROACH

The study conducts original research to verify the savings reported by the IOUs and/or develop revised estimates of savings for each technology studied. This study addresses both electric (kWh, kW) and gas (therm) savings provided over the lifetime of the technology. The primary mechanisms for collecting data include telephone surveys and site visits which were conducted with a sample of customers that installed at least one of the study technologies. The data collected as part of these activities include information on how the technology was installed, and how the technology affects the site's energy consumption.

This evaluation then compares the initial energy savings reported by IOU's to this evaluation's results developed using the data collected on site. The ratio of the evaluation results to utility reported savings is referred to as the "realization rate," or the rate at which reported savings are realized through the evaluation.

We also examine how successful the IOU programs were in influencing program participants to install energy efficient equipment that would not have been installed if the programs had not existed. Participants that would have installed the same energy efficient equipment in the absence of the program are considered free riders. They are referred to as free riders because they are receiving incentives from the programs for actions they would have undertaken without the program's existence. The total amount of savings derived among all participants, including free riders, is referred to as "gross savings," and the savings that is generated net of free riders is "net savings".

Finally, we developed estimates of the ratio between the net and gross levels of savings (the net-to-gross ratio or NTGR). The NTGR is estimated as a ratio where a value of 1 means the IOU-sponsored program completely influenced the installation of the energy efficient equipment and anything less than one indicates the level of free ridership; for example, 25% free ridership would yield an NTGR of 0.75. To estimate the NTGR, the telephone survey includes several questions regarding the program's influence on the participant's decision to install the energy efficient equipment. The survey examines various factors related to the program and asks the participant what they would likely have done in the absence of the program.

1.4 RESULTS

The results of this evaluation establish the net lifecycle energy savings of the seven technologies studied. This value is the estimated energy savings (established by this study) generated by the program over the life of the installed equipment (lifecycle), minus (net) the free riders.

The tables below show the evaluated and reported net lifecycle energy savings values for each technology studied. Therms are shown in Table 1-1 for gas saving technologies, and MWhs and MWs are shown in Table 1-2 for electric saving technologies. Also provided are the realization rates (the ratio of evaluated to the IOU's reported savings) and the corresponding NTGR – for both these ratios the closer to 1, the lower the level of free ridership and the higher the resulting program savings. Except for pipe insulation, the remaining five technologies showed much lower energy savings than reported, and therefore low net realization rates. Furthermore, all seven technologies studied showed that the program had only a moderate influence on the installation of the equipment, as participants would have installed the equipment anyway (hence the low NTGR).

TABLE 1-1: REPORTED AND EVALUATED NET LIFECYCLE THERM SAVINGS, REALIZATION RATES AND NTGRS FOR EVALUATED GAS TECHNOLOGIES

ESPI Technologies	Lifecycle Net Therm Savings			
	Reported	Evaluated	Net Realization Rate Evaluated / Reported	Net-to-Gross Ratio
Food Service – Gas Fryers	10,625,172	2,500,842	0.24	0.41
Food Service – Other	7,788,863	4,982,701	0.64	0.41
Industrial Boiler	6,230,531	3,383,402	0.54	0.42
Pipe Insulation Hot Application	3,078,402	2,642,761	0.86	0.45
Water Heating Boiler	5,584,010	3,927,893	0.70	0.42

TABLE 1-2: REPORTED AND EVALUATED MWH AND MW LIFECYCLE SAVINGS, REALIZATION RATES AND NTGRS FOR EVALUATED ELECTRIC TECHNOLOGIES

ESPI Technology	Lifecycle Net MWh Savings			Lifecycle Net MW Savings			
	Reported	Evaluated	Net Realization Rate Evaluated / Reported	Reported	Evaluated	Net Realization Rate Evaluated / Reported	Net-to-Gross Ratio
Refrigeration Case Lighting	70,418	11,644	0.17	14	3	0.21	0.58
Agricultural Irrigation	32,501	6,778	0.21	26	4	0.17	0.28

Finally, we provide some high-level findings that stem from the evaluation, organized by technology. More details can be found in section 8 of the main report.

1.4.1 Refrigeration Case Lighting

In this evaluation, we compared the inputs and assumptions between the reported savings model and the evaluated savings model. Some of the key differences are listed below:

- **In the IOU reported savings, IOUs assume that participants are currently using older model, less efficient fluorescent lamps. However, participant self-report data suggests otherwise, with the majority of equipment stated to be newer model fluorescent lamps.** This finding resulted in lower gross savings for many of the sampled projects.

- Some of the differences in inputs and assumptions varied by utility:
  - San Diego Gas & Electric (SDG&E) savings models assume that energy savings are per refrigeration case door and that typical cases have more than one light fixture per door. But evaluators verified less than 1.2 light fixtures per door on average, with just one light fixture per door being most common, resulting in a reduction in savings.
  - The estimates for how long the equipment will last following installation vary substantially by utility. Both SDG&E and PG&E assume the lamp will last 16 years, whereas Southern California Edison (SCE) assumes four years. Evaluation results, on the other hand, support a 5.33 year life, thereby reducing the resulting lifecycle savings.

1.4.2 Industrial Boiler

PG&E and SCG offered incentives for both steam and water heating boilers in an industrial setting. The rebates typically exclude boilers used for domestic hot water, space conditioning, pools or spas. This evaluation verified the installation and operating conditions of the boilers and also conducted flue gas testing.

The IOUs' reported assumptions for operating hours, load factors and the assumed efficiency level of the new boiler differed from conclusions in the evaluated savings model. This generally resulted in a reduction in evaluated savings relative to IOU reported savings.

1.4.3 Food Service Technologies

It was common to find installations in the sample that do not save energy or no longer saved energy at the time of field data collection. The expected evaluated savings would have been about 25 percent higher if the issues observed were addressed. Issues observed, ranked from most common to least common, consisted of:

- Projects where the installed and verified equipment were found to be ineligible for program participation.
- Projects where the businesses permanently closed.
- Projects where gas fryers were found to not operate or no longer operate.
- Projects where program-installed gas fryers were removed following installation.
- Projects where only one fryer was found but savings for two fryers were claimed by the program.

Food service technology results indicate high levels of free ridership, especially among chain restaurants and grocery stores. Please see section 6 of the main report for more detail. NTGRs in the 0.30 range provide strong evidence that these technologies are being installed for reasons not related to the program. This is particularly a concern among more sophisticated businesses who are likely to have decided to purchase eligible technologies regardless of program incentives.

1.4.4 Agricultural Irrigation

Five of the 19 sampled projects in this evaluation were determined to be ineligible for program participation. All five of the ineligible sites had previously irrigated their farms with methods that do not meet the CPUC’s minimum discharge pressure requirements. The projects irrigated using a “flood and furrow” method, where farmers flow water down trenches running through their crops. This method uses significantly lower discharge pressure at the pump, and thus does not meet the minimum eligibility criteria for pre-project discharge pressure. This resulted in a reduction in savings.

IOU models for estimating savings were found to lack key parameters that are critical for accurately characterizing irrigation needs and resulting savings. These gaps generally led to a reduction in evaluated savings relative to IOU reported savings.

Agricultural Irrigation evaluation results indicate high levels of free ridership. The evaluated 0.28 NTGR provides strong evidence that these measures are installed for reasons not related to the program.

1.5 CONTACT INFORMATION

The ED Project Manager for this study was Ms. Mona Dzvova. Itron served as the Prime Contractor managing this study, led by Mr. Kris Bradley.

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2 INTRODUCTION AND OVERVIEW OF STUDY

This report documents the activities and results of the Nonresidential Small and Medium Commercial Sector Impact Evaluation of the 2017 California Investor Owned Utilities (IOU) energy efficiency programs. The overall goal of this study is to perform an impact evaluation on specific nonresidential deemed measures[1] that were identified in the Efficiency Savings and Performance Incentive (ESPI) Uncertain Measure List for program year (PY) 2017.[2] The ESPI mechanism was adopted on September 5, 2013 in D.13-09-023 and provides monetary incentives to IOUs for performance in resource and non-resource program activities.

This evaluation focuses on energy efficiency (EE) resource program savings – measured in net ex-post lifecycle energy savings – realized by IOU programs in PY2017. The evaluation team collected and analyzed primary data from PY2017 and existing data from PY2016 to develop net ex-post lifecycle savings and to satisfy impact evaluation requirements for measures on the PY2017 Uncertain List. This report details the goals and objectives of the impact evaluation to meet those requirements. Likewise, the report discusses the researchable issues, information on the measure groups' technologies evaluated, as well as the data sources used, the approach for sampling, the verification analysis and the methods used to determine ex-post net lifecycle energy impacts. Finally, the report presents the results and findings from the analysis that can be used to update the Net-to-Gross Ratios (NTGRs) and gross/net first year and lifecycle savings for the measures detailed in the ESPI decision.

2.1 RESEARCH OBJECTIVES

The objective of this study is to perform a measure or measure-parameter impact evaluation – utilizing existing evaluation data and new primary evaluation data – to update ex-ante gross and net savings estimates and inform future savings values for measures identified in the PY2017 ESPI decision. Attachment A of the ESPI decision provides an overview of the measure groups (i.e., food service equipment, pipe insulation, etc.), the energy resource (i.e., electric, gas) and the parameters that have been identified as potentially requiring ex-post verification. These parameters include installation/verification rates, Unit Energy Savings (UES), NTGRs, gross and net energy savings values, effective useful life (EUL) and impact load shapes. The measure groups and parameters detailed in Attachment A were selected for ex-post verification primarily based on the following two criteria:

[1] Note that nonresidential deemed lighting measures are covered under the Lighting Sector evaluations.

[2] Hansen, R., 2016. Final 2017 Efficiency Savings and Performance Incentive (ESPI) Uncertain Measures List. December 22, 2016.

- Ex-ante savings for the measure are substantially uncertain
- Ex-ante savings for the measure represent a significant proportion of program administrator (PA) portfolio savings

The final 2017 ESPI Uncertain List identifies several portfolio measures related to the Small and Medium Commercial Sector that are subject to some level of ex-post evaluation for PY2017. Below is a list of the measure groups identified in that decision. Note that lighting measures are covered by the Lighting Sector evaluations.[3] Also, note that the parameters associated with these measures represent potential areas of focus and that the ex-post evaluation is not limited in scope to any specific parameters. The evaluation team has determined which measures and measure-parameters are subject to ex-post evaluation. This determination is based on several factors, which will be detailed throughout this report.

Table 2-1 lists the PY2017 small and medium commercial sector uncertain measure groups. Due to budgetary and time constraints, not all measure groups were evaluated, as will be discussed in more detail below. In-scope evaluation activities are identified using bolding in the table, and the "G" and "N" designations indicate gross and net impact evaluation scope, respectively. The ESPI list also indicates the relevant fuel source. Therefore, this evaluation is only focused on measuring either electric or gas savings as it corresponds to the identified fuel source. Note that we have organized these measures into four separate measures classifications as shown below.

[3] See the 2017 Nonresidential ESPI Deemed Lighting Impact Evaluation.

TABLE 2-1: 2017-18 UNCERTAIN MEASURE LIST AND 2017 PARAMETERS RELEVANT TO THE SMALL/MEDIUM COMMERCIAL SECTOR

Measure Class	Measure Group*	Evaluation Activities	Fuel Source	ESPI Parameters
Process	**Food Service**	**G / N**	**Gas**	Installation Rate, Unit Energy Savings (UES), Net-to-Gross Ratio (NTGR), Expected Useful Life (EUL)
Process	**Process Boiler**	**G / N**	**Gas**	Gross Realization Rate (GRR)
Refrigeration	**Refrigeration Case LED Lighting**	**G / N**	**Electric**	Installation Rate, UES, NTGR, EUL
Refrigeration	Refrigeration Case Replacement	X	Gas	Installation Rate, UES, NTGR, EUL
Refrigeration	Refrigeration Evaporator EC Motors	X	Electric	Installation Rate, UES, NTGR, EUL
Water Heating	**Water Heating Boiler**	**N**	**Gas**	Installation Rate, UES, NTGR, EUL
Other	**Agricultural Irrigation**	**G / N**	**Electric**	GRR, NTGR, EUL
Other	**Pipe Insulation Hot Application**	**G / N**	**Gas**	GRR, NTGR
Other	Tank Insulation Hot Application	X	Gas	Installation Rate, UES, NTGR, EUL

Source: Hansen, R., 2016. Final 2017 Efficiency Savings and Performance Incentive (ESPI) Uncertain Measures List. December 22, 2016.

* 2017 program participation in the water heating controls measure is all multi-family (MF) and is therefore assigned instead to the residential evaluation.

** "X" designation indicates ESPI measures that are not being selected for evaluation. Bolded "G" and "N" designations indicate ESPI measures that are being selected for evaluation, with "G" identifying gross impact evaluation scope and "N" indicating net impact evaluation scope.

Rather than develop a full, comprehensive analysis on all uncertain measures, this evaluation focuses on evaluating specific parameters within the savings algorithms for some measures while implementing a more comprehensive analysis on others.

Key Research Questions: Our evaluation will investigate the six key research questions below in order to develop net and gross ex-post impacts for the measures detailed above. These research questions have been addressed either by leveraging existing data from past evaluation efforts or collecting new primary data from participant telephone surveys and on-site visits. Our proposed research questions (and supporting primary deliverables) are:

1. **What is the installation rate?** We confirmed installations (verification) using onsite-based verification of measure installations.
2. **What are key impact parameters that affect measure energy use?** We estimated key impact parameters for both the baseline (both pre-retrofit and code based) and replacement (post-retrofit) conditions -- equipment specifications, operating hours, operating conditions and interactions, and use shapes to support the estimate of gross energy savings values and 8760 impact load shapes.
3. **What is the net-to-gross ratio?** We estimated participant free ridership to support the development of net-to-gross ratios and net savings values.
4. **What is the remaining useful life and effective useful life of program installed equipment?** We estimated remaining useful life values, and updated effective useful life estimates where necessary.
5. **What are the first year and lifetime ex-post gross and net savings impacts (kWh, kW and therms)?** Based on the above, we estimated first year and lifetime gross and net ex-post impacts (kWh, kW and therms) for selected measures.
6. **How can program administrators improve program performance?** We identified measure-specific program delivery recommendations that will improve the corresponding energy efficiency programs. We based all recommendations on the findings that stem from this evaluation.

2.2 STUDIED MEASURE GROUPS

Table 2-2 and Table 2-3 show the ex-ante net lifecycle savings and percentage of total ex-ante savings for the all PY2017 small and medium commercial sector measure groups, for electric and gas savings respectively. Note that measures are only listed as either a gas or electric measure, as identified by the ESPI Fuel Source in Table 2-1. The tables also include the number of tracking system records and unique applications by measure group.

TABLE 2-2: PARTICIPATION SUMMARY, EX-ANTE NET LIFECYCLE ELECTRIC SAVINGS (GWH) AND SHARE OF SMALL/MEDIUM COMMERCIAL SECTOR SAVINGS BY ESPI MEASURE GROUP, PY2017

PY2017 ESPI Small/Medium Commercial Measure Group	PY2017 Tracking System Records*	PY2017 Unique Applications by Measure Group**	Net Lifecycle GWh Savings	Percent of Savings
Refrigeration Case LED Lighting	796	618	70.4	53%
Refrigeration Evaporator EC Motors	449	293	31.1	23%
Agricultural Irrigation	44	40	32.5	24%
Total	1289	951	134.0	100%

Sources:

Hansen, R., 2016. Final 2017 Efficiency Savings and Performance Incentive (ESPI) Uncertain Measures List. December 22, 2016.

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of records with non-zero savings; both positive and negative.

** Count of applications with records of non-zero savings; both positive and negative.

TABLE 2-3: PARTICIPATION SUMMARY, EX-ANTE NET LIFECYCLE GAS SAVINGS (MMTHERM) AND SHARE OF SMALL/MEDIUM COMMERCIAL SECTOR SAVINGS BY ESPI MEASURE GROUP, PY2017

PY2017 ESPI Small/Medium Commercial Measure Group	PY2017 Tracking System Records*	PY2017 Unique Applications by Measure Group**	Net Lifecycle MMThm Savings	Percent of Savings
Food Service	3185	2385	18.4	53%
Process Boiler	68	51	6.2	18%
Refrigeration Case Replacement	40	36	0.4	1%
Water Heating Boiler	246	130	5.6	16%
Pipe Insulation Hot Application	200	101	3.1	9%
Tank Insulation Hot Application	6	5	1.0	3%
Total	3745	2708	34.7	100%

Sources:

Hansen, R., 2016. Final 2017 Efficiency Savings and Performance Incentive (ESPI) Uncertain Measures List. December 22, 2016.

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of records with non-zero savings; both positive and negative.

** Count of applications with records of non-zero savings; both positive and negative.

As shown in Table 2-2 and Table 2-3, each of these measures contributes varying levels of ex-ante lifecycle net portfolio savings. Due to both budgetary and time constraints, only a subset of these measures were selected for ex-post gross evaluation. The three ESPI measures that were not selected for evaluation include refrigeration case replacement, refrigeration evaporative EC motors and tank insulation. The reason for not evaluating this subset of measures is based primarily on their relatively lower contribution to portfolio level savings. Note that the case replacement measure was identified as an ESPI natural gas saving measure, and accounts for only 1 percent of savings (per Table 2-3 above).

The remainder of this report includes the following:

- Section 3 discusses the data sources that were utilized to estimate each of the individual measure parameters, the sample design, and resulting data used in the evaluation.
- Section 4 discusses the overall gross impact methodology and how first year and lifecycle ex-post savings were developed for each measure.
- Section 5 discusses the development of each of the gross impact parameters, such as installation rates, pre-and post-retrofit wattages, operating hours and effective useful life (EUL) and presents the resulting gross realization rates.
- Section 6 discusses the net-to-gross (NTG) analysis and results.
- Section 7 presents the final study results including the first year and lifecycle, gross and net realization rates and savings values.
- Section 8 presents the conclusions and recommendations.
- Appendix AA presents standardized high-level savings for both gross and net first year and lifecycle.
- Appendix AB presents 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 on-site survey instruments.
- Appendix B presents the participant telephone survey instrument.
- Appendix C presents the ESPI measure mapping from measure name in the tracking data.
- Appendix D presents supporting material for the net-to-gross methodology.
- Appendix E presents evaluator responses to comments received on the draft report.

3 DATA SOURCES, SAMPLE DESIGN AND DATA COLLECTION

3.1 DATA SOURCES

The evaluation team utilized a variety of data sources to support the development of ex-post net and gross savings for the ESPI uncertain measures in this study. These data sources were obtained from both past impact evaluation activities and new primary data collection. Each data source is listed below and we describe the specifics of each data source in greater detail below:

- Primary data sources:
  - New on-site data collection
  - New participant telephone surveys
  - Past participant telephone survey and on-site data collection (Refrigeration Case LED Lighting and Agricultural Irrigation measures)
  - Program manager interviews
- Secondary Data sources:
  - Program tracking data and CIS billing data
  - IOU Workpapers and DEER
  - Industry sources

Table 3-1 presents the key primary data sources and ex-post impact evaluation updates for each of the measures discussed in Section 2.

TABLE 3-1: DATA SOURCES AND EX-POST UPDATE FOR PY2017 ESPI MEASURES

2017 ESPI Measure	Data Source			Ex-Post Update	
	New Phone Surveys	New Onsites	Existing Phone Surveys and Onsites	NTG	Gross
Food Service	X	X		X	X
Process Boiler	X	X		X	X
Refrigeration Case LED Lighting	X		X	X	X
Water Heating Boiler	X			X	Pass Through
Agricultural Irrigation	X	X	X	X	X
Pipe Insulation Hot Application	X	X		X	X

3.1.1 Program Manager Interviews

The evaluation established a working relationship with various PA staff, based on their expertise with the measures selected for evaluation. To build those relationships and learn details regarding program implementation, the evaluation fielded program manager interviews with each PA associated with the largest program/measure combinations represented in the evaluation. These interviews ensured that the evaluation data collection and methods development efforts were built from a solid base of understanding and did not mistakenly misinterpret various program delivery realities, including future plans and past lessons learned.

Interviews were completed in early November 2018 of managers of the five largest program/measure combinations represented in the evaluation. Interviews with the following entities were completed:

- PG&E Commercial Deemed Incentive Program (Food Service measures) – on November 1, 2018
- PG&E Industrial and Agricultural Deemed Incentive Programs; Comprehensive Food Processing Energy Efficiency Program (CFPEEP) run by Global Energy Partners (Process Boilers) – on November 1, 2018
- PG&E Energy Smart Grocer and LGP programs (Refrigeration Case LEDs) - on November 5, 2018
- SCG Commercial Deemed Incentive Program (Food Service measures) and Industrial and Agricultural Deemed Incentives (Process Boilers) – on November 7, 2018
- SDG&E 2017 Commercial Deemed Incentive Program (Food Service measures) and Comm Direct Install program (Refrigeration Case LED measure) – on November 7, 2018

3.1.2 Program Tracking and CIS Billing Data

Each of the IOUs upload program tracking and CIS billing data onto a centralized server that were downloaded by the evaluation team. The evaluation team 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 2017 ESPI measures, understand the portfolio-level savings attributable to those rebated measures, and inform the sampling plan for ex-post evaluation.

CIS billing data was also used to support billing analysis for the Agricultural Irrigation measures.

3.1.3 On-Site Verification

For this evaluation, we collected on-site verification data as well as utilized existing on-site data collected for the Refrigeration Case LED Lighting measure. On-site surveyors gathered installation and operational characteristics, collected data relevant to specific parameters that support the estimation of impacts, performed spot watt and end-use metering, and gathered information from Energy Management System (EMS) logs. Table 3-2 provides the details of the data that were collected on-site.

TABLE 3-2: SUMMARY OF PRIMARY SITE-SPECIFIC GROSS IMPACT DATA COLLECTION EFFORTS – SMALL COMMERCIAL IMPACT EVALUATION

Parameter	Food Service	Ag Irrigation	Pipe Insulation	Process Boilers	Refrigeration Case LED Lighting
Installation and operation characteristics	Inspectors recorded the building type, space type and square footage served by each selected unit. Equipment Nameplate: A photograph of the nameplate of each unit was taken. The inspector also recorded the information on the nameplate. Operating Characteristics: Inspectors attempted to collect the operating and set-point schedules. Where possible, the schedules were obtained by direct observation of a programmable thermostat or energy management system. If the inspector could not directly observe the schedules, then facility personnel were queried for the schedules. The inspector obtained the on/off time for weekdays, weekends and holidays as well as relevant set points and seasonality, if applicable. The site contact was also asked for the list of holidays observed at the facility and any other seasonal fluctuations in operation or production.				
Specific parameters of interest	Equipment capacity, usage profiles for cooking equipment	Pump control sequences, crop type, pre-installation crop and irrigation method.	Insulation application, temperature profile, pre-existing conditions	Equipment capacity, usage profiles for boiler loads	New equipment specifications, removed equipment specifications, presence of gas heating, presence of waste heat recovery, case lighting usage profiles, evidence of program induced early replacement
Spot measurements	Flue gas temperature	N/A	Surface temperature	Combustion efficiency	N/A
End-use metering	Flue gas temperature (as a proxy for gas valve position)	N/A	N/A	N/A	Lighting loggers for the onsite sample
EMS logs	N/A	N/A	N/A	SCADA data and boiler logs when available for inspection or download	N/A

As part of the 2016 Nonresidential Deemed Refrigeration Measure Data Collection study, onsites with 40 2016 Refrigeration Case LED Lighting participants were conducted. These data were used to support the gross impact analysis for this measure group.

Furthermore, in prior ESPI evaluation cycles of the agricultural irrigation measure, AMI billing data was used to develop the coincidence factor. However, due to the shortened timeframe of this study, AMI data was not requested in this cycle. We applied the average coincidence factor for field crop measures from the PY2015 evaluation data to determine peak savings for all evaluated sites.

3.1.4 Participant Phone Surveys

We also conducted telephone surveys to support the Net to Gross analysis and 1) confirm with the program participant the measure installation, 2) determine accelerated replacement, natural replacement or replacement on burn-out for measures subject to a dual baseline, 3) estimate free-ridership and 4) gather a variety of data useful to the program assessment, gross impact and ex-ante workpaper review activities.

A market research firm was used to conduct telephone surveys with a representative sample of participants. The questions asked of interviewees were designed to gather information to allow the evaluation team to estimate participant free-ridership to support the development of Net-to-Gross and net savings values. We asked a standard battery of Net-to-Gross questions of all telephone survey respondents.

3.1.5 IOU Workpapers and DEER

The evaluation team also conducted a comparative analysis using ex-ante parameter estimates from the following sources: IOU workpapers, data received directly from the IOUs, data downloaded from DEER and the gross ex-post impacts developed using evaluation data sources. The ex-ante gross impacts for deemed measures are developed with unit energy savings values.

Lifecycle savings are calculated by multiplying the annual unit energy savings by the effective useful life of the measure. The evaluation team 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 each measure.

3.1.6 Industry Sources

Industry sources were used to supplement other evaluation data sources, especially in cases where it is 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 were used to establish robust methods for estimating savings. Some examples include:

- Use of the Uniform Methods Protocols to derive savings estimates
- Use of manufacturer equipment specifications to establish parameters
- Use of performance data available from the Food Service Technology Center
- Use of theoretical irrigation requirements by crop type and climate
- Use of market assessment or market share tracking study results
- Use of literature or interviews with industry experts to establish industry standard practice

3.2 SAMPLE DESIGN AND DATA COLLECTION

3.2.1 Onsite Sample Design

Sampling across measure groups shares a common approach, involving on-site data collection for a sample of points, and conducting M&V for that representative sample following data collection. M&V activities were used to derive independent estimates of ex-post impact estimates and ESPI deliverables, and informed improvements needed to ex-ante impact, EUL and load shape estimates, as well as improvements that can be made to the programs themselves.

Food Service Measure Group

The food service measure group is an important contributor to gas savings within the measures included in this evaluation. Furthermore, we note the following important observations:

- The food service measure group is a gas ESPI measure. **Implication**: only applications/projects with gas savings were included in the sample frame.
- SCG and PG&E contribute the largest share of gas savings in the food services measure group, at 67 and 31 percent, respectively, and with a minority of savings contributed by SDG&E, at 2

percent. **Implication**: only SCG and PG&E applications were sampled, and evaluation results were transferred to establish SDG&E savings.

- The food service measure group mix is highly diverse, consisting of an array of gas measures such as steamers, holding cabinets, convection ovens, conveyor ovens, fryers and more. Furthermore, there is a desire to use the evaluation sample to inform ex-ante impact estimation, but adequate sample size is needed to do so. Additionally, the total sample size of 40 points would only likely support 1 or 2 distinct sub-measures, while meeting statistical rigor expectations. **Implication**: the list of measures being evaluated was narrowed to only gas fryers, which had the highest total savings claimed.
- PG&E program delivery is via downstream and mid-stream approaches. Mid-stream delivery, though it makes up a larger share of participating applications, is noted for having unreliable contact information in the tracking data, especially customer contact name. **Implication**: we used improved contact information stemming from a data request that was submitted to the IOUs. However, evaluators also used business name, address and phone numbers provided to search for and identify an appropriate contact person among mid-stream participants.
- SCG delivery is via a mix of downstream and upstream and all contact information appears to be in good order. **Implication**: the evaluation drew sample points from both populations.

Table 3-3 presents a summary of information surrounding the food service measure group, and the resulting on-site and M&V sample design and the number of on-sites actually visited.

TABLE 3-3: FOOD SERVICE MEASURE GROUP ONSITE SAMPLE DESIGN AND ACHIEVED DATA COLLECTION

Food Service Measure Grouping	PY2017 Tracking Population		Sample Design and Data Collection (Applications)		Achieved Data Collection (% of Population)	
	Applications*	Ex-Ante Net Lifecycle Savings (MMThm)	Target	Actual	% Applications	% Therms
PG&E						
Gas Fryer	589	3.58	20	24	4%	3%
Gas Rack Oven	29	0.82	0	0	0%	0%
Remaining Measures**	357	1.34	0	0	0%	0%
Subtotal	975	5.74	20	24	2%	2%
SCG						
Gas Fryer	1006	6.74	20	20	2%	2%
Gas Rack Oven	60	1.62	0	0	0%	0%
Remaining Measures**	509	3.89	0	0	0%	0%
Subtotal	1575	12.25	20	20	1%	1%
SDG&E						
Gas Fryer	28	0.28	0	0	0%	0%
Gas Rack Oven	1	0.02	0	0	0%	0%
Remaining Measures**	20	0.12	0	0	0%	0%
Subtotal	49	0.42	0	0	0%	0%

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of applications with records of non-zero savings; both positive and negative.

** Remaining gas measures include a mix of steamers, convection ovens, holding cabinets, conveyor ovens, demand controlled ventilation, combination ovens, griddles, etc.

Across utilities with gas saving food service measures, the majority of savings in the food services measure group is contributed by fryers, ranging across the utilities from 55 to 67 percent. The next largest contributing measure is rack ovens, which range across the utilities from 4 to 14 percent representation. Due to the steep drop off in measure savings after fryers, only a single sub-measure was sampled, to best allow for a result that is statistically reliable, while allowing adequate sample points to inform improvements to ex-ante estimates and other evaluation objectives, such as EUL and load shape development. This also mean that all other sub-measures will be passed through during ESPI proceedings.

Overall, we either met or exceeded our targeted number of on-site visits.

Process Boiler Measure Group

Process boiler measures have two distinct sub-categories: steam boilers and water boilers. Table 3-4 presents a summary of the process boiler measure group, segmented by these two sub-categories.

TABLE 3-4: PROCESS BOILER MEASURE GROUP PARTICIPATION SUMMARY – WITH RECORD AND APPLICATION COUNTS AND SAVINGS BY PA AND MEASURE GROUPING, PY2017

Process Boiler Measure Grouping	PY2017 Tracking System Records and Applications		Sum of Gas Ex-Ante Net Lifecycle Savings	
	Records*	Applications**	(MMThm)	Percent
PG&E				
Steam Boiler	18	16	2.88	80%
Water Boiler	2	2	0.73	20%
Subtotal	20	18	3.60	100%
SCG				
Steam Boiler	34	22	1.30	50%
Water Boiler	14	11	1.32	50%
Subtotal	48	33	2.63	100%

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of records with non-zero savings; both positive and negative.

** Count of applications with records of non-zero savings; both positive and negative.

We note the following important observations about the process boiler measure group:

- The process boiler measure group is a gas ESPI measure, and as discussed above, only gas savings were claimed for this measure in PY2017. **Implication**: the full population of applications/projects were included in the sample frame.
- PG&E and SCG contribute all of the gas saving claims in the process boiler measure group, at 58 and 42 percent, respectively. **Implication**: A roughly equal number of sample points were allocated to PG&E and SCG.
- The process boiler measure group includes both steam boilers and water heating boilers. However, the planned gross impact sample size of 15 points will not support the derivation of separate estimates for each class of measure. **Implication**: conduct a sample pull from a population of both measure classes combined and derive a gross impact realization rate using the full sample, both by PA and for both PAs combined. As discussed below, the sample design includes a blend of randomly selected projects and a census of the largest projects.

- Furthermore, although there is a desire to use the evaluation sample to inform ex-ante impact estimation, the sample size is insufficient to support improvement to ex-ante methods for even one, let alone both measure classes. **Implication**: conduct a sample pull from a population of both measure classes combined, and set expectations that the evaluation is unlikely to yield improvements to ex-ante impact methods.

- Process boiler measure program delivery is via downstream provision of deemed participating customer rebates. **Implication**: Reasonable customer contact information is available in the program tracking data, and should suffice for the purposes of on-site recruitment efforts. However, it may also be possible to use improved contact information stemming from the data request that was submitted and response received from the PAs. Evaluators used all available means to reach selected participant sample points.

- On a per-application basis, the water heating boiler measure delivers roughly twice the savings, on average, as a steam boiler measure. **Implication**: Ensure that the sample drawn consists of a roughly proportional savings mix of both measure classes.

Table 3-5 presents a summary of process boiler participation by PA and project size, and the resulting on-site and M&V sample design and the number of on-sites actually visited.

TABLE 3-5: PROCESS BOILER MEASURE GROUP ON-SITE SAMPLE DESIGN AND ACHIEVED DATA COLLECTION

Project Size Strata	PY2017 Tracking Population		Sample Design and Data Collection (Applications)		Achieved Data Collection (% of Population)	
	Applications*	Ex-Ante Net Lifecycle Savings (MMThm)	Target	Actual	% Applications	% Therms
PG&E						
Largest Projects Census Strata	3	1.76	3	2	67%	65%
Remaining Projects Strata	15	1.84	5	6	40%	36%
Subtotal	18	3.60	8	8	44%	50%
SCG						
Largest Projects Census Strata	3	1.33	3	2	67%	83%
Remaining Projects Strata	30	1.30	4	5	17%	12%
Subtotal	33	2.63	7	7	21%	48%

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of applications with records of non-zero savings; both positive and negative.

For a sample design focused on the derivation of gross impact realization rates, often the most efficient sampling procedure involves size stratification of the projects. In this case, for each PA, we created two size strata, with each strata accounting for roughly one-half of the saving claims. The savings is concentrated for each PA among just three large projects, and a stratified design with a census-strata ensures that the largest projects are selected with certainty. Additionally, the remaining smaller projects are selected at random. This balanced approach sought to ensure that the resulting sample represents a significant proportion of the total savings claims directly, while also ensuring that a portion of the sample represents projects that are smaller in size. The resulting evaluation results are applicable to the full measure group population, and thus means that no process boiler claims will be passed through during ESPI proceedings. That is, the resulting realization rate results by PA can be applied to all relevant process boiler claims in the PY2017 sample frame.

Overall, we met our total targeted number of on-site visits, which represented 50% of PG&E's ex-ante net lifecycle savings, and 48% of SCG's.

Pipe Insulation – Hot Application

The pipe insulation (hot application) measure group utilized a combination of downstream and direct installation delivery approaches. Table 3-6 presents a summary of the pipe insulation measure group by delivery approach.

TABLE 3-6: PIPE INSULATION MEASURE GROUP PARTICIPATION SUMMARY WITH SAVINGS BY PA AND DELIVERY METHOD, PY2017

Pipe Insulation Measure Grouping	PY2017 Tracking System Records and Applications		Sum of Gas Ex-Ante Net Lifecycle Savings	
	Records*	Applications**	(MMThm)	Percent
PG&E				
Downstream	93	46	0.98	100%
Subtotal	93	46	0.98	100%
SCG				
Direct Install	31	27	0.04	2%
Downstream	76	28	2.06	98%
Subtotal	107	55	2.10	100%

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of records with non-zero savings; both positive and negative.

** Count of applications with records of non-zero savings; both positive and negative.

From Table 3-6 we note the following observations:

- The pipe insulation measure group is a gas ESPI measure, and as discussed above, only gas savings were claimed for this measure in PY2017. **Implication**: the full population of applications/projects was included in the sample frame.

- PG&E and SCG contribute all of the gas saving claims in the pipe insulation measure group, at 31 and 69 percent, respectively. **Implication**: A similar ratio of sample points was allocated to PG&E and SCG. As the key workpaper assumptions do not significantly vary between PAs, the sample design did not segment by PA, as explained in the paragraph after next.

- Save for a small share of SCG installations labeled “direct install” (2% of SCG therm savings in PY2017), the pipe insulation measure is delivered via downstream provision of deemed participating customer rebates. **Implication**: Due to the small savings share of direct-install participants, the sample design did not segment by delivery method. Reasonable customer contact information was available in the program tracking data and sufficed for the purposes of on-site recruitment efforts. Evaluators used all available means to reach selected participant sample points.

The pipe insulation (hot application) measure had appeared on prior uncertain measure lists and was evaluated in the PY2013-14 and PY2015 ESPI cycles. The two factors that most influence pipe insulation savings are fluid temperature and hours of use. The prior cycles’ sample designs involved segmentation by the key tracking elements that tend to correlate with these variables: facility sector and fluid type. As the current pipe insulation (hot application) workpapers are similar to those from the PY2013-15 cycle, we segmented the sample frame similarly, as illustrated in Table 3-7.

Of the 107 unique projects in PY2017, 101 projects claimed nonzero gas savings. Of those 101 projects, evaluators identified 109 unique fluid-facility type combinations. Therefore, in a few cases, a single participating facility installed insulation on both steam and hot water piping. To be consistent with the workpaper segmentation, evaluators considered such an example as two separate projects. Such segmentation ensured that this study resulted in UES recommendations among the fluid-facility segments prominently featured in PY2017 projects.

Table 3-7 presents a summary of pipe insulation participation by stratum, and the resulting on-site and M&V sample design and the number of on-sites actually visited.

TABLE 3-7: PIPE INSULATION MEASURE GROUP ON-SITE SAMPLE DESIGN AND ACHIEVED DATA COLLECTION

			2017 Tracking Population		Sample Design and Data Collection (Applications)		Achieved Data Collection (% of Population)	
Fluid	**Facility**	**Stratum**	**Ex-Ante Net Lifecycle Savings (Therms)**	**Total Fluid-Facility Combinations (Applications)**	**Target**	**Actual**	**% Applications**	**% Therms**
Hot Water	Com	1	254,463	2	2	2	100%	100%
		2	74,586	6	3	3	50%	62%
		3	10,043	25	0	0	0%	0%
	Ag/Ind	1	183,294	2	2	2	100%	100%
		2	257,494	5	3	4	60%	75%
		3	10,134	2	0	1	50%	92%
Low-Pressure Steam	Com	3	45,059	4	0	0	0%	0%
	Ag/Ind	3	54,826	3	0	1	33%	23%
Medium-Pressure Steam	Com	1	591,660	4	4	4	100%	100%
		2	889,041	43	8	8	19%	21%
		3	45,058	5	0	0	0%	0%
	Ag/Ind	1	428,510	1	1	1	100%	100%
		2	220,678	5	3	4	80%	91%
		3	13,557	2	0	0	0%	0%
Totals			**3,078,402**	**109**	**26**	**30**	**28%**	**69%**

Low-pressure steam installations accounted for only 3% of the total statewide lifecycle therm savings for the pipe insulation (hot application) measure. Therefore, the two low-pressure steam segments were omitted from the gross sample design as well, to achieve highest cost efficiency. This design is consistent with the PY2013-15 evaluation sample designs for the pipe insulation measure. The overall result will be applied to these segments.

Use of SRE sampling techniques ensured that the evaluated sites included the highest savers (strata 1) and excluded the lowest savers (strata 3). The evaluation team was generally successful in achieving the target sites per stratum, with some deviation due to customer refusals or unsuccessful contact. While the evaluators did not intend to recruit any stratum 3 projects—including the limited number of low-pressure steam projects— two were evaluated as they occurred at the same facility as other sampled, higher-saving projects. Overall, the evaluation sample resulted in two more projects than targeted and addressed 69% of the PY2017 population’s net lifecycle therm savings, providing the evaluation team confidence in the representativeness of results.

Agricultural Irrigation

The evaluators examined PY2017 tracking data to design an evaluation sample representative of the population of sprinkler-to-drip irrigation measure participants. We have interpreted the agricultural irrigation measure group to include only the sprinkler-to-drip replacement measure; the agricultural pump upgrades and agricultural pump VFD measures will be addressed in process pumping and pump VFD measure groups, respectively, in subsequent evaluation years.

According to the ESPI decision, the kWh and kW savings associated with the installation of drip irrigation systems are unclear given uncertainties regarding the varying operating schedules and different discharge pressure requirements of affected irrigation pumps.

Table 3-8 presents a summary of information surrounding the agricultural irrigation measure group.

TABLE 3-8: AGRICULTURAL IRRIGATION MEASURE GROUP PARTICIPATION SUMMARY WITH SAVINGS BY PA AND DELIVERY METHOD, PY2017

Agricultural Irrigation Measure Grouping	PY2017 Tracking System Records and Applications		Sum of Electric Ex-Ante Net Lifecycle Savings	
	Records*	Applications**	(GWh)	Percent
		PG&E		
Downstream	44	40	32.5	100%
Subtotal	44	40	32.5	100%

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of records with non-zero savings; both positive and negative.

** Count of applications with records of non-zero savings; both positive and negative.

From Table 3-8 we note the following observations:

- The agricultural irrigation measure group is an electric ESPI measure, and as discussed above, only electric savings were claimed for this measure in PY2017. **Implication**: the full population of applications/projects was included in the sample frame.

- PG&E contributes all of the electric saving claims in the agricultural irrigation measure group. **Implication**: The gross sample consisted only of PG&E projects.

- The agricultural irrigation measure program delivery is via downstream provision of deemed participating customer rebates. **Implication**: The sample design did not segment by delivery method and featured only downstream projects. Reasonable customer contact information was available in the program tracking data and sufficed for the purposes of on-site recruitment efforts. Evaluators used all available means to reach selected participant sample points, including leveraging PG&E account representatives to acquire up-to-date contact information for certain participating customers.

- The agricultural irrigation measure had appeared on prior uncertain measure lists and was evaluated in the PY2013-14 and PY2015 ESPI cycles. However, this measure has evolved since prior cycles and, per the current PG&E workpaper[4], only allows farms with a crop classification of "field vegetable" to participate. Other crop types, such as deciduous crops (fruit and nut trees) and vineyards, were previously eligible in PY2013-15 but were not eligible in PY2017 and beyond. **Implication**: The sample design did not segment by crop.

- Additionally, the agricultural irrigation measure currently only allows upgrades from sprinkler nozzle irrigation to drip irrigation. Prior cycles had allowed low-pressure nozzles or "micronozzles" as high-efficiency replacements but have since been sunset, as reflected in the current PG&E workpaper **Implication**: The sample design did not segment by dispersion technology.

The population of PY2017 sprinkler-to-drip participants consisted of 40 projects, each of which contain at least one measure classified as "Sprinkler to Drip irrigation - Field/Vegs (well and non-well)." Given the relatively small population, evaluators considered a census sample design; however, closer review of the site-by-site savings claims suggested a more optimal sample design that emphasized the highest-saving projects, as reflected in Table 3-9. Evaluators designed the sample using California Evaluation Framework guidance for the stratified ratio estimation sampling technique[5] using lifecycle net kWh savings as the primary variable of interest.

TABLE 3-9: AGRICULTURAL IRRIGATION MEASURE GROUP GROSS IMPACT SAMPLE DESIGN BY SAVINGS STRATUM, PY2017

kWh Savings Stratum	PY2017 Tracking Population		Sample Design and Data Collection (Applications)		Achieved Data Collection (% of Population)	
	Applications*	Ex-Ante Net Lifecycle Savings (GWh)	Target	Actual	% Applications	% GWh
1 (Census)	4	10.3	4	1	25%	25%
2	9	10.1	7	4	44%	43%
3	21	11.2	12	14	57%	63%
4 (Low Savers)	6	0.9	0	0	0	0%
Subtotal	40	32.5	23	19	58%	43%

4 "Work Paper PGECOAGR111 Sprinkler to Drip Irrigation Revision 6," Pacific Gas & Electric Company, January 2016.

5 "The California Evaluation Framework," June 2004, pages 327-339. http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf

Use of SRE sampling techniques ensured that the targeted sites for evaluation included the four highest savers (stratum 1) and excluded the six lowest savers (stratum 4). Stratum 4 (low savers) constituted only 3% of the total PY2017 kWh savings for the measure group and was therefore omitted from the sample design. The evaluation team experienced difficulties in contacting the appropriate project representatives using utility-provided contact data, resulting in only one of the four largest projects being evaluated in the study. Such large projects cannot be replaced with others from Stratum 1; Strata 2 and 3 projects were replaced with backups when possible.

Many farms submit multiple applications in the same program year, which results in significantly fewer unique site contacts than the population of 40 projects. The 23 sampled sites corresponded to only 9 unique contacts. Any site contact that refused participation thus impacted anywhere between one and seven sites in the sample. Of the 19 sites in the actual sample, 6 unique contacts are represented.

To explain the lower-than-expected recruitment rate, we hypothesize that the timing of this study did not align well with farm operating schedules (generally March-October based on the crop types reflected in the sample), resulting in higher rates of non-response. Overall, the evaluation sample accounted for 43% of the PY2017 population's net lifecycle kWh savings.

3.2.2 Telephone Survey Sample Design

Sampling across measure groups involves a common data collection and analysis approach, involving telephone surveys for a sample of points, and, following data collection, estimating net-to-gross (NTG) using established calculations/procedures for each representative sample. Resulting sample-based NTG estimates are used to derive independent estimates of ex-post net impacts, which will be used to inform ESPI deliverables and future ex-ante NTG parameter updates, as well as improvements that can be made to the programs themselves.

Food Service Measure Group

A total sample size of 100 telephone survey points was allocated to the food service measure group. Many of the same observations made above for the on-site sample design are relevant for the telephone survey, leading to the following implications on the sample design:

- We only sampled applications/projects with gas savings.
- We only sampled SCG and PG&E applications, and transferred evaluation results to SDG&E savings where feasible.

Implications that differ from the on-site sample design and/or are more specific to the telephone survey sample design include:

- The food service measure group mix is highly diverse, consisting of an array of gas measures such as steamers, holding cabinets, convection ovens, conveyor ovens, fryers and more. While NTG results at the measure-level might represent a desired outcome, the project timeline does not support telephone survey sample sizes that are adequate to represent an array of unique measure results, and the Workplan sample size is not adequate to represent more than 2 unique gas measures by PA. **Implication**: we developed PA- and segment-level NTGR results that represent all relevant measures in the sample frame combined.

- PG&E program delivery is via downstream and mid-stream approaches, while SCG delivery is via a mix of downstream and upstream approaches. For each delivery approach it is hypothesized that contractors, third-party implementers and distributors/retailers who are engaged with customers and participate in the program delivery process, can have a large influence on the selection of program qualifying equipment in lieu of other available choices in the market place. **Implication**: during telephone surveys with customers concerning their purchase decision, we probed on various influences, both program and non-program.

- Furthermore, each delivery channel for both PG&E and SCG represents a substantial participation channel for food service measures, and represents a substantial level of gas saving claims. **Implication**: the evaluation drew sample points from each of these key PA/delivery channel segments.

- A number of large chains participated in the program. **Implication**: to avoid any bias of over- or under-representing large chain accounts, the population was segmented into large chains and other. A census was attempted on the large chains and the sample design listed below was attempted on the remaining population.

Table 3-10 presents a summary of participation and associated gas saving claim statistics surrounding the food service measure group, by both PA and delivery channel, and the resulting telephone survey sample design and achieved number of surveys completed.

TABLE 3-10: FOOD SERVICE MEASURE GROUP TELEPHONE SURVEY SAMPLE DESIGN AND ACHIEVED DATA COLLECTION

Food Service Measure Delivery	PY2017 Tracking Population		Sample Design and Data Collection (Applications)		Achieved Data Collection (% of Population)	
	Applications*	Ex-Ante Net Lifecycle Savings (MMThm)	Target	Actual	% Applications	% Therms
PG&E						
Downstream	177	2.49	30	45	25%	28%
Mid-Stream	634	3.24	30	21	3%	3%
Upstream	0	0.00	0	0	0	0
Subtotal	**811**	**5.74**	**60**	**66**	**8%**	**14%**
SCG						
Downstream	595	7.20	30	140	24%	4%
Mid-Stream	0	0.00	0	0	0	0
Upstream	934	5.05	30	31	3%	3%
Subtotal	**1529**	**12.25**	**60**	**170**	**11%**	**3%**
SDG&E						
Downstream	45	0.42	0	0	0	0
Mid-Stream	0	0.00	0	0	0	0
Upstream	0	0.00	0	0	0	0
Subtotal	**45**	**0.42**	**0**	**0**	**0**	**0**

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of applications with records of non-zero gas savings; both positive and negative.

The resulting sample design features an allocation of 30 points to each targeted PA/delivery channel segment, and this excludes SDG&E. The resulting design supported ex-post NTGR results for all four PG&E and SCG segments in the ESPI proceedings. For SDG&E, downstream results from PG&E and SCG were transferred to SDG&E for the purposes of deriving ex-post NTGR results.

Our sample size targets were met or exceeded for three of the four segments, as shown above. Overall, we exceeded our total sample quota, surveying 14% of the PG&E population and 3% of the SCG population with respect to ex-ante net lifecycle savings.

Process Boiler Measure Group

For the Process Boiler measure group, 50 telephone survey points were allocated. Furthermore, we note the following important observations:

- The process boiler measure group is a gas ESPI measure, and as discussed above, only gas savings were claimed for this measure in PY2017. **Implication**: the full population of applications/projects was included in the sample frame.
- The full population sample frame incudes just 51 applications, as shown above in Table 3-4. **Implication**: Sampling consisted of a census of points in order to achieve as many completes as feasible/practical.
- For both PAs there are three large projects that constitute roughly 50% of the saving claims. **Implication**: a substantial extra effort was made to ensure that completed surveys were accomplished for each of these six projects. This included outreach to utility representatives to help convince participating customers to comply with our request for a telephone survey. Evaluators used all available means to reach these six participant sample points.
- Process boiler measure program delivery is via downstream provision of deemed participating customer rebates. **Implication**: Reasonable customer contact information is available in the program tracking data, and sufficed for the purposes of telephone survey outreach.

The resulting evaluation results were applied to the full measure group population, and thus means that no process boiler claims will be passed through during ESPI proceedings. That is, the resulting NTGR estimates by PA can be applied to all relevant process boiler claims in the PY2017 sample frame.

For the process boiler measure, we assumed that telephone survey completes would be feasible for roughly half of the available sample frame points, and resulted in an associated allocation of 9 sample points to PG&E and 16 sample points to SCG. Refer to Table 3-11 for a summary of the sample frame, targets and points achieved.

TABLE 3-11: PROCESS BOILER MEASURE GROUP TELEPHONE SURVEY SAMPLE DESIGN AND ACHIEVED DATA COLLECTION

Project Size Strata	PY2017 Tracking Population		Sample Design and Data Collection (Applications)		Achieved Data Collection (% of Population)	
	Applications*	Ex-Ante Net Lifecycle Savings (MMThm)	Target	Actual	% Applications	% Therms
PG&E	18	3.60	9	3	17%	21%
SCG	33	2.63	16	5	15%	37%

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of applications with records of non-zero savings; both positive and negative.

As mentioned above, due to the relatively low population of PY2017 participants, we administered NTG surveys among a census of all participants. As shown above, we were only able to complete 8 NTG surveys in this shortened PY2017 cycle. The following reasons contributed to lower-than-anticipated NTG completes for both this measure and the remaining measures that were sampled, including refrigeration case LED lighting, water heating boiler, pipe insulation hot application, and agricultural irrigation:

- The participant contact data contained within PY2017 tracking data was often unreliable. In some cases, evaluators had to make several follow-up phone calls to identify the appropriate facility contact. Despite extra assistance from PG&E and SCG account representatives, evaluators hit dead ends for many projects in the population.
- In many cases, the project decision-maker could not be reached. This individual(s) is sometimes different from the most appropriate gross contact—typically a facilities manager or maintenance representative.
- Overall, the survey response rate for this evaluation cycle is markedly lower than prior cycles. The evaluation team has observed this among all measure groups for PY2017.
- Finally, the PY2017 evaluation timeframe was reduced compared to typical cycles, limiting the duration of the NTG data collection period.

Refrigeration Case LED Lighting Measure Group

For Refrigeration Case LED Lighting, 50 telephone survey points were initially allocated, but increased to 90 as discussed below. Furthermore, we note the following important observations:

- The refrigeration case LED lighting measure group is both an electric and gas ESPI measure. Furthermore, only the electric saving claims are positive, with the gas saving claims being negative and associated with interactive effects. Also, only PG&E estimates include the negative gas saving claims. **Implication**: relative importance for sampling purposes, and weights associated with downstream analysis, were based on electric saving estimates only.

- PG&E and SDG&E contribute the largest share of electric savings in the refrigeration case LED lighting measure group, at 69 and 29 percent, respectively, and with a minority of savings contributed by SCE, at 2 percent. **Implication**: we only sampled PG&E and SDG&E applications, and transferred evaluation results to SCE savings.

- SDG&E tracking data, which forms the basis for the tables included in this plan, indicate that all program records for the refrigeration case LED lighting measure involve delivery via a downstream incentive approach. However, an interview conducted with the relevant SDG&E Program Manager indicates that in PY2017 all delivery for this measure was via direct installation. **Implication**: the evaluation acknowledges that the resulting tables identify SDG&E participation for this measure as being delivered via downstream, but the discussion in this plan correctly apportions these actions under DI delivery. Also, SDG&E acknowledged this issue some time ago and subsequently corrected it during PY2018.

- PG&E program delivery is via downstream and direct installation approaches, with downstream delivery via a third-party program called EnergySmart Grocer, and DI delivery via an array of LGP programs. Furthermore, both delivery channels for both PG&E represent a substantial participation channel for the refrigeration case LED lighting measure, and represents a substantial level of electric saving claims. For each delivery approach it is hypothesized that contractors, third-party implementers and utility personnel who are engaged with customers and participate in the program delivery process, can have a large influence on the selection of program qualifying equipment in lieu of other available choices in the market place. **Implication**: the evaluation drew sample points from each of these key PG&E delivery channel segments, and during telephone surveys with customers concerning their purchase decision, we probed on various influences, both program and non-program.

- Given that the sample design involves data collection in support of three distinct segments, the Workplan-based sample size of 50 is insufficient and will not support protocol compliant sampling targets of 90/10. **Implication**: To ensure adequate sampling precision in each PA/delivery channel segment, the overall sample size was increased from 50 points to 90.

Table 3-12 presents a summary of participation and associated saving claim statistics surrounding the refrigeration case LED lighting measure group, by both PA and delivery channel, and the resulting telephone survey sample design along with the total number of phone surveys achieved.

TABLE 3-12: REFRIGERATION CASE LED LIGHTING MEASURE TELEPHONE SURVEY SAMPLE DESIGN AND ACHIEVED DATA COLLECTION

Refrigeration Case LED Lighting Measure Delivery	PY2017 Tracking System Records and Applications		Sample Design and Data Collection (Applications)		Achieved Data Collection (% of Population)	
	Applications *	Ex-Ante Net Lifecycle Savings (GWh)	Target	Actual	% Applications	% GWh
PG&E						
Downstream	102	19	30	26	25%	12%
Direct Installation	271	30	30	22	8%	8%
Subtotal	**373**	**49**	**60**	**48**	**13%**	**9%**
SCE						
Downstream	73	1	0	0	0	0
Direct Installation	16	0	0	0	0	0
Subtotal	**89**	**1**	**0**	**0**	**0**	**0**
SDG&E						
Downstream	156	21	30	14	9%	11%
Direct Installation	0	0	0	0	0	0
Subtotal	**156**	**21**	**30**	**14**	**9%**	**11%**

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of records with non-zero savings; both positive and negative.

** Count of applications with records of non-zero savings; both positive and negative.

The resulting sample design features an allocation of 30 points to each targeted PA/delivery channel segment, and this excludes SCE. The resulting design will support ex-post NTGR results for all three PG&E and SDG&E segments in the ESPI proceedings. The overall NTGR was transferred to SCE for the purposes of deriving ex-post NTGR results.

Overall 62 surveys were completed, falling short of the target of 90 (but exceeding the original 50 points allocated in the Work Plan). The competed surveys represent 9% and 11% of PG&E and SDG&E's total ex-ante net lifecycle savings, respectively. As mentioned above under the process boiler measure group, some common reasons contributed to the lower-than-anticipated NTG completion rate.

Water Heating Boiler

The water heating boiler measure group is only being evaluation for net analysis. Table 3-13 illustrates the shares of savings by PA.

TABLE 3-13: WATER HEATING BOILER MEASURE GROUP PARTICIPATION SUMMARY WITH SAVINGS BY PA AND DELIVERY METHOD, PY2017

Water Heating Boiler Measure Grouping	PY2017 Tracking System Records and Applications		Sum of Gas Ex-Ante Net Lifecycle Savings	
	Records *	Applications**	MMThm	Percent
PG&E				
Downstream	28	20	0.67	64%
Midstream	80	49	1.18	36%
Subtotal	**108**	**69**	**1.85**	**100%**
SCG				
Downstream	138	61	3.73	100%
Subtotal	**138**	**61**	**3.73**	**100%**

Source:

CEDARS, 2017. Confirmed Claims Dashboards for 2017 (Cost Effectiveness Output). California Energy Data and Reporting System. Online at cedars.sound-data.com.

* Count of records with non-zero savings; both positive and negative.

** Count of applications with records of non-zero savings; both positive and negative.

From Table 3-13 we note the following observations:

- The water heating boiler measure group is a gas ESPI measure, and only gas savings were claimed for this measure in PY2017. **Implication**: the full population of applications/projects was included in the sample frame.
- Savings were claimed from a total of 130 applications in PY2017. **Implication**: a census of net-to-gross telephone surveys were attempted among all 130 customers in the sample frame.
- PG&E and SCG contribute all of the gas saving claims in this measure group, at 33 and 67 percent, respectively. **Implication**: Given the census attempt of NTG surveys, we did not plan any segmentation of the sample frame by PA. We did not achieve a sufficient count of completed surveys for post hoc analysis by PA.
- Water heater boiler measure delivery occurs through both downstream (79% of total MMtherm savings) and midstream (21%) mechanisms. **Implication**: A downstream-specific NTG telephone

survey was developed and administered among all participants; in some upstream cases, evaluators collected customer contact information from the tracked vendor contact.

As mentioned above, due to the relatively low population of PY2017 participants, evaluators administered NTG surveys among a census of all participants. Evaluators were only able to complete 14 NTG surveys in this shortened PY2017 cycle. As noted above under the process boiler measure group, some common reasons contributed to lower-than-anticipated NTG completion rate.

Pipe Insulation – Hot Application

Due to the relatively low population of PY2017 pipe insulation participants, evaluators administered NTG surveys among a census of all participants. While our objective was to reach a similar count of NTG completes as compared to the gross sample (26), evaluators completed only 7 NTG surveys in this shortened PY2017 cycle. As noted above under the process boiler measure group, some common reasons contributed to lower-than-anticipated NTG completion rates.

Agricultural Irrigation

Due to the relatively low population of PY2017 sprinkler-to-drip irrigation participants, evaluators administered NTG surveys among a census of all participants. While our objective was to reach a similar count of NTG completes as compared to the gross sample (23), evaluators completed 20 NTG surveys in this shortened PY2017 cycle. In addition to the common set of reasons noted above under the process boiler measure group, the following also contributed to the lower-than-anticipated NTG completion rate: While the agricultural irrigation population was 40 projects in PY2017, these projects occurred among 13 unique customers. Therefore, refusal by any individual customer could lead to multiple projects without NTG data.

4 GROSS IMPACT EVALUATION METHODOLOGY

This section provides an overview of the methods used to estimate the gross savings for each of the evaluated ESPI measures identified for PY2017.

4.1 REFRIGERATION LED CASE LIGHTING MEASURES

The gross impact evaluation of PY2017 Refrigeration Case LED lighting measures included on-site verification, installation of data loggers, tracking data review, and engineering analysis activities. The goals of the evaluation were to develop gross realization rates for the measure using primary data collected on-site related to several parameters in the IOU workpaper deemed savings calculations that the ESPI team flagged as data points with a relatively high level of uncertainty.

The sampled measures and their ex-ante unit energy savings are shown in Table 4-1.

TABLE 4-1: REFRIGERATION CASE LED LIGHTING MEASURE CODES AND EX-ANTE SAVINGS

Code	IOU	Measure Description	UES kW	UES kWh	Unit
LB07	PG&E	Linear foot of Tier 2 LED Lightbar, <= 5-foot unit, no occupancy sensor control replacing single lamp profile	0.00	22.1	Length of existing lamps
LB09	PG&E	Linear foot of Tier 2 LED Lightbar, > 5-foot unit, no occupancy sensor control replacing single lamp profile	0.02	86.6	Length of existing lamps
LC03	PG&E	Linear foot of Tier 1 LED Lightbar, > 5-foot unit, no occupancy sensor control replacing multiple lamp profile	0.05	210.0	Length of existing lamps
LC09	PG&E	Linear foot of Tier 3 LED Lightbar, <= 5-foot unit, no occupancy sensor control replacing multiple lamp profile	0.01	56.4	Length of existing lamps
LT-79548	SCE	(1) 72in Retrofits in Medium Temp Reach-in Display Cases LED replacing (1) 72in T12 Linear Fluorescent	0.09	475	Door
402270	SDG&E	Lighting - Premium Tier 5-foot Case Door	0.03	183	Door
402271	SDG&E	Lighting - Premium Tier 6-foot Case Door	0.16	990	Door

Ex-ante claims are based upon IOU-specific, well-documented, workpaper-based approach that was reproduced by the evaluation team, and then subsequently used to provide comparisons against ex-post methods throughout this section.[6] IOU's use different reporting units though. PG&E reports delta watts, demand reductions, and energy savings per linear feet of existing lighting system. SCE and SDG&E report delta watts, demand reductions, and energy savings per refrigerated case door. The general IOU approach is to calculate a delta watt between pre and post lighting and apply interactive effect multiplier, DEER hours of use, and DEER coincident factor variables to arrive at a demand and energy savings (UES) per measure unit. The uncertainty parameters include existing pre-retrofit lighting system characteristics and wattage, annual hours of use, and assumptions related to refrigeration system nameplate efficiency used in interactive effect calculations.

The PY2017 evaluation utilized primary data collected from 40 PY2016 participants by the evaluators in 2017 as part of the PY2013-PY2015 evaluation contract to inform these calculations. These existing data sources consist of evaluation samples that were fielded but had not subsequently been used to estimate program impacts for LED case lighting until this effort. The evaluators installed TOU lighting loggers in refrigeration cases and fielded surveys to collect:

- The schedule of LED lighting operation for 40 distinct participating store schedules
- Self-report LED lighting schedules for those same stores
- Participating store LED make and model numbers supporting lighting connected loads
- Participating store self-report data on baseline lamp type
- Nonparticipating store lamp type designations supporting baseline assessment from 22 stores
- Participating store refrigeration system specifications in support of EER assessment/interactive effects determination, for compressor and condenser systems

The evaluators calculated demand and energy impacts by modifying the algorithms in the IOU workpapers for this measure with data driven adjustments to the following: baseline lighting assumptions (pre-lighting), verified measure counts and wattage (post lighting), and either self-reported hours of use or logger-based hours of use for the case LED lighting system.

First, the evaluators successfully re-calculated the ex-ante UES, 1st year ex-ante savings, and lifecycle savings for all sampled projects and measure codes using tracking data quantities and IOU specific work paper calculations. Our process was to then add each site verified parameter iteratively to derive the final

[6] SCE impacts are based on workpaper SCE13LG098.2, PG&E uses PGECOLTG174 R1, and SDG&E uses WPSDGENRLG0082-Rev02-Msr003

evaluated savings. These include the measure lamp wattage, baseline lamp technology/wattage/lamp profile resulting in existing lighting fixture wattage, self-reported annual hours of use, and finally the logger-based annual hours of use. The final step in the evaluation gross impact analysis was to calculate gross impacts results across all IOU's using the measure lamp quantity as the unit of measure and assuming a one to one replacement of existing fixture with measure fixture. This addresses some assumptions related to assumed number of fixtures per refrigerated case embedded in the deemed savings calculations.

The final evaluated first year kW demand reduction was calculated using the following formula:

$$kW\ Demand\ Reduction = \Delta Watts\ Final\ \times Refrigeration\ Compressor\ Factor \times Coincident\ Demand\ Factor/1000$$

Where,

ΔWatts Final = (Watts of existing fixture – watts of measure fixture) x total quantity of measure lamps as verified through field work.

Refrigeration Compressor Factor = the IOU specific workpaper assumption related to interactive effects of refrigeration system needing to refrigerate less due to reduced heat gain of efficient lamps

Coincident Demand Factor = percent lights that are on during peak period calculated with logger data, where available.

The final evaluated first year kWh energy savings was calculated using the following formula:

$$kWh\ Energy\ Savings = \Delta Watts\ Final\ \times DEER\ Energy\ Interactive\ Effects\ \times Annual\ Hours\ of\ Use\ /1000$$

Where,

ΔWatts Final = (Watts of existing fixture – watts of measure fixture) x total quantity of measure lamps as verified through field work.

DEER Energy Interactive Effects = the IOU specific workpaper assumption related to HVAC interactive effects.

Annual Hours of Use = the number of hours the lighting equipment operates in a year, calculated with logger data, where available.

4.2 PROCESS BOILER MEASURES

The objective of this task was to complete a measure and a measure-parameter impact evaluation of gross savings resulting from the 2017 Small/Medium Commercial Sector Process Boilers measure group administered by both PG&E and SCG. The process boilers measure group entails incentivization of both steam and water heating boilers.

The evaluation completed the following activities in support of this objective:

- Verified the installation and operating conditions of the process boiler installed through the program via onsites for a sample of projects.
- Conduct flue gas testing to determine the measure case efficiency values for the largest projects in the Census strata.

The annual gas energy savings are calculated from the annual operating time, load factor, rated input, and the efficiency ratio of the baseline unit and the new high-efficiency unit. The ex-ante energy savings values for process hot water boilers and process steam boilers are calculated using PA-specific workpapers (WPs). The workpapers reviewed as part of this task are:

- PG&E: PGECOPRO101, Process Boiler Revision 4
- SCG: WPSCGNRPH120206A, Revision 5

Both the WPs listed above present unit energy savings values for both water and steam process boilers expressed as a function of annual operating time, load factor, and the efficiency ratio of the baseline unit and the new high-efficiency unit, bucketed by rated input (capacity) of the boilers. The evaluation team verified the validity of each of these input parameters into the workpaper savings.

All of the evaluated projects had a replace on burnout (ROB) or a new construction (NC) baseline, which were treated akin to ROB, for purposes of setting the baseline efficiency rating, hours of operation determination and load factor calculations. The ex-post values for measure case efficiency, boiler load and operating hours were collected during the onsite via nameplate data collection and participant interviews, in addition to the verification of the boiler installation and operating status. We also verified that each of the sampled boilers met the WP minimum eligibility requirements and were indeed process boilers (i.e., units not primarily used for domestic hot water or space heating use). For the projects in the Census strata, we conducted a flue gas combustion efficiency test to determine the operating efficiency of the boiler during the onsite.

The above data were used in conjunction with the measure-specific workpaper assumptions for load factor and baseline efficiency values to determine a project-specific verified gross savings value. The following algorithm was employed to calculate the project level savings for all evaluated points:

$$\Delta Q = \left[\text{Baseline T x BaselineLF x} \left(\frac{\text{BaselineR}}{100}\right)\right] - \left[\text{EfficientT x EfficientLF x} \left(\frac{\text{EfficientR}}{100}\right) \text{x} \left(\frac{\text{BaselineEff}}{\text{EfficientEff}}\right)\right]$$

Where,

Input Parameter	Definition	Data Source
ΔQ	Energy Saved (therms/yr). Savings which results from installing the high-efficiency equipment.	Ex-post calculation
Baseline T	Baseline Annual Operating Time (hrs/yr). Represents the time that gas equipment is expected to be in operation or available for operation at any rated input (zero load, part load, or full load).	Customer Interview/ Usage Data & SCADA, where possible – same as efficient case due to ROB baseline.
BaselineLF	Baseline Load Factor is the average baseline boiler load during the scheduled operating time.	Customer Interview/ Usage Data & SCADA – same as efficient case due to ROB baseline.
BaselineR	Baseline Rated Input (MBtuh) is the maximum firing rate of the baseline boiler, which is generally equivalent to the nameplate rating.	Same as efficient case due to ROB baseline.
BaselineEff	Baseline boiler efficiency (%)	WP Assumption/ Title 24, Part 6 Requirements
EfficientT	Efficient Annual Operating Time (hrs/yr). Represents the time that gas equipment is expected to be in operation or available for operation at any rated input (zero load, part load, or full load).	Customer Interview/ Usage Data & SCADA, where possible
EfficientLF	Efficient Load Factor is the average efficient boiler load during the scheduled operating time	WP Assumption/Usage Data & SCADA, where possible
EfficientR	Efficient Rated Input (MBtuh) is the maximum firing rate of the efficient boiler, which is generally equivalent to the nameplate rating.	Nameplate Data (Photo/ Specification Sheet)
EfficientEff	Efficient boiler efficiency (%)	Flue Test for Census Strata Points/ Nameplate Data (Photo)

We then rolled up the sampled project-specific gross savings values to the population level to determine the measure realization rate. The evaluation team calculated the lifecycle therms savings by multiplying the verified annual savings by the effective useful life for the process boilers measure group. Section 5 will discuss the detailed approach for estimating each of these individual impact parameters, along with the resulting gross realization rates.

4.3 FOOD SERVICE MEASURES

The primary objective of the impact evaluation was to perform a measure and measure-parameter impact evaluation, utilizing new primary evaluation data, in order to independently derive first year and lifecycle gross savings estimates for gas fryer measures, and to assess gas fryer ex-ante methods and parameters to inform potential updates. Evaluation models were developed to support these objectives, data collection and analyses were conducted in order to derive the following intermediate outputs for each sample point:

- Installed program equipment performance specifications for efficient fryers. Program qualifying gas fryer performance characteristics are based on laboratory testing results obtained from the Food Service and Technology Center (FSTC) where such tests are performed. Field verified make and model was used to perform lookups of the five key measures of equipment performance: pre-heat usage, idle energy rate, cooking efficiency, production rate, and the gas burner input rating.
- Baseline equipment performance for standard practice fryers. Baseline gas fryer performance characteristics are based on a database of testing results obtained from the FSTC. Baseline estimates are based on an average taken across 11 tested fryers with the following characteristics: a standard 14 inch vat width, and with performance specifications that fail to comply with program qualification requirements for both the idle energy rate and cooking efficiency.
- Fryer operating characteristics for eligible program fryers. Key operating characteristics were derived using a combination of short-term metering data and data collected during on-site inspections from a nested sample of projects.
    - Single-channel loggers were deployed in order to support gas valve position – that is valve open and gas to the burner fully on at the rated equipment capacity, or gas valve closed and indicating that the burner is off. A proxy sensor was selected to indicate gas valve position following discussions with experts from the FSTC and the Food Service Equipment Center (FSEC). High temperature thermocouple sensors were deployed into the flue gas, capturing flue gas temperature on a 10 second interval basis. Increasing temperature transitions from sequential readings are a strong indicator of the gas valve position being open, while

decreasing temperatures indicate gas valve closed. Data from each sample point was collected for up to a three-week period. When gas valve open runtime is multiplied with the equipment rated capacity, gas usage results, representing the post-installation condition. These calculations are described in greater detail below for the various equipment operating modes. These modes include fryer off, fryer pre-heat, fryer idle and fryer cooking.

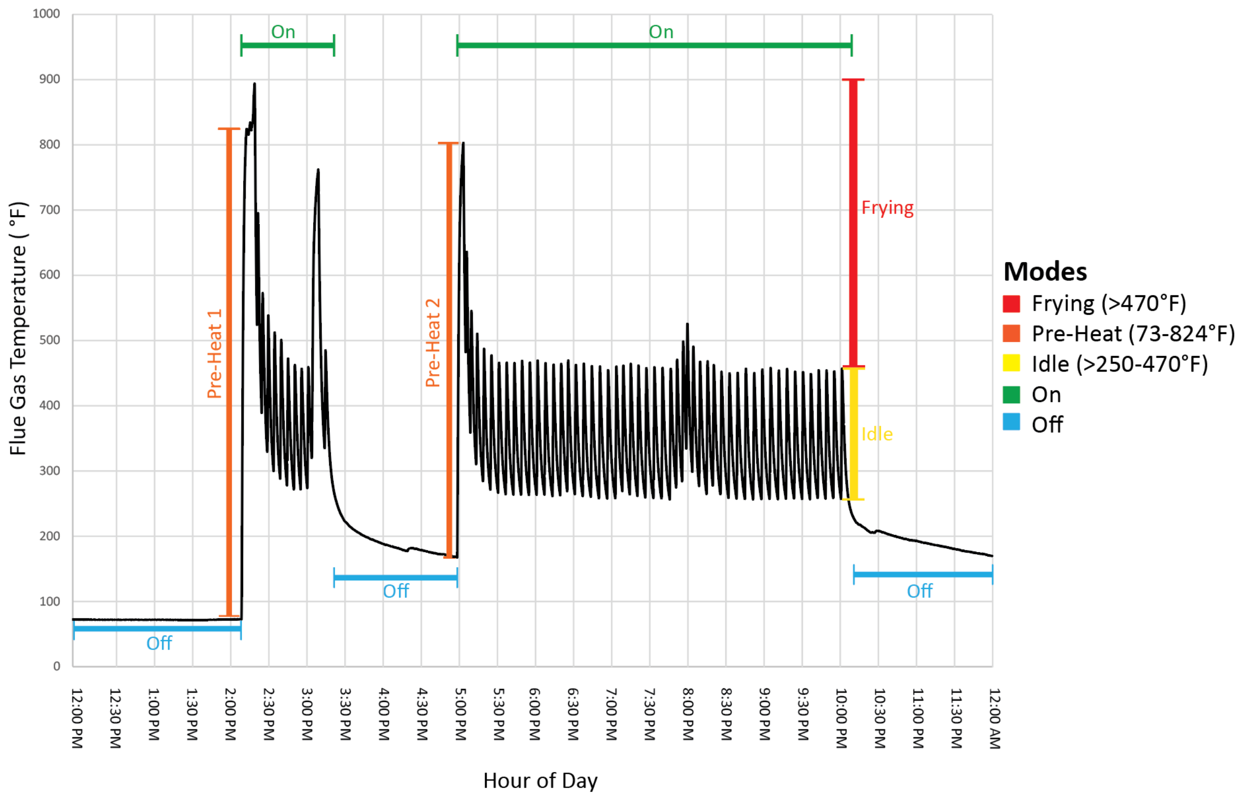
- On-site self-reported schedules of use were used to adjust metering-based observed usage to account for days per year of gas fryer operation. These adjustments account for holidays and days of fryer non-operation.

- On-site data collection efforts were used to identify a class of projects we call zero savers. Zero savers describe projects that do not save energy, either partially due to special circumstances, or entirely due to installation of ineligible equipment and other factors.
  - A partial-zero results from program equipment that are installed and put into service but then are subsequently removed from service – examples include, facility closures, equipment that were observed to be unused, equipment that are no longer in use, and equipment that have been replaced.
  - A full-zero is applied in other instances – for example, closure immediately following equipment installation, equipment that were observed to be unused, no gas fryer installed, and ineligible equipment verified as installed.
- In general, ex-post EUL estimates were left unchanged from the ex-ante value of 12 years. But evaluation-based adjustment were made to capture loss of long-term savings associated with equipment that were removed from operation.

4.3.1 Gas Fryer Operating Mode Determination

Line plots of fryer temperature over time were used to examine and define the operating characteristics of a given fryer sample point on a given day. This is illustrated in Figure 4-1 for one such sample point on December 19, 2018.

FIGURE 4-1: ILLUSTRATIVE DAILY LINE PLOT-BASED FRYER PROFILE



A combination of observed temperature ranges and temperature differences from one 10-second interval observation to the next, were used to derive the duration of various modes of operation in a given day. The plot shown in Figure 4-1 shows the flue gas temperature profile during a selected 12-hour period, and shows the various modes of operation, which includes the following:

- Fryer idling. To get started evaluators choose a flue gas range of temperatures that best represent idle mode. A pattern of up and down lines that are (normally) observed in the data can be used to define the threshold of the idle mode upper and lower temperature bounds for the idle setting.
- Fryer off. When the flue gas temperature falls below a given temperature threshold, typically just below the lower temperature threshold of the idle mode.
- Fryer pre-heat. Pre-heat is defined as a sharp increase in rising temperature following a fryer off period. The duration of pre-heat is set equal to the duration of sequential observations that increase (indicating gas valve open and burner on), until such time that the temperature begins to fall again, indicating gas valve closed.
- Fryer frying. Temperatures above the upper temperature threshold of the of the idle mode.

- Gas valve open during fryer idling. Temperature falls within the idle range and the temperature between sequential observations is increasing.
- Gas valve open during frying. Temperature is above the upper temperature threshold of the idle mode and the temperature between sequential observations is increasing.

These modal settings for each fryer are used to establish hours of operation in any given mode. For any given day/sample point this informs the following: fryer operation schedule, the total duration of time spent in idle mode, frying mode and pre-heat mode, and gas valve open runtime (hours) in each of those modes.

4.3.2 Estimating Efficient Fryer Gas Usage

For efficient fryers the evaluation model estimates annual hours of gas runtime (gas valve open) in each mode by incorporating self-report data to augment metering data, as needed. Gas usage in any given mode is simply set equal to the product of the number of hours and the equipment input rating in Btu/hr. This yields gas usage in Btu's, which is readily converted to therms using a 100,000 Btu/therm constant. To derive the annual gas usage of an efficient fryer, we simply need to calculate the following:

- $EffUsage_{pre\text{-}heat}$ (therms) = $Hours_{pre\text{-}heat}$ (hours) x $EffInput_{rating}$ (Btu/hr) / 100,000 (Btu/therm)
- $EffUsage_{idle}$ (therms) = $Hours_{idle\_open}$ (hours) x $EffInput_{rating}$ (Btu/hr) / 100,000 (Btu/therm)
- $EffUsage_{frying}$ (therms) = $Hours_{frying\_open}$ (hours) x $EffInput_{rating}$ (Btu/hr) / 100,000 (Btu/therm)
- $EffUsage_{total} = EffUsage_{pre\text{-}heat} + EffUsage_{idle} + EffUsage_{frying}$

Where,

- $EffUsage_{pre\text{-}heat}$ is the estimated annual gas consumption of an energy efficient fryer when operating in pre-heat mode
- $Hours_{pre\text{-}heat}$ is the estimated annual hours of gas consumption for an energy efficient fryer when operating in pre-heat mode, during which the gas valve is in the fully open position
- $EffInput_{rating}$ is the gas input rating of an energy efficient fryer, as reported by the manufacturer
- $EffUsage_{idle}$ is the estimated annual gas consumption of an energy efficient fryer when operating in idle mode
- $Hours_{idle\_open}$ is the estimated annual hours of gas consumption for an energy efficient fryer when operating in idle mode, during which the gas valve is in the fully open position

- $EffUsage_{frying}$ is the estimated annual gas consumption of an energy efficient fryer when operating in frying mode
- $Hours_{frying\_open}$ is the estimated annual hours of gas consumption for an energy efficient fryer when operating in frying mode, during which the gas valve is in the fully open position
- $EffUsage_{total}$ is the estimated annual gas consumption of an energy efficient fryer across all modes of operation

4.3.3 Estimating Baseline Fryer Gas Usage

For baseline fryers the evaluation model estimates baseline usage by mode using resulting efficient fryer usage, based on methods described above, in combination with both efficient fryer performance data and baseline fryer performance data. Gas usage in any given mode is simply set equal to the efficient fryer result by mode multiplied by a ratio of baseline and efficient fryer performance parameters. This yields gas usage for a baseline fryer in each mode of operation. To derive the annual gas usage of a baseline fryer, we simply need to calculate the following:

- $BaseUsage_{pre\text{-}heat}$ (therms) = $EffUsage_{pre\text{-}heat}$ (therms) x $BasePerf_{pre\text{-}heat}$ (Btu) / $EffPerf_{pre\text{-}heat}$ (Btu)
- $BaseUsage_{idle}$ (therms) = $EffUsage_{idle}$ (therms) x $BasePerf_{idle}$ (Btu/hr) / $EffPerf_{idle}$ (Btu/hr)
- $BaseUsage_{frying}$ (therms) = $EffUsage_{frying}$ (therms) x $EffPerf_{frying}$ (%) / $BasePerf_{frying}$ (%)
- $BaseUsage_{total} = BaseUsage_{pre\text{-}heat} + BaseUsage_{idle} + BaseUsage_{frying}$

Where,

- $BaseUsage_{pre\text{-}heat}$ is the estimated annual gas consumption of a baseline fryer when operating in pre-heat mode
- $BasePerf_{pre\text{-}heat}$ is the gas consumption for a baseline fryer when operating in pre-heat mode, when tested in a laboratory under American Society for Testing and Materials (ASTM) Standard Test Method for the Performance of Open Deep Fat Fryers (F1361)
- $EffPerf_{pre\text{-}heat}$ is the gas consumption for an efficient fryer when operating in pre-heat mode, when tested in a laboratory under ASTM F1361
- $BaseUsage_{idle}$ is the estimated annual gas consumption of a baseline fryer when operating in idle mode
- $BasePerf_{idle}$ is the idle energy rate for a baseline fryer, when tested in a laboratory under ASTM F1361

- $EffPerf_{idle}$ is the idle energy rate for an efficient fryer, when tested in a laboratory under ASTM F1361
- $BaseUsage_{frying}$ is the estimated annual gas consumption of a baseline fryer when operating in frying mode
- $BasePerf_{frying}$ is the calculated cooking efficiency for a baseline fryer, when tested in a laboratory under ASTM F1361
- $EffPerf_{frying}$ is the calculated cooking efficiency for an efficient fryer, when tested in a laboratory under ASTM F1361
- $BaseUsage_{total}$ is the estimated annual gas consumption of a baseline fryer across all modes of operation

4.3.4 Estimating Gas Fryer Impacts

Gas fryer first year gross impacts are set equal to the following:

- $FryerImpact_{total} = BaseUsage_{total} - EffUsage_{total}$

Where,

- $FryerImpact_{total}$ is the estimated difference in annual gas consumption between a baseline fryer and an efficient fryer across all modes of operation

4.3.5 Effective Useful Life Estimation

Adjustments to ex-ante effective useful life are applied under conditions where the equipment were installed and subsequently removed, or where the facility was closed. In such cases the program equipment is no longer available for inspection, and adjustment to the EUL provides a credit to the program for potential savings associated with the claimed credit. The EUL in such instances is set equal to the duration of time that a given program installation was determined to be in service, based on best available data sources.

For all other zero saver cases, the ex-post EUL is retained at the ex-ante EUL estimate of 12 years. This is to ensure that savings reductions are not double-counted across the EUL and gross impact realization rate results for any given sample point. In all such cases the program-installed equipment, if any were ever determined to be installed, were still available for inspection, but found to be inoperable, and with current operations representative of typical operation across the sample as a whole. CPUC guidance is always to evaluate the as-found conditions. In other cases, the program equipment is never installed, as was the case for missing equipment, or where ineligible equipment were found to be installed; in these cases the ex-ante EUL is also retained.

4.4 AGRICULTURAL IRRIGATION MEASURES

The primary objective of the impact evaluation was to perform a measure and measure-parameter impact evaluation, utilizing new primary evaluation data, in order to update existing gross and net savings estimates and inform future savings values for the agricultural irrigation measure identified in the ESPI decision. Per PY2017 tracking data, the agricultural irrigation measure category includes agricultural pump upgrades, agricultural pump VFDs, and conversions of irrigation nozzles. The pump upgrades and VFDs will be considered within the process pumping measure group, which is targeted for evaluation in PY2018. Therefore, the PY2017 evaluation addressed only the sprinkler-to-drip irrigation conversions, as described in the following paragraphs.

For drip irrigation conversions, electric savings arise from reduced discharge pressure at the irrigation pump (i.e., the pump is required to perform less work to irrigate the crop). The general approach used to estimate ex-post gross savings first considered all available data. As discussed, the challenge in calculating pumping savings is determining the pump head pressure (or associated loading level) of the pre-existing irrigation system's pump(s). In order to characterize the pre-conversion pump operation, evaluators relied on pre-project utility bills, when available. However, as many participating farms featured conversions in crop type and/or irrigation method at the time of the installation, a fair comparison of pre- and post-project utility meter data required normalization by the amount of water delivered after the conversion.

Two methods for normalization were employed by evaluators, depending on the availability, quality, and comparability of pre/post utility consumption data. Regardless of the site-level approach for generating gross ex-post savings values, data collection activities remained consistent for each site. For every project, evaluators administered an engineering telephone survey to collect information needed to ensure fair pre/post comparison of relevant parameters. For verification purposes, evaluators followed up with a visit to approximately half of the surveyed sites in order to inspect a selection of the installed equipment and gain clarity on information collected during the phone survey. Relevant parameters for which detailed information was gathered can be found in the following section while a breakdown of all/additional parameters can be found in Appendix B.

Each of the two evaluation methods are described below, in order of preference.

1. Analysis of pre/post electric bills normalized to water consumption

The evaluator's preferred method for assessing project impacts is characterized by the following formula:

$$\Delta E = \sum_{i=1}^{12}\left[\left(\frac{E}{V}\bigg|_{pre,i} - \frac{E}{V}\bigg|_{post,i}\right) \times V_{post,i}\right]$$

Where,

ΔE = Annual electric energy savings in kWh. This parameter represents the ex-post savings objective of this study.

E_i = Monthly electric energy consumption during month i, obtained via data requested from the IOU. Pre- and post-intervention consumption values are denoted with the subscripts pre and $post$, respectively.

V_i = Total volume of water delivered to the affected field during month i, in units of *acre-feet*. As many participating farms rely on private well water rather than municipally-owned and metered water supplies, historic water usage records were typically not available. Instead, evaluators gathered detailed information on field acreage, crop type, crop age, irrigation method, and irrigation schedule (as described above) to calculate the water requirement of the crop.[7] Normalization by the required acre-feet in pre- and post-intervention cases ensured a fair comparison between pre—and post-intervention electric consumption.[8]

[7] Engineers attempted to collect survey data on irrigation runtime and frequency by month of the year, to determine the site-specific irrigation operating hours and subsequent water volume. However, in some cases, the interview data was insufficient, and the engineers referenced theoretical water requirement data from various sources (as a function of crop type and location) to estimate the pre- and post-project water volumes for normalization in the energy savings calculation.

[8] The normalization also took into account the different water application efficiencies (the amount of water reaching the crop over the total amount of discharged water) of various irrigation methods, per the following reference: https://www.dropbox.com/s/jqbc1j92c4ckuln/Application%20Efficiencies%20-%20UCDavis%20-%20Sandoval%20Solis%20et%20al%202013%20-%20Report.pdf

2. Analysis of project impacts from discharge pressure reduction

When utility consumption data was incomplete or incomparable between pre/post cases, the evaluators assessed project impacts via calculation of the change in pumping power requirement from the drip irrigation system's reduction in pumping discharge pressure, as follows:

$$\Delta E = \frac{1.0241 \times (TDH_{pre} - TDH_{post})}{OPE} \times V_{annual}$$

ΔE = Annual electric energy savings (kWh per year). This parameter represents the ex-post savings objective of this study.

1.0241 = Conversion constant (kWh / acre-foot / feet of head). Converts pump operating pressure difference and annual water requirement into electric energy impact seen at pump.

V_{annual} = Total volume (acre-feet) of water delivered per year, calculated as the sum of the twelve monthly volumes in the previous evaluation method. As many participating farms featured conversions in crop type and/or irrigation method at the time of the project installation, this value was assumed to be the installed water requirement to ensure a fair comparison of pre- and post-project energy usage.

TDH_{pre} = Total dynamic head (feet) of the pre-existing irrigation pumping system. This information was not available in PA tracking data; instead, the evaluators estimated this value from customer interviews and information on irrigation method, well depth, theoretical water requirement, and irrigation operating hours.

TDH_{post} = Total dynamic head (feet) of the installed (low-pressure) irrigation pumping system. Several farmers monitor this value closely and provided rich information for evaluators to determine a representative value in the savings calculation. Evaluators sought to estimate this value via gauge reading when possible, but due to the timing of the study, all affected irrigation pumps were not operating at the time of the site visits.

OPE = The pumping system's overall plant efficiency (unitless). Participating farms were required to complete an OPE assessment within a year of program application; OPEs of 45% or greater were required for program eligibility. Evaluators requested the most recent pump tests that would indicate post-project OPE; however, these records were typically not available from the participating farmer. OPE has been typically estimated by PAs between 45-55% based on field studies.

Non-coincident demand savings (in kW/acre) was calculated using similar equations and parameters presented above.

The above values were informed by researched parameters, including operating hours, changes in irrigation pump discharge pressures, and installation rates. These parameters are discussed in more detail in Section 5, along with the resulting gross realization rates. None of these parameter-level average values are directly used to calculate the realization rates; they are presented for informational purposes only. Unless otherwise indicated, all parameter-level averages have been weighted by project acreage, to ensure that the largest projects are fairly represented.

4.5 PIPE INSULATION MEASURES

The primary objective of the impact evaluation was to perform a measure and measure-parameter impact evaluation, utilizing new primary evaluation data, in order to update existing gross and net savings estimates to inform future savings values for the pipe insulation measures identified in the ESPI decision.

As part of previous evaluation efforts this team has learned that consequential factors affecting pipe insulation measures were: whether the measures are eligible (for example, insulation to prevent burns does not qualify), fluid temperatures, insulation area, installed R-values, and annual operating schedule. We can determine these with only a single site visit for most sampled projects.

The general approach used to estimate pipe insulation gross impacts is based on developing hourly heat loss profiles for both baseline (bare or previously-insulated pipe) and as-built (insulated pipe) conditions. Heat loss calculations reflect conduction, convection, and radiation heat transfer. Spot measurements and metered data, when it is appropriate, support specific parameters included in the following algorithm:

$$\Delta Q = \frac{t \times \left(Q_p - Q_i\right)}{100{,}000 \times E_b}$$

Where:

> ΔQ = annual energy savings (in therms). For instances in which pipe insulation was required by OSHA, the evaluation team adjusted the project baseline to reflect the minimum OSHA-compliant insulation level.
>
> t = annual operating time, in hours. Annual operating time was determined primarily through facility staff interviews, or metered data if the profile was determined to have high uncertainty and adequate metering duration was possible. Metered data on pipe surface temperature

indicated when the insulated pipe transmits heated fluid. Metered data, generally gathered over 1-2 weeks, was extrapolated to represent a full year, after accounting for any seasonal variations determined from facility staff interviews.

Q_p = Heat Loss from Bare Pipe (Btu/hr/ft). Bare pipe experiences heat loss from convection and radiation processes. Both convection and radiation heat losses are primarily dependent on two parameters, pipe surface temperature and ambient temperature. Evaluators measured pipe surface temperature with spot readings from infrared temperature guns and inspection of fluid gauges. Other relevant parameters such as pipe conductivity and pipe emissivity were referenced from a heat transfer resource based on material type. To calculate the baseline heat loss, evaluators utilized insulation calculator 3E-Plus software. Evaluators collected information on the age and condition of the preexisting pipe insulation, replacement practices and the history of past replacements, through on-site survey(s) with facility staff.

Q_i = Heat Loss from Insulated Pipe (Btu/hr/ft). Insulated pipe features convection and radiation heat transfer processes, as described above, but also involves conduction heat transfer between the pipe and insulating material. The insulation's surface temperature was spot-measured during the site visits, and relevant insulation parameters (conductivity and emissivity) were referenced from manufacturer data. Evaluators used 3E-Plus software to calculate heat loss from insulated pipe using information collected during the site visit.

E_b = Efficiency (%) of the boiler being used to generate the hot water or steam in the pipe. Overall boiler efficiency accounts for losses during combustion processes as well as boiler skin losses. Combustion efficiency was estimated based on review of equipment specifications of site-specific equipment.

$100{,}000$ = conversion factor (1 therm = 100,000 Btu).

Each above parameter was calculated for each distinct pipe run, such as pipe diameter, insulation thickness, and fluid type. Researched parameters, including bare pipe temperature, surrounding temperature, boiler operating hours, boiler efficiency, and installation rates can be used to assess ex-post performance for PY2017.

Section 5 will discuss the detailed approach for estimating each of these individual impact parameters, along with the resulting gross realization rates.

5 GROSS IMPACT EVALUATION RESULTS

This section compares and contrasts ex-ante and ex-post gross impact results, and model-based parameters that contribute to each result. The intent of this effort is to demonstrate where differences in modeling approach, inputs and assumptions can lead to differences in impact results, and to best explain why those differences exist. This effort also encourages sharing of information derived by the ex-post evaluation that can be used to potentially improve alignment between ex-post and ex-ante gross impact results, and thus lessen the gap between the two approaches on a going forward basis, where warranted.

5.1 REFRIGERATION LED CASE LIGHTING MEASURES

The gross impact evaluation sampling and analysis focused on the Refrigerated Case LED lighting measure group which included seven unique measure codes across the three utilities, as described in the methodology section.

5.1.1 First Year Gross Impact Results

Table 5-1 through Table 5-3 present the first-year gross impacts for the PG&E, SCE, and SDG&E sample points.

TABLE 5-1: FIRST YEAR GROSS IMPACT RESULTS FOR PG&E SAMPLE POINTS

	Ex-Post		Ex-Ante		Results	
Sample Point Identifier	First Year Gross Impact kW Savings	First Year Gross Impact kWh Savings	First Year Gross Impact kW Claims	First Year Gross Impact kWh Claims	First Year Gross Impact kW Realization Rate	First Year Gross Impact kWh Realization Rate
PG&E-1	1.51	5,337	3.22	15,120	0.47	0.35
PG&E-2	1.14	4,343	2.41	11,340	0.47	0.38
PG&E-3	2.65	11,581	5.63	26,460	0.47	0.44
PG&E-4	2.15	8,203	4.56	21,420	0.47	0.38
PG&E-5	1.39	5,943	2.95	13,860	0.47	0.43
PG&E-6	1.61	4,842	2.95	13,860	0.55	0.35
PG&E-7	2.05	6,162	3.75	17,640	0.55	0.35
PG&E-8	2.49	12,245	4.56	21,420	0.55	0.57
PG&E-9	2.56	8,624	1.10	5,196	2.32	1.66
PG&E-10	0.90	3,647	1.88	8,820	0.48	0.41
PG&E-11	2.45	10,979	5.10	23,940	0.48	0.46
PG&E-12	1.56	5,949	2.95	13,860	0.53	0.43
PG&E-13	1.68	6,403	3.49	16,380	0.48	0.39
PG&E-14	2.40	15,717	5.36	25,200	0.45	0.62
PG&E-15	2.27	14,890	4.83	22,680	0.47	0.66
PG&E-16	0.42	1,613	0.33	1,547	1.27	1.04
PG&E-17	1.40	5,360	1.81	8,524	0.77	0.63
Total	30.6	131,837	56.9	267,267	0.54	0.49
Average	1.80	7,755	3.35	15,722	0.54	0.49

The gross kW and kWh realization rate for PG&E sampled points is 0.54 and 0.49, respectively. The driver of low realization rates for the sites with realization rates less than one is primarily due to the differences in the delta watts attributed to both evaluated existing and evaluated measure fixture wattage. There were only two instances where the verified units (length feet) were different than the ex-ante claims and they were minor, equivalent to one fixture at one site and two fixtures at another site.

LC03 and LC09 assume the measure lighting fixture replaces a two-lamp fixture, referred to as a multiple lamp profile. LC03 assumes an existing fixture with two six-foot T12 high output lamps, with fixture power draw of 300 Watts. As discussed in more detail below, based on the interviews with site contacts at sampled sites, the evaluators changed the existing fixture wattage to reflect a two-lamp T8 fixture with fixture wattage of 125 Watts. The LC03 and LC09 measure codes assumes one 16.5 Watt LED fixture replacing the 300 Watt T12 fixture. Evaluators verified one manufacturer and model of LED lighting fixture in most of the sample points across the state including PG&E territory. The documentation for this LED fixture is 26 Watts as verified from technical specifications and the Design Lights Consortium (DLC) product directory. Therefore, the delta watts are greatly reduced for these measure codes with LC03 being impacted more than measure code LC09. These findings are discussed in more detail below in section 5.1.2

TABLE 5-2: FIRST YEAR GROSS IMPACT RESULTS FOR SCE SAMPLE POINTS

	Ex-Post		Ex-Ante		Results	
Sample Point Identifier	First Year Gross Impact kW Savings	First Year Gross Impact kWh Savings	First Year Gross Impact kW Claims	First Year Gross Impact kWh Claims	First Year Gross Impact kW Realization Rate	First Year Gross Impact kWh Realization Rate
SCE-1	2.04	8,296	2.01	10,440	1.02	0.79

The one SCE site has a demand realization rate of 1.02 and energy realization rate of 0.79. SCE measures assume 1.2 fixtures per door, or six fixtures per five door case, in their calculations. As discussed in more detail below, the surveyors verified one fixture per door thus driving down the delta watts, demand and energy realization rates for this site.

TABLE 5-3: FIRST YEAR GROSS IMPACT RESULTS FOR SDG&E SAMPLE POINTS

	Ex-Post		Ex-Ante		Results	
Sample Point Identifier	First Year Gross Impact kW Savings	First Year Gross Impact kWh Savings	First Year Gross Impact kW Claims	First Year Gross Impact kWh Claims	First Year Gross Impact kW Realization Rate	First Year Gross Impact kWh Realization Rate
SDG&E-1	1.93	7,363	1.80	10,924	1.07	0.67
SDG&E-2	2.23	5,999	6.19	37,630	0.36	0.16
SDG&E-3	1.65	5,796	2.44	14,854	0.67	0.39
SDG&E-4	4.76	17,664	4.07	24,756	1.17	0.71
SDG&E-5	6.80	23,697	6.51	39,610	1.04	0.60
SDG&E-6	4.49	15,659	4.23	25,747	1.06	0.61
SDG&E-7	0.91	3,167	3.26	19,805	0.28	0.16
SDG&E-8	3.16	12,827	2.93	17,825	1.08	0.72
SDG&E-9	0.70	3,049	2.28	13,864	0.31	0.22
SDG&E-10	0.43	1,635	1.30	7,922	0.33	0.21
SDG&E-11	0.55	2,185	1.79	10,893	0.31	0.20
SDG&E-12	4.25	21,103	4.56	27,727	0.93	0.76
SDG&E-13	1.36	6,907	1.47	8,912	0.93	0.77
SDG&E-14	0.76	3,443	2.44	14,854	0.31	0.23
SDG&E-15	4.76	19,781	4.56	27,727	1.04	0.71
SDG&E-16	7.66	31,665	7.25	44,120	1.06	0.72
SDG&E-17	1.55	10,077	5.37	32,678	0.29	0.31
SDG&E-18	0.66	4,275	4.56	27,727	0.14	0.15
SDG&E-19	1.47	9,567	1.47	8,912	1.00	1.07
SDG&E-20	0.94	6,107	3.26	19,805	0.29	0.31
SDG&E-21	1.27	8,245	3.91	23,766	0.32	0.35
SDG&E-22	0.94	6,107	3.26	19,805	0.29	0.31
Total	53.2	226,317	78.9	479,861	0.67	0.47
Average	2.4	10,287	3.6	21,812	0.67	0.47

Similar to SCE, the SDG&E measure codes assume 1.2 fixtures per door, or six fixtures per five door case, in their calculations. As discussed in more detail below, the evaluators consistently verified less than 1.2 fixtures per door thus driving down the delta watts, and realization rates for all SDG&E sites.

The sampled points with lower realization rates are sites with self-reported existing lamp technology of T8 lamps, resulting in lower delta watts and realization rates. This is discussed more below in the measure impacts section.

Also note that for site ID SDG&E-18, it appears this project submitted claims for the same measures twice within the same program year; once under the direct install program and once through the downstream program. The claims in the tracking data are identical except for the program name and building type and the surveyors verified the number of measure units matches each claim. It appears that T8 fixtures were originally in place, then retrofitted with LEDs, which were subsequently retrofitted with LEDs once more. Furthermore, the self-reported existing lighting system is LED. We therefore modeled the baseline as T8, but with an installation rate of only 50% since only half of the total installed measures were still in place.

5.1.2 First Year Measure Impact Results

The total ex-ante claimed and evaluated savings for each of the measure codes claimed by the sample points is summarized in Table 5-4. As is evident from the table, most of the demand and energy savings in the sample are attributed to measure LC03 in PG&E territory and measure 402271 in SDG&E territory.

TABLE 5-4: FIRST YEAR EX-POST GROSS IMPACT RESULTS FOR SAMPLED MEASURE CODES

		Ex-Post		Ex-Ante		Results	
IOU	Measure Code	First Year Gross Impact kW Savings	First Year Gross Impact kWh Savings	First Year Gross Impact kW Claims	First Year Gross Impact kWh Claims	First Year Gross Impact kW Realization Rate	First Year Gross Impact kWh Realization Rate
PG&E	LB07	0.49	1,888	0.37	1,724	1.34	1.10
PG&E	LB09	2.56	8,624	1.10	5,196	2.32	1.66
PG&E	LC03	26.24	116,240	53.64	252,000	0.49	0.46
PG&E	LC09	1.33	5,085	1.78	8,347	0.75	0.61
SCE	LT-79548	2.04	8,296	2.01	10,440	1.02	0.79
SDG&E	402270	0.58	2,261	0.42	2,561	1.37	0.88
SDG&E	402271	52.66	224,055	78.47	477,301	0.67	0.47

Existing Lighting Fixture Wattages

The existing fixture assumptions and resulting fixture wattage used in the ex-ante calculations are summarized in below in Table 5-5. For example, the table shows PG&E measure code LC03 assumes the existing lighting fixture is a 300-Watt T12 fixture consisting of two six-foot T12 high output lamps. SDG&E measure code 402271 assumes a similar fixture as LC03, except it is a one lamp fixture at 150 Watts.

TABLE 5-5: EX-ANTE EXISTING FIXTURE WATTAGE ASSUMPTIONS

IOU	Measure Code	Existing Lamp Technology	Existing Lamp Length	Existing Lamp Profile	Existing Fixture Wattage
PG&E	LB07	Single	5	T8	52.3
PG&E	LB09	Single	6	T12	149.8
PG&E	LC03	Multiple	6	T12	299.5
PG&E	LC09	Multiple	5	T8	104.5
SCE	LT-79548	Single	6	T12	97
SDG&E	402270	Single	5	T8	52.3
SDG&E	402271	Single	6	T12	149.8

Surveyors asked the site contacts at the forty sites about the existing lighting system prior to replacing it with the LED fixtures. In cases when the site contact was able to provide information on the baseline equipment technology (T8 or T12), or when the surveyor found evidence of the baseline equipment technology, that information was used. Twenty-four sites reported T8 technology, and three reported T12. Another site, SDG&E-18 discussed earlier, reported replacing LEDs. However we used T8 equipment as the baseline as mentioned above because the original equipment was T8 and subsequently replaced twice with LEDs. Another two sites indicated LED, which we decided to treat conservatively as T8 because we believed this to be unlikely and did not have any on-site evidence to support the pre-existing LED. Finally, for the remaining sites that did not know the pre-existing equipment type, we defaulted to the technology assumptions used in the ex-ante calculations as described in Table 5-5.

We also maintained the lamp profile used in the ex-ante assumptions. However, we question the use the LC03 code for the applications we verified on-site at PG&E sites. The primary reason is that the three IOU utilities work papers include language that multiple lamp profile fixtures are typically found in horizontal case canopies, and the single lamp profiles are typically found in vertical reach-in cases. SCE separates out canopy measures separately from vertical case measures and the multiple lamp profiles are only available for the canopy case applications.

Table 5-6 through Table 5-7 report on the existing lighting assumptions used in ex-ante calculations and the final evaluated values for the three utilities.

TABLE 5-6: EXISTING FIXTURE CHARACTERISTICS AND WATTAGES FOR PG&E SAMPLE

	Ex-Ante			Ex-Post Final		
Sample Point Identifier	Existing Lamp Technology	Existing Lamp Length	Existing Fixture Wattage	Existing Lamp Technology	Existing Lamp Length	Existing Fixture Wattage
PG&E-1	T12	6.0	299.5	T8	6.0	125.4
PG&E-2	T12	6.0	299.5	T8	6.0	125.4
PG&E-3	T12	6.0	299.5	T8	6.0	125.4
PG&E-4	T12	6.0	299.5	T8	6.0	125.4
PG&E-5	T12	6.0	299.5	T8	6.0	125.4
PG&E-6	T12	6.0	299.5	T8	6.0	125.4
PG&E-7	T12	6.0	299.5	T8	6.0	125.4
PG&E-8	T12	6.0	299.5	T8	6.0	125.4
PG&E-9	T12	6.0	149.8	T12	6.0	149.8
PG&E-10	T12	6.0	299.5	T8	6.0	125.4
PG&E-11	T12	6.0	299.5	T8	6.0	125.4
PG&E-12	T12	6.0	299.5	T8	6.0	125.4
PG&E-13	T12	6.0	299.5	T8	6.0	125.4
PG&E-14	T12	6.0	299.5	T8	6.0	125.4
PG&E-15	T12	6.0	299.5	T8	6.0	125.4
PG&E-16	T8	5.0	52.3	T8	5.0	52.3
PG&E-17	T8	5.0	104.5	T8	5.0	52.3

TABLE 5-7: EXISTING FIXTURE CHARACTERISTICS AND WATTAGES FOR SDG&E SAMPLE

	Ex-Ante			Ex-Post Final		
Sample Point Identifier	Existing Lamp Technology	Existing Lamp Length	Existing Fixture Wattage	Existing Lamp Technology	Existing Lamp Length	Existing Fixture Wattage
SDG&E-1	T8	5	52.3	T8	5	52.3
SDG&E-2	T12	6.0	149.8	T8	6.0	62.7
SDG&E-3	T12	6.0	149.8	T8	6.0	62.7
SDG&E-4	T12	6.0	149.8	T12	6.0	149.8
SDG&E-5	T12	6.0	149.8	T12	6.0	149.8
SDG&E-6	T12	6.0	149.8	T12	6.0	149.8
SDG&E-7	T12	6.0	149.8	T8	6.0	62.7
SDG&E-8	T12	6.0	149.8	T12	6.0	149.8
SDG&E-9	T12	6.0	149.8	T8	6.0	62.7
SDG&E-10	T12	6.0	149.8	T8	6.0	62.7
SDG&E-11	T12	6.0	149.8	T8	6.0	62.7
SDG&E-12	T12	6.0	149.8	T12	6.0	149.8
SDG&E-13	T12	6.0	149.8	T12	6.0	149.8
SDG&E-14	T12	6.0	149.8	LED	6.0	62.7
SDG&E-15	T12	6.0	149.8	T12	6.0	149.8
SDG&E-16	T12	6.0	149.8	T12	6.0	149.8
SDG&E-17	T12	6.0	149.8	T8	6.0	62.7
SDG&E-18	T12	6.0	149.8	LED	6.0	62.7
SDG&E-19	T12	6.0	149.8	T12	6.0	149.8
SDG&E-20	T12	6.0	149.8	T8	6.0	62.7
SDG&E-21	T12	6.0	149.8	LED	6.0	62.7
SDG&E-22	T12	6.0	149.8	T8	6.0	62.7

Measure Lighting Fixture Wattages

Surveyors verified measure lighting fixture wattages in thirty of the forty sites. The majority of these are from one manufacturer and are one model as reported in Table 5-8. We applied the average of verified lamp wattage, 23.8 Watts, to the sites where we were unable to verify the lamp make and model and therefore wattage. Verified measure wattage is less than the ex-ante assumptions in all applications except for the LC03 code, which assumes a 16.5 watt LED lamp as shown in Table 5-9.

TABLE 5-8: VERIFIED MEASURE LAMP WATTAGE

Manufacturer	Model	Count of Sites	Lamp Wattage	Lamp Length
Kadium	FY-T8-1800EC	25	26	6
GE	GELT606750CRH-SB	1	10	6
GE	GELT606750EDL-SY	2	10	6
GE	GELT606750EDR-5Y	1	10	6
GE	LT606750CTR-5Y	1	24	6
unknown	2835 LED-1292x9.2xIMM-6524P-A	1	-	-

TABLE 5-9: EX-ANTE MEASURE LAMP WATTAGE

IOU	Measure Code	Ex-Ante Measure Watts	Efficiency Level
PG&E	LB07	27.5	Tier 2
PG&E	LB09	33.0	Tier 3
PG&E	LC03	16.5	Tier 1
PG&E	LC09	41.25	Tier 3
SCE	LT-79548	30.80	NA
SDG&E	402270	31.65	Premium
SDG&E	402271	38.34	Premium

Annual Hours of Use

Annual hours of use (HOU) used in the ex-ante calculations, the self-report hours, and the logger based hours for sites with completed logger data are reported in Table 5-10 through Table 5-12. Sites with Ex-post logger indicated as NA did not have logger data to support an HOU estimate. For ex-post HOU, we used logger-based estimates where available; otherwise we relied on self-reported HOU. The tables show the self-report hours and logger hours are similar for almost sites with usable logger data. Therefore, we did not apply a correction factor to self-report hours using the ratio of logger HOU to self-report HOU from sites with usable logger data.

TABLE 5-10: HOURS OF USE FOR PG&E SAMPLED POINTS

Sample Point Identifier	Ex-Ante	Ex-Post Self-Report	Ex-Post Logger
PG&E-1	4,710	4,710	NA
PG&E-2	4,710	5,110	NA
PG&E-3	4,710	5,840	NA
PG&E-4	4,710	5,110	NA
PG&E-5	4,710	3,650	5,722
PG&E-6	4,710	4,015	NA
PG&E-7	4,710	4,015	NA
PG&E-8	4,710	6,570	NA
PG&E-9	4,710	4,510	NA
PG&E-10	4,710	5,840	5,408
PG&E-11	4,710	5,995	NA
PG&E-12	4,710	5,110	NA
PG&E-13	4,710	5,110	NA
PG&E-14	4,710	8,760	NA
PG&E-15	4,710	8,760	NA
PG&E-16	4,710	5,110	5,141
PG&E-17	4,710	4,710	NA

TABLE 5-11: HOURS OF USE FOR SCE SAMPLED POINT

Sample Point Identifier	Ex-Ante	Ex-Post Self-Report	Ex-Post Logger
SCE-1	4,710	5,110	NA

TABLE 5-12: HOURS OF USE FOR SDG&E SAMPLED POINTS

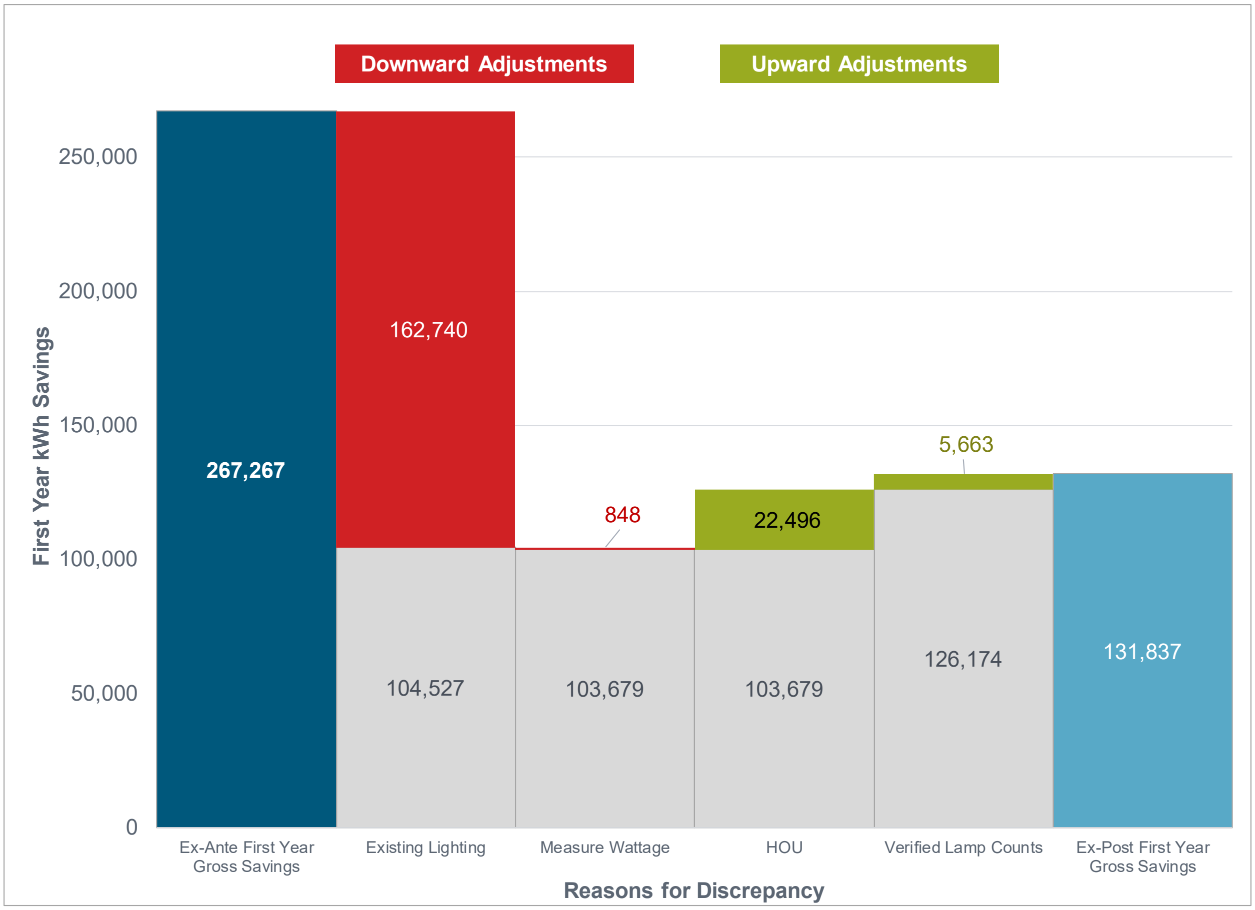
Sample Point Identifier	Ex-Ante	Ex-Post Self-Report	Ex-Post Logger
SDG&E-1	5,390	5,215	5,249
SDG&E-2	5,390	5,110	3,690
SDG&E-3	5,390	5,056	4,387
SDG&E-4	5,390	5,655	5,097
SDG&E-5	5,390	5,004	4,787
SDG&E-6	5,390	5,004	NA
SDG&E-7	5,390	4,849	4,816
SDG&E-8	5,390	4,380	5,182
SDG&E-9	5,390	5,110	5,933
SDG&E-10	5,390	5,110	5,273
SDG&E-11	5,390	5,475	5,413
SDG&E-12	5,390	6,256	6,821
SDG&E-13	5,390	5,304	6,976
SDG&E-14	5,390	6,620	6,254
SDG&E-15	5,390	5,787	5,708
SDG&E-16	5,390	5,110	5,678
SDG&E-17	5,390	5,877	6,534
SDG&E-18	5,390	8,760	8,375
SDG&E-19	5,390	8,760	8,485
SDG&E-20	5,390	8,760	5,563
SDG&E-21	5,390	5,840	5,990

5.1.3 Reasons for Discrepancy

First Year Gross Impact Results

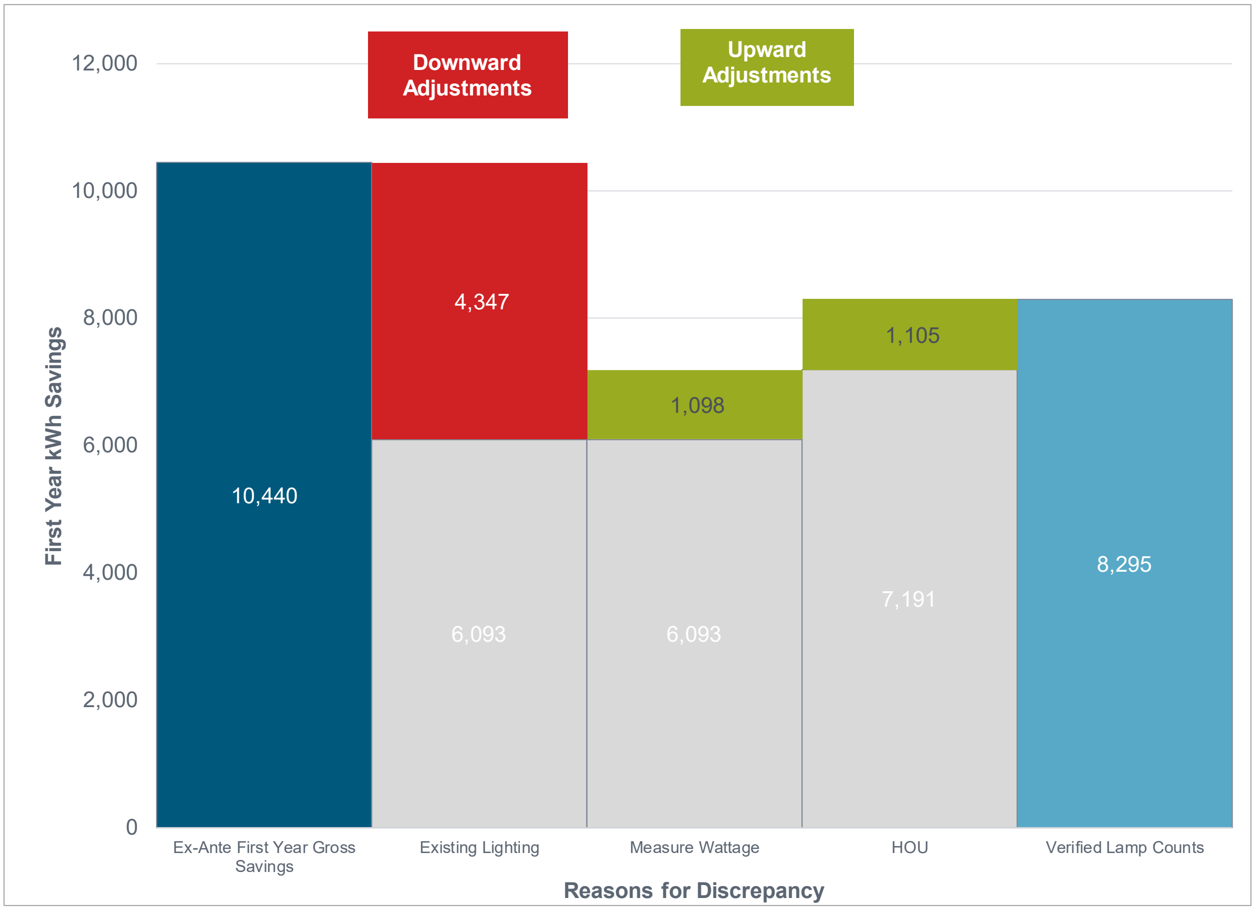
The primary drivers to evaluated kWh savings are the evaluated measure wattage, evaluated baseline lighting wattage, annual hours of use (HOU), and adjusting for a one to one fixture replacement by utilizing the verified quantity of measure lighting fixtures. We verified Installation rates using the measure code units (doors in SCE and SDG&E, and linear feet of baseline lighting fixtures) of almost 100% with differences in only three sites as discussed above. We are reporting the differences in verified lamps and the quantity of lamps assumed in respective workpapers as reported in the figures below in the 1:1 Fixture Replacement column. Figure 5-1 through Figure 5-3 illustrate the impact these changes have on the electric energy savings for the three utilities.

FIGURE 5-1: FIRST YEAR KWH SAVINGS MAGNITUDE REDUCTION WATERFALL BY DISCREPANCY CATEGORY FOR PG&E



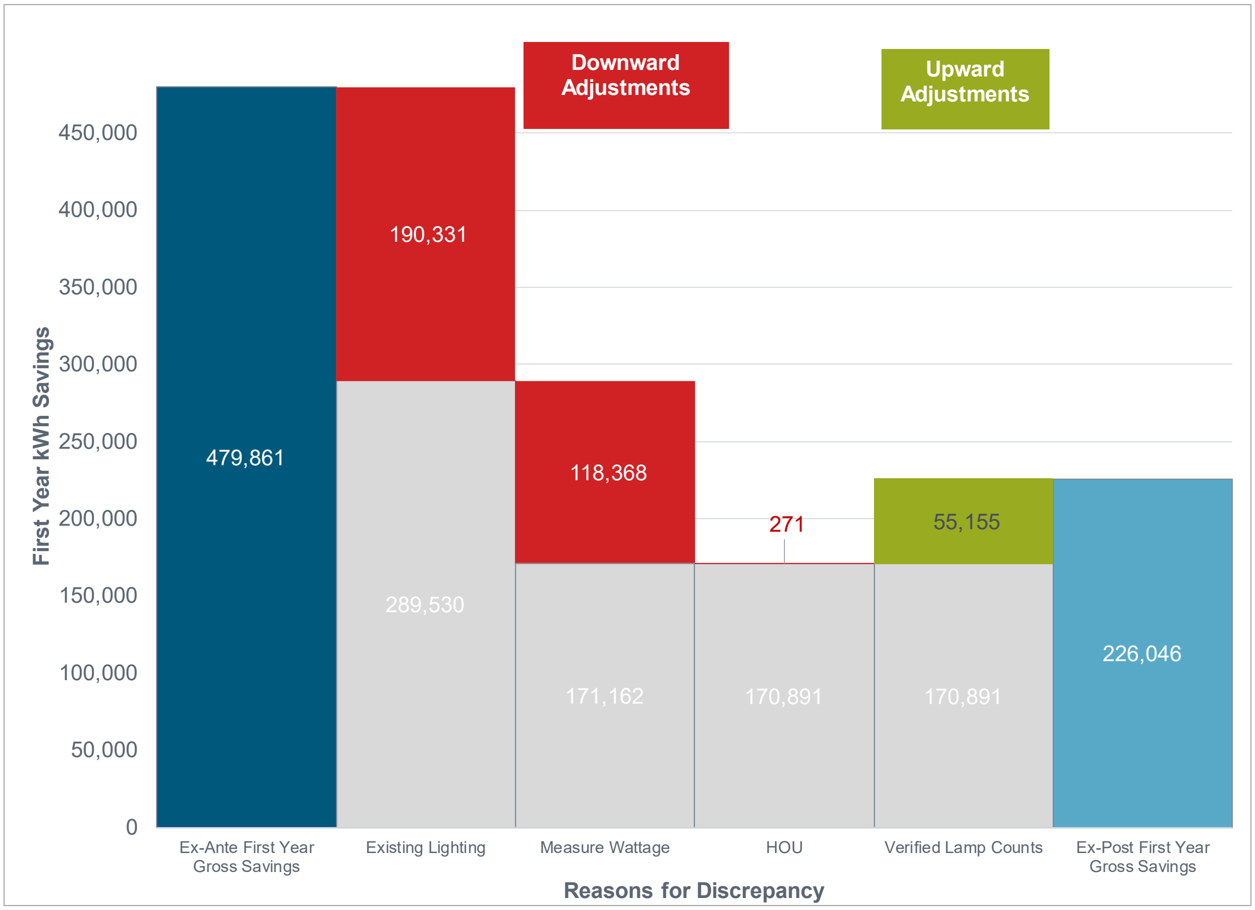
The largest impact on first year kWh savings for PG&E is the assumptions about multiple T12 lamp profile for the existing lighting system in the refrigerated cases. The differences in measure wattage is minor considering the large difference in measure and existing wattage.

FIGURE 5-2: FIRST YEAR KWH SAVINGS MAGNITUDE REDUCTION WATERFALL BY DISCREPANCY CATEGORY FOR SCE



For the one SCE sample point, the driver in first year kWh savings is the actual quantity of verified fixtures is less than the quantity assumed in the ex-ante calculation.

FIGURE 5-3: FIRST YEAR KWH SAVINGS MAGNITUDE REDUCTION WATERFALL BY DISCREPANCY CATEGORY FOR SDG&E



The evaluation found mostly 26 watt LED fixtures with less power draw than assumed in ex-ante calculations, which is mostly 38 watts. The first year kWh savings for SDG&E are impacted equally by the assumptions related to existing fixture technology and actual number of fixtures per site.

Lifecycle Gross Impact Results

Table 5-13 through Table 5-15 present the lifecycle gross impacts for the PG&E, SCE, and SDG&E sample points. We multiplied the first-year gross savings by the evaluated EUL of 5.33 years to calculate lifecycle savings for each measure and project. We assumed the life of the measure is equal to the remaining useful life (RUL) of the host equipment, in this case the refrigeration case itself which has an EUL of 16, using DEER assumptions of 1/3 of the EUL. Therefore, we applied EUL of 5.33 to the first-year savings to calculate lifecycle savings.

TABLE 5-13: LIFECYCLE EX-POST GROSS IMPACT RESULTS FOR PG&E SAMPLE POINTS

	Ex-Post		Ex-Ante		Results	
Sample Point Identifier	Lifecycle Gross Impact kW Savings	Lifecycle Gross Impact kWh Savings	Lifecycle Gross Impact kW Claims	Lifecycle Gross Impact kWh Claims	Lifecycle Gross Impact kW Realization Rate	Lifecycle Gross Impact kWh Realization Rate
PG&E-1	8.1	28,465	51.5	241,920	0.16	0.12
PG&E-2	6.1	23,162	38.6	181,440	0.16	0.13
PG&E-3	14.1	61,765	90.1	423,360	0.16	0.15
PG&E-4	11.4	43,750	73.0	342,720	0.16	0.13
PG&E-5	7.4	31,697	47.2	221,760	0.16	0.14
PG&E-6	8.6	25,823	47.2	221,760	0.18	0.12
PG&E-7	10.9	32,866	60.1	282,240	0.18	0.12
PG&E-8	13.3	65,304	73.0	342,720	0.18	0.19
PG&E-9	13.6	45,996	17.7	83,136	0.77	0.55
PG&E-10	4.8	19,449	30.0	141,120	0.16	0.14
PG&E-11	13.1	58,555	81.5	383,040	0.16	0.15
PG&E-12	8.3	31,726	47.2	221,760	0.18	0.14
PG&E-13	8.9	34,149	55.8	262,080	0.16	0.13
PG&E-14	12.8	83,824	85.8	403,200	0.15	0.21
PG&E-15	12.1	79,412	77.2	362,880	0.16	0.22
PG&E-16	2.2	8,603	5.3	24,752	0.42	0.35
PG&E-17	7.5	28,586	29.0	136,384	0.26	0.21
Total	163.3	703,132	910.2	4,276,272	0.18	0.16
Average	9.6	41,361	53.5	251,545	0.18	0.16

The lifecycle savings realization rates are lower than first year realization rates because PG&E assumed a 16-year EUL compared to the 5.33 EUL the evaluation applied.

TABLE 5-14: LIFECYCLE EX-POST GROSS IMPACT RESULTS FOR SCE SAMPLE POINTS

	Ex-Post		Ex-Ante		Results	
Sample Point Identifier	Lifecycle Gross Impact kW Savings	Lifecycle Gross Impact kWh Savings	Lifecycle Gross Impact kW Claims	Lifecycle Gross Impact kWh Claims	Lifecycle Gross Impact kW Realization Rate	Lifecycle Gross Impact kWh Realization Rate
SCE-1	10.89	44,244	8.03	41,758	1.36	1.06

The lifecycle savings realization rates are higher than first year realization rates because SCE assumed a four-year EUL compared to the 5.33 EUL the evaluation applied.

TABLE 5-15: LIFECYCLE EX-POST GROSS IMPACT RESULTS FOR SDG&E SAMPLE POINTS

	Ex-Post		Ex-Ante		Results	
Sample Point Identifier	**Lifecycle Gross Impact kW Savings**	**Lifecycle Gross Impact kWh Savings**	**Lifecycle Gross Impact kW Claims**	**Lifecycle Gross Impact kWh Claims**	**Lifecycle Gross Impact kW Realization Rate**	**Lifecycle Gross Impact kWh Realization Rate**
SDG&E-1	10.3	39,268	28.7	174,790	0.36	0.22
SDG&E-2	11.9	31,994	99.0	602,072	0.12	0.05
SDG&E-3	8.8	30,910	39.1	237,660	0.22	0.13
SDG&E-4	25.4	94,208	65.1	396,100	0.39	0.24
SDG&E-5	36.3	126,382	104.2	633,760	0.35	0.20
SDG&E-6	24.0	83,516	67.7	411,944	0.35	0.20
SDG&E-7	4.8	16,888	52.1	316,880	0.09	0.05
SDG&E-8	16.9	68,412	46.9	285,192	0.36	0.24
SDG&E-9	3.7	16,259	36.5	221,816	0.10	0.07
SDG&E-10	2.3	8,720	20.8	126,752	0.11	0.07
SDG&E-11	3.0	11,654	28.7	174,284	0.10	0.07
SDG&E-12	22.7	112,550	72.9	443,632	0.31	0.25
SDG&E-13	7.3	36,835	23.4	142,596	0.31	0.26
SDG&E-14	4.0	18,361	39.1	237,660	0.10	0.08
SDG&E-15	25.4	105,497	72.9	443,632	0.35	0.24
SDG&E-16	40.9	168,880	116.1	705,916	0.35	0.24
SDG&E-17	8.3	53,744	86.0	522,852	0.10	0.10
SDG&E-18	3.5	22,801	72.9	443,632	0.05	0.05
SDG&E-19	7.9	51,026	23.4	142,596	0.33	0.36
SDG&E-20	5.0	32,572	52.1	316,880	0.10	0.10
SDG&E-21	6.8	43,973	62.5	380,256	0.11	0.12
SDG&E-22	5.0	32,572	52.1	316,880	0.10	0.10
Total	283.9	1,207,021	1262.3	7,677,782	0.22	0.16
Average	12.9	54,865	57.4	348,990	0.22	0.16

The lifecycle savings realization rates are lower than first year realization rates because SDG&E assumed an EUL of 16 compared to the 5.33 EUL the evaluation applied.

5.2 PROCESS BOILER MEASURES

As discussed in Section 3, the evaluation team completed a total of 15 on-sites during this effort. There were eight on-sites for PG&E and seven on-sites for SCG in total. As stated in Section 3, we drew a combined sample entailing both water process boiler and steam process boiler technologies. The following sections present the gross impact results and findings from this effort, broken out by technology where possible.

5.2.1 First Year Gross Impact Results

Table 5-16 and Table 5-17 present first year gross impact results for the PG&E and SCG process boiler measure group samples, respectively. The ex-ante savings claims are based upon a well-documented workpaper-based approach that was reproduced by the evaluation team, and then subsequently used to provide comparisons against ex-post methods throughout this section.

PG&E gross impact realization rates range from 0.67 to 1.13, yielding a sample-based weighted average first year gross impact realization rate of 0.83.

TABLE 5-16: FIRST YEAR GROSS IMPACT RESULTS FOR PG&E SAMPLE POINTS

Sample Point Identifier	Ex-Ante	Ex-Post	Results
	First Year Gross Impact Savings (Therms)	First Year Gross Impact Claim (Therms)	First Year Gross Impact Realization Rate
PG&E-1	49,600	33,264	0.67
PG&E-2	38,000	38,000	1.00
PG&E-3	11,225	9,072	0.81
PG&E-4	21,934	21,047	0.96
PG&E-5	3,791	2,593	0.68
PG&E-6	6,650	7,522	1.13
PG&E-7	3,743	2,335	0.62
PG&E-8	5,612	1,415	0.25
Total	140,554	115,248	0.83

SCG gross impact realization rates range from 0.39 to 1.10, yielding a sample-based weighted average first year gross impact realization rate of 0.82.

TABLE 5-17: FIRST YEAR GROSS IMPACT RESULTS FOR SCG SAMPLE POINTS

Sample Point Identifier	Ex-Ante	Ex-Post	Results
	First Year Gross Impact Savings (Therms)	First Year Gross Impact Claim (Therms)	First Year Gross Impact Realization Rate
SCG-1	17,268	17,268	1.00
SCG-2	67,823	56,823	0.84
SCG-3	1,851	1,790	0.97
SCG-4	371	408	1.10
SCG-5	1,700	1,573	0.93
SCG-6	6,025	4,300	0.71
SCG-7	1,974	779	0.39
Total	97,013	82,941	0.82

Lifecycle Partial-Zero Savers

One PG&E site was determined to be a partial-zero saver through the measure lifecycle. Table 5-18 describes the circumstances that led this partial-zero savings for the PG&E sample point.

TABLE 5-18: INSTANCES OF LIFECYCLE PARTIAL-ZERO SAVINGS IN THE PG&E SAMPLE

Sample Point Identifier	Comments Pertaining to Partial-Zero Savers
PG&E-2	Facility closure. Ex-post savings estimate assumes 21 months of operation following installation. Installation was completed on March 17, 2017 and per ex-post findings,[9] the plant ceased production operations at the end of 2018 and remains open as a distribution warehouse.

There were no partial or zero-savers in the SCG ex-post sample.

[9] Source: call with facility distribution manager and press release.

5.2.2 Parameter by Parameter Assessment

The sections below present a comparison between the workpaper input parameter-level assumptions and the ex-post findings for the PG&E and SCG samples, respectively. The three most important parameters that support both ex-ante and ex-post calculations are:

- Annual operating hours
- Capacity factor (for PG&E)/ Load factor (for SCG)
- Efficiency (for process water and process steam boilers)

Other parameters that support ex-ante estimates and impact results are the boiler rated input capacity and the baseline type. However, these are project-specific and when used with the above three parameters, result in a project-specific savings estimate. A detailed discussion of utility specific findings for the above input parameters is presented below.

Baseline Type

The baseline type claimed within the IOU tracking data was replace on burnout (ROB), which stipulates a code compliant minimum baseline efficiency unit based on the technology (water/steam) and capacity needs. While the ex-post baseline findings generally agreed with the ex-ante claims for ROB, there were a few new construction (NC) projects where there was no boiler before. In those cases, the counterfactual boiler efficiency would have to be set equal to the code minimum level, which is akin to the ROB baseline type. Therefore, there was no impact on the ex-ante claims due to this finding.

Annual Operating Hours

One of the primary inputs to the gross savings calculation is the number of annual hours that the process boiler operates. The evaluators estimated the site-specific operating hours of the hot water or steam boiler(s) through interviews with knowledgeable facility staff and by direct observation during the site visit and using SCADA/ EMS data in several instances; however, most facilities in this sector only have rudimentary control systems that do not have logging/ trending capabilities.

Parameter Findings for PG&E

PG&E's workpaper referenced in Section 4 uses 8,760 hours of operation and adjusted it using a capacity factor (referred to as load factor by SCG), which is discussed later in this section. The evaluation team collected data for the annual operating hours during the on-sites for seven out of the eight points. A site visit was not completed for PG&E-2 due to confirmed operations cessation. The ex-post average runtime across all PG&E onsite sample points was 7,640 which was about 13% (weighted mean to account for different boiler sizes) lower than ex-ante. Ex-post annual operating hour findings for each sample point are also applied to estimate gas consumption for the baseline case.

TABLE 5-19: ANNUAL OPERATING HOURS COMPARISON FOR THE PG&E SAMPLE

	Ex-Ante		Ex-Post		Difference	
Parameter	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
Annual Operating Hours	8,760	8,760	7,640	7,640	13%	13%

Parameter Findings for SCG

SCG stipulates a range of values for the hours of operation in the workpaper as indicated in Table 5-20 and adjusted it using a load factor (referred to as capacity factor by PG&E), which is discussed below.

TABLE 5-20: SCG WORKPAPER OPERATING HOURS

Equipment Type	Tier 1 Hot Water Boiler		Tier 2 Hot Water Boiler		Steam Boiler	
Rated Input (MMBtu/hr) **->**	≤ 2	2 – 10	≤ 2	2 – 10	≤ 2	2 – 10
Scheduled Annual Operating Time	4,305	5,545	4,305	5,545	3,479	4,711

The ex-post boiler capacities of the SCG sample fell within or exceeded the 2-10 MMBtu/hr size, so the average runtime across the two tiers of boilers in that size range was used for this comparison. The annual operating hours for water boilers were 6% lower than ex-ante workpaper assumptions, while the steam boiler annual operating hours were 7% lower (weighted mean to account for different boiler sizes) as shown in Table 5-21. Similar to PG&E, the baseline boiler operating hours are set equal to the post-installation boiler operating hours.

TABLE 5-21: ANNUAL OPERATING HOURS COMPARISON FOR THE SCG SAMPLE

	Ex-Ante		Ex-Post		Difference	
Parameter	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
Annual Operating Hours_Water Boiler (2-10 MMBtu/hr)	5,545	5,545	5,217	5,217	6%	6%
Annual Operating Hours_Steam Boiler	4,711	4,711	4,362	4,362	7%	7%

Capacity Factor (PG&E) / Load Factor (SCG)

Capacity factor (PG&E)/ Load factor (SCG) is the ratio of actual energy consumption during a certain time period and the consumption that would have occurred if the boiler were at full capacity during the same period. This is due to the fact that the number of operating hours of a boiler is not an accurate representation of its energy consumption as boilers tend to operate at a fraction of their nominal capacity due to modulating controls (see formula below).

$$CF/LF = AGC/MGC$$

Where,

CF/LF = capacity factor/ Load Factor, no units

AGC = actual gas consumption during a given time period, kBTUh/ MBTUh

MGC = maximum gas consumption during a given time period, kBTUh/ MBTUh

Parameter Findings for PG&E

The evaluation team collected data for the capacity factor during the on-sites for seven out of the eight points, as a site visit was not completed for PG&E-2 due to operations cessation. The IOU workpaper used a 0.42 value based on an industry average, while the ex-post capacity factor, based on the observed process type, was 0.40 (a 5% difference using a weighted mean to account for different boiler sizes). The ex-post capacity factor is based on a lookup by process type using ex-ante workpaper inputs. It is noted that the baseline capacity factor is set equal to the post-installation capacity factor for all sample points.

TABLE 5-22: CAPACITY FACTOR COMPARISON FOR THE PG&E SAMPLE

	Ex-Ante		Ex-Post		Difference	
Parameter	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
Capacity Factor	0.42	0.42	0.40	0.40	5%	5%

Parameter Findings for SCG

The IOU workpaper recommends a range of load factor values, as shown in Table 5-23. These averages are derived from process-specific values that are provided within the SCG workpaper.

TABLE 5-23: SCG WORKPAPER LOAD FACTORS

Equipment Type	Tier 1 Hot Water Boiler		Tier 2 Hot Water Boiler		Steam Boiler	
Rated Input (MMBtu/hr) ->	≤ 2	2 – 10	≤ 2	2 – 10	≤ 2	2 – 10
Average Load Factor	28.00%	23.00%	25.30%	21.00%	29.00%	30.80%

The ex-post boiler capacities of the SCG sample fell within or exceeded the 2-10 MMBtu/hr size, so the average load factor for the two tiers of boilers in that size range was used for this comparison. Similar to PG&E, the baseline load factor is set equal to the post-installation load factor. The ex-post impact estimation used the process-specific values provided within the workpaper, which resulted in the adjustments as shown below. That is, the ex-post capacity factor is based on a lookup by process type using ex-ante workpaper inputs.

TABLE 5-24: LOAD FACTOR HOURS COMPARISON FOR THE SCG SAMPLE

	Ex-Ante		Ex-Post		Difference	
Parameter	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
Load Factor_Water Boiler (2-10 MMBtu/hr)	22.00%	22.00%	21.78%	21.78%	1%	1%
Load Factor_Steam Boiler	30.80%	30.80%	29.67%	29.67%	4%	4%

Efficiency

Boiler efficiency is stipulated within the IOU workpaper by boiler type (water/steam) and the ex-post findings generally agreed with the ex-ante workpaper based values for PG&E, but generally differed to some degree for SCG sample points. We checked that the baseline efficiencies were following the Title 24, Part 6 requirements and validated the ex-ante assumptions. The measure case efficiency values were derived from a flue gas test (for census strata points) and nameplate and manufacturer specification verification during the ex-post impact estimation.

Parameter Findings for PG&E

The evaluation team collected data for the above input parameters during the on-sites for seven out of the eight points, as a site visit was not completed for PG&E-2 due to operations cessation. The table below shows the comparison of IOU workpaper values vs. ex-post findings. The two sets of efficiency estimates, for both steam and water boilers, do not vary substantially.

TABLE 5-25: EFFICIENCY COMPARISON FOR THE PG&E SAMPLE

	Ex-Ante		Ex-Post		Difference	
Parameter	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
Efficiency_Steam Boiler	80.00%	84.40%	79.94%	84.34%	0.1%	0.1%
Efficiency_Water Boiler	82.00%	89.40%	82.00%	89.40%	0.0%	0.0%

Parameter Findings for SCG

Table 5-26 shows boiler efficiency values stipulated within the SCG workpaper by boiler type (water/steam), and the ex-post findings shown in Table 5-27 differed to a small degree from the ex-ante workpaper based values.

TABLE 5-26: SCG WORKPAPER BOILER EFFICIENCY INPUTS

Equipment Type	Tier 1 Hot Water Boiler		Tier 2 Hot Water Boiler		Steam Boiler	
Rated Input (MMBtu/hr) **->**	≤ 2	2 – 10	≤ 2	2 – 10	≤ 2	2 – 10
Average Base Efficiency	80%	80%	80%	80%	80%	80%
Qualifying Measure Efficiency	85%	85%	90%	90%	83%	83%
Average Measure Efficiency	85.60%	85.50%	94.40%	93.40%	83.20%	83.00%

The ex-ante workpaper assumptions for SCG Water Boiler baseline efficiency was set at 80% based on Titles 20 and 24 for gas packaged boilers, while the PG&E workpaper, lists a standard/ base case efficiency of 82% for a hot water boiler (based on 2013 Title 24 minimum efficiencies for boilers). The ex-post team reviewed both IOUs' claims and used the PG&E minimum threshold of 82% for the gross impact analysis efforts for SCG sample points.

The ex-post boiler capacities for both steam and water boilers within the SCG sampled points fell within or exceeded the Tier 2, 2-10 MMBtu/hr size range, therefore the ex-ante baseline values for the Tier 2 water boilers (2-10 MMBtu/hr capacity) and steam boilers (2-10 MMBtu/hr capacity) were chosen for this assessment, and the resulting weighted mean is shown below. The ex-post measure case efficiency values for both boiler types were derived from a flue gas test (for census strata points) and nameplate and manufacturer specification verification conducted during M&V.

TABLE 5-27: EFFICIENCY COMPARISON FOR THE SCG SAMPLE

	Ex-Ante		Ex-Post		Difference	
Parameter	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
Efficiency_Steam Boiler	80.00%	83.00%	80.00%	82.84%	0.0%	0.2%
Efficiency_Water Boiler	80.00%	90.00%	82.00%	90.64%	2.4%	-0.7%

5.2.3 Effective Useful Life Evaluation Results

Table 5-28 and Table 5-29 present effective useful life (EUL) results for the PG&E and SCG samples, respectively. In general, ex-post EUL estimates were left unchanged from the ex-ante value of 20 years. But there was one exception for PG&E. This project received a partial lifecycle gross savings credit. An explanation for these changes is described for each project in Table 5-18 above.

TABLE 5-28: EUL COMPARISON IN THE PG&E SAMPLE

Sample Point Identifier	Ex-Ante Effective Useful Life	Ex-Post Effective Useful Life
PG&E-1	20	20
PG&E-2*	20	1.75
PG&E-3	20	20
PG&E-4	20	20
PG&E-5	20	20
PG&E-6	20	20
PG&E-7	20	20
PG&E-8	20	20

* See Table 5-18 above for an explanation for this change

TABLE 5-29: EUL COMPARISON IN THE SCG SAMPLE

Sample Point Identifier	Ex-Ante Effective Useful Life	Ex-Post Effective Useful Life
SCG-1	20	20
SCG-2	20	20
SCG-3	20	20
SCG-4	20	20
SCG-5	20	20
SCG-6	20	20
SCG-7	20	20

5.2.4 Lifecycle Gross Realization Rates

Table 5-30 and Table 5-31 present lifecycle gross impact results for the PG&E and SCG on-site samples, respectively. Lifecycle savings represent first year gross impacts multiplied by the EUL for each project.

TABLE 5-30: LIFECYCLE GROSS IMPACT RESULTS FOR PG&E SAMPLE POINTS

Sample Point Identifier	Ex-Ante	Ex-Post	Results
	Lifecycle Gross Impact Savings (Therms)	Lifecycle Gross Impact Claim (Therms)	Lifecycle Gross Impact Realization Rate
PG&E-1	992,000	665,284	0.67
PG&E-2*	760,000	66,500	0.09
PG&E-3	224,504	181,437	0.81
PG&E-4	438,672	420,936	0.96
PG&E-5	75,810	51,862	0.68
PG&E-6	133,000	150,433	1.13
PG&E-7	74,860	46,694	0.62
PG&E-8	112,238	28,306	0.25
Total	2,811,084	1,611,453	0.70

* See Table 5-18 above for an explanation for this change

TABLE 5-31: LIFECYCLE GROSS IMPACT RESULTS FOR SCG SAMPLE POINTS

Sample Point Identifier	Ex-Ante	Ex-Post	Results
	Lifecycle Gross Impact Savings (Therms)	Lifecycle Gross Impact Claim (Therms)	Lifecycle Gross Impact Realization Rate
SCG-1	345,365	345,365	1.00
SCG-2	1,356,463	1,136,453	0.84
SCG-3	37,027	35,795	0.97
SCG-4	7,426	8,160	1.10
SCG-5	34,000	31,458	0.93
SCG-6	120,496	86,005	0.71
SCG-7	39,480	15,585	0.39
Total	1,940,257	1,658,822	0.82

The mean results presented above for the sample yield realization rates of 0.70 for PG&E and 0.82 for SCG. Adjustment of the EUL for PG&E sample point PG&E-2 yields a relatively low lifecycle realization rate compared to first year realization rate results.

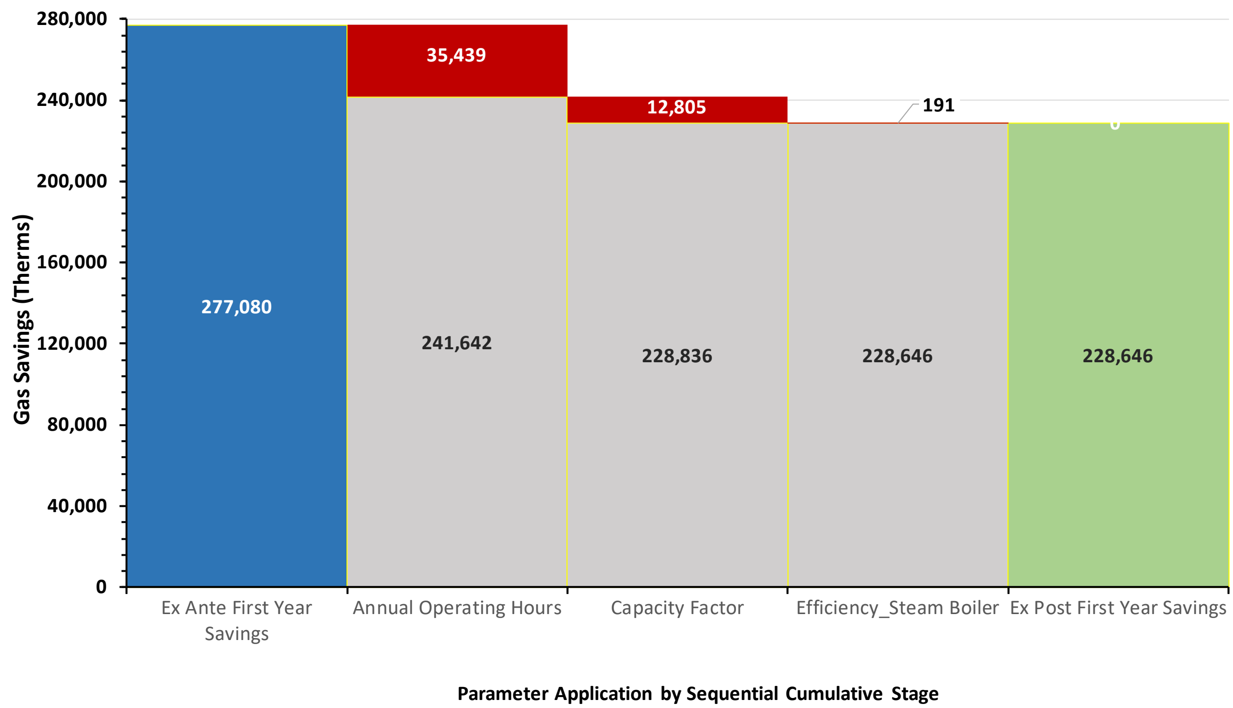
5.2.5 Reasons for Discrepancy

The primary drivers for the ex-post realization rates for both PG&E and SCG were the verified hours of operation, combustion efficiency and load factors, based on the evaluation-based observed conditions and process type. A PA-specific assessment of the reasons for discrepancy is provided below.

Reasons for Discrepancy: PG&E

Figure 5-4 illustrates the relative shares that each discrepancy category contributed to PG&E's first year gross impact realization rate of 0.83. The discrepancy categories are explained in the paragraphs following the figure.

FIGURE 5-4: FIRST YEAR SAVINGS MAGNITUDE REDUCTION WATERFALL BY DISCREPANCY CATEGORY FOR PG&E



Annual Operating Hours

The annual operating hours that we observed onsite were lower than the ex-ante assumptions for PG&E. This resulted in an overall reduction of 13% (on a weighted mean basis across the sample) of the ex-ante estimates as shown in the waterfall chart above.

Capacity Factor

Changes to the ex-post capacity factors resulted in a 5% (on a weighted mean basis) reduction of the ex-ante estimates as shown in the waterfall chart above.

Efficiency

Adjustments to the measure case efficiencies had an almost negligible effect, reducing the ex-ante estimates by 0.1% (on a weighted mean basis) as shown in the waterfall chart above.

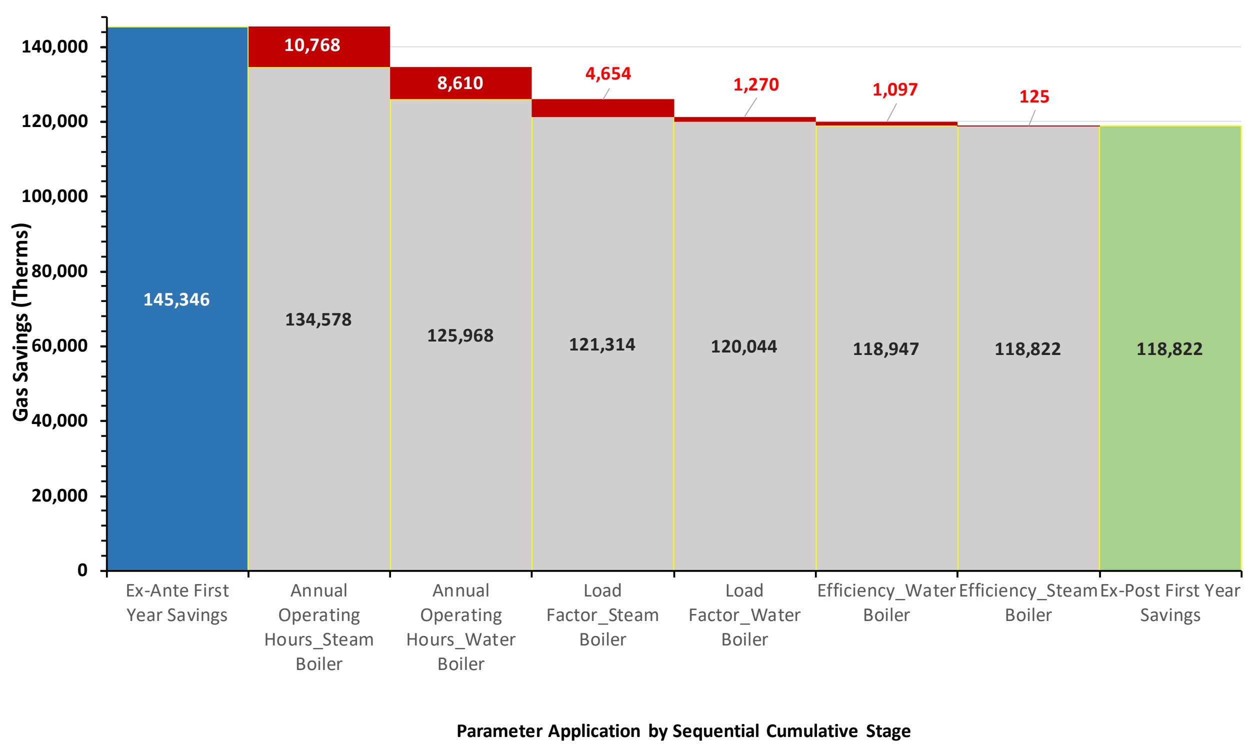
Conclusion

The above three reasons for discrepancy resulted in an overall reduction to 17%, resulting in a GRR of 0.83 based on PG&E's first year ex-ante gross savings for the process boilers measure group.

Reasons for Discrepancy: SCG

Figure 5-5 illustrates the relative shares that each discrepancy category contributed to SCG's first year gross impact realization rate of 0.82. The discrepancy categories are explained in the paragraphs following the figure.

FIGURE 5-5: FIRST YEAR SAVINGS MAGNITUDE REDUCTION WATERFALL BY DISCREPANCY CATEGORY FOR SCG



Annual Operating Hours

The annual operating hours that we observed on-site were lower than the ex-ante assumptions on a combined overall basis (water and process boiler). This resulted in a reduction of 13% of the ex-ante estimates as shown (weighted mean-based reductions shown as staggered steps to illustrate the overall impact) in the waterfall chart above.

Load Factor

The average (across all boiler types) ex-post capacity factor, based on the observed process type, resulted in a 5% reduction of the ex-ante estimates as shown (weighted mean-based reductions shown as staggered steps to illustrate the overall impact) in the waterfall chart above.

Efficiency

Adjustments to the measure case efficiencies resulted in an insignificant decrease in the ex-ante estimates for process water and process steam boilers combined for a total of <1%. The measure case efficiency findings for the steam boilers reduced the savings by 0.09%.

The ex-post baseline efficiency for the water boilers resulted in a <2% reduction in savings, while the measure case efficiency increased the savings by 0.7%, resulting in an approximately 1% decrease, as shown (weighted mean-based reductions shown as staggered steps to illustrate the overall impact) in the waterfall chart above.

Conclusion

The above three reasons for discrepancy resulted in an overall reduction to 18%, resulting in a GRR of 0.82 based on SCG's first year ex-ante gross savings for the process boilers measure group.

5.3 FOOD SERVICE MEASURES

As discussed, gross impact evaluation sampling and analysis was completed for just a single food service measure – gas fryers.

5.3.1 First Year Gross Impact Results

Table 5-32 and Table 5-33 present first year gross impact results for the PG&E and SCG on-site samples, respectively. The ex-ante savings claims are consistently 548 therms per fryer vat installed, with some participating customer projects installing up to two fryer vats in the sample, resulting in an average claim per sample point of 596 therms for PG&E and 740 therms for SCG, and ranging from 548 to 1,096 per point for both PAs. Ex-ante claims are based upon a well-documented workpaper-based approach that was reproduced by the evaluation team, and then subsequently used to provide comparisons against ex-post methods throughout this section.

TABLE 5-32: FIRST YEAR GROSS IMPACT RESULTS FOR PG&E SAMPLE POINTS

Sample Point Identifier	Ex-Post	Ex-Ante	Results
	First Year Gross Impact Savings (Therms)	First Year Gross Impact Claim (Therms)	First Year Gross Impact Realization Rate
PGE-1	546	548	1.00
PGE-2	99	548	0.18
PGE-3	144	1,096	0.13
PGE-4	146	548	0.27
PGE-5	405	548	0.74
PGE-6	500	548	0.91
PGE-7	128	548	0.23
PGE-8	417	548	0.76
PGE-9	374	548	0.68
PGE-10	328	548	0.60
PGE-11	152	548	0.28
PGE-12	77	1,096	0.07
PGE-13	365	548	0.67
PGE-14	245	548	0.45
PGE-15	245	548	0.45
PGE-16	245	548	0.45
PGE-Zero-1	0	548	0.00
PGE-Zero-2	0	548	0.00
PGE-Zero-3	0	548	0.00
PGE-Zero-4	51	548	0.09
PGE-Zero-5	0	548	0.00
PGE-Zero-6	245	548	0.45
PGE-Zero-7	143	548	0.26
Total	4,856	13,700	
Average	211	596	0.35
Average of Modeled Points*	283	632	0.45

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

Impacts for PGE-14 through PGE-16 were derived using a weighted mean gross realization rate result from PGE-1 through PGE-13.

Impacts for PGE-Zero-1 through PGE-Zero-7 were derived using a similar approach to PGE-14 through PGE-16 but adjusted to reflect no savings or a partial savings credit.

Impacts for PGE-3 were also adjusted to reflect no savings for one of two fryer vats claimed.

PG&E gross impact results per sample point range from zero to 546 therms, with realization rates ranging from 0.00 to 1.00, and yielding a sample-based weighted mean of 211 therms per sample point. This yields a weighted average first year gross impact realization rate of 0.35.

- A metering-based ex-post evaluation model was used to derive savings for sample points PGE-1 through PGE-13, along with a downward adjustment to PGE-3 to account for one fryer vat that was not verified to have been installed. Separate reporting is provided on the mean claim and mean ex-post first year savings across these modeled sample points, yielding an average claim of 632 therms, an average ex-post impact of 283 therms and a realization rate of 0.45. This realization rate is high relative to the mean for the full sample, due mostly to the added influence of partial/zero savers on the remainder of the sample points. Zero savers describe projects that do not save energy, either partially due to special circumstances, or entirely due to installation of ineligible equipment and other factors.
- The rest of the projects in the sample were derived using a mean realization rate derived from PGE-1 through PGE-13 – 0.45. This result was applied to the remaining sample points, adjusted where warranted to account for the influence of partial/zero savers.
  - For PGE-14 through PGE-16 a weighted average realization rate was applied due to metering data collection issues; for example, damaged equipment or customer removal of the metering equipment.
  - For PGE-Zero-1 through PGE-Zero-7 the metering data recovered from these sites, if any, was not for an eligible, program-installed gas fryer; this was due to facility closure and other factors described in greater detail below. For these sites we were unable to model a valid program fryer.

These differences are substantial, on average for the PG&E results, and vary widely across sample points, but directionally the ex-post estimates are much lower, with the majority of the realization rates falling below 0.5, and only 6 out of 23 sample points having realization rates above that threshold.

TABLE 5-33: FIRST YEAR GROSS IMPACT RESULTS FOR SCG SAMPLE POINTS

Sample Point Identifier	Ex-Post	Ex-Ante	Results
	First Year Gross Impact Savings (Therms)	First Year Gross Impact Claim (Therms)	First Year Gross Impact Realization Rate
SCG-1	280	548	0.51
SCG-2	216	548	0.39
SCG-3	515	1,096	0.47
SCG-4	388	548	0.71
SCG-5	269	548	0.49
SCG-6	14	1,096	0.01
SCG-7	397	548	0.72
SCG-8	101	548	0.18
SCG-9	209	548	0.38
SCG-10	205	548	0.37
SCG-11	259	548	0.47
SCG-12	1,297	1,096	1.18
SCG-13	553	1,096	0.50
SCG-Zero-1	277	548	0.50
SCG-Zero-2	231	548	0.42
SCG-Zero-3	277	548	0.50
SCG-Zero-4	0	1,096	0.00
SCG-Zero-5	0	1,096	0.00
SCG-Zero-6	0	548	0.00
SCG-Zero-7	0	1,096	0.00
Total	5,486	14,796	
Average	274	740	0.37
Average of Modeled Points*	346	685	0.50

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

Impacts for SCG-13 was derived using a weighted mean gross realization rate result from SCG-1 through SCG-12.

Impacts for SCG-Zero-1 through SCG-Zero-7 were derived using a similar approach to SCG-13 but adjusted to reflect no savings or a partial savings credit.

Impacts for SCG-6 was also adjusted to reflect no savings for one of two fryer vats claimed.

SCG gross impact results per sample point range from zero to 1,297 therms, with realization rates ranging from 0.00 to 1.18, and yielding a sample-based weighted mean of 274 therms per sample point. This yields a weighted average first year gross impact realization rate of 0.37.

- A metering-based ex-post evaluation model was used to derive savings for sample points SCG-1 through SCG-12, along with a downward adjustment to SCG-6 to account for the fryer vat that is never used. Separate reporting is provided on the mean claim and mean ex-post first year savings across these modeled sample points, yielding an average claim of 685 therms, an average ex-post impact of 346 therms and a realization rate of 0.50. This realization rate is high relative to the mean for the full sample, due mostly to the added influence of partial/zero savers on the remainder of the sample points. Zero savers describe projects that do not save energy, either partially due to special circumstances, or entirely due to installation of ineligible equipment and other factors.
- The rest of the projects in the sample were derived using a mean realization rate derived from SCG-1 through SCG-12 – 0.50. This result was applied to the remaining sample points, adjusted where warranted to account for the influence of partial/zero savers.
  - For SCG-13 a weighted average realization rate was applied due to metering data collection issues; for example, damaged equipment or customer removal of the metering equipment.
  - For SCG-Zero-1 through SCG-Zero-7 the metering data recovered from these sites, if any, was not for an eligible, program-installed gas fryer; this was due to facility closure and other factors described in greater detail below. For these sites we were unable to model a valid program fryer.

These differences are substantial, on average for the SCG results, and vary widely across sample points, but directionally the ex-post estimates are much lower, with only 4 out of 23 sample points having realization rates above 0.50.

Table 5-34 and Table 5-35 describe the circumstances, by sample point, that led to partial- or full-zero savings for PG&E and SCG sample points, respectively.

TABLE 5-34: INSTANCES OF PARTIAL- OR FULL-ZERO SAVINGS IN THE PG&E SAMPLE

Sample Point Identifier	Comments Pertaining to Partial-Zero or Full-Zero Savers
PGE-3	There was only 1 unit installed in this small restaurant, so second missing unit accounts for zero savings.
PGE-Zero-1	The participant filed for bankruptcy and closed the site down almost immediately after receiving the fryer incentive.
PGE-Zero-2	The participant owns an electric fryer that he purchased second hand, and never received a rebate for a gas fryer.
PGE-Zero-3	The participant owns an electric fryer and does not currently own a gas fryer (at any of his restaurants).
PGE-Zero-4	Store manager indicated that the originally installed program fryer was removed roughly 2.5 months following the installation, and after multiple attempts to repair the fryer.
PGE-Zero-5	The unit found on-site is not eligible for the program.
PGE-Zero-6	Facility closure. Savings estimate assumes 12 months of operation following installation. Installation was completed on March 20, 2017 but can't be certain of closure date.
PGE-Zero-7	Facility closure. Savings estimate assumes 7 months of operation following installation, based on newspaper reports on closure date. Installation was completed on March 22, 2017, and closure was reported to be early November 2017.

For PG&E the savings determination of 8 projects in the sample were adversely affected by conditions that led to a determination of partial- or full-zero savings. An explanation is provided for each project in Table 5-34.

- The impact of partial- and full-zero sample points helps to explain the relatively low overall first year gross impact realization rate derived – 0.35. The scenarios leading to partial- or full-zero conclusion includes the following:
  - A partial-zero results from program equipment that are installed and put into service but then are subsequently removed from service – facility closures and equipment replacement are two such instances. Another instance involves sample point PGE-3, where the claim is for 2 fryer vats, but only 1 fryer vat was verified to be installed on-site.
  - A full-zero is applied in other instances – closure immediately following equipment installation, no gas fryer installed, and ineligible equipment verified as installed.

TABLE 5-35: INSTANCES OF PARTIAL- OR FULL-ZERO SAVINGS IN THE SCG SAMPLE

Sample Point Identifier	Comments Pertaining to Partial-Zero or Full-Zero Savers
SCG-6	2 units installed, but one never operates; therefore, the non-metered data contribute zero savings.
SCG-Zero-1	The participant closed the business in late 2018, following installation on July 14, 2017. Crediting savings for a 17-month period by setting EUL accordingly.
SCG-Zero-2	The participant stopped using the fryer in mid-2018, following a change to a bakery operation. The fryer installation was on August 25, 2017. Crediting savings for a 10-month period of savings and restricting the ex-post EUL to 1 year.
SCG-Zero-3	The originally installed equipment broke and was replaced with a unit from another restaurant. The fryer installation was on June 19, 2017. Crediting savings for a 12-month period of savings and restricting the ex-post EUL to 1 year.
SCG-Zero-4	The fryers are not used; one is in storage and the other held dirty dishes.
SCG-Zero-5	The fryer installed is not on the qualified products listing and is ineligible; standard equipment make and model.
SCG-Zero-6	The fryer installed is not on the qualified products listing and is ineligible; standard equipment make and model.
SCG-Zero-7	The fryer installed is not on the qualified products listing and is ineligible; standard equipment make and model.

For SCG the savings determination of 8 projects in the sample were adversely affected by conditions that led to a determination of partial- or full-zero savings. An explanation is provided for each project in Table 5-35.

- The impact of partial- and full-zero sample points helps to explain the relatively low overall first year gross impact realization rate derived – 0.37. The scenarios leading to partial- or full-zero conclusion includes the following:
  - A partial-zero results from program equipment that are installed and put into service but then subsequently removed from service – facility closures, equipment that are no longer in use, and equipment replacement are three such instances. Another instance involves sample point SCG-6, where the claim is for 2 fryer vats, but only 1 fryer vat operates.
  - A full-zero is applied in other instances – equipment that were observed to be unused, and ineligible equipment verified as installed.

The rationale for other relatively low realization rates are described throughout the remainder of this section, with an emphasis on key parameters used to derive savings and a comparison between ex-ante and ex-post parameter-level or modeling results.

5.3.2 Fryer Modeling-Based Impact Results

Table 5-36 and Table 5-37 present first year gross impact results supported by valid metering data and models, for the PG&E and SCG samples, respectively. These ex-post models support impact results derivation associated with three components of gas fryer usage – pre-heat mode, idle mode and frying (or cooking) mode – in addition to total savings across all three modes of operation. It is noted that for two ex-post SCG evaluation points in the sample it was not feasible to separate idle and frying modes of operation, and so the modes were combined for analysis purposes. For this reason, mean SCG evaluation results are also combined across both modes. For both PG&E and SCG the result show that impacts derived using ex-ante methods do not agree well with ex-post results, on average across all modeled points – both in total and at the component (mode)-level. All ex-post versus ex-ante results vary by more than 60%. Ex-post estimates of pre-heat gas savings are considerable higher than ex-ante estimates, while the opposite is true for the other components of savings. However, pre-heat savings opportunities are limited by low hours of operation in pre-heat mode. During fryer operation, fryers, on average, spend most of their time either in the idle mode of operation, where savings potential is great for that reason. The dramatic differences in modeling results across the two approaches are explored in great detail throughout this section of the report.

TABLE 5-36: EX-POST MODELING-BASED SAVINGS IN THE PG&E SAMPLE*

Sample Point Identifier	Ex-Post			
	Annual Pre-Heat Gas Savings (Therms)	Annual Idle Gas Savings (Therms)	Annual Frying Gas Savings (Therms)	Total Annual Fryer Savings (Therms)
PGE-1	15	112	419	546
PGE-2	11	33	55	99
PGE-3	13	108	23	144
PGE-4	28	105	13	146
PGE-5	21	321	62	405
PGE-6	22	183	295	500
PGE-7	12	88	28	128
PGE-8	22	191	205	417
PGE-9	28	200	147	374
PGE-10	30	76	222	328
PGE-11	10	105	36	152
PGE-12	13	23	2	39
PGE-13	18	189	158	365
Ex-Post Average Estimate	19	133	128	280
Ex-Ante Estimate	9	425	344	778
Percent Difference	-104%	69%	63%	64%

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

TABLE 5-37: EX-POST MODELING-BASED SAVINGS IN THE SCG SAMPLE*

Sample Point Identifier	Ex-Post			
	Annual Pre-Heat Gas Savings (Therms)	Annual Idle Gas Savings (Therms)	Annual Frying Gas Savings (Therms)	Total Annual Fryer Savings (Therms)
SCG-1	28	135	118	280
SCG-2	21	137	58	216
SCG-3	16	200	41	258
SCG-4	22	161	205	388
SCG-5	17	193	59	269
SCG-6	2	8	4	14
SCG-7	22	212	163	397
SCG-8	14	78	9	101
SCG-9	16	131	62	209
SCG-10	31	71	103	205
SCG-11	9	250		259
SCG-12	23	625		648
Ex-Post Average Estimate	18	252		270
Ex-Ante Estimate	9	425	344	778
Percent Difference	-102%	67%		65%

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

5.3.3 Effective Useful Life Evaluation Results

Table 5-38 and Table 5-39 present effective useful life (EUL) results for the PG&E and SCG samples, respectively. In general, ex-post EUL estimates were left unchanged from the ex-ante value of 12 years. But there are exceptions for each utility that are discussed below. These were all projects that received partial first year gross savings credit. An explanation for these changes is described for each project in Table 5-34 and Table 5-35 above.

TABLE 5-38: EX-POST EUL ESTIMATES IN THE PG&E SAMPLE

Sample Point Identifier	Ex-Post Effective Useful Life**	Ex-Ante Effective Useful Life
PGE-1	12	12
PGE-2	12	12
PGE-3	12	12
PGE-4	12	12
PGE-5	12	12
PGE-6	12	12
PGE-7	12	12
PGE-8	12	12
PGE-9	12	12
PGE-10	12	12
PGE-11	12	12
PGE-12	12	12
PGE-13	12	12
PGE-14	12	12
PGE-15	12	12
PGE-16	12	12
PGE-Zero-1	12	12
PGE-Zero-2	12	12
PGE-Zero-3	12	12
PGE-Zero-4	1	12
PGE-Zero-5	12	12
PGE-Zero-6	1	12
PGE-Zero-7	1	12
Total		
Average	11	12
Average of Modeled Points*	12	12

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

Impacts for PGE-14 through PGE-16 were derived using a weighted mean gross realization rate result from PGE-1 through PGE-13.

Impacts for PGE-Zero-1 through PGE-Zero-7 were derived using a similar approach to PGE-14 through PGE-16 but adjusted to reflect no savings or a partial savings credit.

Impacts for PGE-3 were also adjusted to reflect no savings for one of two fryer vats claimed.

** Effective useful life estimates were adjusted for each of three sampled applications in order to address equipment that were removed from operation.

Adjusted EUL estimates were derived for PGE-Zero-4, PGE-Zero-6 and PGE-Zero-7; otherwise ex-ante EUL estimates were left unchanged in the sample.

PG&E EUL results deviate from 12 years for three projects in the sample – PGE-Zero-4, PGE-Zero-6 and PGE-Zero-7. In all three cases this adjustment was made to capture loss of long-term savings associated with equipment that were removed from operation.

TABLE 5-39: EX-POST EUL ESTIMATES IN THE SCG SAMPLE

Sample Point Identifier	Ex-Post Effective Useful Life**	Ex-Ante Effective Useful Life
SCG-1	12	12
SCG-2	12	12
SCG-3	12	12
SCG-4	12	12
SCG-5	12	12
SCG-6	12	12
SCG-7	12	12
SCG-8	12	12
SCG-9	12	12
SCG-10	12	12
SCG-11	12	12
SCG-12	12	12
SCG-13	12	12
SCG-Zero-1	1.4	12
SCG-Zero-2	1.0	12
SCG-Zero-3	1.0	12
SCG-Zero-4	12	12
SCG-Zero-5	12	12
SCG-Zero-6	12	12
SCG-Zero-7	12	12
Total		
Average	11	12
Average of Modeled Points*	12	12

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.
Impacts for SCG-13 was derived using a weighted mean gross realization rate result from SCG-1 through SCG-12.
Impacts for SCG-Zero-1 through SCG-Zero-7 were derived using a similar approach to SCG-13 but adjusted to reflect no savings or a partial savings credit.
Impacts for SCG-6 was also adjusted to reflect no savings for one of two fryer vats claimed.

** Effective useful life estimates were adjusted for each of three sampled applications in order to address equipment that were removed from operation.
Adjusted EUL estimates were derived for SCG-Zero-1 through SCG-Zero-3; otherwise ex-ante EUL estimates were left unchanged in the sample.

SCG EUL results also deviate from 12 years for three projects in the sample – SCG-Zero-1 through SCG-Zero-3. In all three cases this adjustment was made to capture loss of long-term savings associated with equipment that were removed from operation.

The ex-ante EUL may understate the degree to which program installed equipment were found to be removed from service. In a period of about 1.5 years following installations, substantial EUL reductions were found to be applicable for three projects for both PG&E and SCG, in a total sample size of 23 and 20 projects, respectively. If this rate of removal from service were to continue, the resulting average EUL would be greatly shortened.

Furthermore, the ex-post mean EUL result masks the severity of program equipment claims that are no longer generating savings today. In the evaluation some projects are treated as full-zero savers, and an additional adjustment to the EUL would lead to a double-counting of savings reduction, so no such EUL adjustments were applied in those instances. Still, the true incidence in the sample of projects that no longer generate savings today is somewhat in excess of 7 projects for both PG&E and SCG; indicating that the true impact of deeply shortened savings is much greater than is implied by the ex-post EUL results.

For these reasons the PAs should consider reduction in the ex-ante EUL of 12 years. However, it should be noted that additional suggestions are provided at the close of this sub-section that could also be used to reduce the incidence rate of zero savers, which, as noted above, also have a significant effect on the duration over which program claims provide savings benefits. Some mix of both sets of recommendations is likely needed.

5.3.4 Lifecycle Gross Impact Results

Table 5-40 and Table 5-41 present lifecycle gross impact results for the PG&E and SCG on-site samples, respectively. Lifecycle savings represent first year gross impacts multiplied by the EUL for each project, and mean results presented here for the sample yield realization rates of 0.33 for PG&E and 0.32 for SCG. Adjustments to EUL estimates lead to lower lifecycle realization rates relative to first year realization rates discussed above.

TABLE 5-40: LIFECYCLE GROSS IMPACT RESULTS FOR PG&E SAMPLE POINTS

Sample Point Identifier	Ex-Post Lifecycle Gross Impact Savings (Therms)	Ex-Ante Lifecycle Gross Impact Claim (Therms)	Results Lifecycle Gross Impact Realization Rate
PGE-1	6,548	6,576	1.00
PGE-2	1,188	6,576	0.18
PGE-3	1,730	13,152	0.13
PGE-4	1,748	6,576	0.27
PGE-5	4,859	6,576	0.74
PGE-6	5,997	6,576	0.91
PGE-7	1,535	6,576	0.23
PGE-8	5,008	6,576	0.76
PGE-9	4,493	6,576	0.68
PGE-10	3,938	6,576	0.60
PGE-11	1,819	6,576	0.28
PGE-12	924	13,152	0.07
PGE-13	4,377	6,576	0.67
PGE-14	2,944	6,576	0.45
PGE-15	2,944	6,576	0.45
PGE-16	2,944	6,576	0.45
PGE-Zero-1	0	6,576	0.00
PGE-Zero-2	0	6,576	0.00
PGE-Zero-3	0	6,576	0.00
PGE-Zero-4	51	6,576	0.01
PGE-Zero-5	0	6,576	0.00
PGE-Zero-6	245	6,576	0.04
PGE-Zero-7	143	6,576	0.02
Total	53,436	164,400	
Average	2,323	7,148	0.33
Average of Modeled Points*	3,397	7,588	0.45

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

Impacts for PGE-14 through PGE-16 were derived using a weighted mean gross realization rate result from PGE-1 through PGE-13.

Impacts for PGE-Zero-1 through PGE-Zero-7 were derived using a similar approach to PGE-14 through PGE-16 but adjusted to reflect no savings or a partial savings credit.

Impacts for PGE-3 were also adjusted to reflect no savings for one of two fryer vats claimed.

TABLE 5-41: LIFECYCLE GROSS IMPACT RESULTS FOR SCG SAMPLE POINTS

Sample Point Identifier	Ex-Post Lifecycle Gross Impact Savings (Therms)	Ex-Ante Lifecycle Gross Impact Claim (Therms)	Results Lifecycle Gross Impact Realization Rate
SCG-1	3,366	6,576	0.51
SCG-2	2,597	6,576	0.39
SCG-3	6,181	13,152	0.47
SCG-4	4,659	6,576	0.71
SCG-5	3,223	6,576	0.49
SCG-6	163	13,152	0.01
SCG-7	4,761	6,576	0.72
SCG-8	1,213	6,576	0.18
SCG-9	2,513	6,576	0.38
SCG-10	2,455	6,576	0.37
SCG-11	3,103	6,576	0.47
SCG-12	15,558	13,152	1.18
SCG-13	6,639	13,152	0.50
SCG-Zero-1	392	6,576	0.06
SCG-Zero-2	231	6,576	0.04
SCG-Zero-3	277	6,576	0.04
SCG-Zero-4	0	13,152	0.00
SCG-Zero-5	0	13,152	0.00
SCG-Zero-6	0	6,576	0.00
SCG-Zero-7	0	13,152	0.00
Total	57,330	177,552	
Average	2,867	8,878	0.32
Average of Modeled Points*	4,149	8,220	0.50

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

Impacts for SCG-13 was derived using a weighted mean gross realization rate result from SCG-1 through SCG-12.

Impacts for SCG-Zero-1 through SCG-Zero-7 were derived using a similar approach to SCG-13 but adjusted to reflect no savings or a partial savings credit.

Impacts for SCG-6 was also adjusted to reflect no savings for one of two fryer vats claimed.

5.3.5 Fryer Modeling-Based Usage Results

We saw above in Table 5-36 and Table 5-37 that a comparison of impacts between ex-post and ex-ante fryer modeling yields diverging results, but these same models also allow for a comparison of fryer usage across the two model sources, for both the efficient fryer and baseline fryer condition. Table 5-42 and Table 5-43 present annual gas usage results for the efficient fryer case, supported by valid metering data and models, for the PG&E and SCG samples, respectively. For all fryer modes of operation modeled, the ex-post model, on average yields lower usage estimates than does the ex-ante model.

TABLE 5-42: EX-POST MODELING-BASED EFFICIENT FRYER USAGE IN THE PG&E SAMPLE*

Sample Point Identifier	Ex-Post Efficient Fryer			
	Annual Pre-Heat Gas Usage (Therms)	Annual Idle Gas Usage (Therms)	Annual Frying Gas Usage (Therms)	Annual Total Fryer Gas Usage (Therms)
PGE-1	20	164	988	1,172
PGE-2	15	66	129	210
PGE-3	17	159	54	230
PGE-4	37	154	31	221
PGE-5	28	471	147	646
PGE-6	30	365	695	1,090
PGE-7	16	175	66	258
PGE-8	29	280	482	791
PGE-9	37	293	347	676
PGE-10	41	151	524	716
PGE-11	14	210	85	309
PGE-12	17	34	5	57
PGE-13	24	276	372	673
Ex-Post Average Estimate	25	215	302	542
Ex-Ante Estimate	58	273	548	879
Percent Difference	57%	21%	45%	38%

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

TABLE 5-43: EX-POST MODELING-BASED EFFICIENT FRYER USAGE IN THE SCG SAMPLE*

Sample Point Identifier	Ex-Post Efficient Fryer			
	Annual Pre-Heat Gas Usage (Therms)	Annual Idle Gas Usage (Therms)	Annual Frying Gas Usage (Therms)	Annual Total Fryer Gas Usage (Therms)
SCG-1	38	269	278	585
SCG-2	29	273	137	439
SCG-3	21	293	98	412
SCG-4	31	321	483	835
SCG-5	23	385	139	546
SCG-6	2	11	10	23
SCG-7	29	423	384	837
SCG-8	19	156	21	196
SCG-9	22	261	147	430
SCG-10	43	141	242	426
SCG-11	12	519		532
SCG-12	31	1,301		1,332
Ex-Post Average Estimate	25	524		549
Ex-Ante Estimate	58	273	548	879
Percent Difference	57%	36%		38%

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

Table 5-44 and Table 5-45 present annual gas usage results for the baseline fryer case, supported by valid metering data and models, for the PG&E and SCG samples, respectively. Again, we see that for all fryer modes of operation modeled, the ex-post model, on average yields lower usage estimates than does the ex-ante model.

TABLE 5-44: EX-POST MODELING-BASED BASELINE FRYER USAGE IN THE PG&E SAMPLE*

Sample Point Identifier	Ex-Post Baseline Fryer			
	Annual Pre-Heat Gas Usage (Therms)	Annual Idle Gas Usage (Therms)	Annual Frying Gas Usage (Therms)	Annual Total Fryer Gas Usage (Therms)
PGE-1	34	275	1,407	1,717
PGE-2	27	99	184	309
PGE-3	30	267	77	374
PGE-4	64	259	43	367
PGE-5	49	793	209	1,051
PGE-6	51	548	990	1,590
PGE-7	28	263	95	386
PGE-8	51	471	687	1,208
PGE-9	64	492	494	1,051
PGE-10	71	227	747	1,044
PGE-11	24	316	120	460
PGE-12	31	57	8	95
PGE-13	43	465	530	1,038
Ex-Post Average Estimate	44	349	430	822
Ex-Ante Estimate	68	698	892	1,657
Percent Difference	35%	50%	52%	50%

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

TABLE 5-45: EX-POST MODELING-BASED BASELINE FRYER USAGE IN THE SCG SAMPLE*

Sample Point Identifier	Ex-Post Baseline Fryer			
	Annual Pre-Heat Gas Usage (Therms)	Annual Idle Gas Usage (Therms)	Annual Frying Gas Usage (Therms)	Annual Total Fryer Gas Usage (Therms)
SCG-1	66	404	396	865
SCG-2	50	410	195	656
SCG-3	37	493	139	670
SCG-4	53	482	688	1,223
SCG-5	40	578	197	815
SCG-6	4	19	14	37
SCG-7	51	635	547	1,233
SCG-8	33	235	29	297
SCG-9	38	392	209	639
SCG-10	74	212	345	630
SCG-11	21	769		790
SCG-12	54	1,926		1,980
Ex-Post Average Estimate	43	776		820
Ex-Ante Estimate	68	698	892	1,657
Percent Difference	36%	51%		51%

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

So how might we seek to explain the dramatic level of differences that we see in modeling-based usage and impact estimates? The answer lies in the underlying parameter-level inputs that we explore next.

5.3.6 Fryer Performance Specifications

An important and common set of inputs that contribute to both the ex-post and ex-ante modeling-based impact results are performance testing data for both the efficient fryer and baseline fryer conditions. Table 5-46 and Table 5-47 present equipment performance data for the efficient fryer case, supported by laboratory testing results obtained from the Food Service and Technology Center (FSTC), for the PG&E and SCG samples, respectively. Units verified during on-site inspection were used to identify the appropriate testing results for each model. All verified installations, across both PG&E and SCG, are for two very popular program qualifying units. Test results yield the following important modeling parameters: pre-heat usage, the idle energy rate and the tested cooking efficiency. These are all common parameters to both the ex-post and ex-ante models. Testing-based results are also provided for the equipment tested production capacity, which is utilized in the ex-ante model, but was not incorporated into the ex-post model. Also, for the ex-post model the rated input capacity is an important term (that does not contribute to the ex-ante model) – 70,000 Btu/hr for all verified installations.

The average parameters for the samples are compared against parameters applied in the ex-ante model. Results are very similar for both the PG&E and SCG samples.

- As stated earlier, pre-heat usage estimates, though different, have only a modest impact on the overall gas fryer savings estimate. However, the ex-post evaluation result, being a lower estimate in the post-installation efficient fryer condition, effectively increases impacts relative to the ex-ante performance point.
- The ex-post average idle energy rate for the post-installation efficient fryer is somewhat higher than the ex-ante parameter, which has a downward effect on the resulting impact.
- The ex-post average cooking efficiency for the post-installation efficient fryer is somewhat lower than the ex-ante parameter, which has a downward effect on the resulting impact.

It is notable that these differences in efficient fryer performance would be expected to have a moderately important effect on resulting ex-ante impact estimates, and should be taken under consideration for the purposes of revisions to ex-ante workpapers and resulting impact claims on a going forward basis. Ex-ante performance parameters are based on an average taken across a great number of tested equipment, and yet we see that program participation appears to be comprised largely of just two eligible fryer models on the market. Market and program preferences in equipment selection should be considered for the purposes of updating efficient fryer performance parameters that are used in updates to the ex-ante model.

TABLE 5-46: EX-POST MODELING-BASED EFFICIENT FRYER PERFORMANCE IN THE PG&E SAMPLE*

Sample Point Identifier	Ex-Post Efficient Fryer			
	Installed Equipment Tested Pre-Heat (Btu)	Installed Equipment Tested Idle Energy Rate (Btu/hr)	Installed Equipment Tested Cooking Efficiency	Installed Equipment Tested Production Capacity (Lbs/hr)
PGE-1	9,456	7,349	50%	59
PGE-2	9,582	8,233	50%	58
PGE-3	9,456	7,349	50%	59
PGE-4	9,456	7,349	50%	59
PGE-5	9,456	7,349	50%	59
PGE-6	9,582	8,233	50%	58
PGE-7	9,582	8,233	50%	58
PGE-8	9,456	7,349	50%	59
PGE-9	9,456	7,349	50%	59
PGE-10	9,582	8,233	50%	58
PGE-11	9,582	8,233	50%	58
PGE-12	9,456	7,349	50%	59
PGE-13	9,456	7,349	50%	59
Ex-Post Average Estimate	9,504	7,689	50%	59
Ex-Ante Estimate	16,000	6,371	57%	75
Percent Difference	41%	-21%	12%	22%

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

TABLE 5-47: EX-POST MODELING-BASED EFFICIENT FRYER USAGE IN THE SCG SAMPLE*

Sample Point Identifier	Ex-Post Efficient Fryer			
	Installed Equipment Tested Pre-Heat (Btu)	Installed Equipment Tested Idle Energy Rate (Btu/hr)	Installed Equipment Tested Cooking Efficiency	Installed Equipment Tested Production Capacity (Lbs/hr)
SCG-1	9,582	8,233	50%	58
SCG-2	9,582	8,233	50%	58
SCG-3	9,456	7,349	50%	59
SCG-4	9,582	8,233	50%	58
SCG-5	9,582	8,233	50%	58
SCG-6	9,456	7,349	50%	59
SCG-7	9,582	8,233	50%	58
SCG-8	9,582	8,233	50%	58
SCG-9	9,582	8,233	50%	58
SCG-10	9,582	8,233	50%	58
SCG-11	9,582	8,233	50%	58
SCG-12	9,456	7,349	50%	59
Ex-Post Average Estimate	9,551	8,012	50%	58
Ex-Ante Estimate	16,000	6,371	57%	75
Percent Difference	40%	-26%	12%	22%

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

Table 5-48 and Table 5-49 present equipment performance data for the baseline fryer case, supported by laboratory testing results obtained from the FSTC, for the PG&E and SCG samples, respectively. The FSTC-supplied database was sorted in order to isolate gas fryers, with a standard 14 inch vat width, and with performance specifications that fail to comply with program qualification requirements for both the idle energy rate and cooking efficiency. That is, all idle energy rates were greater than or equal to 9,000 Btu/hr and all cooking efficiency parameters were less than 50 percent – with the program eligibility threshold being less than 9,000 Btu/hr and equal to or less than 50%. The resulting subset of baseline units in the database totaled 11 units, with idle energy rates ranging from 9,403 Btu/hr to 14,955 Btu/hr and cooking efficiencies ranging from 24% to 42%. An average was then derived across baseline units for each performance parameter shown in Table 5-48 and Table 5-49 , and this average was applied to derived gas baseline usage and fryer savings for each point in the modeling-based evaluation sample.

The average parameters for the samples are compared against parameters applied in the ex-ante model. Results are identical for both the PG&E and SCG samples.

- Pre-heat usage estimates vary by only a 10 percent difference, and this has only a modest impact on the overall gas fryer savings estimate. However, the ex-post evaluation result, being a lower estimate in the baseline fryer condition, effectively decreases impacts relative to the ex-ante performance point.
- The ex-post average idle energy rate for the baseline fryer is substantially lower than the ex-ante parameter, which has a large downward effect on the resulting impact. The ex-ante parameter, equal to 17,000 Btu/hr, appears unreasonable, given that not a single standard baseline unit analyzed in the FSTC database had an idle energy rate that high.
- The ex-post average cooking efficiency for the baseline fryer is equal to the ex-ante parameter, and serves to confirm that this ex-ante parameter is reasonable.

The difference in baseline idle energy rate would be expected to have a substantial effect on resulting ex-ante impact estimates, and should be taken under consideration for the purposes of revisions to ex-ante workpapers and resulting impact claims on a going forward basis. It is recommended that a market assessment be conducted by the PAs in order to better understand customer equipment choices in the marketplace as a function of market segment and other factors. Baseline for the program should reflect common market choices for equipment, and performance testing should subsequently be performed on equipment that reflect these market-based preferences. Baseline conditions used in the ex-ante estimates should reflect common practice for a given segment of the population, or perhaps a weighted blend of customer preferences, given underlying program participation patterns by segment. It is further recommended that CPUC Standard Practice Guidelines be following for the purposes of conducting a market assessment.

TABLE 5-48: EX-POST MODELING-BASED BASELINE FRYER PERFORMANCE IN THE PG&E SAMPLE*

Sample Point Identifier	Ex-Post Baseline Fryer			
	Baseline Equipment Tested Pre-Heat (Btu)	Baseline Equipment Tested Idle Energy Rate (Btu/hr)	Baseline Equipment Tested Cooking Efficiency	Baseline Equipment Tested Production Capacity (Lbs/hr)
PGE-1	16,589	12,364	35%	54
PGE-2	16,589	12,364	35%	54
PGE-3	16,589	12,364	35%	54
PGE-4	16,589	12,364	35%	54
PGE-5	16,589	12,364	35%	54
PGE-6	16,589	12,364	35%	54
PGE-7	16,589	12,364	35%	54
PGE-8	16,589	12,364	35%	54
PGE-9	16,589	12,364	35%	54
PGE-10	16,589	12,364	35%	54
PGE-11	16,589	12,364	35%	54
PGE-12	16,589	12,364	35%	54
PGE-13	16,589	12,364	35%	54
Ex-Post Average Estimate	16,589	12,364	35%	54
Ex-Ante Estimate	18,500	17,000	35%	60
Percent Difference	10%	27%	0%	9%

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

TABLE 5-49: EX-POST MODELING-BASED BASELINE FRYER PERFORMANCE IN THE SCG SAMPLE*

Sample Point Identifier	Ex-Post Baseline Fryer			
	Baseline Equipment Tested Pre-Heat (Btu)	Baseline Equipment Tested Idle Energy Rate (Btu/hr)	Baseline Equipment Tested Cooking Efficiency	Baseline Equipment Tested Production Capacity (Lbs/hr)
SCG-1	16,589	12,364	35%	54
SCG-2	16,589	12,364	35%	54
SCG-3	16,589	12,364	35%	54
SCG-4	16,589	12,364	35%	54
SCG-5	16,589	12,364	35%	54
SCG-6	16,589	12,364	35%	54
SCG-7	16,589	12,364	35%	54
SCG-8	16,589	12,364	35%	54
SCG-9	16,589	12,364	35%	54
SCG-10	16,589	12,364	35%	54
SCG-11	16,589	12,364	35%	54
SCG-12	16,589	12,364	35%	54
Ex-Post Average Estimate	16,589	12,364	35%	54
Ex-Ante Estimate	18,500	17,000	35%	60
Percent Difference	10%	27%	0%	9%

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

5.3.7 Fryer Operation

An important and common set of inputs that contribute to both the ex-post and ex-ante modeling-based impact results are operating profiles for both the efficient fryer and baseline fryer conditions. Table 5-50 and Table 5-51 present observed fryer operating profiles, supported by a combination of metering data-based profiles and participant self-reported information, for the PG&E and SCG samples, respectively. The associated ex-post parameters derived for each metering-based sample point include operating days per year, daily average hours of fryer operation and average daily minutes of pre-heat burner runtime. When comparing ex-post and ex-ante resulting parameters, the average results across sample points all indicate fewer days of operation, fewer hours of fryer operation per day and fewer minutes of pre-heat runtime. Each difference leads to a reduction in ex-post impacts relative to ex-ante, with daily schedule of operation being very important, operating days per year having a meaningful effect, and pre-heat minutes being somewhat inconsequential to the level of reduction in impacts.

- A relatively small number of sample points were found to influence the average ex-post result for daily operating hours downwards. Not all fryers operate for a long duration of hours per day, with the most obvious examples being PGE-12 and SCG-6. One project is a catering outfit and the other is an assisted living facility, and both of these participants operate their fryers on a sporadic basis.
- Regarding operating days per year, both PGE-12 and SCG-6 also contribute to the downward ex-post average. Other projects having a substantial downward effect on the average includes facilities that have more than one fryer and alternate schedules/days of frying between the two fryers.

TABLE 5-50: EX-POST MODELING-BASED FRYER OPERATING PROFILES IN THE PG&E SAMPLE*

Sample Point Identifier	Ex-Post Efficient Fryer		
	Operating Days per Year	**Daily Average Operating Fryer Hours**	**Average Daily Operating Pre-Heat Runtime (Minutes Burner On)**
PGE-1	363	12	5
PGE-2	280	6	8
PGE-3	258	10	6
PGE-4	361	5	9
PGE-5	364	13	7
PGE-6	361	14	7
PGE-7	182	11	8
PGE-8	363	11	7
PGE-9	363	11	9
PGE-10	365	15	10
PGE-11	182	11	7
PGE-12	163	1	9
PGE-13	358	8	6
Ex-Post Average Estimate	305	10	7
Ex-Ante Estimate	365	14	15
Percent Difference	16%	29%	52%

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

TABLE 5-51: EX-POST MODELING-BASED FRYER OPERATING PROFILES IN THE SCG SAMPLE*

Sample Point Identifier	Ex-Post Efficient Fryer		
	Operating Days per Year	Daily Average Operating Fryer Hours	Average Daily Operating Pre-Heat Runtime (Minutes Burner On)
SCG-1	361	11	9
SCG-2	364	11	7
SCG-3	365	11	5
SCG-4	363	14	7
SCG-5	363	14	5
SCG-6	63	3	3
SCG-7	364	17	7
SCG-8	362	9	6
SCG-9	358	11	5
SCG-10	363	11	14
SCG-11	188	11	6
SCG-12	363	17	7
Ex-Post Average Estimate	323	12	7
Ex-Ante Estimate	365	14	15
Percent Difference	11%	17%	54%

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

It should be noted that metering data were most valuable to the evaluation in being able to discern each fryer operation parameter, but supplemental self-report data was also necessary to accurately model each parameter. It is recommended that metering-based results from this study be incorporated into revisions to workpaper models, and perhaps supplemented with additional metering and participant self-report data sources. Preferably additional metering can be undertaken by the PAs, due to the value of that knowledge resource relative to self-report information, even given substantial costs versus purely self-report data. It may also be feasible to mine other available industry data sources, including previous field metering projects.

So what happens if we meld together the ex-post evaluation-based parameters with the ex-ante model? We explore that in the next sub-section below.

5.3.8 Gas Fryer Discrepancy Factors

In an effort to further explore the discrepancy factors that lead to dramatic differences between ex-ante modeled impacts and ex-post modeled impacts, the ex-post evaluation parameters were sequentially and cumulatively applied to the ex-ante model in order to derive an ex-ante result under the observed field conditions from the metering-based ex-post samples. This also provides an opportunity to explore differences between the two models surrounding each of the parameter differences described above in Section 5.3.6 and 5.3.7. Also, the ex-ante model applied excludes the CPUC 30% adjustment factor, allowing for an assessment of model accuracy without incumbrances from this adjustment, which has no basis in facts related to real-world fryer operations and savings. Not so, however, for the other parameters used in the model.

Table 5-52 and Table 5-53 present each of the key parameters that contribute to the ex-ante model for both the baseline fryer and efficient fryer cases, for PG&E and SCG, respectively. Changes from ex-ante to ex-post model parameters were applied in each of 4 stages shown in the tables, including one additional fifth stage associated with zero savers:

- Stage 1 baseline equipment performance
- Stage 2 efficient equipment performance
- Stage 3 fryer operation parameters
- Stage 4 other; modeled as adjustments to food loads in pounds of food cooked per day
- Stage 5 partial- or full-zero savers

TABLE 5-52: SUMMARY OF EX-ANTE MODEL PARAMETER ADJUSTMENTS FOR PG&E*

Parameter	Ex-Ante Model Adjustment Stage	Ex-Ante Parameters		Ex-Post Parameters	
		Base Case Model	Measure Case Model	Baseline Fryer	Efficient Fryer
Number of Preheats per Day (#/day)		1	1	1	1
Preheat Time (minutes)	3 Fryer Operation	15	15	7	7
Fryer Size (inches)		14	14	14	14
Preheat Energy (Btu)	1 Baseline Performance / 2 Efficient Performance	18,500	16,000	16,589	9,504
Idle Energy Rate (Btu/hr)	1 Baseline Performance / 2 Efficient Performance	17,000	6,371	12,364	7,689
Heavy Load Cooking Energy Efficiency (%)	1 Baseline Performance / 2 Efficient Performance	35%	57%	35%	50%
Production Capacity (lbs/hr)	1 Baseline Performance / 2 Efficient Performance	60	75	54	59
Pounds of Food Cooked per Day	4 Other	150	150	100	100
ASTM Energy to Food (Btu/lb)		570	570	570	570
Operating Hours/Day	3 Fryer Operation	14	14	10	10
Operating Days/Year	3 Fryer Operation	365	365	305	305
CPUC Adjustment Factor -- IOU		30%		NA	
Btu's per Therm		100,000		100,000	

* Using metering data, annual gross impacts were modeled in the evaluation for PGE-1 through PGE-13.

TABLE 5-53: SUMMARY OF EX-ANTE MODEL PARAMETER ADJUSTMENTS FOR SCG*

Parameter	Ex-Ante Model Adjustment Stage	Ex-Ante Parameters: Base Case Model	Ex-Ante Parameters: Measure Case Model	Ex-Post Parameters: Baseline Fryer	Ex-Post Parameters: Efficient Fryer
Number of Preheats per Day (#/day)		1	1	1	1
Preheat Time (minutes)	3 Fryer Operation	15	15	7	7
Fryer Size (inches)		14	14	14	14
Preheat Energy (Btu)	1 Baseline Performance / 2 Efficient Performance	18,500	16,000	16,589	9,551
Idle Energy Rate (Btu/hr)	1 Baseline Performance / 2 Efficient Performance	17,000	6,371	12,364	8,012
Heavy Load Cooking Energy Efficiency (%)	1 Baseline Performance / 2 Efficient Performance	35%	57%	35%	50%
Production Capacity (lbs/hr)	1 Baseline Performance / 2 Efficient Performance	60	75	54	58
Pounds of Food Cooked per Day	4 Other	150	150	100	100
ASTM Energy to Food (Btu/lb.)		570	570	570	570
Operating Hours/Day	3 Fryer Operation	14	14	12	12
Operating Days/Year	3 Fryer Operation	365	365	323	323
CPUC Adjustment Factor -- IOU		30%		NA	
Btu's per Therm		100,000		100,000	

* Using metering data, annual gross impacts were modeled in the evaluation for SCG-1 through SCG-12.

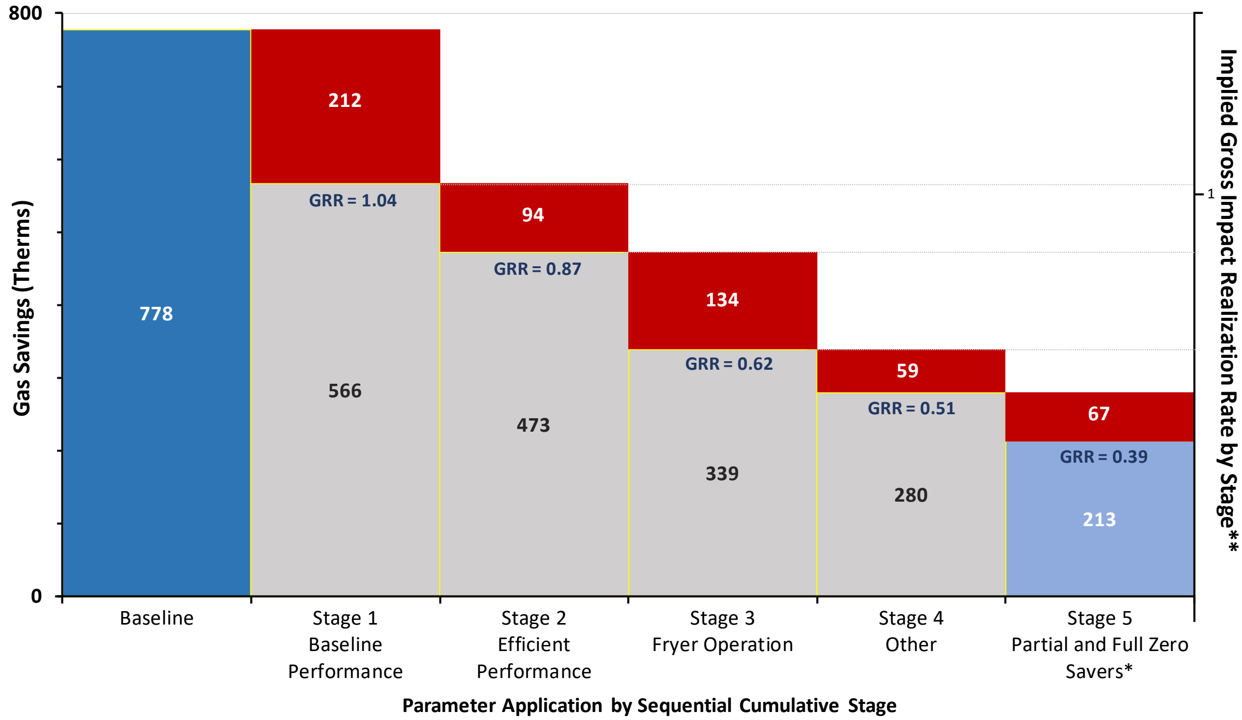
The adjustments accumulate going from Stage 1 to Stage 5 in each of five versions of the ex-ante model. For example, Stage 2 consists of adjustments that include both baseline efficient fryer performance adjustments. The ex-ante model-based impact results developed in each stage were then recorded; this allowed the evaluation team to examine the degree of savings associated with each model-based parameter adjustment, both in isolation and in total.

In all cases, except for lack of a formal assessment of Stage 4 food loads in the ex-post sample, the adjustments are all based on ex-post parameter-level results for the evaluation samples. The food load data and information collected as part of the evaluation effort was never used as a source of data in developing ex-post savings estimates, and so was never formally vetted by the evaluation team. First, the data were incomplete, and second the data were sometimes recorded by inspectors using inconsistent methods across sample points. For these reasons we have elected to not present that ex-post data in this section. However, the reported food loads in the samples, where reliable information was obtained, were generally lower than the 150 pounds per operating day applied in the ex-ante model. For modeling purposes a food load of 100 pounds was substituted. There are likely other non-modeled explanatory factors associated with the Stage 4 adjustment besides food loads, but food load is the only other significant model input that could be changed in order to capture Stage 4 effects on impacts derived using ex-ante methods.

Figure 5-6 and Figure 5-7 present ex-ante model-based impact estimates for each cumulative stage of adjustment discussed above, for PG&E and SCG, respectively. Additionally, the level of savings reduction of each stage is identified, culminating in an ex-ante model-derived estimate of impact consistent with conditions/parameters observed in the ex-post samples. The implied realization rate is also shown in the figures, based on an ex-ante savings of 545 Therms per fryer vat, which includes the 30% CPUC adjustment, as does the basis for first year gross impact realization rates derived above in Section 5.1. This allows for a direct and fair comparison with evaluation realization rate results presented above in Table 5-32 and Table 5-33.

- For PG&E the resulting savings per fryer vat is well aligned with Table 5-14 results, yielding a realization rate of 0.39 versus 0.35.
- For SCG the results are similar, yielding a realization rate of 0.39 versus 0.37.

FIGURE 5-6: EX-ANTE MODEL-DERIVED IMPACTS PER FRYER VAT FOR PG&E

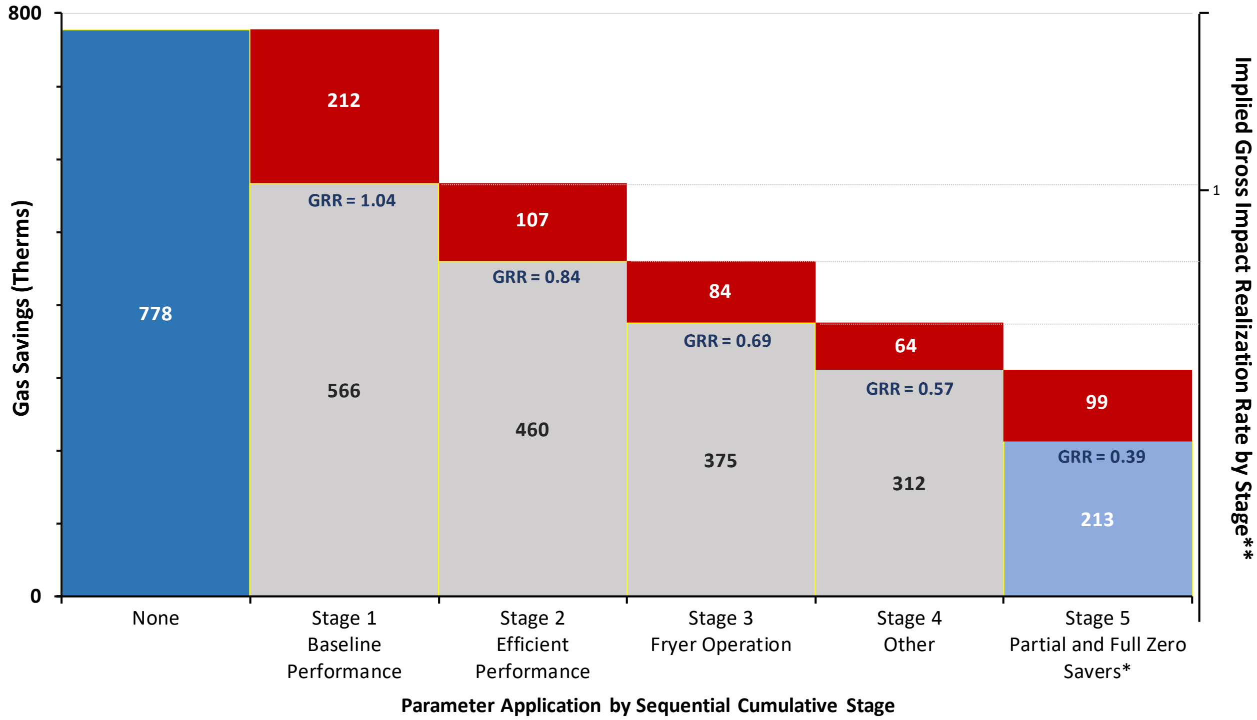


* There is a 23 percent probability of any given fryer vat in the PG&E sample being zero for first year gross savings, and 280 Therms is the mean ex-ante model-based first year savings estimate for a fryer vat following cumulative parameter updates through Stage 4. And 280 x (1-0.23) = 213, where 213 represents the cumulative Stage 5 savings.

** The implied gross impact realization rate is the ratio of the unadjusted ex-ante model impact per fryer vat divided by the adjusted ex-ante model impact per fryer vat. The denominator in each ratio is 545 Therms, and the numerator is the ex-ante model-based annual fryer gas savings for each Stage. All estimates were independently derived using ex-ante methods, with the exception of the Stage 5 increment due to zero savers.

Based on the incremental savings reduction of each stage for the PG&E model, the ranking of reduction from greatest to least is: baseline fryer performance, fryer operation, efficient fryer performance, zero savers and other. It should be noted that the order in which a given parameter is introduced at particular stage also influences the level of savings associated with each adjustment. For example, the influence on impacts of the baseline fryer performance differences may be artificially high due to this parameter being introduced first in order. This could be resolved through averaging of every possible order iteration, but that was not really the purpose of the exercise performed and presented here.

FIGURE 5-7: EX-ANTE MODEL-DERIVED IMPACTS PER FRYER VAT FOR SCG



* There is a 32 percent probability of any given fryer vat in the SCG sample being zero for first year gross savings, and 312 Therms is the mean ex-ante model-based first year savings estimate for a fryer vat following cumulative parameter updates through Stage 4. And 312 x (1-0.32) = 213, where 213 represents the cumulative Stage 5 savings.

** The implied gross impact realization rate is the ratio of the unadjusted ex-ante model impact per fryer vat divided by the adjusted ex-ante model impact per fryer vat. The denominator in each ratio is 545 Therms, and the numerator is the ex-ante model-based annual fryer gas savings for each Stage. All estimates were independently derived using ex-ante methods, with the exception of the Stage 5 increment due to zero savers.

Based on the incremental savings reduction of each stage for the SCG model, the ranking of reduction from greatest to least is: baseline fryer performance, efficient fryer performance, zero savers, fryer operation and other.

Importantly the results of this analysis support the robustness of both the ex-post and ex-ante models, as both approaches yield very similar results. This is encouraging because it implies that in addition to addressing the reasons for zero savers in the program population, which is very important as well, updates to ex-ante model parameters can be used to largely close the gap between ex-ante and ex-post estimates of savings.

Regarding zero savers, tighter program controls may be warranted to reduce the downward effect of those projects on realized savings.

- *Verification that installed units are program qualifying models*
- *Verification that units were ever installed*
- *Verification that all installed units will operate*
- *Perform testing on qualified unit models to ensure survival under normal operating conditions*

Unfortunately, zero savers due facility closures likely cannot be avoided.

5.4 AGRICULTURAL IRRIGATION MEASURES

Below we discuss the detailed approach for estimating each individual impact parameter, including the installation rate, annual operating hours, reduction in pumping discharge pressure and coincidence factor, and resulting gross realization rates.

Installation Rate

The installation rate is defined as the ratio of affected acreage served by the installed equipment, as verified by the evaluators, versus the affected acreage reported to the program administrator. The installation rate is estimated for each site based on data gathered during the engineering interview and on-site visit (where applicable). As part of the interviews and on-site visits, an objective of the evaluator was to identify and assess the quantity and operability of all equipment installed as well as the acreage of plot served by the irrigation system.

For the PY2017 cycle, evaluators assessed 19 participating sites and determined **an installation rate of 99.4%**, and all site inspections corroborated the installation rate findings initially gathered over the phone. Installation rates for 7 projects were corroborated via supplemental on-site visits.[10]

The key measure count identified during the interviews and visits is the acreage served by the rebated irrigation system currently installed and in working condition. Evaluators used a combination of interview questions, inspection, and review of project invoices to confirm the acreage served. The installation rate

[10] As discussed below, the evaluators determined that five sampled projects were ineligible because they were either growing deciduous crops, previously irrigated using an ineligible method, or both. However, these sites are included in the installation rate, as the rebated equipment was properly installed and functioning.

is calculated directly from this measurement. Additionally, when possible, the evaluator collected data on the length of rebated drip tape.

$$IR = \frac{A_V}{A_R}$$

Where:

IR = Installation Rate

A_V = Affected area (acres) verified by evaluators

A_R = Affected area (acres) reported in program tracking system

For the 19 sprinkler nozzle projects in the sample, the evaluators determined an installation rate of 99.4%, as two sites (both of which are part of the same farm) were confirmed via site visit to have installed the rebated equipment on only a portion of the acreage reported to the program. The site contact noted that the reported acreage was equivalent to "county acres", but the actual farmed acreage is slightly less. The remainder of sites installed the drip irrigation system on the fully reported acreage; all installed drip systems were confirmed as properly functioning (i.e., no installed drip systems were failed, removed, or in storage). Table 5-54 breaks down the installation rate by the categories defined previously.

TABLE 5-54: DISPOSITION OF ESPI MICRO-NOZZLE AND DRIP IRRIGATION VERIFICATION

Measure	Sites	Received Rate	Failure Rate	Storage Rate	Removal Rate	Installation Rate
Drip Irrigation	19	100%	0.0%	0.0%	0.0%	99.4%

Operating Hours

One of the primary inputs to the gross savings calculations is the number of annual hours that the irrigation pump operates. Savings from drip irrigation systems are theoretically realized during each hour of irrigation pump operation. This section will discuss the development of the annual operating hour value from site-level data collection.

For each sampled project, annual operating hour estimates were triangulated among two different calculations, depending on data availability and quality:

1. Engineering interviews collected information, per the data collection form in Appendix B on customer-reported irrigation frequency and hours per irrigation, in order to estimate pre- and post-project irrigation pump runtimes.
2. Field staff noted the rated horsepower of affected irrigation pump(s) in the pre- and post-project configurations. If the pump(s) operated at constant speed, the annual utility consumption total divided by the kW rating of the pump(s) results in an estimate of annual full-load operating hours.

Because the estimates above might not have encompassed a full year, the operating hours estimates typically needed to be extrapolated out to a full year of 8,760 hours. These extrapolations considered seasonal irrigation patterns and water requirements by crop type. For example, Central Valley farms with field crops typically do not irrigate between the months of November and February.

After applying the two-pronged operating hours approach described above for each sampled project, the evaluators determined an average post-installation irrigation operating hour value weighted by project acreage to be 1,352 hours. The applicable PG&E workpaper (PGECOAGR111 Revision 6) does not explicitly specify the operating hours reflected in the deemed ex-ante savings.[11]

Pumping Discharge Pressure

A key variable affecting the sprinkler replacement savings is the reduction in discharge pressure experienced by the irrigation pump. Evaluators gathered information on this parameter using engineering interviews regarding pre- and post-intervention discharge pressures. Farmers typically monitor these values closely, to ensure no overwatering occurs, which can lead to crop disease. Evaluators noted their pre/post discharge pressure estimates during phone interviews and site visits. Evaluators sought to estimate this value via gauge reading when possible, but due to the timing of the study, all affected irrigation pumps were not operating at the time of the site visits.

The evaluators calculated the weighted average discharge pressure reduction for eligible sites to be **34 psi**. As a point of comparison, prior PG&E workpapers (PGECOAGR111 Revisions 3 and earlier) reflected an assumed discharge pressure reduction of 20 psi; however, the current workpaper (Revision 6) does not explicitly specify the discharge pressure reduction reflected in ex-ante savings.

[11] In previous evaluations of this program, evaluators estimated that the workpaper reflected equivalent full load hours of 1,260 based on comparison of ex-ante kWh and kW unit energy savings. However, that value corresponded to a wider array of eligible crop types than the current workpaper allows.

Coincidence Factor

As interval utility data was not analyzed in this shortened evaluation cycle, the evaluators could not calculate site-specific coincidence factors. Therefore, the evaluators referenced an average coincidence factor of 0.37 from the 2015 Nonresidential Downstream ESPI Deemed Sprinkler Impact Evaluation Study for sites that installed drip irrigation for field crops. This assumed CF was used to calculate ex-post peak demand savings.

Gross First Year Realization Rates

The evaluation team estimated gross realization rates (GRRs) by examining the ratio of the aggregate evaluated gross savings to the aggregated ex-ante gross savings.

Table 5-55 below presents the population-level first year gross kWh and kW realization rates for the drip irrigation measure along with the aggregate ex-ante and ex-post first year kWh and kW savings. The corresponding relative precisions are also presented. The first year kWh GRR is 42% with a corresponding relative precision of 20% at the 90% confidence interval and the kW GRR is 35% with a corresponding relative precision of 41% at the 90% confidence interval.[12] The reasons behind the low GRRs are examined further in this section.

TABLE 5-55: PGE FIRST YEAR GROSS KWH AND KW REALIZATION RATES FOR SPRINKLER-TO-DRIP MEASURE

PA	First Year Gross kWh Savings				First Year Gross kW Savings			
	Ex-Ante Savings	Ex-Post Savings	GRR	RP	Ex-Ante Savings	Ex-Post Savings	GRR	RP
PGE	2,500,096	1,043,096	42%	20%	1,984	690	35%	41%

The ex-post impacts and ex-ante claims are products of several unique parameters that are generated in the impact algorithm. The underlying ex-ante assumptions differ from ex-post findings for those parameters, resulting in ex-post impact differences. Below is a brief discussion of some of those underlying differences and how they affected the overall realization rates.

- Five projects were determined to be ineligible[13] for program participation and therefore resulted in zero savings, driving the GRR down by 29%.

[12] Relative precision is calculated as the confidence interval divided by the mean. A smaller relative precision value indicates a more precise mean result. Relative precision presented in this report is at the 90% confidence level.

[13] As the program is currently inactive, eligibility requirements cannot be cited via web link of the program application. However, per program workpapers and the program measure offering catalog, evaluators

- All five ineligible projects were previously irrigated with flood or furrow methods, which differs from the high-pressure sprinkler method required by the workpaper. As compared with sprinkler nozzle irrigation, flood/furrow irrigation generally requires a significantly lower discharge pressure at the irrigation pump. These lower pressures do not meet the measure's eligibility criteria of a pre-project discharge pressure of 50 psi or more.
- Three projects involved irrigation upgrades within almond fields, which are classified as a deciduous/orchard crop. Revision 6 of the PGECOAGR111 workpaper, which applied during PY2017, specified only field/vegetable crops and explicitly stated that deciduous crops are no longer eligible due to changes in industry standard practice.

- As shown above, evaluators determined a weighted average value of 1,352 annual operating hours. While evaluators cannot directly compare with an ex-ante equivalent value, as the current workpaper does not specify, we believe this difference in operation decreased the kWh GRR by 20%.
- Evaluators determined that three sites involved a crop switch at the time of the irrigation measure installation. These differences in crops further reduced the kWh GRR by 7% after normalization to post-project water requirements.
- As shown above, evaluators determined a weighted average pump discharge pressure reduction of 34 psi. This difference reduced the kWh GRR by 2%.

The key discrepancies categories and their relative contribution to the overall program-level kWh GRR are illustrated in Table 5-56.

TABLE 5-56: KEY DISCREPANCY CATEGORIES AND CONTRIBUTIONS TO OVERALL KWH GRR – SPRINKLER-TO-DRIP

Discrepancy Category	# Instances	Impact on GRR
Ineligible measure	5	-29%
Difference in irrigation hours of operation	14	-20%
Switch in crop type	3	-7%
Difference in pump discharge pressure reduction	11	-2%
Total	**33**	**-58%**

determined that the following eligibility requirements were not met for these five projects: eligible projects must involve pre-project irrigation discharge pressure ≥50 psi and must be not be growing deciduous crops.

Gross Lifecycle Realization Rates

Table 5-57 presents the population-level gross lifecycle kWh and kW realization rates for the evaluated sprinkler-to-drip irrigation measures, along with the aggregate ex-ante and ex-post lifecycle kWh and kW savings. The corresponding relative precisions are also presented. Due to the prevalence of crop switches among sampled projects, evaluators found that the preexisting irrigation systems were not replaced near end-of-life; rather, the customer replaced the irrigation systems earlier than required for other reasons. Therefore, the evaluation team could not conduct a comprehensive effective useful life (EUL) analysis for the sprinkler-to-drip measure and instead referenced the workpaper's recommended EUL, so the first-year and lifecycle GRRs are identical.

TABLE 5-57: PGE LIFECYCLE GROSS KWH AND KW REALIZATION RATES FOR SPRINKLER-TO-DRIP MEASURE

PA	Lifecycle Gross kWh Savings				Lifecycle Gross kW Savings			
	Ex-Ante	Ex-Post	GRR	RP	Ex-Ante	Ex-Post	GRR	RP
PGE	50,001,920	20,873,712	42%	20%	39,686	13,808	35%	41%

5.5 PIPE INSULATION MEASURES

Below we discuss the approach for estimating each of the individual impact parameters, along with the resulting gross realization rates. Each parameter was calculated for each distinct pipe run, such as pipe diameter, insulation thickness, and fluid type. Researched parameters, including bare pipe temperature, surrounding temperature, boiler operating hours, boiler efficiency, and installation rates. Derived parameters were used to estimate ex-post savings and assess ex-post performance for PY2017.

Installation Rate

The installation rate is defined as the percentage of equipment found to be installed and operable. The installation rate is estimated for each site based on data gathered during the on-site visit. As part of these on-site visits, an objective of the auditor was to attempt to identify and assess the quantity and operability of all pipe insulation installed.

The key measure count that is identified on site is the length (in feet) of pipe insulation that is currently installed and in working condition. Field auditors used a combination of spot measurement, staff interviews, and review of project invoices to confirm the quantity of incented pipe insulation in feet. The installation rate is calculated directly from this measurement:

$$IR = \frac{L_V}{L_R}$$

Where:

IR = Installation Rate.

L_V = length of pipe insulation installed and operable, as measured during on-site verification.

L_R = length of pipe insulation reported in program tracking system.

In addition to identifying the amount of equipment that was installed and operable, the auditor was also prepared to identify the length of insulation that was:

- Failed and in place – The length of pipe insulation currently installed but not in working condition (failed).
- Failed and replaced – The length of pipe insulation that had been installed, but then had failed and was replaced with different insulation.
- Removed and not replaced – The length of pipe insulation that had been installed, but had been removed (either due to failure or other reasons), but was not replaced, such that the pipe is now bare.
- Code-mandated – OSHA requires that pipes with a surface temperature of 140°F or greater that are "located within 7 feet measured from floor or working level or within 15 inches measures horizontally from stairways, ramps, or fixed ladders shall be covered with a thermal insulating material or otherwise guarded against contact." Such piping requires a minimally-compliant amount of insulation, reducing the program savings due to baseline adjustment.

For all 30 pipe insulation projects in the sample among 24 unique facilities, the field auditors found the pipe insulation to be 95.3% installed, through visual inspection, spot measurement, and review of project invoices. The field auditors also found that 2.0% of the rebated insulated piping required insulation to minimally comply with OSHA. Table 5-58 breaks down the installation rate among each of the categories described above.

TABLE 5-58: INSTALLATION RATES FOR PIPE INSULATION – HOT APPLICATION

Measure Group	Facilities*	Received Rate	Failure Rate	Storage Rate	Removal Rate	Code-Mandated Rate	Installation Rate
Pipe Insulation – Hot Application	24	95.3%	0.0%	0.0%	0.0%	2.0%	93.3%

* This is the number of unique locations visited among the 30 projects in the sample. Several of the facilities featured more than one pipe insulation project, tracked by different fluid types.

Operating Hours

One of the primary inputs to the gross savings calculation is the number of annual hours that the insulated pipe is heated and therefore saving natural gas. Due to the reduced evaluation timeframe for PY2017 measures, evaluators only deployed long-term metering equipment for a small number of sites to assess annual hours. Otherwise, evaluators estimated the site-specific operating hours of the parent hot water or steam boiler(s) through interviews with knowledgeable facility staff and by direct observation during the site visit.

IOUs classify participating pipe insulation customers as small commercial, large commercial, and agricultural/industrial. In order to compare ex-post findings with workpaper assumptions, evaluators aggregated the operating hours data collected by customer type among the 24 evaluated facilities. Table 5-59 compares the ex-ante operating hours assumption with the ex-post findings for each customer type.

TABLE 5-59: COMPARISON OF EX-ANTE AND EX-POST ANNUAL OPERATING HOURS BY CUSTOMER TYPE

Customer Type	Sites	Observations†	PY2017 Ex-Ante Operating Hours††	Current Workpaper Operating Hours	Mean Ex-Post Operating Hours	Ex-Post Standard Deviation (Hours)
Small Commercial	6	22	2,425	7,003	2,006	518
Large Commercial	8	36	4,380	6,056	4,482	1,897
Agricultural/Industrial	10	35	7,752	6,333	6,933	2,644

† An observation refers to each unique pipe run with specific parameters (customer type, fluid type, pipe size) classified by the program.

†† Deemed operating hours have been updated in recent IOU workpapers (see column to the right). However, the updates occurred after PY2017 and therefore are not reflected in PY2017 ex-ante savings.

Small commercial and industrial facilities were found to operate fewer hours than assumed within PY2017 ex-ante savings, by 17% and 11%, respectively. However, large commercial customers were found to operate for 2% more hours. Evaluators found that industrial customers had the largest standard deviation in the findings.

The active SCG workpaper (SCGWP110812A Revision 4) incorporates prior evaluation findings from PY2013-15 studies, including revised operating hours values. However, the workpaper was updated in December 2017 and is therefore not reflected in PY2017 deemed savings.

Bare Pipe Temperature

Pipe heat loss is a combination of conductive, convective, and radiative heat losses, each of which is a function of bare pipe temperature, among other factors. Field auditors collected relevant information related to bare pipe temperature using a combination of methods:

- **Data metering** – The type-K thermocouple loggers provided interval data on bare pipe temperature for a 1- to 2-week period for a select number of sites, deemed to have highly variable loads.
- **Gauge readings and spot-measurement** – Field auditors performed spot readings from infrared temperature guns and inspection of fluid gauges. As pipe material is highly conductive, fluid temperature and bare pipe temperature values are typically within one percent.
- **Customer interviews on schedule and seasonality** – Metered temperature data was confirmed as representative of the facility's process over an entire year through interviews with facility contacts on site and/or over the phone, as needed.

The 3E-Plus heat loss calculation tool takes an input of the average bare pipe temperature when the pipe is heated. As IOUs classify heating processes based on fluid temperature and pressure, Table 5-60 compares ex-ante bare pipe temperature assumptions with ex-post findings for three fluid categories: hot water, low-pressure steam, and medium-pressure steam.

TABLE 5-60: COMPARISON OF EX-ANTE AND EX-POST BARE PIPE TEMPERATURE BY FLUID TYPE

Fluid Type	Observations†	Ex-Ante Bare Pipe Temperature (°F)	Mean Ex-Post Bare Pipe Temperature (°F)	Ex-Post Bare Pipe Temp. Standard Deviation (°F)
Hot Water	48	150.0	140.3	33.6
Low-Pressure Steam	0	241.0	N/A	N/A
Medium-Pressure Steam	48	328.0	324.2	45.0

† An observation refers to each unique pipe run with specific parameters (customer type, fluid type, pipe size) classified by the program.

N/A = Not applicable, as sampled sites tracked as low-pressure steam were found to have medium-pressure steam piping instead.

Hot water and medium-pressure steam piping account for the most significant shares of total measure group savings and were featured exclusively in the evaluation sample. Both hot water and medium-pressure steam piping, featured lower bare pipe temperatures than reflected within the IOUs' deemed savings assumptions. Please note that no low-pressure steam runs were encountered among the sampled projects, due to differences in fluid type between the ex-ante reported information and ex-post findings.

Evaluators further assessed variation in hot water and medium-pressure steam bare pipe temperature as a function of customer type, as summarized in Table 5-61. The commercial customer-fluid permutations resulted in lower ex-post bare pipe temperatures than the ex-ante assumptions. However, the industrial customer-fluid permutations resulted in higher ex-post temperatures than the ex-ante assumptions.

TABLE 5-61: COMPARISON OF EX-ANTE AND EX-POST BARE PIPE TEMPERATURES BY FLUID AND CUSTOMER TYPE

Customer Type Fluid Type	Observations*	Ex-Ante Bare Pipe Temperature (°F)	Mean Ex-Post Bare Pipe Temperature (°F)	Ex-Post Bare Pipe Temp. Standard Deviation (°F)
Commercial				
Hot Water	31	150.0	137.2	34.5
Medium-Pressure Steam	30	328.0	299.6	33.5
Industrial				
Hot Water	17	150.0	151.3	32.9
Medium-Pressure Steam	18	328.0	390.3	56.7

* Excludes low-pressure steam data due to zero observed pipe runs. An observation refers to each unique pipe run with specific parameters (customer type, fluid type, pipe size) classified by the program.

Surrounding Air Temperature

In addition to pipe temperature, heat loss is also a function of the temperature of the air surrounding the pipe. Field auditors collected relevant information related to surrounding air temperature using the following methods

- **Long-term metering and spot-measurement** – Field auditors measured air temperature near the deployed equipment using digital thermometers. Additionally, field auditors deployed air temperature loggers for long-term metering at a selection of sites.
- **Customer interviews** – Air temperature data was confirmed as representative of the facility's process over an entire year through interviews with facility contacts on site and/or over the phone, as needed.

The 3E-Plus heat loss calculation tool incorporated the average surrounding air temperature when the pipe was heated. Table 5-62 presents evaluator findings in surrounding temperature as a function of fluid type.

TABLE 5-62: COMPARISON OF EX-ANTE AND EX-POST SURROUNDING AIR TEMPERATURE BY FLUID TYPE

Fluid Type	Observations†	Ex-Ante Surrounding Air Temperature (°F) ††	Mean Ex-Post Surrounding Air Temperature (°F)	Ex-Post Surrounding Air Temp. Standard Deviation (°F)
Hot Water	48	75.0	72.1	4.6
Low-Pressure Steam	0	75.0	N.D.	N.D.
Medium-Pressure Steam	48	75.0	70.7	5.5

† An observation refers to each unique pipe run with specific parameters (customer type, fluid type, pipe size) classified by the program.

†† Similarly to the operating hours value, the current SCG workpaper appears to have been revised since PY2017. The 75°F assumption is reflected in PY2017 ex-ante savings values.

N.D. = No data within sample

Evaluators determined surrounding air temperature to be slightly lower than the ex-ante assumption for both hot water and medium-pressure steam piping.

Evaluators further assessed variation in hot water and medium-pressure steam surrounding air temperatures as a function of customer type, as summarized in Table 5-63. All of the customer-fluid permutations resulted in an ex-post surrounding air temperature slightly lower than the ex-ante assumption of 75°F. Lower surrounding air temperatures resulted in increased ex-post savings, as the heat loss rate calculation incorporates the difference between bare pipe surface temperature and surrounding air temperature.

TABLE 5-63: COMPARISON OF EX-ANTE AND EX-POST SURROUNDING AIR TEMPERATURE BY CUSTOMER AND FLUID TYPE

Customer Type Fluid Type	Observations*	Ex-Ante Surrounding Air Temperature (°F)	Mean Ex-Post Surrounding Air Temperature (°F)	Ex-Post Surrounding Air Temp. Standard Deviation (°F)
Commercial				
Hot Water	31	75.0	73.3	3.7
Medium-Pressure Steam	30	75.0	73.0	4.5
Industrial				
Hot Water	17	75.0	67.6	4.9
Medium-Pressure Steam	18	75.0	64.4	6.2

* Excludes low-pressure steam data due to low observation count. An observation refers to each unique pipe run with specific parameters (customer type, fluid type, pipe size) classified by the program.

Combustion Efficiency

In prior evaluation cycles of the pipe insulation measure, evaluators were generally able to collect at least one combustion efficiency measurement of the parent boiler(s). However, due to the shortened evaluation timeframe in this cycle, as well as lower boiler accessibility than expected, evaluators were unable to calculate representative combustion efficiency values for PY2017 projects. We recommend that the programs reference the PY2013-14 and PY2015 impact evaluation reports for boiler combustion efficiency.

Development of Unit Energy Savings

The evaluated annual operating hours, bare pipe heat loss rate, insulated pipe heat loss rate, and boiler combustion efficiency parameter estimates were applied to the hourly heat loss equation for all customer type and fluid type combinations to calculate ex-post savings. Table 5-64 presents the ex-post unit energy savings (UES) values as a function of customer type and fluid type. Due to constraints in sample size, not all customer-fluid combinations were reflected in the evaluation sample; these cells are noted with N.D. (no data).

In prior evaluation cycles for this measure, the active workpapers delineated two UES tiers based on pipe diameter: less than and equal to 1” and greater than 1”. Active workpapers for both PG&E and SCG appear to have added a third, larger-diameter tier: greater than 4” diameter. To align with the current workpapers’ UES format, we present UES values using the same diameter tiers.

TABLE 5-64: EX-POST UES VALUES BY CUSTOMER TYPE, FLUID TYPE, AND PIPE DIAMETER

Customer Type Fluid and Pipe Size	Obs.†	Mean Pipe Dia.	Delta Temp. (°F)	Annual Operating Hours	Boiler Combustion Efficiency	UES (therms per foot)
Small Commercial						
Hot Water (≤1” Pipe)	10	0.86"	132.3	1,631	80.53%	1.7
Hot Water (1”< x ≤4" Pipe)	1	2.00"	138.0	2,148	80.00%	4.7
Hot Water (>4" Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Low-Pressure Steam (≤1” Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Low-Pressure Steam (1”< x ≤4" Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Low-Pressure Steam (>4" Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Medium-Pressure Steam (≤1” Pipe)	13	0.85"	236.7	2,110	80.31%	4.9
Medium-Pressure Steam (1”< x ≤4" Pipe)	1	2.00"	245.0	2,148	80.00%	10.3
Medium-Pressure Steam (>4" Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Large Commercial						
Hot Water (≤1” Pipe)	5	0.76"	60.3	4,253	82.92%	1.5
Hot Water (1”< x ≤4" Pipe)	15	2.65"	61.4	5,371	86.35%	5.1
Hot Water (>4" Pipe)	0	N.D	N.D	N.D	N.D	N.D
Low-Pressure Steam (≤1” Pipe)	0	N.D	N.D	N.D	N.D	N.D
Low-Pressure Steam (1”< x ≤4" Pipe)	0	N.D	N.D	N.D	N.D	N.D
Low-Pressure Steam (>4" Pipe)	0	N.D	N.D	N.D	N.D	N.D
Medium-Pressure Steam (≤1” Pipe)	6	0.94"	202.5	2,620	82.50%	5.2
Medium-Pressure Steam (1”< x ≤4" Pipe)	8	1.89"	222.6	2,573	83.00%	10.3
Medium-Pressure Steam (>4" Pipe)	2	4.25"	268.5	5,732	82.00%	64.3
Industrial						
Hot Water (≤1” Pipe)	2	0.50"	72.0	4,200	90.00%	1.4
Hot Water (1”< x ≤4" Pipe)	15	2.09"	87.8	7,753	83.86%	4.3
Hot Water (>4" Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Low-Pressure Steam (≤1” Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Low-Pressure Steam (1”< x ≤4" Pipe)	0	N.D	N.D	N.D	N.D	N.D
Low-Pressure Steam (>4" Pipe)	0	N.D	N.D	N.D	N.D	N.D
Medium-Pressure Steam (≤1” Pipe)	6	0.92"	291.3	5,239	85.07%	16.7
Medium-Pressure Steam (1”< x ≤4" Pipe)	7	1.95"	354.2	6,039	83.44%	48.2
Medium-Pressure Steam (>4" Pipe)	5	4.50"	249	6,189	83.00%	63.7

† An observation refers to each unique pipe run with specific parameters (customer type, fluid type, pipe size) classified by the program.

Gross First Year Realization Rates

Once all the UES values have been created, these values can be applied to the population of participants. Gross realization rates are then estimated for therm savings by looking at the ratio of the aggregate evaluated gross savings to the aggregate ex-ante gross savings.

Table 5-65 below presents the population-level first year gross therm realization rate by PA for the pipe insulation-hot application measure with the aggregate ex-ante and ex-post first year therm savings. The corresponding relative precision is also presented.

TABLE 5-65: FIRST-YEAR GROSS THERM REALIZATION RATE FOR PIPE INSULATION – HOT APPLICATION MEASURE

Measure Group by PA	First Year Gross Therm Savings			
	Ex-Ante Savings	Ex-Post Savings	GRR	RP
Pipe Insulation – Hot Application – PG&E	406,108	84,356	21%	27%
Pipe Insulation – Hot Application – SCG	293,946	392,024	133%	50%
Pipe Insulation – Hot Application – Total	**700,054**	**476,380**	**68%**	**53%†**

† The poorer-than-anticipated relative precision is largely due to a single site with ex-post savings over 400% higher than ex-ante. The RP improves to 21% if that site is not considered.

While the pipe insulation sample was not originally segmented by PA, evaluators found significant differences in savings estimation and GRR between PG&E and SCG projects. Therefore, the extrapolation of savings from the sample to the population accounts for these differences, as reflected in the table above. Further discussion on savings by PA can be found in subsequent paragraphs.

Table 5-66 presents the therm first year gross realization rates, by customer and fluid type. Also shown are the aggregate ex-post and ex-ante savings values for the sample by segment that were used to develop the realization rates.

TABLE 5-66: FIRST YEAR GROSS THERMS REALIZATION RATES BY CUSTOMER AND FLUID TYPE

Customer Type – Fluid Type	Sample Size	Ex-Ante Savings	Ex-Post Savings	GRR
Agricultural/Industrial – Medium-Pressure Steam	5	103,741	97,228	94%
Agricultural/Industrial – Low-Pressure Steam	1	15,813	9,197	58%
Agricultural/Industrial - Hot Water	7	86,403	35,328	41%
Commercial - Medium-Pressure Steam	12	413,654	305,118	74%
Commercial - Hot Water	5	48,486	51,331	106%

As discussed, the ex-post impacts and ex-ante claims are products of several unique parameters that are generated in the impact algorithm. The underlying ex-ante assumptions regarding each parameter vary by measure as do the ex-post impacts. Below is a brief discussion of some of those underlying differences and how they affected the overall realization rates.

Table 5-67 illustrates the relative shares that each discrepancy category contributed to the overall realization rate of 68%. Please note that both positive and negative impacts per category are illustrated in the figure, often counteracting each other to lead to overall ex-post therm savings 32% lower than ex-ante. The discrepancy categories are explained in the paragraphs following the figure.

TABLE 5-67: COUNTS AND GRR MAGNITUDES BY DISCREPANCY CATEGORY

	Negative Impact		Positive Impact	
Discrepancy Category	**# Instances**	**GRR Impact**	**GRR Impact**	**# Instances**
Difference in boiler efficiency	3	-2.6%	0.0%	0
Difference in fluid temperature	9	-6.7%	11.0%	8
Difference in fluid type (steam vs. HW)	2	-1.5%	0.0%	0
Difference in operating hours	16	-14.0%	4.2%	4
Ex-ante documentation	10	-28.6%	0.0%	0
Incorrect insulation quantity	8	-10.9%	0.0%	0
Incorrect insulation thickness	0	0.0%	2.5%	6
Incorrect pipe diameter	2	-0.1%	14.5%	10
Total	**50**	**-64%**	**32%**	**28**

For **agricultural or industrial** facilities, several factors led to key differences between ex-post first-year therm savings as compared with ex-ante:

- **Ex-ante documentation** – Evaluators recreated the ex-ante savings using workpaper assumptions and tracking information and found that these hypothetical ex-ante savings were significantly lower than reported for PG&E sites in particular. Evaluators were unable to determine the cause of the erroneously high reported ex-ante savings for these projects. However, the ex-ante lifecycle savings were significantly closer to ex-post lifecycle savings for PG&E projects, indicating that the issue was limited to PG&E first-year savings only. Evaluators observe that the PG&E lifecycle savings were generally calculated appropriately using the EUL of 11 years. However, the PG&E first-year ex-ante savings appeared to have been calculated by dividing the lifecycle savings by a RUL of 3.7 years (one-third of the EUL).
- **Incorrect insulation quantity** – Field auditors determined an installed insulation rate 4.7% lower than the assumed 100% rate.

- **Difference in operating hours** – Lower-than-anticipated annual operating hours—11% lower than assumed within IOU deemed savings, per Table 5-59—primarily reduced the ex-post annual therm savings for agricultural and industrial projects.
- **Incorrect pipe diameter** – Counteracting the three reductions in ex-post savings listed above, the field auditors determined that insulated pipe at industrial facilities was larger in diameter than assumed within IOU deemed savings calculations. Evaluators found that industrial hot water piping was 20% higher-diameter than the weighted average IOU assumption, and industrial medium-steam piping 39% higher-diameter. Higher diameter pipe leads to higher baseline heat loss rates, leading to higher therm savings for insulated pipe.
- **Difference in fluid temperature** – Greater-than-anticipated process steam temperatures—19% higher than assumed within IOU deemed savings, per Table 5-60. Table 5-59—primarily increased the ex-post annual therm savings for agricultural and industrial projects.

For **commercial** facilities, evaluated savings were 6% higher and 26% lower for hot water and medium-pressure steam projects, respectively, than reported by IOUs. The following factors led to these savings differences:

- **Ex-ante documentation** – Evaluators recreated the ex-ante savings using workpaper assumptions and tracking information and found that these hypothetical ex-ante savings were significantly lower than reported. The issue occurred primarily among PG&E projects, which were prevalent within the commercial medium-pressure steam segment. Evaluators were unable to determine the cause of the erroneously high reported ex-ante savings for these projects. However, the ex-ante lifecycle savings were significantly closer to ex-post lifecycle savings for PG&E projects, indicating that the issue was limited to PG&E first-year savings only. Evaluators observe that the PG&E lifecycle savings were generally calculated appropriately using the EUL of 11 years. However, the PG&E first-year ex-ante savings appeared to have been calculated by dividing the lifecycle savings by a RUL of 3.7 years (one-third of the EUL).
- **Difference in operating hours** – Table 5-59 indicates that evaluators determined 2% higher and 17% lower annual operating hours at large and small commercial facilities, respectively, as compared with the IOU assumption. Overall, the impact is a decrease in operating hours.
- **Incorrect pipe diameter** – Conversely, insulated pipe at commercial facilities was generally of higher diameter than assumed by the IOU. Larger diameter pipe drove the evaluated savings higher than the ex-ante estimate.

Lifecycle Gross Realization Rates

Table 5-68 presents the lifecycle gross realization rates for the evaluated Pipe Insulation Hot Application measure group along with the corresponding aggregate ex-ante and ex-post lifecycle therms savings. The corresponding relative precisions are also presented.

TABLE 5-68: AGGREGATE LIFECYCLE GROSS THERMS SAVINGS FOR PIPE INSULATION HOT APPLICATION

Measure Group by PA	Lifecycle Gross Therm Savings			
	Ex-Ante Savings	Ex-Post Savings	GRR	RP
Pipe Insulation – Hot Application – PG&E	1,502,599	927,912	62%	42%
Pipe Insulation – Hot Application – SCG	3,233,404	4,312,267	133%	65%
Pipe Insulation – Hot Application – Total	**4,763,003**	**5,240,178**	**111%**	**56%†**

† The poorer-than-anticipated relative precision is largely due to a single site with ex-post savings over 400% higher than ex-ante. The RP improves to 13% if that site is not considered.

Lifecycle savings values are typically equal to the first year savings multiplied by the EUL. Because this study did not evaluate the EULs, the evaluators adopted the ex-ante EUL of 11 years per workpaper SCGWP110812A Revision 3.[14]

Interestingly, the calculation or data entry errors for PG&E first-year ex-ante savings did not affect lifecycle savings, thereby resulting in a higher lifecycle GRR than first-year GRR. Based on our review of the tracking data, evaluators observe that the PG&E lifecycle savings were generally calculated appropriately using the EUL of 11 years. However, the PG&E first-year ex-ante savings appeared to have been calculated by dividing the lifecycle savings by an RUL of 3.7 years (one-third of the EUL). Since the pipe insulation measure is classified as a retrofit add-on measure, and since we do not expect significant changes in the piping systems themselves over the life of the insulation, we recommend that the programs apply the EUL to first-year savings when calculating lifecycle savings.

[14] Evaluators applied the pipe insulation EUL per workpaper SCGWP110812A Revision 3, which applied to PY2017 measures. In the course of researching appropriate EUL, evaluators found a wide variety of EUL sources. The DEER EUL of 5 years for pipe insulation implies an EUL for the host equipment of 15 years (where the RUL of the host equipment is set equal to the default 1/3 of the host equipment EUL). The evaluation team believes that this implied EUL for the host equipment (the piping itself) is low, as piping is typically only changed or removed in major renovations or facility changes. The current SCG workpaper (Revision 4) acknowledges such: “Various studies and source show that piping life expectancy is of over 20 years.” The evaluation team conclusion is that the host equipment implied is likely the water heater; and given that this measure addresses long pipe runs, and not just insulation near the water heater, we believe that the water heater is not a reasonable host equipment choice. That is, the vast majority of the pipe insulation would not be disturbed by water heater replacement and would therefore likely remain in place following water heater replacement. The evaluation team believes that an 11-year EUL for pipe insulation is therefore a more accurate estimate, as it implies an EUL for the piping itself of 33 years.

6 NET-TO-GROSS ANALYSIS

The net impact methodology involved a two-step process:

- First, a net-of-free-ridership ratio was estimated for each project evaluated through analysis of surveys and/or professional in-depth interviews.
- Second, a net-of-free ridership estimate was developed for the population by extrapolating from the sample to the entire population sample frame.

6.1 NET IMPACT EVALUATION METHODOLOGY

Over the last several evaluation cycles, Net-to-Gross (NTG) analysis for Nonresidential programs has used a standardized Self-Report Approach (SRA)[15] that is based on the results of self-report telephone surveys with program participants. This 2017 evaluation continues use of this standard SRA framework with relatively minor modifications to NTG survey question batteries, and revisions to the NTG scoring algorithm based on specific recommendations from the 2013-2015 Program Performance Assessment of the Nonresidential Downstream Programs.[16] The most significant change to the NTG scoring algorithm is elimination of the PAI-1 score when calculating the NTG ratio. The evaluation team also considered modifying the NTG framework for this 2017 evaluation to incorporate a dual baseline NTG approach but decided to defer it to the 2018 evaluation cycle since there were very few measures in this cycle where the dual baseline approach applied. The team will continue to develop and refine the dual baseline framework using data collected in this cycle after this 2017 evaluation is completed.

The net savings calculations for this evaluation follow the original methods, with the modifications noted.

6.1.1 Overview of Approach to Estimating Free Ridership

The methodology described in this section was developed to address the unique needs of nonresidential customer projects developed through energy efficiency programs offered by the four California IOUs and third-party implementers. The free ridership method used for this study relies exclusively on the standardized Self-Report Approach (SRA) to estimate project and domain-level net-to-gross ratios (NTGRs), since other available methods and research designs are generally not feasible. The SRA in this

[15] This SRA framework was originally developed by the statewide Nonresidential NTG working group during 2008.

[16] https://pda.energydataweb.com/api/view/1975/2013-2015%20Program%20Performance%20Assessment%20Of%20The%20Nonresidential%20Downstream%20Programs%20-%20Final.pdf

evaluation was implemented in accordance with the relevant EM&V guidelines including the California Energy Efficiency Evaluation Protocols (April 2006).

The SRA methodology used in this study provides a standard framework, including decision rules, for integrating findings from both quantitative and qualitative information in the calculation of the NTGR in a systematic and consistent manner. The method uses a 0 to 10 scoring system for key questions used to estimate the NTGR rather than using fixed categories that were assigned weights. Respondents were asked to jointly consider and rate the importance of the many likely events or factors that may have influenced their energy efficiency decision making for the project in question, rather than focusing narrowly on only their rating of the program's importance. This question structure more accurately reflects the complex nature of the real-world decision making and helped to ensure that all non-program influences were taken into account in assessing the unique contribution of the program to the energy efficiency project's implementation.

6.1.2 NTG Questions and Scoring Algorithm

Approach Used in Previous Evaluations

Historically, the NTGR has been calculated as an average of three scores, or program attribution indices (PAI). Each of these scores represents the highest response or the average of several responses given to one or more questions about the decision to install a program measure.

- **Score PAI-1** that reflects the influence of the most important of various program and non-program elements in the customer's decision to select the specific program measure at this time. Program influence through vendor recommendations was also incorporated in this score. Note that Score PAI-1 took the highest program score divided by the sum of the maximum of the program and non-program scores.

- **Score PAI-2** that captures the perceived importance of the program (whether incentive, recommendation, audit, or other program intervention) relative to non-program factors in the decision to implement the specific measure that was eventually adopted or installed. This score was determined by asking respondents to assign importance values to both the program and most important non-program influences so that the two values total 10. The program influence score was reduced by half if respondents said they had already made their decision to install the specific program qualifying measure before they learned their project was eligible for program rebates.

- **Score PAI-3** that captures the likelihood of various actions the customer might have taken at the time or project decision making, and in the future, if the program had not been available (the counterfactual). This score also accounts for deferred free ridership by incorporating the likelihood that the customer would have installed program-qualifying measures at a later date if the program had not been available.

When there are multiple questions that fed into the scoring algorithm, as is the case for Score PAI-1, the maximum value for program and non-program influences is always used. The rationale for using the maximum value is to capture the most important program and non-program elements in the participant's decision making. Thus, the score is always based on the strongest influence, whether program or non-program, indicated by the respondent. However, high scores that are inconsistent with other previous responses trigger consistency checks and lead to follow-up questions to clarify and resolve the discrepancy.

When there are missing data or 'don't knows' to critical elements of each score, one of two options is used. The most common approach, in cases where it was one of several other elements that are considered in the algorithm, is to simply exclude the missing element from consideration.

The resulting self-reported NTGR in most cases is simply the average of all three scores, divided by 10. The one exception to this is when the respondent indicated a 10 in 10 probability of installing the same equipment at the same time in the absence of the program, in which case the NTGR is based on the average of Scores 2 and 3 only.

Overview of Approach Used in 2017 Evaluation

This PY2017 evaluation has continued use of this standard SRA framework with certain changes, which were made based on specific recommendations from the 2013-2015 Program Performance Assessment:

The NTG scoring algorithm was revised. The only change was to eliminate the PAI-1 score from the calculation of the NTG ratio. PAI-1 was removed for two primary reasons:

1. **PAI-1 scores did not appear to be correlated with free ridership.** We compared the PAI-1 scores to other survey questions that would indicate a high likelihood for free ridership and did not see the PAI-1 scores correlate well to these metrics.
2. **The inclusion of the PAI-1 score biases the NTGR towards a value of 0.5.** The PAI-1 score tends to converge to a value of around 5. This is likely due to respondents rating at least one program and one non-program factor very highly, at least a 9. Averaging in the PAI-1 score with PAI-2 and PAI-3 will therefore move the NTGR towards a value of 0.5.

The analyses underlying these changes to the NTG algorithm are presented in the next section.

6.1.3 Analysis to Support Changes to NTG Algorithm

Issue 1: PAI-1 scores did not appear to be correlated with free ridership. We examined the relationship between PAI-1 and two survey questions that we felt were strong indications of free ridership:

N2: Did your organization make the decision to install this new equipment before or, after, or at the same time as you became aware of the program rebate?

N6: Now I would like you to think one last time about what action you would have taken if the program had not been available. Which of the following alternatives would you have been MOST likely to do?

1 Install/Delamped fewer units
2 Install standard efficiency equipment or whatever required by code
3 Installed equipment more efficient than code but less efficient than what you installed through the program
4 Done nothing (keep existing equipment as is)
5 Done the same thing I would have done as I did through the program
6 Repair/rewind or overhaul the existing equipment
77 Something else (specify what _____________)

For question N2, we would expect higher levels of free ridership to be associated with respondents stating they already made the decision to install their new equipment before they became aware of the program rebate, and that PAI-1 scores would be substantially lower for this response than the other two responses.

Table 6-1 provides a comparison of question N2 and the three PAI scores.

TABLE 6-1: COMPARISON OF PAI-1 SCORES WITH TIMING OF DECISION TO INSTALL EQUIPMENT

Timing of Decision Relative to Awareness of Rebate	PAI-1	PAI-2	PAI-3
Before	4.90	3.03	2.28
Same Time	4.92	6.74	3.78
After	4.98	6.35	6.11

Our expectation is that we would see significant increases in the PAI scores for the Same Time and After responses, compared to the Before response. This is clearly the case for PAI-2, PAI-3 and N41. However, we see the PAI-1 scores change by only 0.08 points.

Another telling indication of program influence is the self-reported action that participants say they would have taken had the program not existed in question N6. Respondents were asked what they would have been most likely to do if the program had not been available. Two common responses were “done nothing and keep existing equipment as is”, and “done the same thing I would have done as I did through the program”. One would expect relatively high PAI scores for the “done nothing” and relatively low PAI scores for the “done the same thing” responses. As shown in the table below, the PAI-2 and PAI-3 scores did meet this expectation, but the PAI-1 scores differed by only 0.10 points.

TABLE 6-2: COMPARISON OF PAI-1 SCORES WITH NO-PROGRAM BEHAVIORS

Stated Action in Absence of the Program	PAI-1	PAI-2	PAI-3
Done nothing, keep existing equipment as is	4.89	7.19	6.42
Done the same thing I would have done as I did through the program	4.79	5.34	1.48

Issue 2: The inclusion of the PAI-1 score biases the NTGR towards a value of 0.5. Overall, we found the average PAI-1 score to be 4.9, with over 80 percent of the individual scores within 0.5 of that mean (i.e., between 4.4 and 5.4). This is likely due to respondents rating at least one program and one non-program factor very high. We found that respondents rated at least one program factor a 9 or 10, 72 percent of the time, and at least one non-program factor a 9 or 10, 80 percent of the time. Furthermore, 66 percent of the time, the respondent’s highest rated program and non-program factors were rated equally. Respondents are likely to score at least one program and one non-program influence very highly, leading most PAI-1 scores to fall near 4.9. This has the effect of biasing the NTGRs towards 0.5.

6.2 NTG RESULTS

Table 6-3 presents the ex-post NTGR scores by sample strata that were developed for the evaluated sampling domains using the above methodology. Also presented are the ex-ante NTG values as well as the average PAI2 and PAI3 scores for each segment. These data are weighted by ex-post lifecycle kWh.

TABLE 6-3: EX-ANTE AND EX-POST NET-TO-GROSS RATIOS AND PAI SCORES BY MEASURE TYPE AND SAMPLING DOMAIN

Measure Type	PA/Delivery Approach	Applications	NTG			PAI Score	
		n	Ex-Ante	Ex-Post	Relative Precision [17]	PAI2	PAI3
Food Service	PG&E Downstream	45	0.60	0.39	0.21	3.88	3.84
	PG&E Midstream	21	0.60	0.39	0.18	5.59	2.11
	SCG Downstream	140	0.60	0.32	0.20	4.01	1.86
	SCG Upstream	31	0.60	0.57	0.12	7.13	4.29
	SDGE Downstream*	185	0.60	0.33	0.12	3.98	2.32
	Overall Weighted Average	**237**	**0.60**	**0.41**	**0.05**	**5.18**	**2.85**
Refrigeration Case LED Lighting	PG&E Downstream	26	0.60	0.57	0.08	6.13	5.51
	PG&E Direct Install	22	0.60	0.54	0.13	6.84	4.11
	SCE Overall**	62	0.60	0.58	0.06	6.98	4.69
	SDGE Downstream	14	0.60	0.66	0.12	7.90	4.90
	Overall Weighted Average	**62**	**0.60**	**0.58**	**0.06**	**6.98**	**4.69**
Agricultural Irrigation	**Overall Weighted Average**	**20**	**0.60**	**0.28**	**0.44**	**3.34**	**2.16**
Pipe Insulation Hot Application	**Overall Weighted Average**	**7**	**0.60**	**0.45**	**0.28**	**4.47**	**4.61**
Process Boilers	**Overall Weighted Average**	**8**	**0.60**	**0.42**	**0.64**	**4.35**	**4.06**
Water Heating Boilers	**Overall Weighted Average**	**14**	**0.60**	**0.42**	**0.21**	**4.18**	**4.11**

* The NTGR for the SDG&E Downstream Food Service measure was set equal to the weighted average of the PG&E and SCG Downstream NTGRs.

** The NTGR for the SCE Refrigeration Case LED Lighting measure was set equal to the overall measure level NTGR.

[17] Relative precision is calculated as the confidence interval divided by the mean. A smaller relative precision value indicates a more precise mean result. Relative precision presented in this report is at the 90% confidence level.

Because of limited budget, the evaluation focused on those IOU and measure combinations with the largest shares of claimed savings. However, the applicability of these values is broader than these specific IOU and measure combinations and extends to all savings claims by IOUs that correspond to these measure categories. As discussed in Section 3, no sample was allocated to the SDG&E Downstream Food Service or SCE Refrigeration Case LED Lighting measures. Therefore, results from the PG&E and SCE Downstream food service segments were transferred to the SDG&E segment; and the overall Refrigeration Case LED Lighting measure NTGR was transferred to the SCE segment.

Table 6-4 illustrates how these values are to be applied. Ideally, results would be applied consistently statewide and vary by program delivery mechanism. Results are shown below by delivery mechanism when the data could support an estimate at that level. In all other cases, those not shown in the table, the default DEER NTG value for measures with greater than a 2-year measure life will be applied.

TABLE 6-4: RECOMMENDED DEER NTG VALUES BASED ON EVALUATED RESULTS

Measure Type	Overall	Direct Install	Deemed Downstream	Deemed Mid/Upstream
Food Service	0.41	---	0.33	0.50
Process Boiler	0.42	---	---	---
Water Heating Boiler	0.42	---	---	---
Pipe Insulation Hot Application	0.45	---	---	---
Agricultural Irrigation	0.28	---	---	---
Refrigeration Case LED Lighting	0.58	0.54	0.62	---

6.2.1 Food Service Measure Group

- PG&E Food Service Measures
  - Downstream and Midstream Delivery Channels
    - The ex-post NTG ratio of 0.39 (same for both channels) falls well short of the ex-ante value of 0.60.
    - For the Downstream channel, PAI-2 and PAI-3 average scores were nearly the same. Project specific values for both scores ranged from 0 to 10. Scores were fairly evenly distributed above and below the mid-range value of 5 (on a 10-point scale). However, a significant portion of PAI-2 and PAI-3 score ratings were 0s.
    - For the Midstream channel. PAI-2 and PAI-3 scores differed significantly with average values of 5.59 for PAI-2 and 2.11 for PAI-3. The source of this difference is unclear, however, well over half of respondents for this channel had PAI-3 scores of 0 indicating absolute certainty they would have installed the incented measure outside of the program.

- SCE Food Service Measures
  - Downstream Delivery Channel
    - The NTG ratio for the Downstream channel averaged 0.32. A significant driver of this low value was participation by large restaurant chains who had already made the decision to install the incented measure outside of the program and thus reported zero program influence.
    - At the individual project level, PAI-2 scores showed substantial variation, and values between 3 and 6 were common (yielding an average score of 4.01). In contrast, nearly two-thirds of PAI-3 scores ranged from 0 to 3, contributing significantly to the low average PAI-3 value of 1.86 across all projects.
  - Upstream Delivery Channel
    - Results for the Upstream channel were significantly better, with an average NTGR of 0.57. Participants in this channel tended to be single location restaurants ("mom and pops") that are less likely than chain restaurants to have proactively decided to install energy efficient equipment outside the program.
    - Regarding the PAI-2 score, which averaged 7.13, two thirds of respondents provided scores of 6 and higher, indicating a medium-high level of program influence. Nearly one third provided a maximum PAI-2 score value of 10. PAI-3 scores averaged 4.29 and were not as favorable. Nearly half of respondents provided scores of 3 and below.

6.2.2 Process Boilers

- Process Boilers
  - In general, the NTG ratio for this measure was low, averaging 0.42 across both the PG&E and SCG programs.
  - PAI-2 and PAI-3 average scores were similarly low. Individual PAI-2 score values ranged widely, from 1 to 9, with most clustered around values of 4 to 5. PAI-3 scores trended even lower, with ratings of zero for half of the projects.

6.2.3 Water Heating Boilers

- Water Heating Boilers
  - Overall, the NTG ratio for this measure averaged 0.42. Although the sample was initially stratified by IOU, survey findings were insufficient to support utility-specific values.
  - PAI-2 and PAI-3 average score values mimic the NTG ratio value, with relatively little variation. PAI-2 score values are commonly 4, 5 and 6. PAI-3 values range widely, from 0 to 10, but the weighted average value of 4.11 tracks the NTG ratio value.

6.2.4 Pipe Insulation, Hot Application

- Pipe Insulation, Hot Application
  - The ex-post NTG ratio averaged 0.45, which is somewhat less than the 0.60 ex-ante value. Although the sample was initially stratified by IOU, survey findings were insufficient to support utility-specific values.
  - There was significant variation in the PAI-2 and PAI-3 scores across respondents. Values ranged from 3 to 10 for both PAI-2 and PAI-3 with mean values approaching 5s for both scores.

6.2.5 Agricultural Irrigation

- PG&E Agricultural Irrigation
  - The ex-post NTG ratios are significantly less than the ex-ante value. Overall, the ex-post NTG ratio is 0.28 compared to an ex-ante NTG of 0.60.
  - The PAI-2 and PAI-3 scores ranged from 0 to 6, and most were clustered around values of 2 and 3. The overall PAI-2 score of 3.34 suggests, on average, that program participants perceived the importance of program related factors to be half as important as that for non-program factors. In other words, given 10 points to allocate between program and non-program factors, participants allocated nearly twice as many points (6.56) points to non-program factors. The average PAI3 score of 2.16 suggests very weak program influence overall.

6.2.6 Refrigerated Case LED Lighting

- PG&E Refrigerated Case LED Lighting
  - Downstream Delivery Channel
    - In general, this measure exhibited medium high program influence with an average ex-post NTG ratio of 0.57. The ex-post NTG ratio for this channel is very close to the ex-ante value of 0.60.
    - Individual PAI-2 scores generally ranged between 6 and 10, signifying strong program influence. Two-thirds of the scores provided were scores of 8, 9 and 10. PAI-3 scores were not as strong, with values covering the entire 0-to-10 range.
  - Direct Install Delivery Channel
    - The Direct Install channel (associated with the Energy Smart Grocer program) also demonstrated medium high program influence, with an average NTG ratio of 0.54. Again, this is nearly equal to the ex-ante value of 0.60.

- PAI-2 scores at the project level were generally very strong, with two-thirds of respondents providing scores of 7 and above. The PAI-2 score averaged 6.84 across all projects. PAI-3 scores were significantly lower, with an average value of 4.11 and individual scores ranging from 0 to 10. There were approximately the same proportions of PAI-3 scores above and below the mid-range value of 5.

- SDG&E Refrigerated Case LED Lighting
  - The SDG&E Downstream channel exhibited the strongest level of program influence, with an average NTG ratio of 0.66 across all applications. Nearly half of the evaluated projects had NTGRs of 0.8 to 1.0.
  - There was some variability with respect to individual PAI-2 and PAI-3 scores, which ranged from 4 to 10. There was also a significant difference between the average PAI-2 score of 7.90 and the PAI-3 average value of 4.90. In general, the relationship between PAI-2 and PAI-3 scores followed a similar pattern with other measure categories.

7 EVALUATION RESULTS

This section of the report presents the gross and net realization rates the evaluation team developed for the 2017 Small and Medium Commercial Sector ESPI measures discussed throughout the report. These results are presented for both first year and lifecycle electric and gas savings, were applicable.

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 customer specific GRRs:

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

Where:

$Gross\_Ex\_Post\_Impact_{i,m}$ = the gross ex-post impact estimate for $site_i$ of $measure_m$ in the sample.

$Gross\_Ex\_Ante\_Impact_{i,m}$ = the gross ex-ante impact estimate $site_i$ of $measure_m$ in the sample.

Table 7-1 and Table 7-2 below present the population level first year gross gas and electric realization rates, respectively, for evaluated measures along with the aggregate ex-ante and ex-post first year savings. The corresponding relative precision at the 90% confidence interval is also presented.[18]

[18] Relative precision is calculated as the confidence interval divided by the mean. A smaller relative precision value indicates a more precise mean result. Relative precision presented in this report is at the 90% confidence level.

TABLE 7-1: POPULATION FIRST YEAR GROSS THERM REALIZATION RATES FOR EVALUATED GAS MEASURES

ESPI Measure Group	First Year Gross Therm Savings			
	Ex-Ante Savings	Ex-Post Savings	GRR	RP
Food Service – Gas Fryers	1,356,848	495,478	0.37	18%
Food Service – Other*	954,303	954,303	1.00	n/a
Process Boiler	479,272	393,940	0.82	4%
Pipe Insulation Hot Application	700,054	476,380	0.68	53%†
Water Heating Boiler*	422,778	422,778	1.00	n/a

* Note that gross ex-post evaluation was not performed for Food Service – Other and Water Heater Boiler measures, so ex-ante savings was passed thru.

† The poorer-than-anticipated relative precision is largely due to a single site with ex-post savings over 400% higher than ex-ante. The RP improves to 21% if that site is not considered.

TABLE 7-2: POPULATION FIRST YEAR GROSS MWH AND MW REALIZATION RATES FOR EVALUATED ELECTRIC MEASURES

ESPI Measure Group	First Year Gross MWh Savings				First Year Gross MW Savings			
	Ex-Ante Savings	Ex-Post Savings	GRR	RP	Ex-Ante Savings	Ex-Post Savings	GRR	RP
Refrigeration Case LED Lighting	7,139	3,453	0.48	13%	1.42	0.89	0.62	15%
Agricultural Irrigation	2,500	1,043	0.42	20%	1.98	0.69	0.35	41%

7.2 GROSS LIFECYCLE REALIZATION RATES

Table 7-3 and Table 7-4 present the population level gross lifecycle gas and electric realization rates for the evaluated ESPI measures along with the aggregate ex-ante and ex-post lifecycle savings. The corresponding relative precision at the 90% confidence interval is also presented.

TABLE 7-3: POPULATION LIFECYCLE GROSS THERM REALIZATION RATES FOR EVALUATED GAS MEASURES

ESPI Measure Group	Lifecycle Gross Therm Savings			
	Ex-Ante Savings	Ex-Post Savings	GRR	RP
Food Service – Gas Fryers	16,282,176	5,269,354	0.32	20%
Food Service – Other	11,468,420	11,468,420	1.00	n/a
Process Boiler	9,585,432	7,185,270	0.75	5%
Pipe Insulation Hot Application	4,736,003	5,240,178	1.11	56%†
Water Heating Boiler*	8,455,556	8,455,556	1.00	n/a

* Note that gross ex-post evaluation was not performed for Food Service – Other and Water Heater Boiler measures, so ex-ante savings was passed thru.

† The poorer-than-anticipated relative precision is largely due to a single site with ex-post savings over 400% higher than ex-ante. The RP improves to 13% if that site is not considered.

TABLE 7-4: POPULATION LIFECYCLE GROSS MWH AND MW REALIZATION RATES FOR EVALUATED ELECTRIC MEASURES

ESPI Measure Group	Lifecycle Gross MWh Savings				Lifecycle Gross MW Savings			
	Ex-Ante Savings	Ex-Post Savings	GRR	RP	Ex-Ante Savings	Ex-Post Savings	GRR	RP
Refrigeration Case LED Lighting	108,335	18,416	0.17	13%	21.53	4.73	0.22	15%
Agricultural Irrigation	50,002	20,874	0.42	20%	39.69	13.81	0.35	41%

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:

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

Where:

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

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

Table 7-5 and Table 7-6 below present the population level first year gas and electric net realization rates for the evaluated ESPI measures along with the aggregate ex-ante and ex-post first year net savings. The net realization rate is impacted by the difference in ex-ante and ex-post gross savings along with the differences between the ex-ante and ex-post NTG ratios.

TABLE 7-5: POPULATION FIRST YEAR NET THERM REALIZATION RATES FOR EVALUATED GAS MEASURES

ESPI Measure Group	First Year Net Therm Savings			
	Ex-Ante Savings	Ex-Post Savings	NRR	RP
Food Service – Gas Fryers	885,431	235,473	0.27	0.19
Food Service – Other	646,834	414,296	0.64	n/a
Process Boiler	311,527	185,499	0.60	0.64
Pipe Insulation Hot Application	455,035	240,251	0.53	0.60
Water Heating Boiler	279,201	196,395	0.70	n/a

TABLE 7-6: POPULATION FIRST YEAR NET MWH AND MW REALIZATION RATES FOR EVALUATED ELECTRIC MEASURES

ESPI Measure Group	First Year Net MWh Savings				First Year Net MW Savings			
	Ex-Ante Savings	Ex-Post Savings	NRR	RP	Ex-Ante Savings	Ex-Post Savings	NRR	RP
Refrigeration Case LED Lighting	4,640	2,183	0.47	0.14	0.93	0.56	0.60	0.16
Agricultural Irrigation	1,625	339	0.21	0.48	1.29	0.22	0.17	0.60

7.4 NET LIFECYCLE REALIZATION RATES

Table 7-7 and Table 7-8 present the population lifecycle gas and electric net realization rates for the evaluated ESPI measures along with the aggregate ex-ante and ex-post lifecycle net savings. The corresponding relative precision at the 90% confidence interval is also presented.

TABLE 7-7: POPULATION LIFECYCLE NET THERM REALIZATION RATES FOR EVALUATED GAS MEASURES

ESPI Measure Group	Lifecycle Net Therm Savings			
	Ex-Ante Savings	Ex-Post Savings	NRR	RP
Food Service – Gas Fryers	10,625,172	2,500,842	0.24	0.21
Food Service – Other	7,788,863	4,982,701	0.64	n/a
Process Boiler	6,230,531	3,383,402	0.54	0.64
Pipe Insulation Hot Application	3,078,402	2,642,764	0.86	0.63
Water Heating Boiler	5,584,010	3,927,893	0.70	n/a

TABLE 7-8: POPULATION LIFECYCLE NET MWH AND MW REALIZATION RATES FOR EVALUATED ELECTRIC MEASURES

ESPI Measure Group	Lifecycle Net MWh Savings				Lifecycle Net MW Savings			
	Ex-Ante Savings	Ex-Post Savings	NRR	RP	Ex-Ante Savings	Ex-Post Savings	NRR	RP
Refrigeration Case LED Lighting	70,418	11,644	0.17	0.14	13.99	2.97	0.21	0.16
Agricultural Irrigation	32,501	6,778	0.21	0.48	25.80	4.48	0.17	0.60

8 CONCLUSIONS AND RECOMMENDATIONS

This section of the report provides conclusions and recommendations related to the findings that were developed from this evaluation.

8.1 REFRIGERATION LED CASE LIGHTING MEASURES

Conclusion RL1 [Section 5]: The use of a multiple lamp profile for PG&E measure code LC03 results in a very large delta watts value. This measure code assumes one six-foot 16.5 watt LED fixture replaces one six-foot fixture with two T12 high output lamps rated at 299.5 watts. The use of multiple lamp profiles appears more applicable to the canopy style horizontal refrigerated cases than vertical cases where all these measures were verified to be installed. Furthermore, LC01 is a Tier I measure, and the efficiency requirements are <= 2.0 watts/linear feet of lamp. However, Itron verified lamps with efficacy of greater than 2.0 in the majority of the LC03 claims, putting them in the Tier 3 category.

Recommendations RL1 [PG&E]: PG&E should revisit the use of the LC03 measure code. It does not appear most of the claimed LC03 measures are eligible for the Tier 1 category. If the incentives are greater for the Tier 1 measure compared to Tier 2 through Tier 4, than PG&E may have paid higher rebates than the measure qualified for and inflated demand and energy savings values. PG&E should revisit the application of this measure code to their projects and improve documentation of the existing lighting system.

Conclusion RL2 [Section 5]: T12 lamps are assumed existing condition for all six foot LED lamp measures, yet the self-reported lamp technology was overwhelmingly T8. This finding resulted in lower realization rates for many of the projects, particularly in PG&E and SDG&E since the verified claims were predominantly in their service territories.

Recommendations RL2 [PG&E, SCE, SDG&E]: Utilities should revisit the assumption of T-12 lamps as the existing condition for all LED measures that are 6 feet in length. The IOUs should consider adding additional separate measure codes for the measure with LED lamps > 5' that have T8 baseline or T12 baseline. For example:

> LC03 - Linear foot of Tier 1 LED Lightbar, > 5-foot unit, no occupancy sensor control replacing multiple T8 lamp profile

LC03(new measure#) - Linear foot of Tier 1 LED Lightbar, > 5-foot unit, no occupancy sensor control replacing multiple T12 lamp profile

Conclusion RL3 [Section 5]: SDG&E uses the unit refrigerated case door for the measure. The unit energy savings are per door and assumes more than one fixture per door. Overall, the evaluators verified less than 1.2 fixtures per door resulting in less connected load, delta watts, and a lower realization rate.

Recommendations RL3 [SDG&E]: SDG&E should revisit the assumption of 1.2 fixtures per door. Most sites with this measure were small convenience store type buildings. It is possible that in larger grocery stores there are on average 1.2 fixtures per door, but in the sampled points this was not the finding. SDG&E should consider revising this assumption, or moving to a different reporting unit, such as fixture.

Conclusion RL4 [Section 5]: Ex-post hours of operation generally support the HOU used in the workpapers and deemed savings for the refrigerated case LED measures. Except for sites verified with 24/7 operation through both self-report and logger data, the HOU assumption in the work papers seem appropriate.

Recommendations RL4 [SDG&E]: Utilities should continue using the HOU currently being used in the ex-ante calculations. One possible exception is to develop a measure code for buildings that are open 24/7.

Conclusion RL5 [Section 5]: SDG&E and PG&E applied an EUL of 16 years to the measures. SCE applied an EUL of four years. Evaluators concluded the remaining useful life of the refrigerated case, or 1/3 of the case's 16 year EUL, is more appropriate to use when calculating lifecycle savings because when the case is replaced, the LED's rebated through the program will be removed from service.

Recommendations RL5 [PG&E, SCE, SDG&E]: The IOUs should revise the EUL they use for lifecycle savings. Instead of claiming these measures as replace on burnout with a 16 year EUL (or only 4 years for SCE), we recommend they be considered early replacement with an EUL equal to the remaining useful life of the refrigerated case itself, or 5.33 years.

Conclusion RL6 [Section 6]: In general, Refrigerated LED Case Lighting measures exhibited commendable medium-high program influence levels. Ex-post NTG ratios averaged 0.57 (PG&E Downstream channel), 0.54 (PG&E Direct Install channel) and 0.66 (SDG&E Downstream channel).

Recommendation RL6 [PG&E, SCE, SDG&E]: If Refrigerated LED Case Lighting measures continue to be incented, free ridership should be monitored on an ongoing basis. As the market matures for this technology and free ridership levels rise, programs should revisit incentive eligibility.

8.2 PROCESS BOILER MEASURES

Conclusion PB1 [Section 5]: The workpaper stipulations for operating hours, load factors and measure case efficiency values differed from the ex-post findings and contributed to the gross savings gap. The three most pertinent parameters in the IOU savings algorithms differed from the ex-ante workpaper recommendations. The hours of operation for the measure case differed by approximately 13% for both IOUs, and was compounded by the use of average capacity/load factors, which were not always representative of the process which the boilers serve.

> **Recommendation PB1a [PG&E, SCG]: The program's application and review process should be expanded to increase the range of boiler performance information captured in the ex-ante tracking databases.** Although, Section 3 notes that this ex-post impact sample size is insufficient to support any ex-ante parameter improvements, the PAs should consider including fields within the project application forms for proposed boiler runtime, the process the boiler will serve, etc., and use as-installed conditions where possible, to provide more context to the ex-post verification process (e.g., operating hours, capacity/ load factor, etc.). A table of values for load/capacity factors, such as the ones already listed within the IOU-specific workpapers must be used to fine tune ex-ante savings values to accurately represent the process load the boilers will be serving. Collection of these parameters in addition to collecting possibly the make and model information for the proposed boilers can help reduce the savings gap.

> **Recommendation PB1b [PG&E, SCG]: The PAs should consider using an enhanced measure savings algorithm that provides for some reasonable level of customization for relevant input parameters.** Based on observations during this evaluation, we believe that process boilers are better suited as a quasi-prescriptive (partially-deemed) measure rather than a fully deemed measure. Each process (end-use) served by participating boilers was found to differ across each sample point; to that effect, using process-specific capacity/ load factor values would, for example, more accurately characterize the measure savings. Additionally, if the PAs are already collecting combustion efficiency test results, those should be used to calculate the measure savings. Using the deemed values, which are in-turn based on averages from previous studies, etc., will likely misrepresent realized program savings.

Conclusion PB2 [Section 5]: The baseline efficiency for hot water boilers in the SCG workpaper are not consistent with baseline requirements within the PG&E workpaper. While PG&E workpaper lists a standard/ base case efficiency of 82% for a hot water boiler (based on 2013 Title 24 minimum efficiencies for boilers), the SCG workpaper lists the same requirement at 80% based on Titles 20 and 24 for gas packaged boilers.

Recommendation PB2 [SCG]: The workpaper base case efficiency needs to be updated to reflect current Title 24, Part 6 standards. This will ensure the SCG workpaper stipulations are in compliance with Title 24, Part 6 requirements and will result in cross-PA consistency in baseline treatment for this class of measures.

Conclusion PB3 [Section 5]: Very few of the participants were able to measure, store, and analyze boiler consumption data as it results in increased overall operational costs. While it is unreasonable to expect all participants to have advanced EMS/SCADA systems with logging abilities, having a basic EMS trending system is a fairly cheap upgrade that results in improved ability to analyze and optimize operations. During the on-sites, some participants said that the digital interface on the boiler that reports combustion efficiency, cumulative run time, etc. was "a techy gadget add-on that we didn't understand at the time."

Recommendation PB3 [PG&E, SCG]: The PAs should encourage customer investment in, and involvement with, performance monitoring of equipment by means of a rebate program or something similar. The PAs should consider funding these EMS upgrades by means of a rebate program as it can ultimately lead to optimal scheduling of the boilers and thereby resulting in a more energy efficient operation, saving natural gas.

Conclusion PB4 [Section 6]: The measure's average ex-post NTG ratio of 0.42 suggests a medium-low level of program influence and corresponding medium-high level of free ridership. This result is associated with project-level findings that vary widely.

Recommendation PB4 [PG&E, SCG]: Given the medium-low program influence level, the programs should monitor free ridership on an ongoing basis. Based on these findings, the programs should adjust the program design, including promotional strategies, as needed to maximize program influence and discourage free ridership.

8.3 FOOD SERVICE MEASURES

Conclusion FS1 [Section 5]: Realization rates, after discounting zero savers, would be 10 or more percentage points greater than the ex-post realization rate results. For example, roughly 0.45 to 0.50 for PG&E and SCG, respectively; and compared with ex-post realization rate results of 0.35 and 0.37, respectively. Zero savers describe projects that do not save energy, either partially due to special circumstances, or entirely due to installation of ineligible equipment and other factors. There are several well-understood factors that lead to this result, and those factors are discussed in greater detail below.

Conclusion FS1a [Section 5]: Across both the PG&E and SCG samples, 6 out of 43 projects were found to be ineligible for program participation. For four of those projects the installed gas unit was inspected and found to not be among the make and model of gas fryers in the qualified products listings. For the other two cases, the only fryers installed on-site were electric fryers. For these projects no ex-post gross savings accrue to the evaluation result.

Conclusion FS1b [Section 5]: Across both the PG&E and SCG samples, involving 3 out of 43 projects, the gas fryers were found to not operate/no longer operate. For one project where two units were claimed, one fryer was in storage and the other held dirty dishes; customer stated that they no longer use the fryers. Another different project had also stopped using their fryer due to change in business operations to a bakery. For the final project, there were two units claimed, but the participant only operates one of the units.

Conclusion FS1c [Section 5]: Across both the PG&E and SCG samples, involving 1 out of 43 projects, only one gas fryer was found. The claim was for two fryer vats, but only 1 vat was verified as installed and operable.

Conclusion FS1d [Section 5]: Across both the PG&E and SCG samples, involving 2 out of 43 projects, program-installed gas fryers were removed following installation. In one instance fryer did not work properly following multiple attempts to repair it. In the other instance the fryer broke and was replaced.

Conclusion FS1e [Section 5]: Across both the PG&E and SCG samples, involving 4 out of 43 projects, the facilities closed down. Following closure the fryers no longer accrue savings to the program.

Recommendation FS1 [PG&E, SCG, SDG&E]: The program's application and review process should be enhanced to screen projects against the eligible equipment listing, and verification should be performed to ensure that installations claimed are valid. Regarding zero savers, tighter program controls may be warranted to reduce the downward effect of those projects on realized savings.

- Verification that installed units are program qualifying models
- Verification that units were ever installed
- Verification that all installed units will operate
- Perform testing on qualified unit models to ensure survival under normal operating conditions

Unfortunately, zero savers due facility closures likely cannot be avoided.

Conclusion FS2 [Section 5]: Across both the PG&E and SCG samples, 6 of 43 projects received EUL adjustments to account for loss of long-term savings associated with equipment that were removed from operation. Ex-post EUL estimates were otherwise left unchanged from the ex-ante value of 12 years. However, The ex-ante EUL may understate the degree to which program installed equipment were found to be removed from service. In a period of about 1.5 years following installations, substantial EUL reductions were found to be warranted. Furthermore, the ex-post mean EUL result masks the severity of program equipment claims that are no longer generating savings today. This is due to treatment in the sample of some projects as full-zero savers, where any additional EUL adjustments would unfairly skew results downwards. Still, the true incidence in the sample of projects that no longer generate savings today is roughly 15 projects out of a total sample across both PG&E and SCG of 43 projects; indicating that the true impact of deeply shortened savings is much greater than is implied by the ex-post EUL results.

Recommendation FS2 [PG&E, SCG, SDG&E]: The PAs should consider reducing ex-ante EUL of 12 years. However, it should be noted that additional suggestions are provided above under Recommendation FS1 that could also be used to reduce the incidence rate of zero savers, which also have a significant effect on the duration over which program claims provide savings benefits. Some mix of both sets of recommendations is likely needed.

Conclusion FS3 [Section 5]: Evaluation results provide validation for the robustness of both the ex-post and ex-ante models, as both approaches yield very similar results when modeling parameters are uniform across both models. In an effort to further explore the discrepancy factors that lead to dramatic differences between ex-ante modeled impacts and ex-post modeled impacts, the ex-post evaluation parameters were sequentially and cumulatively applied to the ex-ante model in order to derive an ex-ante result under the observed field conditions from the metering-based ex-post samples. This allowed for a direct and fair comparison with evaluation realization rate results, and yielded an implied realization rate of 0.39. Gross impact realization rate results were similar in magnitude – 0.35 and 0.37 for PG&E and SCG, respectively.

Recommendation FS3 [PG&E, SCG, SDG&E]: With the ex-ante model validated in this way, the focus of updates to ex-ante methods -- to better align ex-ante and ex-post results -- can focus on parameter updates.

Parameter-level conclusions and recommendations are addressed next.

Conclusion FS4 [Section 5]: Differences between ex-post and ex-ante model-based parameters resulted in a relatively large reduction in ex-post savings relative to claims. Individual parameters are discussed in more detail below.

Conclusion FS4a [Section 5]: Ex-post versus ex-ante efficient fryer performance differed substantially for fryer operating modes, including pre-heat, idle and frying. These differences in efficient fryer performance would be expected to have a moderately important effect on resulting ex-ante impact estimates. Ex-ante performance parameters are based on an average taken across a great number of tested equipment, and yet we see that program participation appears to be comprised largely of just two eligible fryer models on the market.

Conclusion FS4b [Section 5]: Ex-post baseline idle energy rate would be expected to have a substantial effect on resulting ex-ante impact estimates. The ex-post average idle energy rate for the baseline fryer is substantially lower than the ex-ante parameter, which has a large downward effect on the resulting impact. The ex-ante parameter, equal to 17,000 Btu/hr, appears unreasonable, given that not a single standard baseline unit analyzed in the FSTC database had an idle energy rate that high.

Conclusion FS4c [Section 5]: It should be noted that metering data were most valuable to the evaluation in being able to discern each fryer operation parameter, but supplemental self-report data were also needed to accurately model each parameter. An important and common set of inputs that contribute to both the ex-post and ex-ante modeling-based impact results are operating profiles for both the efficient fryer and baseline fryer conditions. The associated ex-post parameters derived for each metering-based sample point include operating days per year, daily average hours of fryer operation and average daily minutes of pre-heat burner runtime. When comparing ex-post and ex-ante resulting parameters, the average results across sample points all indicate fewer days of operation, fewer hours of fryer operation per day and fewer minutes of pre-heat runtime. Each difference leads to a reduction in ex-post impacts relative to ex-ante, with daily schedule of operation being very important, operating days per year having a meaningful effect, and pre-heat minutes being somewhat inconsequential to the level of reduction in impacts.

Recommendation FS4 [PG&E, SCG, SDG&E]: Future workpaper revisions should incorporate all PY2013-17 evaluation data to revise parameter-level assumptions. The PAs should also consider making use of other secondary data sources already available, and supplementing with additional data collection, per the following update recommendations:

- Updates to efficient fryer performance specifications should be undertaken for the purposes of revisions to ex-ante workpapers and resulting impact claims on a going forward basis. Market and program preferences in equipment selection should be considered for the purposes of updating efficient fryer performance parameters that are used in updates to the ex-ante model.
- Updates to the ex-ante baseline idle energy rate should be undertaken for the purposes of revisions to ex-ante workpapers and resulting impact claims on a going forward basis. It is recommended that a market assessment be conducted by the PAs in order to better understand customer equipment choices in the marketplace as a function of market segment and other factors. Baseline for the program should reflect common market choices for equipment, and performance testing should subsequently be performed on equipment that reflect these market-based preferences. Baseline conditions used in the ex-ante estimates should reflect common practice for a given segment of the population, or perhaps a weighted blend of customer preferences, given underlying program participation patterns by segment. It is further recommended that CPUC Standard Practice Guidelines be following for the purposes of conducting this proposed market assessment.
- It is recommended that metering-based results from this study be incorporated into revisions to workpaper models, and perhaps supplemented with additional metering and participant self-report data sources. Preferably additional metering can be undertaken by the PAs, due to the value of that knowledge resource relative to self-report information, even given substantial costs versus purely self-report data. It may also be feasible to mine other available industry data sources, including previous field metering projects.

Conclusion FS5 [Section 6]. Food service measures associated with the Midstream and Downstream delivery channels experienced high levels of free ridership, with ex-post NTGRs of 0.39 (PG&E Downstream and Midstream) and 0.32 (SCG Downstream). NTGRs of this magnitude provide strong evidence that these measures are being installed for reasons not related to the program. Chain restaurants and grocery stores in particular are more sophisticated consumers and in many cases, have already decided to purchase eligible measures before they participate.

> **Recommendation FS5a [PG&E, SCG, SDG&E]. Review the set of technologies that are currently eligible for incentives and research new technologies that are less commonly installed.** Assuming the programs plan to continue to actively involve large chains, the current set of measures needs to be revisited. Often, these are measures that have been incented by the program for several years, and where the chain is already proactively installing them across the chain. The programs need to conduct market research to identify less widely adopted measures and/or emerging technologies. This research can take the form of investigation of industry

practices (for example, interviews with manufacturers, distributors, retailers, and designers), analysis of sales data, literature reviews, project application pipeline, measure economics, and review of evaluation results.

Recommendation FS5b [PG&E, SCG, SDG&E]. Adjust the set of technologies that are eligible for incentives. After this research has been completed, program implementers need to carefully review the list of qualifying measures. Based on this review, they should eliminate eligibility for measures that are already likely or very likely to be installed by a significant fraction of the market and add new measures that are less-well adopted or emerging technologies.

Recommendation FS5c [PG&E, SCG, SDG&E]. In addition, for account managed chain customers in particular, program implementers should change their promotional practices to actively highlight and promote these new, less commonly adopted technologies. Such measures are much less likely to be prone to high free ridership.

8.4 AGRICULTURAL IRRIGATION

Conclusion AI1 [Section 5]: The agricultural irrigation workpaper revisions made over the last several years have resulted in more accurate savings estimation. This study represents the third evaluation of the agricultural irrigation measure. Table 8-1 below shows the gross realization rates for each of the evaluations by program year, which have steadily increased with time. Each iteration of the workpaper has progressed the deemed savings values toward a more accurate estimate, and we commend the IOUs in adjusting workpaper savings and eligibility requirements to reflect a dynamic industry standard.

TABLE 8-1: GROSS KWH AND KW REALIZATION RATES OVER TIME – AGRICULTURAL IRRIGATION MEASURES

Evaluated Program Years	kWh GRR	kW GRR
2013-14	3%	2%
2015	13%	10%
2018	42%	35%

Additionally, based on the findings of the 19 sampled sites and the discrepancy analysis in Section 5, the workpaper is accurately estimating the discharge pressure reduction of a sprinkler-to-drip irrigation conversion, which is one of the major factors affecting savings values.

Recommendation AI1 [PG&E]: The programs should maintain eligibility requirements for pre-existing irrigation method and crop type. Recent revisions of the workpaper have disallowed farms with preexisting low-pressure micronozzle irrigation systems, along with any farms with deciduous and vineyard crops, from participating in the program. Based on the higher GRRs of this study as compared with prior evaluation cycles, the evaluators recommend that the workpaper maintains these eligibility requirements, as they have mitigated the participation of low- or zero-saving farms.

Conclusion AI2 [Section 5]: Five of the 19 sampled projects were determined to be ineligible for program participation. All 5 of the ineligible sites had previously irrigated their farms with flood or furrow methods, which do not meet the workpaper's minimum discharge pressure requirement and could result in an energy penalty. Of the 5 ineligible sites, 3 sites were also growing deciduous crops (almond orchards), which are no longer eligible for the measure due to changes in industry standard practice. 6 of the 19 sampled projects involved a switch in crop type at the time of project installation, as participating farmers saw the crop switch as an opportunity to install a new irrigation system.

Recommendation AI2 [PG&E]: The program's application and review process should be enhanced to collect additional relevant data and more carefully screen applicants to avoid ineligible projects. The application process should require documented proof of the following: existing crop type, planned crop type, and existing irrigation method, as well as relevant photographs and a prior year's worth of electric billing data for the affected irrigation pump. A more rigorous application and screening process would also identify potential crop switch projects that could result in lower-than-expected savings at the electric meter.

Conclusion AI3 [Section 5]: Agricultural irrigation projects are difficult to accurately characterize with a single deemed savings value. Due to its prescriptive delivery mechanism, the program was unaware of several key variables that affect savings at the irrigation pump. Nearly each of the 19 sampled projects was a unique permutation of the following variables not considered in the program deemed savings calculation: pre-project crop type, pre-project irrigation method, and post-project crop type. Each of these variables can significantly affect irrigation requirements and subsequent savings from drip irrigation installations.

Recommendation AI3 [PG&E]: The program should consider adding more granularity to the sprinkler-to-drip workpaper's unit energy savings based on key variables determined from project applications. Evaluators found that crop type and pre-project irrigation method are two variables that significantly affect project savings. Any information on these parameters, even self-reported via the program application, would be helpful in developing accurate savings claims. The results of this PY2017 evaluation, as well as for the PY2013-15 projects still eligible per current workpaper requirements, should inform a broader set of deemed savings based on crop type and pre-project irrigation method. Evaluators look forward to collaborating with the PAs on this endeavor.

Conclusion AI4 [Section 5]: Evaluators were unable to assess EUL in this evaluation cycle; however, the current workpaper's EUL recommendation of 20 years is overstated. An objective of the study involved quantifying the effective useful life (EUL) of agricultural irrigation systems. However, after collecting site-specific data among the 19 sampled projects, evaluators found that the irrigation systems were often replaced due to non-energy considerations such as water impacts or crop switches. Additionally, the conversion to drip irrigation does not typically require overhaul of the full irrigation system, including the pump, filters, piping, and controls. The current version of the workpaper recommends an EUL of 20 years based on all parts of the irrigation system.

Recommendation AI4 [PG&E]: Future evaluation cycles and PA research should emphasize measure EUL, which is likely too high in the current workpaper. This measure incentivizes the installation of drip tape, but the EUL reflects the lifetime of the entire irrigation system. Though this study did not produce sufficiently usable data to update the EUL on its own, the evaluators believe that a measure life of 20 years is far longer than the life expectancy of drip tape, which, according to online sources, is approximately 5 years. Although the evaluators cannot recommend a new value to be applied, it is clear that the current value is notably higher. The sprinkler-to-drip workpaper appears to have carried over the EUL from prior irrigation measures such as low-pressure sprinkler nozzles, which are likely more resistant to corrosion than drip tape.

Conclusion AI5 [Section 6]. Agricultural Irrigation measures experienced high levels of free ridership. The ex-post 0.28 NTG ratio provides strong evidence that these measures are installed for reasons not related to the program.

> **Recommendation AI5a [PG&E]. Adjust the set of technologies that are eligible for incentives.** Program implementers need to carefully review the list of qualifying measures and eliminate eligibility for those that are standard practice. Measures that are already likely or very likely to be installed by a significant fraction of the market should, in most cases, not qualify for incentives. A number of such measures can be identified through investigation of industry practices (for example, interviews with manufacturers, distributors, retailers, and designers), analysis of sales data, literature reviews, project application pipeline, measure economics, and review of evaluation results.
>
> **Recommendation AI5b [PG&E]. In addition, program implementers should actively highlight and promote technologies that are less well-adopted, cutting edge, or emerging technologies.** Such measures are much less likely to be prone to high free ridership.

8.5 PIPE INSULATION

Conclusion PI1 [Section 5]: For PG&E projects in particular, the tracked ex-ante savings did not appear to follow established workpaper recommendations for several of the evaluated sites. Evaluators recreated the ex-ante savings calculations using tracked information, workpaper assumptions, and an assumed 100% installation rate. The recalculated ex-ante savings were significantly lower than the tracked savings for sampled PG&E projects in particular, as reflected in the PA-specific results examined in Section 5. Evaluators could not pinpoint the cause for the discrepancy but observed that it affected first-year savings more significantly than lifetime savings for PG&E projects.

Recommendation PI1 [PG&E, SCG]: Future pipe insulation savings claims should reflect current workpaper assumptions and parameters. The discrepancy between tracked ex-ante savings and the recreated ex-ante savings using program assumptions represented a significant impact on gross realization rate. To avoid such savings inaccuracies in the future, we recommend that the PAs strictly adhere to active workpaper guidance on unit energy savings, EUL, and NTGR.

Conclusion PI2 [Section 5]: Differences in operating hours, installation rate, pipe diameter, and fluid temperature resulted in a lower GRR overall. These parameters are discussed in more detail in the following sub-conclusions 2a, 2b, 2c, and 2d.

> **Conclusion PI2a [Section 5]: Affected boilers at participating small commercial facilities operate 17% less frequently than assumed within IOU deemed savings values, while affected boilers at participating industrial facilities operate 11% less.** Boilers at small commercial facilities in PY2017 were assumed to operate 2,425 hours per year, but evaluators determined that they only operate 2,006 hours per year. Boiler at industrial facilities in PY2017 were assumed to operate 7,752 hours per year, but evaluators determined that they only operate 6,933 hours per year.
>
> **Conclusion PI2b [Section 5]: The visually inspected insulation was determined to be 95.3% installed as tracked, reducing ex-post savings.** Field auditors determined that 95.3% of the rebated insulation was installed and operable via visual inspection, spot measurement, and review of project invoices. Much of this difference is attributable to closed facilities or project incompletion. In addition, evaluators found that approximately 2% of rebated insulation was required by OSHA's safety regulations, resulting in baseline revisions and reduced savings.[19]

[19] OSHA requires that pipes with a surface temperature of 140°F or greater that are "located within 7 feet measured from floor or working level or within 15 inches measures horizontally from stairways, ramps, or fixed ladders shall be covered with a thermal insulating material or otherwise guarded against contact."

Conclusion PI2c [Section 5]: The average diameter of insulated pipe was greater for all fluid types and sectors, increasing ex-post savings. The PAs classified pipe insulation measures by diameter in PY2017: less than 1” (0.7 average assumed in the workpapers) and greater than or equal to 1” (1.7” average assumed in the workpapers). Evaluators determined a greater average diameter for all size tiers, resulting in higher savings per linear foot of insulation.

Conclusion PI2d [Section 5]: Ex-post bare pipe temperatures were significantly higher than the ex-ante assumption for industrial customers with medium-pressure steam piping, increasing savings for that segment of participants. The medium-pressure steam bare pipe temperature was found to be 390°F at industrial facilities as compared to the ex-ante assumption of 328°F. Otherwise, evaluator-measured pipe temperatures did not deviate significantly from workpaper assumptions.

Recommendation PI2 [PG&E, SCG]: Future workpaper revisions should incorporate all PY2013-17 evaluation data to revise parameter-level assumptions. Evaluators are pleased to see that prior evaluation results are being considered in current versions of pipe insulation workpapers (e.g., SCGWP110812A Revision 4). As this study represents a third evaluation cycle for the pipe insulation measure since PY2013, the data set of field-verified operating hours and temperatures has grown to approximately 80 sites. The evaluators recommend that, when the pipe insulation workpapers are next updated, the PAs incorporate the weighted average parameters from PY2013-17 evaluations in revised UES values. The evaluation team looks forward to collaborating with the PAs on this effort. **So as not to double-count evaluator findings, we *do not* recommend that the workpapers incorporate evaluation GRRs as well.** These GRRs inherently incorporate ex-ante savings discrepancies going back to 2013; as the active workpapers have been recently revised with parameter-level ex-post data, these GRRs are no longer appropriate.

Conclusion PI3 [Section 5]: Evaluators are pleased to observe that the current SCG and PG&E workpapers have added a third, large-diameter tier to the UES recommendations. In both SCG and PG&E workpapers, the UES tiers were revised to: less than or equal to 1”, greater than 1” and less than or equal to 4”, and greater than 4”. These new tiers will likely reduce savings discrepancies due to higher-than-anticipated pipe diameter, as found in the prior PY2015 evaluation study. Larger-than-expected pipe diameter was the primary cause of a single site’s 526% RR that resulted in a poorer relative precision than targeted in this study.

Recommendation PI3 [PG&E, SCG]: Continue incorporating evaluator recommendations in future workpaper updates. It is clear that both SCG and PG&E have incorporated evaluator recommendations when updating the pipe insulation workpapers; we commend their responsiveness to our findings. This coordination will help improve savings accuracy in future program cycles.

Conclusion PI4 [Section 6]: The measure's average ex-post NTG ratio of 0.45 suggests a medium-low level of program influence and corresponding medium-high level of free ridership. This result is associated with findings which are highly variable at the individual project level.

Recommendation PI4 [PG&E, SCG]: Given the medium-low program influence level, the programs should monitor free ridership on an ongoing basis. Based on these findings, the programs should adjust the program design, including promotional strategies, as needed to maximize program influence and discourage free ridership.

8.6 WATER HEATING BOILER MEASURES

Conclusion WH1 [Section 6]: The measure's average ex-post NTG ratio of 0.45 suggests a medium-low level of program influence and corresponding medium-high level of free ridership. This result is associated with findings which are highly variable at the individual project level.

Recommendation WH1 [PG&E,SCG]: Given the medium-low program influence level, the programs should monitor free ridership on an ongoing basis. Based on these findings, the programs should adjust the program design, including promotional strategies, as needed to maximize program influence and discourage free ridership.

APPENDIX AA STANDARDIZED HIGH LEVEL SAVINGS

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	AG IRRIGATION	50,002	20,874	0.42	0.0%	0.42
PGE	AG PUMP MOTOR REPLACEMENT	3,377	3,377	1.00	100.0%	
PGE	AG PUMPING VFD	89,459	89,459	1.00	100.0%	
PGE	FOOD SERVICE	29,540	29,540	1.00	100.0%	
PGE	PIPE INSULATION HOT APPLICATION	0	0			
PGE	PROCESS BOILER	0	0			
PGE	PROCESS PUMPING VFD	1,289	1,289	1.00	100.0%	
PGE	REFRIGERATION CASE LED LIGHTING	74,672	12,040	0.16	0.0%	0.16
PGE	REFRIGERATION CASE REPLACEMENT	21,158	21,158	1.00	100.0%	
PGE	REFRIGERATION EVAPORATOR EC MOTORS	47,876	47,876	1.00	100.0%	
PGE	WATER HEATING BOILER	-258	-258	1.00	100.0%	
PGE	**Total**	**317,116**	**225,356**	**0.71**	**60.7%**	**0.26**
SCE	AG PUMPING VFD	11,917	11,917	1.00	100.0%	
SCE	FOOD SERVICE	11,204	11,204	1.00	100.0%	
SCE	REFRIGERATION CASE LED LIGHTING	1,961	1,265	0.64	0.0%	0.64
SCE	REFRIGERATION CASE REPLACEMENT	0	0			
SCE	**Total**	**25,083**	**24,386**	**0.97**	**92.2%**	**0.64**
SCG	FOOD SERVICE	0	0			
SCG	PIPE INSULATION HOT APPLICATION	0	0			
SCG	PROCESS BOILER	0	0			
SCG	REFRIGERATION CASE REPLACEMENT	0	0			
SCG	TANK INSULATION HOT APPLICATION	0	0			
SCG	WATER HEATING BOILER	0	0			
SCG	**Total**	**0**	**0**			
SDGE	FOOD SERVICE	25	25	1.00	100.0%	
SDGE	REFRIGERATION CASE LED LIGHTING	31,702	5,112	0.16	0.0%	0.16
SDGE	**Total**	**31,727**	**5,137**	**0.16**	**0.1%**	**0.16**
MCE	REFRIGERATION CASE LED LIGHTING	1,465	1,465	1.00	100.0%	
MCE	REFRIGERATION EVAPORATOR EC MOTORS	687	687	1.00	100.0%	
MCE	**Total**	**2,151**	**2,151**	**1.00**	**100.0%**	
	Statewide	***376,076***	***257,030***	***0.68***	***57.9%***	***0.25***

Net Lifecycle Savings (MWh)

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
PGE	AG IRRIGATION	32,501	6,778	0.21	0.0%	0.65	0.32	0.65	0.32
PGE	AG PUMP MOTOR REPLACEMENT	2,195	2,195	1.00	100.0%	0.65	0.65		
PGE	AG PUMPING VFD	59,183	59,183	1.00	100.0%	0.66	0.66		
PGE	FOOD SERVICE	22,533	16,316	0.72	45.0%	0.76	0.55	0.87	0.44
PGE	PIPE INSULATION HOT APPLICATION	0	0						
PGE	PROCESS BOILER	0	0						
PGE	PROCESS PUMPING VFD	838	838	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION CASE LED LIGHTING	48,537	7,227	0.15	0.0%	0.65	0.60	0.65	0.60
PGE	REFRIGERATION CASE REPLACEMENT	13,753	13,753	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION EVAPORATOR EC MOTORS	31,119	31,119	1.00	100.0%	0.65	0.65		
PGE	WATER HEATING BOILER	-168	-120	0.71	0.0%	0.65	0.46	0.65	0.46
PGE	**Total**	**210,491**	**137,290**	**0.65**	**55.7%**	**0.66**	**0.61**	**0.67**	**0.43**
SCE	AG PUMPING VFD	7,746	7,746	1.00	100.0%	0.65	0.65		
SCE	FOOD SERVICE	8,613	8,613	1.00	100.0%	0.77	0.77		
SCE	REFRIGERATION CASE LED LIGHTING	1,275	800	0.63	0.0%	0.65	0.63	0.65	0.63
SCE	REFRIGERATION CASE REPLACEMENT	0	0						
SCE	**Total**	**17,634**	**17,159**	**0.97**	**92.8%**	**0.70**	**0.70**	**0.65**	**0.63**
SCG	FOOD SERVICE	0	0						
SCG	PIPE INSULATION HOT APPLICATION	0	0						
SCG	PROCESS BOILER	0	0						
SCG	REFRIGERATION CASE REPLACEMENT	0	0						
SCG	TANK INSULATION HOT APPLICATION	0	0						
SCG	WATER HEATING BOILER	0	0						
SCG	**Total**	**0**	**0**						
SDGE	FOOD SERVICE	16	16	1.00	100.0%	0.65	0.65		
SDGE	REFRIGERATION CASE LED LIGHTING	20,606	3,617	0.18	0.0%	0.65	0.71	0.65	0.71
SDGE	**Total**	**20,622**	**3,633**	**0.18**	**0.1%**	**0.65**	**0.71**	**0.65**	**0.71**
MCE	REFRIGERATION CASE LED LIGHTING	1,047	1,047	1.00	100.0%	0.72	0.72		
MCE	REFRIGERATION EVAPORATOR EC MOTORS	613	613	1.00	100.0%	0.89	0.89		
MCE	**Total**	**1,660**	**1,660**	**1.00**	**100.0%**	**0.77**	**0.77**		
	Statewide	***250,407***	***159,742***	***0.64***	***54.0%***	***0.67***	***0.62***	***0.67***	***0.46***

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	AG IRRIGATION	39.7	13.8	0.35	0.0%	0.35
PGE	AG PUMP MOTOR REPLACEMENT	1.5	1.5	1.00	100.0%	
PGE	AG PUMPING VFD	43.0	43.0	1.00	100.0%	
PGE	FOOD SERVICE	4.9	4.9	1.00	100.0%	
PGE	PIPE INSULATION HOT APPLICATION	0.0	0.0			
PGE	PROCESS BOILER	0.0	0.0			
PGE	PROCESS PUMPING VFD	0.0	0.0			
PGE	REFRIGERATION CASE LED LIGHTING	15.9	3.3	0.21	0.0%	0.21
PGE	REFRIGERATION CASE REPLACEMENT	4.0	4.0	1.00	100.0%	
PGE	REFRIGERATION EVAPORATOR EC MOTORS	6.0	6.0	1.00	100.0%	
PGE	WATER HEATING BOILER	0.0	0.0	1.00	100.0%	
PGE	**Total**	**115.0**	**76.5**	**0.67**	**51.7%**	**0.31**
SCE	AG PUMPING VFD	5.8	5.8	1.00	100.0%	
SCE	FOOD SERVICE	2.3	2.3	1.00	100.0%	
SCE	REFRIGERATION CASE LED LIGHTING	0.4	0.3	0.83	0.0%	0.83
SCE	REFRIGERATION CASE REPLACEMENT	0.0	0.0			
SCE	**Total**	**8.5**	**8.4**	**0.99**	**95.1%**	**0.83**
SCG	FOOD SERVICE	0.0	0.0			
SCG	PIPE INSULATION HOT APPLICATION	0.0	0.0			
SCG	PROCESS BOILER	0.0	0.0			
SCG	REFRIGERATION CASE REPLACEMENT	0.0	0.0			
SCG	TANK INSULATION HOT APPLICATION	0.0	0.0			
SCG	WATER HEATING BOILER	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**			
SDGE	FOOD SERVICE	0.0	0.0	1.00	100.0%	
SDGE	REFRIGERATION CASE LED LIGHTING	5.2	1.1	0.21	0.0%	0.21
SDGE	**Total**	**5.2**	**1.1**	**0.21**	**0.1%**	**0.21**
MCE	REFRIGERATION CASE LED LIGHTING	0.3	0.3	1.00	100.0%	
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0.1	0.1	1.00	100.0%	
MCE	**Total**	**0.4**	**0.4**	**1.00**	**100.0%**	
	Statewide	***129.1***	***86.4***	***0.67***	***52.6%***	***0.30***

Net Lifecycle Savings (MW)

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
PGE	AG IRRIGATION	25.8	4.5	0.17	0.0%	0.65	0.32	0.65	0.32
PGE	AG PUMP MOTOR REPLACEMENT	1.0	1.0	1.00	100.0%	0.65	0.65		
PGE	AG PUMPING VFD	28.4	28.4	1.00	100.0%	0.66	0.66		
PGE	FOOD SERVICE	3.7	2.8	0.75	51.1%	0.75	0.57	0.87	0.44
PGE	PIPE INSULATION HOT APPLICATION	0.0	0.0						
PGE	PROCESS BOILER	0.0	0.0						
PGE	PROCESS PUMPING VFD	0.0	0.0						
PGE	REFRIGERATION CASE LED LIGHTING	10.3	2.0	0.19	0.0%	0.65	0.60	0.65	0.60
PGE	REFRIGERATION CASE REPLACEMENT	2.6	2.6	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION EVAPORATOR EC MOTORS	3.9	3.9	1.00	100.0%	0.65	0.65		
PGE	WATER HEATING BOILER	0.0	0.0	0.71	0.0%	0.65	0.46	0.65	0.46
PGE	**Total**	**75.7**	**45.2**	**0.60**	**49.9%**	**0.66**	**0.59**	**0.66**	**0.38**
SCE	AG PUMPING VFD	3.7	3.7	1.00	100.0%	0.65	0.65		
SCE	FOOD SERVICE	1.8	1.8	1.00	100.0%	0.77	0.77		
SCE	REFRIGERATION CASE LED LIGHTING	0.3	0.2	0.81	0.0%	0.65	0.63	0.65	0.63
SCE	REFRIGERATION CASE REPLACEMENT	0.0	0.0						
SCE	**Total**	**5.8**	**5.7**	**0.99**	**95.3%**	**0.68**	**0.68**	**0.65**	**0.63**
SCG	FOOD SERVICE	0.0	0.0						
SCG	PIPE INSULATION HOT APPLICATION	0.0	0.0						
SCG	PROCESS BOILER	0.0	0.0						
SCG	REFRIGERATION CASE REPLACEMENT	0.0	0.0						
SCG	TANK INSULATION HOT APPLICATION	0.0	0.0						
SCG	WATER HEATING BOILER	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**						
SDGE	FOOD SERVICE	0.0	0.0	1.00	100.0%	0.65	0.65		
SDGE	REFRIGERATION CASE LED LIGHTING	3.4	0.8	0.23	0.0%	0.65	0.71	0.65	0.71
SDGE	**Total**	**3.4**	**0.8**	**0.23**	**0.1%**	**0.65**	**0.71**	**0.65**	**0.71**
MCE	REFRIGERATION CASE LED LIGHTING	0.2	0.2	1.00	100.0%	0.72	0.72		
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0.1	0.1	1.00	100.0%	0.89	0.89		
MCE	**Total**	**0.3**	**0.3**	**1.00**	**100.0%**	**0.75**	**0.75**		
	Statewide	***85.2***	***52.0***	***0.61***	***51.2%***	***0.66***	***0.60***	***0.66***	***0.41***

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	AG IRRIGATION	0	0			
PGE	AG PUMP MOTOR REPLACEMENT	0	0			
PGE	AG PUMPING VFD	0	0			
PGE	FOOD SERVICE	8,568	4,892	0.57	36.4%	0.33
PGE	PIPE INSULATION HOT APPLICATION	1,503	928	0.62	0.0%	0.62
PGE	PROCESS BOILER	5,542	3,879	0.70	0.0%	0.70
PGE	PROCESS PUMPING VFD	0	0			
PGE	REFRIGERATION CASE LED LIGHTING	-1,032	-166	0.16	0.0%	0.16
PGE	REFRIGERATION CASE REPLACEMENT	637	637	1.00	100.0%	
PGE	REFRIGERATION EVAPORATOR EC MOTORS	-2	-2	1.00	100.0%	
PGE	WATER HEATING BOILER	2,886	2,886	1.00	100.0%	
PGE	**Total**	**18,101**	**13,054**	**0.72**	**36.7%**	**0.56**
SCE	AG PUMPING VFD	0	0			
SCE	FOOD SERVICE	0	0			
SCE	REFRIGERATION CASE LED LIGHTING	0	0			
SCE	REFRIGERATION CASE REPLACEMENT	0	0			
SCE	**Total**	**0**	**0**			
SCG	FOOD SERVICE	18,550	11,532	0.62	44.1%	0.32
SCG	PIPE INSULATION HOT APPLICATION	3,233	4,312	1.33	0.0%	1.33
SCG	PROCESS BOILER	4,044	3,306	0.82	0.0%	0.82
SCG	REFRIGERATION CASE REPLACEMENT	0	0			
SCG	TANK INSULATION HOT APPLICATION	1,496	1,496	1.00	100.0%	
SCG	WATER HEATING BOILER	5,569	5,569	1.00	100.0%	
SCG	**Total**	**32,892**	**26,216**	**0.80**	**46.4%**	**0.62**
SDGE	FOOD SERVICE	633	313	0.49	25.2%	0.32
SDGE	REFRIGERATION CASE LED LIGHTING	0	0			
SDGE	**Total**	**633**	**313**	**0.49**	**25.2%**	**0.32**
MCE	REFRIGERATION CASE LED LIGHTING	-18	-18	1.00	100.0%	
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0	0	1.00	100.0%	
MCE	**Total**	**-18**	**-18**	**1.00**	**100.0%**	
	Statewide	***51,608***	***39,565***	***0.77***	***42.7%***	***0.59***

Net Lifecycle Savings (MTherms)

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
PGE	AG IRRIGATION	0	0						
PGE	AG PUMP MOTOR REPLACEMENT	0	0						
PGE	AG PUMPING VFD	0	0						
PGE	FOOD SERVICE	5,737	2,145	0.37	0.0%	0.67	0.44	0.67	0.44
PGE	PIPE INSULATION HOT APPLICATION	977	468	0.48	0.0%	0.65	0.50	0.65	0.50
PGE	PROCESS BOILER	3,602	1,827	0.51	0.0%	0.65	0.47	0.65	0.47
PGE	PROCESS PUMPING VFD	0	0						
PGE	REFRIGERATION CASE LED LIGHTING	-671	-100	0.15	0.0%	0.65	0.60	0.65	0.60
PGE	REFRIGERATION CASE REPLACEMENT	414	414	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION EVAPORATOR EC MOTORS	-1	-1	1.00	100.0%	0.65	0.65		
PGE	WATER HEATING BOILER	1,851	1,341	0.72	0.0%	0.64	0.46	0.64	0.46
PGE	**Total**	**11,909**	**6,093**	**0.51**	**3.5%**	**0.66**	**0.47**	**0.66**	**0.46**
SCE	AG PUMPING VFD	0	0						
SCE	FOOD SERVICE	0	0						
SCE	REFRIGERATION CASE LED LIGHTING	0	0						
SCE	REFRIGERATION CASE REPLACEMENT	0	0						
SCE	**Total**	**0**	**0**						
SCG	FOOD SERVICE	12,255	5,219	0.43	0.0%	0.66	0.45	0.66	0.45
SCG	PIPE INSULATION HOT APPLICATION	2,102	2,175	1.03	0.0%	0.65	0.50	0.65	0.50
SCG	PROCESS BOILER	2,628	1,557	0.59	0.0%	0.65	0.47	0.65	0.47
SCG	REFRIGERATION CASE REPLACEMENT	0	0						
SCG	TANK INSULATION HOT APPLICATION	973	973	1.00	100.0%	0.65	0.65		
SCG	WATER HEATING BOILER	3,733	2,587	0.69	0.0%	0.67	0.46	0.67	0.46
SCG	**Total**	**21,691**	**12,510**	**0.58**	**4.5%**	**0.66**	**0.48**	**0.66**	**0.47**
SDGE	FOOD SERVICE	422	119	0.28	0.0%	0.67	0.38	0.67	0.38
SDGE	REFRIGERATION CASE LED LIGHTING	0	0						
SDGE	**Total**	**422**	**119**	**0.28**	**0.0%**	**0.67**	**0.38**	**0.67**	**0.38**
MCE	REFRIGERATION CASE LED LIGHTING	-13	-13	1.00	100.0%	0.72	0.72		
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0	0	1.00	100.0%	0.89	0.89		
MCE	**Total**	**-13**	**-13**	**1.00**	**100.0%**	**0.72**	**0.72**		
	Statewide	***34,008***	***18,709***	***0.55***	***4.0%***	***0.66***	***0.47***	***0.66***	***0.46***

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	AG IRRIGATION	2,500	1,043	0.42	0.0%	0.42
PGE	AG PUMP MOTOR REPLACEMENT	225	225	1.00	100.0%	
PGE	AG PUMPING VFD	18,853	18,853	1.00	100.0%	
PGE	FOOD SERVICE	2,226	2,226	1.00	100.0%	
PGE	PIPE INSULATION HOT APPLICATION	0	0			
PGE	PROCESS BOILER	0	0			
PGE	PROCESS PUMPING VFD	258	258	1.00	100.0%	
PGE	REFRIGERATION CASE LED LIGHTING	4,667	2,258	0.48	0.0%	0.48
PGE	REFRIGERATION CASE REPLACEMENT	4,597	4,597	1.00	100.0%	
PGE	REFRIGERATION EVAPORATOR EC MOTORS	3,190	3,190	1.00	100.0%	
PGE	WATER HEATING BOILER	-13	-13	1.00	100.0%	
PGE	**Total**	**36,503**	**32,637**	**0.89**	**80.4%**	**0.46**
SCE	AG PUMPING VFD	1,787	1,787	1.00	100.0%	
SCE	FOOD SERVICE	934	934	1.00	100.0%	
SCE	REFRIGERATION CASE LED LIGHTING	490	237	0.48	0.0%	0.48
SCE	REFRIGERATION CASE REPLACEMENT	0	0			
SCE	**Total**	**3,211**	**2,958**	**0.92**	**84.7%**	**0.48**
SCG	FOOD SERVICE	0	0			
SCG	PIPE INSULATION HOT APPLICATION	0	0			
SCG	PROCESS BOILER	0	0			
SCG	REFRIGERATION CASE REPLACEMENT	0	0			
SCG	TANK INSULATION HOT APPLICATION	0	0			
SCG	WATER HEATING BOILER	0	0			
SCG	**Total**	**0**	**0**			
SDGE	FOOD SERVICE	2	2	1.00	100.0%	
SDGE	REFRIGERATION CASE LED LIGHTING	1,981	958	0.48	0.0%	0.48
SDGE	**Total**	**1,983**	**961**	**0.48**	**0.1%**	**0.48**
MCE	REFRIGERATION CASE LED LIGHTING	169	169	1.00	100.0%	
MCE	REFRIGERATION EVAPORATOR EC MOTORS	47	47	1.00	100.0%	
MCE	**Total**	**215**	**215**	**1.00**	**100.0%**	
	Statewide	***41,913***	***36,770***	***0.88***	***77.0%***	***0.47***

Net First Year Savings (MWh)

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
PGE	AG IRRIGATION	1,625	339	0.21	0.0%	0.65	0.32	0.65	0.32
PGE	AG PUMP MOTOR REPLACEMENT	146	146	1.00	100.0%	0.65	0.65		
PGE	AG PUMPING VFD	12,568	12,568	1.00	100.0%	0.67	0.67		
PGE	FOOD SERVICE	1,671	1,257	0.75	50.6%	0.75	0.56	0.87	0.44
PGE	PIPE INSULATION HOT APPLICATION	0	0						
PGE	PROCESS BOILER	0	0						
PGE	PROCESS PUMPING VFD	168	168	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION CASE LED LIGHTING	3,034	1,355	0.45	0.0%	0.65	0.60	0.65	0.60
PGE	REFRIGERATION CASE REPLACEMENT	2,988	2,988	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION EVAPORATOR EC MOTORS	2,074	2,074	1.00	100.0%	0.65	0.65		
PGE	WATER HEATING BOILER	-8	-6	0.71	0.0%	0.65	0.46	0.65	0.46
PGE	**Total**	**24,265**	**20,888**	**0.86**	**77.4%**	**0.66**	**0.64**	**0.68**	**0.50**
SCE	AG PUMPING VFD	1,161	1,161	1.00	100.0%	0.65	0.65		
SCE	FOOD SERVICE	718	718	1.00	100.0%	0.77	0.77		
SCE	REFRIGERATION CASE LED LIGHTING	319	150	0.47	0.0%	0.65	0.63	0.65	0.63
SCE	REFRIGERATION CASE REPLACEMENT	0	0						
SCE	**Total**	**2,198**	**2,029**	**0.92**	**85.5%**	**0.68**	**0.69**	**0.65**	**0.63**
SCG	FOOD SERVICE	0	0						
SCG	PIPE INSULATION HOT APPLICATION	0	0						
SCG	PROCESS BOILER	0	0						
SCG	REFRIGERATION CASE REPLACEMENT	0	0						
SCG	TANK INSULATION HOT APPLICATION	0	0						
SCG	WATER HEATING BOILER	0	0						
SCG	**Total**	**0**	**0**						
SDGE	FOOD SERVICE	1	1	1.00	100.0%	0.65	0.65		
SDGE	REFRIGERATION CASE LED LIGHTING	1,288	678	0.53	0.0%	0.65	0.71	0.65	0.71
SDGE	**Total**	**1,289**	**679**	**0.53**	**0.1%**	**0.65**	**0.71**	**0.65**	**0.71**
MCE	REFRIGERATION CASE LED LIGHTING	127	127	1.00	100.0%	0.75	0.75		
MCE	REFRIGERATION EVAPORATOR EC MOTORS	42	42	1.00	100.0%	0.89	0.89		
MCE	**Total**	**169**	**169**	**1.00**	**100.0%**	**0.78**	**0.78**		
	Statewide	***27,921***	***23,766***	***0.85***	***74.6%***	***0.67***	***0.65***	***0.67***	***0.54***

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	AG IRRIGATION	2.0	0.7	0.35	0.0%	0.35
PGE	AG PUMP MOTOR REPLACEMENT	0.1	0.1	1.00	100.0%	
PGE	AG PUMPING VFD	9.1	9.1	1.00	100.0%	
PGE	FOOD SERVICE	0.4	0.4	1.00	100.0%	
PGE	PIPE INSULATION HOT APPLICATION	0.0	0.0			
PGE	PROCESS BOILER	0.0	0.0			
PGE	PROCESS PUMPING VFD	0.0	0.0			
PGE	REFRIGERATION CASE LED LIGHTING	1.0	0.6	0.62	0.0%	0.62
PGE	REFRIGERATION CASE REPLACEMENT	0.9	0.9	1.00	100.0%	
PGE	REFRIGERATION EVAPORATOR EC MOTORS	0.4	0.4	1.00	100.0%	
PGE	WATER HEATING BOILER	0.0	0.0	1.00	100.0%	
PGE	**Total**	**13.8**	**12.1**	**0.88**	**78.4%**	**0.44**
SCE	AG PUMPING VFD	0.9	0.9	1.00	100.0%	
SCE	FOOD SERVICE	0.2	0.2	1.00	100.0%	
SCE	REFRIGERATION CASE LED LIGHTING	0.1	0.1	0.62	0.0%	0.62
SCE	REFRIGERATION CASE REPLACEMENT	0.0	0.0			
SCE	**Total**	**1.2**	**1.1**	**0.97**	**91.0%**	**0.62**
SCG	FOOD SERVICE	0.0	0.0			
SCG	PIPE INSULATION HOT APPLICATION	0.0	0.0			
SCG	PROCESS BOILER	0.0	0.0			
SCG	REFRIGERATION CASE REPLACEMENT	0.0	0.0			
SCG	TANK INSULATION HOT APPLICATION	0.0	0.0			
SCG	WATER HEATING BOILER	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**			
SDGE	FOOD SERVICE	0.0	0.0	1.00	100.0%	
SDGE	REFRIGERATION CASE LED LIGHTING	0.3	0.2	0.62	0.0%	0.62
SDGE	**Total**	**0.3**	**0.2**	**0.62**	**0.1%**	**0.62**
MCE	REFRIGERATION CASE LED LIGHTING	0.0	0.0	1.00	100.0%	
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0.0	0.0	1.00	100.0%	
MCE	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	
	Statewide	***15.3***	***13.5***	***0.88***	***77.8%***	***0.46***

Net First Year Savings (MW)

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
PGE	AG IRRIGATION	1.3	0.2	0.17	0.0%	0.65	0.32	0.65	0.32
PGE	AG PUMP MOTOR REPLACEMENT	0.1	0.1	1.00	100.0%	0.65	0.65		
PGE	AG PUMPING VFD	6.0	6.0	1.00	100.0%	0.67	0.67		
PGE	FOOD SERVICE	0.3	0.2	0.78	56.6%	0.74	0.58	0.87	0.44
PGE	PIPE INSULATION HOT APPLICATION	0.0	0.0						
PGE	PROCESS BOILER	0.0	0.0						
PGE	PROCESS PUMPING VFD	0.0	0.0						
PGE	REFRIGERATION CASE LED LIGHTING	0.6	0.4	0.58	0.0%	0.65	0.60	0.65	0.60
PGE	REFRIGERATION CASE REPLACEMENT	0.6	0.6	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION EVAPORATOR EC MOTORS	0.3	0.3	1.00	100.0%	0.65	0.65		
PGE	WATER HEATING BOILER	0.0	0.0	0.71	0.0%	0.65	0.46	0.65	0.46
PGE	**Total**	**9.2**	**7.8**	**0.85**	**77.5%**	**0.66**	**0.64**	**0.66**	**0.45**
SCE	AG PUMPING VFD	0.6	0.6	1.00	100.0%	0.65	0.65		
SCE	FOOD SERVICE	0.1	0.1	1.00	100.0%	0.77	0.77		
SCE	REFRIGERATION CASE LED LIGHTING	0.1	0.0	0.61	0.0%	0.65	0.63	0.65	0.63
SCE	REFRIGERATION CASE REPLACEMENT	0.0	0.0						
SCE	**Total**	**0.8**	**0.7**	**0.97**	**91.3%**	**0.67**	**0.67**	**0.65**	**0.63**
SCG	FOOD SERVICE	0.0	0.0						
SCG	PIPE INSULATION HOT APPLICATION	0.0	0.0						
SCG	PROCESS BOILER	0.0	0.0						
SCG	REFRIGERATION CASE REPLACEMENT	0.0	0.0						
SCG	TANK INSULATION HOT APPLICATION	0.0	0.0						
SCG	WATER HEATING BOILER	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**						
SDGE	FOOD SERVICE	0.0	0.0	1.00	100.0%	0.65	0.65		
SDGE	REFRIGERATION CASE LED LIGHTING	0.2	0.1	0.68	0.0%	0.65	0.71	0.65	0.71
SDGE	**Total**	**0.2**	**0.1**	**0.68**	**0.1%**	**0.65**	**0.71**	**0.65**	**0.71**
MCE	REFRIGERATION CASE LED LIGHTING	0.0	0.0	1.00	100.0%	0.75	0.75		
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0.0	0.0	1.00	100.0%	0.89	0.89		
MCE	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	**0.77**	**0.77**		
	Statewide	***10.2***	***8.7***	***0.85***	***77.1%***	***0.66***	***0.64***	***0.66***	***0.49***

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	AG IRRIGATION	0	0			
PGE	AG PUMP MOTOR REPLACEMENT	0	0			
PGE	AG PUMPING VFD	0	0			
PGE	FOOD SERVICE	708	415	0.59	35.9%	0.35
PGE	PIPE INSULATION HOT APPLICATION	406	84	0.21	0.0%	0.21
PGE	PROCESS BOILER	277	229	0.83	0.0%	0.83
PGE	PROCESS PUMPING VFD	0	0			
PGE	REFRIGERATION CASE LED LIGHTING	-64	-31	0.48	0.0%	0.48
PGE	REFRIGERATION CASE REPLACEMENT	160	160	1.00	100.0%	
PGE	REFRIGERATION EVAPORATOR EC MOTORS	0	0	1.00	100.0%	
PGE	WATER HEATING BOILER	144	144	1.00	100.0%	
PGE	**Total**	**1,631**	**1,001**	**0.61**	**34.3%**	**0.41**
SCE	AG PUMPING VFD	0	0			
SCE	FOOD SERVICE	0	0			
SCE	REFRIGERATION CASE LED LIGHTING	0	0			
SCE	REFRIGERATION CASE REPLACEMENT	0	0			
SCE	**Total**	**0**	**0**			
SCG	FOOD SERVICE	1,550	1,007	0.65	44.3%	0.37
SCG	PIPE INSULATION HOT APPLICATION	294	392	1.33	0.0%	1.33
SCG	PROCESS BOILER	202	165	0.82	0.0%	0.82
SCG	REFRIGERATION CASE REPLACEMENT	0	0			
SCG	TANK INSULATION HOT APPLICATION	214	214	1.00	100.0%	
SCG	WATER HEATING BOILER	278	278	1.00	100.0%	
SCG	**Total**	**2,539**	**2,056**	**0.81**	**46.4%**	**0.65**
SDGE	FOOD SERVICE	53	28	0.53	25.2%	0.37
SDGE	REFRIGERATION CASE LED LIGHTING	0	0			
SDGE	**Total**	**53**	**28**	**0.53**	**25.2%**	**0.37**
MCE	REFRIGERATION CASE LED LIGHTING	-2	-2	1.00	100.0%	
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0	0	1.00	100.0%	
MCE	**Total**	**-2**	**-2**	**1.00**	**100.0%**	
	Statewide	***4,220***	***3,083***	***0.73***	***41.4%***	***0.54***

Net First Year Savings (MTherms)

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
PGE	AG IRRIGATION	0	0						
PGE	AG PUMP MOTOR REPLACEMENT	0	0						
PGE	AG PUMPING VFD	0	0						
PGE	FOOD SERVICE	473	182	0.38	0.0%	0.67	0.44	0.67	0.44
PGE	PIPE INSULATION HOT APPLICATION	264	43	0.16	0.0%	0.65	0.50	0.65	0.50
PGE	PROCESS BOILER	180	108	0.60	0.0%	0.65	0.47	0.65	0.47
PGE	PROCESS PUMPING VFD	0	0						
PGE	REFRIGERATION CASE LED LIGHTING	-42	-19	0.45	0.0%	0.65	0.60	0.65	0.60
PGE	REFRIGERATION CASE REPLACEMENT	104	104	1.00	100.0%	0.65	0.65		
PGE	REFRIGERATION EVAPORATOR EC MOTORS	0	0	1.00	100.0%	0.65	0.65		
PGE	WATER HEATING BOILER	93	67	0.72	0.0%	0.64	0.46	0.64	0.46
PGE	**Total**	**1,072**	**485**	**0.45**	**9.7%**	**0.66**	**0.48**	**0.66**	**0.45**
SCE	AG PUMPING VFD	0	0						
SCE	FOOD SERVICE	0	0						
SCE	REFRIGERATION CASE LED LIGHTING	0	0						
SCE	REFRIGERATION CASE REPLACEMENT	0	0						
SCE	**Total**	**0**	**0**						
SCG	FOOD SERVICE	1,024	457	0.45	0.0%	0.66	0.45	0.66	0.45
SCG	PIPE INSULATION HOT APPLICATION	191	198	1.03	0.0%	0.65	0.50	0.65	0.50
SCG	PROCESS BOILER	131	78	0.59	0.0%	0.65	0.47	0.65	0.47
SCG	REFRIGERATION CASE REPLACEMENT	0	0						
SCG	TANK INSULATION HOT APPLICATION	139	139	1.00	100.0%	0.65	0.65		
SCG	WATER HEATING BOILER	187	129	0.69	0.0%	0.67	0.46	0.67	0.46
SCG	**Total**	**1,672**	**1,001**	**0.60**	**8.3%**	**0.66**	**0.49**	**0.66**	**0.47**
SDGE	FOOD SERVICE	35	11	0.30	0.0%	0.67	0.38	0.67	0.38
SDGE	REFRIGERATION CASE LED LIGHTING	0	0						
SDGE	**Total**	**35**	**11**	**0.30**	**0.0%**	**0.67**	**0.38**	**0.67**	**0.38**
MCE	REFRIGERATION CASE LED LIGHTING	-2	-2	1.00	100.0%	0.76	0.76		
MCE	REFRIGERATION EVAPORATOR EC MOTORS	0	0	1.00	100.0%	0.89	0.89		
MCE	**Total**	**-2**	**-2**	**1.00**	**100.0%**	**0.76**	**0.76**		
	Statewide	***2,777***	***1,495***	***0.54***	***8.7%***	***0.66***	***0.48***	***0.66***	***0.46***

APPENDIX AB STANDARDIZED PER UNIT SAVINGS

Per Unit (Quantity) Gross Energy Savings (kWh)

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
PGE	AG IRRIGATION	0	0.0%	0.0%	20.0	3,965.9	198.2	198.3
PGE	FOOD SERVICE	0	0.0%	0.0%	12.0	0.0	0.0	0.0
PGE	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	3.7	0.0	0.0	0.0
PGE	PROCESS BOILER	0	0.0%	0.0%	20.0	0.0	0.0	0.0
PGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	186.2	34.9	11.6
PGE	AG PUMP MOTOR REPLACEMENT	1	0.0%		15.0	375.3	25.0	25.0
PGE	AG PUMPING VFD	1	0.0%		4.7	1,193.0	251.4	251.4
PGE	FOOD SERVICE	1	0.0%		12.7	28,791.6	2,169.2	2,169.2
PGE	PROCESS PUMPING VFD	1	0.0%		5.0	117,203.5	23,440.7	23,440.7
PGE	REFRIGERATION CASE REPLACEMENT	1	0.0%		7.2	4,198.4	912.2	912.2
PGE	REFRIGERATION EVAPORATOR EC MOTORS	1	28.8%		15.0	8,107.7	540.2	540.2
PGE	WATER HEATING BOILER	1	0.0%		20.0	-3.1	-0.2	-0.2
SCE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	4.0	946.0	177.4	236.5
SCE	AG PUMPING VFD	1	0.0%		6.7	1,667.9	250.1	250.1
SCE	FOOD SERVICE	1	0.0%		12.0	138,323.0	11,526.9	11,526.9
SCE	REFRIGERATION CASE REPLACEMENT	1	0.0%		12.0	0.0	0.0	0.0
SCG	FOOD SERVICE	0	0.0%	0.0%	12.0	0.0	0.0	0.0
SCG	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	11.0	0.0	0.0	0.0
SCG	PROCESS BOILER	0	0.0%	0.0%	20.0	0.0	0.0	0.0
SCG	FOOD SERVICE	1	0.0%		11.6	0.0	0.0	0.0
SCG	REFRIGERATION CASE REPLACEMENT	1	0.0%		4.0	0.0	0.0	0.0
SCG	TANK INSULATION HOT APPLICATION	1	0.0%		7.0	0.0	0.0	0.0
SCG	WATER HEATING BOILER	1	0.0%		20.0	0.0	0.0	0.0
SDGE	FOOD SERVICE	0	0.0%	0.0%	12.0	0.0	0.0	0.0
SDGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	2,003.0	375.6	125.2
SDGE	FOOD SERVICE	1	0.0%		12.0	624.9	52.1	52.1
MCE	REFRIGERATION CASE LED LIGHTING	1	0.0%		6.6	1,100.4	126.8	126.8
MCE	REFRIGERATION EVAPORATOR EC MOTORS	1	0.0%		14.6	7,229.8	491.3	491.3

Per Unit (Quantity) Gross Energy Savings (Therms)

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
PGE	AG IRRIGATION	0	0.0%	0.0%	20.0	0.0	0.0	0.0
PGE	FOOD SERVICE	0	0.0%	0.0%	12.0	2,137.4	194.2	178.1
PGE	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	3.7	31.0	2.8	8.4
PGE	PROCESS BOILER	0	0.0%	0.0%	20.0	28.0	1.7	1.4
PGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	-2.6	-0.5	-0.2
PGE	AG PUMP MOTOR REPLACEMENT	1	0.0%		15.0	0.0	0.0	0.0
PGE	AG PUMPING VFD	1	0.0%		4.7	0.0	0.0	0.0
PGE	FOOD SERVICE	1	0.0%		12.7	3,043.6	247.9	247.9
PGE	PROCESS PUMPING VFD	1	0.0%		5.0	0.0	0.0	0.0
PGE	REFRIGERATION CASE REPLACEMENT	1	0.0%		7.2	126.3	31.8	31.8
PGE	REFRIGERATION EVAPORATOR EC MOTORS	1	28.8%		15.0	-0.4	0.0	0.0
PGE	WATER HEATING BOILER	1	0.0%		20.0	34.1	1.7	1.7
SCE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	4.0	0.0	0.0	0.0
SCE	AG PUMPING VFD	1	0.0%		6.7	0.0	0.0	0.0
SCE	FOOD SERVICE	1	0.0%		12.0	0.0	0.0	0.0
SCE	REFRIGERATION CASE REPLACEMENT	1	0.0%		12.0	0.0	0.0	0.0
SCG	FOOD SERVICE	0	0.0%	0.0%	12.0	2,123.3	203.2	176.9
SCG	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	11.0	131.9	12.0	12.0
SCG	PROCESS BOILER	0	0.0%	0.0%	20.0	9.0	0.5	0.5
SCG	FOOD SERVICE	1	0.0%		11.6	6,333.3	531.3	531.3
SCG	REFRIGERATION CASE REPLACEMENT	1	0.0%		4.0	0.0	0.0	0.0
SCG	TANK INSULATION HOT APPLICATION	1	0.0%		7.0	74.8	10.7	10.7
SCG	WATER HEATING BOILER	1	0.0%		20.0	28.9	1.4	1.4
SDGE	FOOD SERVICE	0	0.0%	0.0%	12.0	2,128.2	200.1	177.3
SDGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	0.0	0.0	0.0
SDGE	FOOD SERVICE	1	0.0%		12.0	3,997.8	333.2	333.2
MCE	REFRIGERATION CASE LED LIGHTING	1	0.0%		6.6	-13.8	-1.6	-1.6
MCE	REFRIGERATION EVAPORATOR EC MOTORS	1	0.0%		14.6	-0.2	0.0	0.0

Per Unit (Quantity) Net Energy Savings (kWh)

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
PGE	AG IRRIGATION	0	0.0%	0.0%	20.0	1,287.8	64.4	64.4
PGE	FOOD SERVICE	0	0.0%	0.0%	12.5	4,128.6	275.2	275.2
PGE	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	3.7	0.0	0.0	0.0
PGE	PROCESS BOILER	0	0.0%	0.0%	20.0	0.0	0.0	0.0
PGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	111.7	21.0	7.0
PGE	WATER HEATING BOILER	0	0.0%	0.0%	20.0	-1.4	-0.1	-0.1
PGE	AG PUMP MOTOR REPLACEMENT	1	0.0%		15.0	243.9	16.3	16.3
PGE	AG PUMPING VFD	1	0.0%		4.7	789.2	167.6	167.6
PGE	FOOD SERVICE	1	0.0%		12.0	28,323.7	2,360.3	2,360.3
PGE	PROCESS PUMPING VFD	1	0.0%		5.0	76,182.2	15,236.4	15,236.4
PGE	REFRIGERATION CASE REPLACEMENT	1	0.0%		7.2	2,728.9	593.0	593.0
PGE	REFRIGERATION EVAPORATOR EC MOTORS	1	28.8%		15.0	5,270.0	351.2	351.2
SCE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	4.0	598.4	112.2	149.6
SCE	AG PUMPING VFD	1	0.0%		6.7	1,084.1	162.5	162.5
SCE	FOOD SERVICE	1	0.0%		12.0	106,328.0	8,860.7	8,860.7
SCE	REFRIGERATION CASE REPLACEMENT	1	0.0%		12.0	0.0	0.0	0.0
SCG	FOOD SERVICE	0	0.0%	0.0%	11.8	0.0	0.0	0.0
SCG	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	11.0	0.0	0.0	0.0
SCG	PROCESS BOILER	0	0.0%	0.0%	20.0	0.0	0.0	0.0
SCG	WATER HEATING BOILER	0	0.0%	0.0%	20.0	0.0	0.0	0.0
SCG	FOOD SERVICE	1	0.0%		12.0	0.0	0.0	0.0
SCG	REFRIGERATION CASE REPLACEMENT	1	0.0%		4.0	0.0	0.0	0.0
SCG	TANK INSULATION HOT APPLICATION	1	0.0%		7.0	0.0	0.0	0.0
SDGE	FOOD SERVICE	0	0.0%	0.0%	12.0	0.0	0.0	0.0
SDGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	1,417.2	265.7	88.6
SDGE	FOOD SERVICE	1	0.0%		12.0	16,247.4	1,354.0	1,354.0
MCE	REFRIGERATION CASE LED LIGHTING	1	0.0%		6.6	786.9	95.6	95.6
MCE	REFRIGERATION EVAPORATOR EC MOTORS	1	0.0%		14.6	6,451.8	438.5	438.5

Per Unit (Quantity) Net Energy Savings (Therms)

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
PGE	AG IRRIGATION	0	0.0%	0.0%	20.0	0.0	0.0	0.0
PGE	FOOD SERVICE	0	0.0%	0.0%	12.5	1,433.9	121.7	117.8
PGE	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	3.7	15.6	1.4	4.2
PGE	PROCESS BOILER	0	0.0%	0.0%	20.0	13.2	0.8	0.7
PGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	-1.5	-0.3	-0.1
PGE	WATER HEATING BOILER	0	0.0%	0.0%	20.0	15.8	0.8	0.8
PGE	AG PUMP MOTOR REPLACEMENT	1	0.0%		15.0	0.0	0.0	0.0
PGE	AG PUMPING VFD	1	0.0%		4.7	0.0	0.0	0.0
PGE	FOOD SERVICE	1	0.0%		12.0	0.0	0.0	0.0
PGE	PROCESS PUMPING VFD	1	0.0%		5.0	0.0	0.0	0.0
PGE	REFRIGERATION CASE REPLACEMENT	1	0.0%		7.2	82.1	20.7	20.7
PGE	REFRIGERATION EVAPORATOR EC MOTORS	1	28.8%		15.0	-0.3	0.0	0.0
SCE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	4.0	0.0	0.0	0.0
SCE	AG PUMPING VFD	1	0.0%		6.7	0.0	0.0	0.0
SCE	FOOD SERVICE	1	0.0%		12.0	0.0	0.0	0.0
SCE	REFRIGERATION CASE REPLACEMENT	1	0.0%		12.0	0.0	0.0	0.0
SCG	FOOD SERVICE	0	0.0%	0.0%	11.8	1,886.5	165.2	157.8
SCG	PIPE INSULATION HOT APPLICATION	0	0.0%	0.0%	11.0	66.5	6.0	6.0
SCG	PROCESS BOILER	0	0.0%	0.0%	20.0	4.3	0.2	0.2
SCG	WATER HEATING BOILER	0	0.0%	0.0%	20.0	13.4	0.7	0.7
SCG	FOOD SERVICE	1	0.0%		12.0	0.0	0.0	0.0
SCG	REFRIGERATION CASE REPLACEMENT	1	0.0%		4.0	0.0	0.0	0.0
SCG	TANK INSULATION HOT APPLICATION	1	0.0%		7.0	48.6	6.9	6.9
SDGE	FOOD SERVICE	0	0.0%	0.0%	12.0	1,075.3	95.2	89.6
SDGE	REFRIGERATION CASE LED LIGHTING	0	0.0%	0.0%	16.0	0.0	0.0	0.0
SDGE	FOOD SERVICE	1	0.0%		12.0	0.0	0.0	0.0
MCE	REFRIGERATION CASE LED LIGHTING	1	0.0%		6.6	-9.9	-1.2	-1.2
MCE	REFRIGERATION EVAPORATOR EC MOTORS	1	0.0%		14.6	-0.2	0.0	0.0

APPENDIX AC RESPONSE TO RECOMMENDATIONS

EM&V Impact Study Recommendations
Study Title: 2017 Small and Medium Sector ESPI Impact Evaluation
Study Manager: CPUC

ID	PA	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)
Refrigeration Case LED Lighting Measures						
RL1	PG&E	Section 5	The use of a multiple lamp profile for PG&E measure code LC03 results in a very large delta watts value.	PG&E should revisit the use of the LC03 measure code.		
RL2	PG&E, SCE SDG&E	Section 5	T12 lamps are assumed existing condition for all six foot LED lamp measures, yet the self-reported lamp technology was overwhelmingly T8.	Utilities should revisit the assumption of T-12 lamps as the existing condition for all LED measures that are 6 feet in length.		
RL3	SDG&E	Section 5	SDG&E uses the unit refrigerated case door for the measure.	SDG&E should revisit the assumption of 1.2 fixtures per door.		
RL4	SDG&E	Section 5	SDG&E uses the unit refrigerated case door for the measure.	SDG&E should revisit the assumption of 1.2 fixtures per door.		
RL5	SDG&E	Section 5	Ex-post hours of operation generally support the HOU used in the workpapers and deemed savings for the refrigerated case LED measures.	Utilities should continue using the HOU currently being used in the ex-ante calculations.		
RL6	PG&E, SCE SDG&E	Section 5	SDG&E and PG&E applied an EUL of 16 years to the measures.	The IOUs should revise the EUL they use for lifecycle savings.		
RL7	PG&E, SCE SDG&E	Section 6	In general, Refrigerated LED Case Lighting measures exhibited commendable medium-high program influence levels.	If Refrigerated LED Case Lighting measures continue to be incented, free ridership should be monitored on an ongoing basis.		

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ID	PA	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)
Process Boiler Measures						
PB1a	PG&E, SCG	Section 5	The workpaper stipulations for operating hours, load factors and measure case efficiency values differed from the ex-post findings and contributed to the gross savings gap.	The program's application and review process should be expanded to increase the range of boiler performance information captured in the ex-ante tracking databases.		
PB1b	PG&E, SCG	Section 5	The workpaper stipulations for operating hours, load factors and measure case efficiency values differed from the ex-post findings and contributed to the gross savings gap.	The PAs should consider using an enhanced measure savings algorithm that provides for some reasonable level of customization for relevant input parameters.		
PB2	SCG	Section 5	The baseline efficiency for hot water boilers in the SCG workpaper are not consistent with baseline requirements within the PG&E workpaper.	The workpaper base case efficiency needs to be updated to reflect current Title 24, Part 6 standards.		
PB3	PG&E, SCG	Section 5	Very few of the participants were able to measure, store, and analyze boiler consumption data as it results in increased overall operational costs.	The PAs should encourage customer investment in, and involvement with, performance monitoring of equipment by means of a rebate program or something similar.		
PB4	PG&E, SCG	Section 6	The measure's average ex-post NTG ratio of 0.42 suggests a medium-low level of program influence and corresponding medium-high level of free ridership.	Given the medium-low program influence level, the programs should monitor free ridership on an ongoing basis.		

EM&V Impact Study Recommendations
Study Title: 2017 Small and Medium Sector ESPI Impact Evaluation
Study Manager: CPUC

ID	PA	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)
Food Service Measures						
FS1	PG&E, SCG, SDG&E	Section 5	Realization rates, after discounting zero savers, would be 10 or more percentage points greater than the ex-post realization rate results.	The program's application and review process should be enhanced to screen projects against the eligible equipment listing, and verification should be performed to ensure that installations claimed are valid.		
FS2	PG&E, SCG, SDG&E	Section 5	Across both the PG&E and SCG samples, 6 of 43 projects received EUL adjustments to account for loss of long-term savings associated with equipment that were removed from operation.	The PAs should consider reducing ex-ante EUL of 12 years.		
FS3	PG&E, SCG, SDG&E	Section 5	Evaluation results provide validation for the robustness of both the ex-post and ex-ante models, as both approaches yield very similar results when modeling parameters are uniform across both models.	With the ex-ante model validated in this way, the focus of updates to ex-ante methods -- to better align ex-ante and ex-post results -- can focus on parameter updates.		
FS4	PG&E, SCG, SDG&E	Section 5	Differences between ex-post and ex-ante model-based parameters resulted in a relatively large reduction in ex-post savings relative to claims.	Future workpaper revisions should incorporate all PY2013-17 evaluation data to revise parameter-level assumptions.		

EM&V Impact Study Recommendations
Study Title: 2017 Small and Medium Sector ESPI Impact Evaluation
Study Manager: CPUC

ID	PA	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)
FS5	PG&E, SCG, SDG&E	Section 6	Food service measures associated with the Midstream and Downstream delivery channels experienced high levels of free ridership.	Review the set of technologies that are currently eligible for incentives and research new technologies that are less commonly installed and adjust the set of technologies that are eligible for incentives. In addition, for account managed chain customers in particular, program implementers should change their promotional practices to actively highlight and promote these new, less commonly adopted technologies.		

EM&V Impact Study Recommendations
Study Title: 2017 Small and Medium Sector ESPI Impact Evaluation
Study Manager: CPUC

ID	PA	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)
Agricultural Irrigation Measures						
AI1	PG&E	Section 5	The agricultural irrigation workpaper revisions made over the last several years have resulted in more accurate savings estimation.	The programs should maintain eligibility requirements for pre-existing irrigation method and crop type.		
AI2	PG&E	Section 5	Five of the 19 sampled projects were determined to be ineligible for program participation.	The program's application and review process should be enhanced to collect additional relevant data and more carefully screen applicants to avoid ineligible projects.		
AI3	PG&E	Section 5	Agricultural irrigation projects are difficult to accurately characterize with a single deemed savings value.	The program should consider adding more granularity to the sprinkler-to-drip workpaper's unit energy savings based on key variables determined from project applications.		
AI4	PG&E	Section 5	Evaluators were unable to assess EUL in this evaluation cycle; however, the current workpaper's EUL recommendation of 20 years is overstated.	Future evaluation cycles and PA research should emphasize measure EUL, which is likely too high in the current workpaper.		
AI5	PG&E	Section 6	Agricultural Irrigation measures experienced high levels of free ridership.	Adjust the set of technologies that are eligible for incentives. In addition, program implementers should actively highlight and promote technologies that are less well-adopted, cutting edge, or emerging technologies.		

EM&V Impact Study Recommendations
Study Title: 2017 Small and Medium Sector ESPI Impact Evaluation
Study Manager: CPUC

ID	PA	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)
Pipe Insulation Measures						
PI1	PG&E, SCG	Section 5	For PG&E projects in particular, the tracked ex-ante savings did not appear to follow established workpaper recommendations for several of the evaluated sites.	Future pipe insulation savings claims should reflect current workpaper assumptions and parameters.		
PI2	PG&E, SCG	Section 5	Differences in operating hours, installation rate, pipe diameter, and fluid temperature resulted in a lower GRR overall.	Future workpaper revisions should incorporate all PY2013-17 evaluation data to revise parameter-level assumptions. So as not to double-count evaluator findings, we do not recommend incorporating evaluation GRRs as well.		
PI3	PG&E, SCG	Section 5	Evaluators are pleased to observe that the current SCG and PG&E workpapers have added a third, large-diameter tier to the UES recommendations.	Continue incorporating evaluator recommendations in future workpaper updates.		
PI4	PG&E, SCG	Section 6	The measure's average ex-post NTG ratio of 0.45 suggests a medium-low level of program influence and corresponding medium-high level of free ridership.	Given the medium-low program influence level, the programs should monitor free ridership on an ongoing basis.		

EM&V Impact Study Recommendations
Study Title: 2017 Small and Medium Sector ESPI Impact Evaluation
Study Manager: CPUC

ID	PA	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)
Water Heating Boiler Measures						
WH1	PG&E, SCG	Section 6	The measure's average ex-post NTG ratio of 0.45 suggests a medium-low level of program influence and corresponding medium-high level of free ridership.	Given the medium-low program influence level, the programs should monitor free ridership on an ongoing basis.		

APPENDIX A – SMALL COMMERCIAL SECTOR PARTICIPANT TELEPHONE SURVEY INSTRUMENT

	Participant Survey for CPUC	
	PY2017 Downstream Lighting and Small Commercial Evaluation	
	INTRODUCTION AND FINDING CORRECT RESPONDENT	
OUTCOME1	This is %n calling on behalf of the CPUC, from Pacific Market Research. THIS IS NOT A SALES CALL NOR A SERVICE CALL. May I please speak with ...<%CONTACT> ...<%OLDCONTACT> ... <%BUSINESS> ... the person at your organization that is most knowledgeable about your participation in <%UTILITY>'s <%PROGRAM> program. !___[IF NEEDED]...This is a fact-finding survey only, authorized by the California Public Utilities Commission.	
1	Yes (go to next screen)	Continue
2	Make appointment	Make appt and record time
3	Busy/engaged	Record Response and T&T
4	No Answer	Record Response and T&T
5	Refused	Record Response and T&T
6	Disconnected	Record Response and T&T
7	Answering Machine - no message	Record Response and T&T
8	Duplicate	Record Response and T&T
9	DRNA	Record Response and T&T
10	Disability	Record Response and T&T
11-12	Language Barriers	Record Response and T&T
13	Answering Machine - left message	Record Response and T&T

14	NO SCREEN - Participant	Record Response and T&T
15	Hang up	Record Response and T&T
16	Residence	Record Response and T&T
17	Fax	Record Response and T&T
18	Quota full	Record Response and T&T
19	Wrong Address	Record Response and T&T
20	Home office	Record Response and T&T
21	Max attempts	Record Response and T&T
24	General callback	Record Response and T&T
25	Name/Number changed	Record Response and T&T
Thank & Terminate PBLOCK NO_ONE	Thank you for your time. For this study, we need to speak to someone about your organization's installation of energy efficient equipment that your organization installed through <%UTILITY>'s <%PROGRAM> program.	END
Q1B	[IF YOU ARE TRANSFERRED TO ANOTHER PERSON OTHER THAN THE BEST CONTACT] Who would be the person most familiar about your organization's participation in <%UTILITY>'S <%PROGRAM> 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 your firm in any way. The California Public Utilities Commission wants to better understand how businesses think about and manage their energy consumption.	
77	There is no one here who can help you	T&T
1	Continue Q1B until you find appropriate contact person, record as &NEW CONTACT NAME	Intro3:s

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 Pacific Market Research. THIS IS NOT A SALES CALL. We are interested in speaking with the person most knowledgeable about your organization's participation in ... <%UTILITY>'s <%PROGRAM> program during 2017......I was told that would be you. ...Your organization participated in <%UTILITY>'s <%PROGRAM> by installing energy saving equipment in 2017 You should have received an email recently that explained the evaluation process and provided a letter from the CPUC validating this study.	
	Through this program, your organization installed.... <%CUSTOM_MEASURE> on <CUST_INSTALL_DATE>...<CUST_PAID_DATE>... <%UNITS_1> ... <%MEASURE_1> on <MEASURE_1_DATE> <%UNITS_2> ... <%MEASURE_2> on <MEASURE_2_DATE> <%UNITS_3> ... <%MEASURE_3> on <MEASURE_3_DATE> Are you the best person to speak to about your organization's participation in this program?	
1	Yes	Person:s
2	No, there is someone else	Intro3:s
3	No and I don't know who to refer you to	Appoint
5	Property management company handles this	PMNAME
99	Don’t know/refused	T&T
Ext	Is there a phone extension or phone number you recommend we use when we call back?	
77	Record Extension or Phone Number, &PHONE	Thank&Terminate
88	Refused	Thank&Terminate
99	Don’t know	Thank&Terminate
PMNAME	May I have the name and contact information of your property management company?	
1	Yes - RECORD	Record Response and T&T
2	No	Thank&Terminate
88	Refused	Thank&Terminate
99	Don't Know	Thank&Terminate
Appoint	[IF RECOMMENDED CONTACT IS NOT CURRENTLY AVAILABLE] When would be a good day and time for us to call back?	

77	Record day of the week, time of day and date to call back, as &APPOINT	Record Response and T&T
88	Refused	Intro3(99)
99	Don’t know	Intro3(99)
	If Person(3)	
Intro3(99)	Thank you for your time. We need to speak with the person at your organization that is most familiar with this facility's energy using equipment. Those are all of the questions I have for you today.	Abandoned User30
PBLOCK Hi	Who would be the person at this location who is most knowledgeable about this facility's energy using equipment? [Enter New Contact Name and move on.]	
77	Record Name, as &CONTACT	May_I
88	Refused	Thank&Terminate
99	Don’t know	Intro3(99)
May_I	May I speak with him/her?	
77	Yes	Intro3:s
88	No (not available right now@, set cb)	Abandoned Appointment
PERSON:s	According to our records, your organization participated in <%UTILITY>'s <%PROGRAM> program by installing energy saving equipment around ... <%DEEM_PAID_DATE1> <%CUST_PAID_DATE> Through this program, your organization installed.... <%CUSTOM_MEASURE> on <CUST_INSTALL_DATE>...<CUST_PAID_DATE>... <%UNITS_1> ... <%MEASURE_1> on <MEASURE_1_DATE> <%UNITS_2> ... <%MEASURE_2> on <MEASURE_2_DATE> <%UNITS_3> ... <%MEASURE_3> on <MEASURE_3_DATE> Are you the person most knowledgeable about your organization's participation in ...<%UTILITY>'s <%PROGRAM> Program?	
1	Yes	Continue
2	Yes, need to make appointment	Appoint
4	No, but I will give you a name	Thank&Terminate
99	No one knows about the energy using equipment	Thank&Terminate

	If you need to provide validation for this survey, provide the following contact name and number: Mona Dzvova, California Public Utilities Commission, Energy Division, (415) 703-1231, and the following website: www.cpuc.ca.gov/eevalidation	
DISPLAY	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 organizations like yours. We are interested in how organizations like yours think about and manage their energy consumption. 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 your organization 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 ....<%UTILITY>'s <%PROGRAM> ...program as the PROGRAM.	
Scrn_Addr	First, I'd like to ask you a few questions about your organization and facility. Our records show your organization is located at %ADDRESS in %CITY. Is that correct?	
	[CONTINUE IF ADDRESS REPORTED BY RESPONDENT IS SIMILAR ENOUGH]	
1	Yes	Bus_Name
2	No	CORRECT
88	Refused	COMMENT
99	Don't Know	COMMENT

COMMENT	We were attempting to reach <%UTILITY>'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	Bus_Name
2	Totally Different	COMMENT2
COMMENT2	We were attempting to reach the <%UTILITY> 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
BUS_NAME	Our records show your organization's name as: <%BUSINESS> <%CONTACT> <%OLDCONTACT>. Is that correct?	
1	Yes	INCENT
2	No	Bus_Correct
88	Refused	COMMENT
99	Don't Know	COMMENT
BUS_CORRECT	What is the correct name for your organization?	
&BUS_CORRECT	Corrected Business	INCENT
INCENT	What percentage of the cost of your rebated equipment was covered by the program?	
77	RECORD RESPONSE	A1gg
101	REFUSED	FM050
102	DON'T KNOW	FM050
	IF INCENT <> 100 then ask; Else skip to FM050	
A1gg	What incentive amount did your organization receive from the program towards your energy efficient equipment installation?	
77	RECORD VERBATIM	FM050

88	Refused	FM050
99999	Don't know	FM050
FM050	What is the main business ACTIVITY at this facility? [DO NOT READ] (SINGLE RESPONSE)	
1	Offices (non-medical)	FM050a
2	Restaurant/Food Service	FM050b
3	Food Store (grocery/liquor/convenience)	FM050c
4	Agricultural (farms, greenhouses)	FM050d
5	Retail Stores	FM050e
6	Warehouse	FM050f
7	Health Care	FM050g
8	Education	FM050h
9	Lodging (hotel/rooms)	FM050i
10	Public Assembly (church, fitness, theatre, library, museum, convention)	FM050j
11	Services (hair, nail, massage, spa, gas, repair)	FM050k
12	Industrial (food processing plant, manufacturing)	FM050l
13	Laundry (Coin Operated, Commercial Laundry Facility, Dry Cleaner)	FM050m
14	Condo Assoc./Apartment Mgr (Garden Style, Mobile Home Park, High-rise, Townhouse)	FM050n
15	Public Service (fire/police/postal/military)	FM050o
77	OPEN\Record Other Service Shop	LANG
88	Refused	LANG
99	Don’t know	LANG
FM050a	Which of the following types of offices best describes this facility? Would you say...[READ] (SINGLE RESPONSE)v	
1	Administration and management	LANG
2	Financial/Legal	LANG
3	Insurance/Real Estate	LANG
4	Data Processing/Computer Center	LANG
5	Mixed-Use/Multi-tenant	LANG
6	Lab/R&D Facility	LANG
7	Software Development	LANG
8	Government Services	LANG
9	Office with Warehouse	LANG
10	Contractor's Offices	LANG
11	Telecommunications Center (call center)	LANG
12	Travel Services (Travel Agent)	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG

99	Don’t know	LANG
FM050b	Which of the following types of restaurants or food service best describes this facility? Would you say… [READ] (SINGLE RESPONSE)	
1	Fast Food or Self Service	LANG
2	Specialty/Novelty Food Service	LANG
3	Table Service	LANG
4	Bar/Tavern/Nightclub/Brew Pub or Microbrewery/Other entertainment	LANG
5	Caterer	LANG
6	Other Food Service	LANG
88	Refused	LANG
99	Don’t know	LANG
FM050c	Which of the following types of food stores best describes this facility? Would you say…[READ] (SINGLE RESPONSE)	
1	Supermarkets	LANG
2	Small General Grocery	LANG
3	Specialty/Ethnic Grocery/Deli	LANG
4	Convenience Store	LANG
5	Liquor Store	LANG
6	Retail Bakery	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don’t know	LANG
FM050d	What type of agricultural facility is this? [READ] (SINGLE RESPONSE)	
1	Commercial Greenhouse	LANG
2	Commercial Farm	LANG
3	Dairy/Ranch	LANG
4	Vineyard/Orchard	LANG
5	Agricultural Storage (Grain Elevators, etc.)	LANG
6	Equine Facility (Horse Boarding/Grooming/Racing/Breeding)	LANG
77	OPEN\Describe type of agricultural facility	LANG
88	Refused	LANG
99	Don’t know	LANG
FM050e	Which of the following types of retail stores best describes this facility? Would you say… [READ] (SINGLE RESPONSE)	
1	Department/Variety Store	LANG
2	Retail Warehouse/Club	LANG

3	Shop in Enclosed Mall	LANG
4	Shop in Strip Mall	LANG
5	Auto/Truck/Motorcycle Sales	LANG
6	Art Gallery	LANG
7	Auction House	LANG
8	Heavy Equipment Sales	LANG
9	Facility is a Mall/Strip Mall	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don't know	LANG
FM050f	Which of the following types of warehouses best describes this facility? Would you say… [READ] (SINGLE RESPONSE)	
1	Refrigerated Warehouse	LANG
2	Unconditioned Warehouse, High Bay (lighting higher than 13 ft.)	LANG
3	Unconditioned Warehouse, Low Bay	LANG
4	Conditioned Warehouse, High Bay (lighting higher than 13 ft.)	LANG
5	Conditioned Warehouse, Low Bay	LANG
6	Shipping/Distribution Center	LANG
7	Garage/Parking/Storage for Commercial Fleet	LANG
8	Public Self Storage Facility	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don't know	LANG
FM050g	Which of the following types of health care centers best describes this facility? Would you say… [READ] (SINGLE RESPONSE)	
1	Hospital	LANG
2	Nursing Home	LANG
3	Medical/Dental Office	LANG
4	Clinic/Outpatient Care	LANG
5	Medical/Dental Lab	LANG
6	Alcohol/Drug Treatment/Rehabilitation	LANG
7	Doctor's Office	LANG
8	Dentist's Office	LANG
9	Veterinary Hospital/Clinic	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don't know	LANG

FM050h	Which of the following types of educational centers best describes this facility? Would you say… [READ] (SINGLE RESPONSE)	
1	Daycare or Preschool	LANG
2	Elementary School	LANG
3	Middle/Secondary School	LANG
4	College or University	LANG
5	Vocational or Trade School	LANG
6	Instructional Studio (Dance/Music/Martial Arts)	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don't know	LANG
FM050i	Which of the following types of lodging best describes this facility? Would you say… [READ] (SINGLE RESPONSE)	
1	Hotel	LANG
2	Motel	LANG
3	Resort	LANG
4	Bed and Breakfast	LANG
5	Campground/Trailer Camping/KOA	LANG
6	Residential Hotel/Motel	LANG
7	Dormitory/Sorority/Fraternity	LANG
8	Activity Camp/Summer Camp	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don't know	LANG
FM050j	Which of the following types of public assembly buildings best describes this facility? Would you say… [READ] (SINGLE RESPONSE)	
1	Religious Assembly (worship only)	LANG
2	Religious Assembly (mixed use)	LANG
3	Health/Fitness Center/Athletic Center/Gym	LANG
4	Movie Theaters	LANG
5	Theater/Performing Arts Venue	LANG
6	Library/Museum	LANG
7	Conference/Convention Center	LANG
8	Community Center/Activity Center	LANG
9	Country Club	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don't know	LANG

FM050k	Which of the following types of service buildings best describes this facility? Would you say...[READ] (SINGLE RESPONSE)	
1	Hair Salon	LANG
2	Nail Salon	LANG
3	Massage Spa	LANG
4	Day Spa	LANG
5	Gas Station/Auto Repair	LANG
6	Gas Station w/Convenience Store	LANG
7	Repair (Non-Auto)	LANG
8	Copy Center/Printing	LANG
9	Package Delivery (Fed Ex/UPS/DHL)	LANG
10	HVAC Repair Installation	LANG
11	Aircraft Maintenance/Repair	LANG
12	Airport	LANG
13	Parking Lot/Commuter Service	LANG
14	Marina	LANG
15	Amusement (mini-golf/go-carts/skating/bowling)	LANG
16	Pet Care/Grooming	LANG
17	Car Rental	LANG
18	Car Wash	LANG
19	Cemetery/Mortuary/Crematorium	LANG
20	Equipment Rental	LANG
21	Fleet Fueling Services	LANG
22	Pest Control	LANG
23	Photographer	LANG
24	Vehicle Inspections	LANG
25	Transportation	LANG
26	Upholstery	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don't know	LANG
FM050l	Which of the following types of buildings best describes this facility? Would you say...[READ] (SINGLE RESPONSE)	
1	Assembly/Light Manufacturing	LANG
2	Food Processing Plant	LANG
3	Recycling Center	LANG
4	Commercial/Industrial Bakery	LANG
5	Commercial Brewery/Winery	LANG
6	Chemical/Petrochemical Production	LANG
7	Industrial Process	LANG
8	Radio/Television/Film/Music Production	LANG

9	Energy Generation/Distribution	LANG
10	Machine Shop	LANG
11	Pharmaceutical Production/Manufacturing	LANG
12	Mail Sorting	LANG
13	Mining	LANG
77	OPEN\DO NOT USE unless necessary	LANG
88	Refused	LANG
99	Don’t know	LANG
FM050m	What type of laundry facility is this? [READ] (SINGLE RESPONSE)	
1	Coin Operated	LANG
2	Commercial Laundry Facility	LANG
3	Dry Cleaners	LANG
77	OPEN\Record other building type	LANG
88	Refused	LANG
99	Don’t know	LANG
FM050n	Which of the following types of buildings best describes this facility? Would you say...[READ] (SINGLE RESPONSE)	
1	Garden Style	LANG
2	Mobile Home	LANG
3	High-rise	LANG
4	Townhouse	LANG
5	Condominium	LANG
6	Apartment	LANG
7	Artists' Studio/Live Work/Loft	LANG
8	Assisted Living	LANG
77	OPEN\Record other building type	LANG
88	Refused	LANG
99	Don’t know	LANG
FM050o	Which of the following types of buildings best describes this facility? Would you say...[READ] (SINGLE RESPONSE)	
1	Police station	LANG
2	Fire station	LANG
3	Post office	LANG
4	Military	LANG
5	Ambulance Service	LANG
6	Jail/Correctional facility	LANG
7	Courthouse	LANG
8	Library	LANG
9	Water/Waste Water Treatment	LANG

10	General Government (Municipal/State/Federal Agency Buildings)	LANG
11	Public Park	LANG
77	OPEN\Record other building type	LANG
88	Refused	LANG
99	Don't know	LANG
LANG	Is another language besides English used to conduct business at this facility? (SINGLE RESPONSE)	
1	Yes	OTH_LANG
2	No	CC2a
88	Refused	CC2a
99	Don't Know	CC2a
OTH_LANG	Which languages are used to conduct business at this facility? [ACCEPT MULTIPLES]	
1	Spanish	CC2a
2	Chinese	CC2a
3	Korean	CC2a
4	Vietnamese	CC2a
5	Japanese	CC2a
6	Hindi	CC2a
77	OPEN (Specify)	CC2a
88	Refused	CC2a
99	Don't know	CC2a
	CUSTOMER CHARACTERISTICS	
	Now, I'd like to ask you questions regarding your facility.	
CC2a	What is the total square footage at this facility?	
77	RECORD Square feet	CC2c
888888	Refused	CC3
999999	Don't know	CC3
	IF CC2a IN (88, 99)	
CC3	Would you say that the floor area is ...?	
1	less than 1,500 sq. ft.	CC2c
2	1,500 - 5,000 sq. ft.	CC2c
3	5,000 - 10,000 sq. ft.	CC2c
4	10,000 – 25,000 sq. ft.	CC2c
5	25,000 – 50,000 sq. ft.	CC2c
6	50,000 – 75,000 sq. ft.	CC2c

7	75,000 – 100,000 sq. ft.	CC2c
8	over 100,000 sq. ft. (ag area)	CC2c
88	Refused	CC2c
99	Don’t know	CC2c
CC2c	Is the entire floor area of this facility heated or cooled?	
1	Yes	CC3a
2	No	CC2d
88	Refused	C0
99	Don’t know	C0
CC2d	What percentage of the floor area is heated or cooled?	
77	Percent	CC3a
101	Refused	C0
102	Don’t know	C0
	If CC2d > 0 or CC2c = 1; else skip to C0	
CC3a	Is your space heated using electricity or gas or something else?	
1	Electricity	C0
2	Gas	C0
3	Both electricity and gas	C0
4	Propane	C0
77	OPEN\Other-record	C0
88	Refused	C0
99	Don't know	C0
C0	About what percentage of your operating costs does energy account for?	
1	Less than 1 percent	CC4
2	1-2 percent	CC4
3	3-5 percent	CC4
4	6-10 percent	CC4
5	11-15 percent	CC4
6	16-20 percent	CC4
7	21-50 percent	CC4
8	Over 51 percent	CC4
88	Refused	CC4
99	Don't Know	CC4
CC4	Does your organization own, lease, or manage the facility?	
1	Own	C5
2	Lease/Rent	C5

3	Manage	C5
88	Refused	C5
99	Don’t know	C5
C5	How many locations does your organization have. Is it....	
1	This facility only	CC6
2	2 to 4 locations	CC6
3	5 to 10 locations	CC6
4	11 to 25 locations	CC6
5	more than 25 locations	CC6
88	Don't know	CC6
99	Refused	CC6
CC6	How active a role does your organization take in making purchase decisions related to energy using equipment at this facility? Would you say you are…	
1	Very active – involved in all phases and have veto power	CC7
2	Somewhat active – we approve decisions and provide some input and review	CC7
3	Slightly active – we have a voice but it’s not the dominant voice	CC7
4	Not active at all – we’re part of a larger firm	CC7
5	Not active at all – our firm doesn’t get involved in these issues	CC7
88	Refused	CC7
99	Don't know	CC7
CC7	Does your firm have a maintenance company that you use to maintain any of your building systems such as lighting, HVAC, refrigeration, or food service equipment?	
1	Yes	CC8
2	No	CC8
88	Refused	CC8
99	Don't Know	CC8
CC8	In what year was the facility built?	
7777	Year	CC11
8888	Refused	CC10
9999	Don’t know	CC10
	If CC8 in (88, 99) then ask; else skip to CC11	
CC10	If don't know, would you say it was…	
1	After 2010	CC11

2	2000s	CC11
3	1990s	CC11
4	1980s	CC11
5	1970s	CC11
6	1960s	CC11
7	1950	CC11
8	Before 1950	CC11
88	Refused	CC11
99	Don't know	CC11
CC11	In what year was this facility last remodeled? [PROBE FOR BEST GUESS]	
7777	Year	CC11ab
6666	Never Remodeled	CC12a
8888	Refused	CC11a
9999	Don't know	CC11a
	Ask if CC11 in (88, 99); else skip to CC11ab If CC11 = Never remodeled, skip to CC12a	
CC11a	Would you say the last remodeling was done …. [READ RESPONSES.]	
1	Between 2010 and present	CC11ab
2	Between 2006 and end of 2009	CC11ab
3	Between 2000 and the end of 2005	CC11ab
4	During the 1990s	CC11ab
5	Before the 1990s	CC11ab
88	Refused	CC11ab
99	Don't know	CC11ab
CC11ab	When you remodeled, did you change out your building systems?	
1	Yes	CC11ac
2	No	CC11ad
88	Refused	CC11ae
99	Don't know	CC11ae
	IF CC11ab = 1, THEN ASK. ELSE SKIP TO CC11ad. IF CC11ab=88,99 THEN SKIP TO CC11ae	
CC11ac	Why did you decide to change out your building systems?	
77	RECORD VERBATIM	CC11ae
88	Refused	CC11ae
99	Don't know	CC11ae

	IF CC11ab = 2, THEN ASK. ELSE SKIP TO CC11ae	
CC11ad	Why did you decide not to change out your building systems?	
77	RECORD VERBATIM	CC11ae
88	Refused	CC11ae
99	Don't know	CC11ae
CC11ae	When you remodeled the facility, what energy systems did you change?	
1	Did not change any of them	CC11ag
77	RECORD VERBATIM	CC11af
88	Refused	CC12a
99	Don't know	CC12a
	IF CC11ae = 77, THEN ASK. ELSE SKIP TO CC11ag	
CC11af	Why did you decide to change out your energy systems?	
77	RECORD VERBATIM	CC12a
88	Refused	CC12a
99	Don't know	CC12a
	IF CC11ae = 1, THEN ASK. ELSE SKIP TO CC12a	
CC11ag	Why did you decide not to change out your energy systems?	
77	RECORD VERBATIM	CC12a
88	Refused	CC12a
99	Don't know	CC12a
CC12a	In what year was this organization established at this location?	
7777	Year	BC090
8888	Refused	CC12b
9999	Don't know	CC12b
	If CC12a in (88, 99) then ask; else skip to BC090	
CC12b	Would you say it was…	
1	After 2010	BC090
2	Between 2006 and 2010	BC090
3	Between 2000 and 2005	BC090
4	In the 1990s	BC090
5	In the 1980s	BC090
6	In the 1970s	BC090
7	In the 1960s or	BC090
8	Before 1960	BC090

88	Don't know	BC090
99	Refused	BC090
	ADDITIONAL FACILITY CHARACTERISTICS	
BC090	Has the square footage of the facility increased, decreased or remained the same since January 2016?	
1	Increase in square footage	BC100
2	Decrease in square footage	BC110
3	Stayed the same	V1
88	Refused	V1
99	Don't know	V1
	If BC090 = 1 then ask; else skip to BC110	
BC100	How many square feet were added?	
77	Square feet	BC120
88	Refused	BC120
99	Don't know	BC120
	If BC090 = 2 then ask; else skip to BC120	
BC110	By how many square feet was the facility reduced?	
77	Square feet	BC120
88	Refused	BC120
99	Don't know	BC120
	If BC090 in (1, 2) then ask; else skip to CA15	
BC120	In what year did this <%BC090> occur?	
1	2016	V1
2	2017	V1
88	Refused	V1
99	Don't know	V1

	ROLE OF CONTRACTORS	
V1	Did you use a contractor/vendor to **[IF POS=1, Did a restaurant supply firm…EXPLAIN: In the following questions, I'm going to refer to the restaurant supply firm as the vendor]** install any of the energy efficient measures that were 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	How did you come into contact with the contractor/vendor?	
1	They contacted you	V2b
2	You contacted them	V3
3	You had worked with them before	V2a
77	OTHER - Record	V3
88	Refused	V3
99	Don't Know	V3
	Ask if V2 = 3; else skip to V2b	
V2a	In relation to this project, did the vendor/contractor approach you about your energy efficient equipment retrofit/installation?	
1	Yes	V2b
2	No	V3
88	Refused	V3
99	Don't Know	V3
	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 your organization 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 program?	
1	Yes	V4
2	No	AP9

88	Refused	AP9
99	Don't Know	AP9
	Ask if V3 = 1; else skip to AP9	
V4	Prior to coming into contact with the contractor/vendor, did your organization have plans to replace/install this equipment?	
1	Yes	V4a
2	No	V4a
88	Refused	V4a
99	Don't Know	V4a
V4a	Using the same scale of 0 - 10 as before, how likely is it that your organization would have installed the new energy efficient equipment had the contractor/vendor not recommended it?	
1	0-10 response	V4b
88	Refused	V4b
99	Don't Know	V4b
V4b	Using the same scale, how likely is it that your organization would have installed the energy efficient equipment with the same level of efficiency if the contractor/vendor had not recommended to do so?	
1	0-10 response	V40
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 about various energy efficiency programs and what influenced your program participation.	
AP9	How did you FIRST learn about <%UTILITY>'s program? [DO NOT READ ANSWERS]	

1	Bill insert	AP9a
2	Program literature	AP9a
3	Account representative	AP9a
4	Program approved vendor	AP9a
5	Program representative	AP9a
6	Utility or program website	AP9a
7	Trade publication	AP9a
8	Conference	AP9a
9	Newspaper article	AP9a
10	Word of mouth	AP9a
11	Previous experience with it	AP9a
12	Company used it at other locations	AP9a
13	Contractor	AP9a
14	Result of an audit	AP9a
15	Part of a larger expansion or remodeling effort	AP9a
16	Restaurant supply firm	AP9a
77	Other (RECORD VERBATIM)	AP9a
88	Refused	A1b
99	Don’t know	A1b
	If AP9 in (1-77) then ask; else skip to A1b	
AP9a	How ELSE did you learn about <%UTILITY>'s program? [DO NOT READ LIST, ACCEPT MULTIPLES]	
1	Bill insert	N33
2	Program literature	N33
3	Account representative	N33
4	Program approved vendor	N33
5	Program representative	N33
6	Utility or program website	N33
7	Trade publication	N33
8	Conference	N33
9	Newspaper article	N33
10	Word of mouth	N33
11	Previous experience with it	N33
12	Company used it at other locations	N33
13	Contractor	N33
14	Result of an audit	N33
15	Part of a larger expansion or remodeling effort	N33
66	No other sources	N33
77	Other (RECORD VERBATIM)	N33
88	Refused	N33
99	Don’t know	N33

	If AP9 = 3 or AP9A = 3 then ask; else skip to A1b	
N33	You mentioned that you have a Utility or Program Administrator Account Rep. Can you give me his or her name? !!___Do you have his/her email address? !___Do you have a phone number for him/her? !___Do you have a cell phone number for him/her?\,	
77	RECORD NAME, Phone, Email, etc.	NEXT SECTION (MEASURE BATTERY)
88	Refused	NEXT SECTION (MEASURE BATTERY)
99	Don't know	NEXT SECTION (MEASURE BATTERY)

	REFRIGERATION CASE LED LIGHTING EQUIPMENT	
	Ask if REFLEDLIGHTING = 1; else skip to B99	
Comment	One way that organizations like yours can reduce their energy use is to install more energy efficient lighting equipment. I would like to ask you about the refrigeration case LED lighting you recently installed as part of your participation in <%UTILITY>'s program.	LED99
	CONTINUE IF REFLEDLIGHTING = 1	
LED99	Our records indicate that your organization installed REFRIGERATION CASE LED LIGHTING EQUIPMENT through the program. It is described as <%REFLEDLIGHTING_MEASURE>. Is this correct?	
1	Yes	LED100
2	No	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY
	Ask if LED99 = 2, 88, 99; else skip to LED100.	
DISPLAY	We cannot continue this study unless we can speak to someone at your organization that is familiar with the refrigeration case LED lighting equipment that was installed through the program. Is there another person we can speak to?	Go to next person and loop back to LED99

	Ask if LED99 = 1; else T&T	
LED100	What types and sizes [IF NEEDED: bulb lengths] of Refrigeration Case LED lighting were installed as part of this installation?	<$2>
77	Other (PLEASE SPECIFY)	LED101C ($4)
88	Refused	LED101C (_4)
99	Don't know	LED101C (_4)
	ASK IF C5 DOES NOT EQUAL 1; ELSE SKIP TO LED101D <_5>	
LED101C (_4)	Were any of the program provided <REFLEDLIGHTING_MEASURE> placed/installed at another facility? If so, what percentage would you estimate?	
1	Yes, #record percentage	LED101D <_5>
2	No	LED101D <_5>
88	Refused	LED101D <_5>
99	Don't know	LED101D <_5>
LED101D (_5)	What type of lighting equipment was removed and replaced when you installed <REFLEDLIGHTING_MEASURE> through the program?	
1	T12 Linear Fluorescent <= 5 ft Unit	LED101F <_7>
2	T12 Linear Fluorescent > 5 ft Unit	LED101F <_7>
3	T8 Linear Fluorescent <= 5 ft Unit	LED101F <_7>
4	T8 Linear Fluorescent > 5 ft Unit	LED101F <_7>
5	Premium Tier LED Case Lighting <= 5 ft Unit	LED101E <_6>
6	Premium Tier LED Case Lighting > 5 ft Unit	LED101F <_7>
66	Did not replace anything - new equipment	LED90
77	Other (PLEASE SPECIFY)	LED101F <_7>
88	Refused	LED101F <_7>
99	Don't know	LED101F <_7>
	Ask if LED101D <_5> DOES NOT EQUAL 66; else skip to LED90	
LED101F (_7)	Approximately how old was the Refrigerator Case lighting that was removed and replaced with <REFLEDLIGHTING_MEASURE>? Would you say...	
1	Less than 5 years old	LED101G <_8>
2	Between 5 and 10 years old	LED101G <_8>
3	Between 10 and 15 years old	LED101G <_8>
4	More than 15 years old	LED101G <_8>
88	Refused	LED101G <_8>
99	Don't know	LED101G <_8>

LED101G (_8)	How would you describe the condition of the removed Refrigerator Case lighting equipment? Would you say they were in…	
1	Poor condition	LED101H <_9>
2	Fair condition	LED101H <_9>
3	Good condition	LED101H <_9>
88	Refused	LED101H <_9>
99	Don’t know	LED101H <_9>
LED101H (_9)	Approximately what percentage of the Refrigerator Case lighting that was removed and replaced was broken or not working prior to installing <REFLEDLIGHTING_MEASURE>?	
%	Percent	LED101I (_10)
88	Refused	LED101I (_10)
99	Don't know	LED101I (_10)
LED101I (_10)	Approximately how old are the Refrigerator Cases with the lighting that was removed and replaced with <_2>? Would you say…	
1	Less than 5 years old	LED101J (_11)
2	Between 5 and 10 years old	LED101J (_11)
3	Between 10 and 15 years old	LED101J (_11)
4	More than 15 years old	LED101J (_11)
88	Refused	LED101J (_11)
99	Don't know	LED101J ($11)
LED101J ($11)	How many years do you anticipate are left in the refrigerated case itself until you will replace the entire case?	
# Yrs	RECORD Number of years left	OP1
88	Refused	OP1
99	Don't know	OP1

Operating Schedule for Refrigeration Case Lighting		
DISPLAY	The next few questions are to help us get a full understanding of the hours of operation for the refrigeration display case lighting.	
OP1	Does the refrigeration display case lighting operate 24 hours a day, 7 days a week?	
1	Yes	OP5
2	No	OP2
88	Refused	OP5
99	Don't know	OP5
OP2	Are there certain days of the week when the refrigeration display case lighting operates less than 24 hours?	
1	Yes	OP3
2	No	OP5
88	Refused	OP5
99	Don't know	OP5
OP3	Which days are they [IF NEEDED: when the refrigeration display case lighting operates less than 24 hours]?	
1	Monday	OP4
2	Tuesday	OP4
3	Wednesday	OP4
4	Thursday	OP4
5	Friday	OP4
6	Saturday	OP4
7	Sunday	OP4
88	Refused	OP5
99	Don't know	OP5
[FOR EACH DAY MENTIONED IN OP3, ASK]		
OP4	What hours does the refrigeration display case lighting operate on those days, in terms of the starting and ending times?	
1	Monday starting/ending hours [RECORD]	OP5
2	Tuesday starting/ending hours [RECORD]	OP5
3	Wednesday starting/ending hours [RECORD]	OP5
4	Thursday starting/ending hours [RECORD]	OP5
5	Friday starting/ending hours [RECORD]	OP5
6	Saturday starting/ending hours [RECORD]	OP5
7	Sunday starting/ending hours [RECORD]	OP5

88	Refused	OP5
99	Don't know	OP5
OP5	Does the refrigeration display case lighting schedule vary by the type of product stored in the refrigerated cases?	
1	Yes	OP5a
2	No	OP6
88	Refused	OP6
OP5a	Please explain [IF NEEDED: how the lighting schedule varies by the type of product stored in the refrigerated cases].	
77	RECORD VERBATIM	OP6
88	Refused	OP6
99	Don't know	OP6
OP6	Do you lower the level of illumination in the refrigeration display cases at certain times?	
1	Yes	OP6a
2	No	SP1
88	Refused	SP1
OP6a	What approach do you use to lower the level of illumination in the refrigeration display cases at certain times? [IF NEEDED: what technology do you use?]	
77	RECORD VERBATIM	SP1
88	Refused	SP1
99	Don't know	SP1
<u>LEDs as Standard Practice</u>		
SP1	Do you consider LED refrigerator case lighting to be standard practice for firms like yours? [IF NEEDED: by this, we mean that the majority of firms like yours install LED refrigerator case lighting on a routine basis either at the time of equipment replacement or on an accelerated schedule.}	
1	Yes	SP1a
2	No	SP1b
88	Refused	NTG BATTERY
SP1a	Why do you consider LED refrigerator case lighting to be standard practice for firms like yours?	
77	RECORD VERBATIM	NTG BATTERY
88	Refused	NTG BATTERY

99	Don't know	NTG BATTERY
SP1b	What do you consider to be standard practice when replacing lighting in refrigerator cases?	
77	RECORD VERBATIM	NTG BATTERY
88	Refused	NTG BATTERY
99	Don't know	NTG BATTERY
NTGCHECK	**GO TO NTG BATTERY**	

	PROCESS BOILERS	
	Ask if PROCESSBOILER=1; else skip to FS99	
DISPLAY	In this next section we will be discussing the GAS BOILERS present in your facility.	
B99	Our records indicate that your organization installed PROCESS BOILER EQUIPMENT through the program. It is described as <%PROCESS_BOILER_MEASURE> . Is this correct?	
1	Yes	B100
2	No	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY
	Ask if B99 in (2-99); else skip to B100.	
DISPLAY	We cannot continue this study unless we can speak to someone at your organization that is familiar with the PROCESS BOILER equipment that was installed through the program. Is there another person we can speak to?	Go to next person and loop back to B99
	Ask if B99 = 1; else T&T	
B100	Is the <%PROCESS_BOILER_MEASURE> a new installation, or did it replace an existing boiler?	
1	New installation	B100
2	Replaced existing equipment	B101A
88	Refused	B101A
99	Don't know	B101A
	Ask if B100 <> 1; else skip to BOP1	

B101A	Approximately how old was the <%PROCESS_BOILER_MEASURE> that was removed and replaced? Would you say…	
1	Less than 5 years old	B101B
2	Between 5 and 10 years old	B101B
3	Between 10 and 15 years old	B101B
4	More than 15 years old	B101B
88	Refused	B101B
99	Don't know	B101B
B101B	How would you describe the removed equipment's condition? Would you say it was in…	
1	Poor condition	DISPLAY
2	Fair condition	DISPLAY
3	Good condition	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY
<u>Operating Schedule for Boilers</u>		
DISPLAY	The next few questions are to help us get a full understanding of the schedule of operation for boiler loads	
BOP1	Does the boiler operate 24 hours a day, 7 days a week?	
1	Yes	BOP5
2	No	BOP2
88	Refused	BOP5
99	Don't know	BOP5
BOP2	Are there certain days of the week when the boiler operates less than 24 hours?	
1	Yes	BOP2a
2	No	BOP5
88	Refused	BOP5
99	Don't know	BOP5
BOP2a	Which days are they [IF NEEDED: when the boiler operates less than 24 hours]?	
1	Monday	BOP2b
2	Tuesday	BOP2b
3	Wednesday	BOP2b
4	Thursday	BOP2b
5	Friday	BOP2b

6	Saturday	BOP2b
7	Sunday	BOP2b
88	Refused	BOP3
99	Don't know	BOP3
[FOR EACH DAY MENTIONED IN BOP2a, ASK]		
BOP2b	What hours does the boiler operate on those days, in terms of the starting and ending times?	
1	Monday starting/ending hours [RECORD]	BOP3
2	Tuesday starting/ending hours [RECORD]	BOP3
3	Wednesday starting/ending hours [RECORD]	BOP3
4	Thursday starting/ending hours [RECORD]	BOP3
5	Friday starting/ending hours [RECORD]	BOP3
6	Saturday starting/ending hours [RECORD]	BOP3
7	Sunday starting/ending hours [RECORD]	BOP3
88	Refused	BOP3
99	Don't know	BOP3
BOP3	Does the boiler operation vary by season of the year?	
1	Yes	BOP3a
2	No	BOP4
88	Refused	BOP4
99	Don't know	BOP4
BOP3a	Which seasons does the boiler operate during?	
1	Winter	BOP3b
2	Fall	BOP3b
3	Spring	BOP3b
4	Summer	BOP3b
77	Other [RECORD VERBATIM]	BOP3b
88	Refused	BOP4
99	Don't know	BOP4
[FOR EACH SEASON MENTIONED IN BOP3a, ASK]		
BOP3b	What percentage of the time does the boiler operate during those seasons?	
1	Winter percentage of time [RECORD]	BOP4
2	Fall percentage of time [RECORD]	BOP4
3	Spring percentage of time [RECORD]	BOP4
4	Summer percentage of time [RECORD]	BOP4
88	Refused	BOP4
99	Don't know	BOP4

BOP4	Is the <%PROCESS_BOILER_MEASURE> used rarely, moderately, most of the time, or always during your facility's operating hours?	
1	Rarely	BLOAD1
2	Moderately	BLOAD1
3	Most of the time	BLOAD1
4	All of the time	BLOAD1
77	Other [RECORD VERBATIM]	BLOAD1
88	Refused	BLOAD1
99	Don't know	BLOAD1
Ask if PROCESSBOILER=1; else skip to NTG BATTERY		
BLOAD1	What types of loads is the hot water from the boiler used for?	
77	RECORD VERBATIM	BLOAD1a
88	Refused	NTG BATTERY
99	Don't know	NTG BATTERY
[FOR EACH TYPE OF LOAD MENTIONED IN BLOAD1, ASK]		
BLOAD1a	What is the volume or output of that load? [IF NEEDED: for example, pounds of laundry washed and dried per week]	
1	Mention #1 quantity [RECORD VERBATIM]	NTG BATTERY
2	Mention #2 quantity [RECORD VERBATIM]	NTG BATTERY
3	Mention #3 quantity [RECORD VERBATIM]	NTG BATTERY
4	Mention #4 quantity [RECORD VERBATIM]	NTG BATTERY
88	Refused	NTG BATTERY
99	Don't know	NTG BATTERY
NTGCHECK	**GO TO NTG BATTERY**	

	FOOD SERVICE	
	Ask if GASFRYER=1; else skip to NTG BATTERY	
DISPLAY	In this next section we will be discussing the FOOD SERVICE equipment present in your facility.	
FS99	Our records indicate that your organization installed FOOD SERVICE EQUIPMENT through the program. It is described as <%_FOOD_SERVICE_MEASUREx>. Is this correct? [READ: In future questions, I will be referring to this as your new gas fryer(s).]	

1	Yes	FS100
2	No	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY
	Ask if FS99 in (2-99); else skip to FS100.	
DISPLAY	We cannot continue this study unless we can speak to someone at your organization that is familiar with the <%_FOOD_SERVICE_MEASURE1> [IF APPLICABLE: <%_FOOD_SERVICE_MEASURE2>, <%_FOOD_SERVICE_MEASURE3>] that was installed through the program. Is there another person we can speak to?	Go to next person and loop back to FS99
	Ask if FS99 = 1; else T&T	
FS100	Did the new gas fryer replace an existing fryer?	
1	New installation	FS100
2	Replaced existing equipment	FS101A
88	Refused	FS101A
99	Don't know	FS101A
	Ask if FS100 = 2, 88, 99; else IF FS100=1, skip to FSOP1	
FS101A	Approximately how old was the gas fryer that was removed and replaced? Would you say...	
1	Less than 5 years old	FS101B
2	Between 5 and 10 years old	FS101B
3	Between 10 and 15 years old	FS101B
4	More than 15 years old	FS101B
88	Refused	FS101B
99	Don't know	FS101B
FS101B	How would you describe the removed equipment's condition? Would you say it was in…	
1	Poor condition	DISPLAY
2	Fair condition	DISPLAY
3	Good condition	DISPLAY
88	Refused	DISPLAY
99	Don’t know	DISPLAY

Operating Schedule for Kitchen		
DISPLAY	The next several questions are to help us get a full understanding of the schedule of operation for the kitchen [IF NEEDED: where the food service equipment is used]	
FSOP1	Does the kitchen operate 7 days a week?	
1	Yes	FSOP2
2	No	FSOP1a
88	Refused	FSOP3
99	Don't know	FSOP3
FSOP1a	Which days of the week is the kitchen closed?	
1	Monday	FSOP2
2	Tuesday	FSOP2
3	Wednesday	FSOP2
4	Thursday	FSOP2
5	Friday	FSOP2
6	Saturday	FSOP2
7	Sunday	FSOP2
88	Refused	FSOP2
99	Don't know	FSOP2
[FOR EACH DAY NOT MENTIONED IN FSOP1a, ASK]		
FSOP2	What hours does the kitchen operate on those days when it is open, in terms of the starting and ending times?	
1	Monday starting/ending hours [RECORD]	FSOP3
2	Tuesday starting/ending hours [RECORD]	FSOP3
3	Wednesday starting/ending hours [RECORD]	FSOP3
4	Thursday starting/ending hours [RECORD]	FSOP3
5	Friday starting/ending hours [RECORD]	FSOP3
6	Saturday starting/ending hours [RECORD]	FSOP3
7	Sunday starting/ending hours [RECORD]	FSOP3
8	All days of the week starting/ending hours [RECORD]	FSOP3
88	Refused	FSOP3
99	Don't know	FSOP3
FSOP3	Which meals are prepared in the kitchen on weekdays and separately, on weekends? [IF NEEDED: in terms of breakfast, lunch, dinner, brunch, late night meals]	
1	Weekday meals [RECORD VERBATIM]	FSOP4
2	Weekend meals [RECORD VERBATIM]	FSOP4
88	Refused	FSOP4

99	Don't know	FSOP4
FSOP4	Approximately how many meals per day are prepared in the kitchen on weekdays and separately, on weekends?	
1	Weekday meals [RECORD VERBATIM]	FSOP5
2	Weekend meals [RECORD VERBATIM]	FSOP5
88	Refused	FSOP5
99	Don't know	FSOP5
FSOP5	What are the busiest times of the day for meal preparation in the kitchen on weekdays and separately, on weekends?	
1	Weekday busiest times [RECORD Start/End times]	FSM1
2	Weekend busiest times [RECORD Start/End times]	FSM1
88	Refused	FSM1
99	Don't know	FSM1
Operating Schedule for <%_FOOD_SERVICE_MEASURE>		
DISPLAY	The next several questions are to help us get a full understanding of the schedule of operation for the gas fryer that you installed through the program.	
FSM1	Is the gas fryer used continuously or only turned on as needed?	
1	Used continuously	FSM1a
2	Turned on as needed	FSM1a
77	Other [RECORD VERBATIM]	FSM1a
88	Refused	FSM1a
99	Don't know	FSM1a
IF FSM1=1, 2 or 3, THEN ASK. ELSE SKIP TO NTG BATTERY		
FSM1a	Approximately what percent of the time is food being cooked on the gas fryer?	
%	RECORD PERCENTAGE	FSM1aa
88	Refused	FSM1aa
99	Don't know	FSM1aa
FSM1aa	Does the frequency, that is percentage, of use [IF NEEDED: of the gas fryer] vary significantly by weekdays versus weekends?	
1	Yes	FSM1b
2	No	FSM2

88	Refused	FSM2
99	Don't know	FSM2
FSM1b	Approximately what percentage of the time is the gas fryer used during weekdays and separately, on weekends?	
1	Weekdays [RECORD PERCENTAGE]	FSM2
2	Weekend meals [RECORD VERBATIM]	FSM2
88	Refused	FSM2
99	Don't know	FSM2
FSM2	What specific factors influence the frequency with which the gas fryer is used?	
1	Coincident with core kitchen hours	NTG BATTERY
2	Certain menu items in demand (e.g., fried foods)	NTG BATTERY
3	Pre-cooking in anticipation of meal orders	NTG BATTERY
4	High volume of business in general	NTG BATTERY
77	Other [RECORD VERBATIM]	NTG BATTERY
88	Refused	NTG BATTERY
99	Don't know	NTG BATTERY
NTGCHECK	**GO TO NTG BATTERY**	

	NET TO GROSS	

IF MULTIPLE = 1, THEN ASK. ELSE A1c

A1b. Our records show that your organization installed more than one MEASURE at <%ADDRESS> through the <%UTILITY>'s <%PROGRAM> Program. They are … <%QTY_1> <%MEASURE1>, <%QTY_2> <%MEASURE2>, <%QTY_3> <%MEASURE3>. Was there a single decision making process for the installation of this equipment, or was there a separate decision making process for each type of equipment?

1	Single decision making process	A1c.
2	Separate decision making process for each type of equipment	A1c.
88	Refused	A1c.
99	Don't know	A1c.

IF MULTADD = 1, THEN ASK. ELSE AA3

A1c. Our records also show that your organization installed the same MEASURE at other addresses. Applications were submitted for the following addresses: <%ADDRESS1>, <%ADDRESS2>, <%ADDRESS3> … <%ADDRESS20>. Was the decision making process the same for all of these addresses or was it different at each address?

1	Same decision making process for all addresses	AA3
2	Different decision making process for all addresses	AA3
88	Refused	AA3
99	Don't know	AA3
DISPLAY	For the sake of expediency, during this next battery we will be referring to the ..... program as THE PROGRAM and we will be referring to the installation of ...<%NTGMEASURE>... as THE MEASURE.	
AA3	There are usually a number of reasons why an organization like yours decides 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?	
1	To replace old or outdated equipment	AA3a
2	As part of a planned remodeling, build-out, or expansion	N2
3	To gain more control over how the equipment was used	N2
4	Maintenance downtime/associated expenses for old equipment were too high	A3a
5	Had process problems and were seeking a solution	N2
6	To improve equipment performance	N2
7	To improve production as a result of the change in equipment	N2
8	To comply with codes set by regulatory agencies	N2
9	To improve visibility/plant safety	N2
10	To comply with company policies regarding regular equipment retrofits or remodeling	A3a
11	To get a rebate from the program	N2
12	To protect the environment	N2
13	To reduce energy costs	N2
14	To reduce energy use/power outages	N2
15	To update to the latest technology	N2
16	To improve the comfort level of the facility	N2
77	RECORD VERBATIM	N2
88	Don't know	N2
99	Refused	N2
IF A3=1, 4 or 10 and PROCESSBOILER =1 OR FOODSERVICE = 1, THEN ASK. ELSE N2		
AA3a	Had the equipment that you replaced reached the end of its useful life?	
1	Yes	N2

2	No	N2
88	Refused	N2
99	Don't know	N2
N2	Did your organization make the decision to install this new equipment before or, after, or at the same time as you became aware of that rebates [IF NEEDED: to reduce the cost of the measure] were available through the PROGRAM?	
1	Before	N3a
2	After	N3a
3	Same time	N3a
88	Refused	N3a
99	Don't know	N3a
DISPLAY	Next, I'm going to ask you to rate the importance of the program as well as other factors that might have influenced your decision to install this equipment through the program. 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...	
N3a	The age or condition of the old equipment	
#	Record 0 to 10 score (_______)	N3aa
88	Refused	N3b
99	Don't know	N3b
	IF N3a > 5 and NTG_TYPE >= 2 THEN ASK	
N3aa	How, specifically, did this enter into your decision to install/delamp this equipment?	
77	RECORD VERBATIM	N3b
88	Don't know	N3b
99	Refused	N3b
N3b	Availability of the PROGRAM rebate [IF NEEDED: to reduce the cost of the measure]	
#	Record 0 to 10 score (_______)	N3bb
88	Refused	N3c
99	Don't know	N3c
	IF N3b > 7 AND NTG_TYPE >= 2, THEN ASK	
N3bb	Why do you give it this rating?	
77	Record VERBATIM	N3c
88	Refused	N3c
99	Don't know	N3c

	IF A1B(1)|ID0(1) THEN ASK; ELSE SKIP TO N3d	
N3c	Please rate the degree of importance of information provided through...A1B(1)|<ID0(1)/The Facility or System AUDIT/>	
#	Record 0 to 10 score (_______)	N3cc
88	Refused	N3d
99	Don't know	N3d
	IF N3c > 7 and NTG_TYPE >= 2, THEN ASK	
N3cc	Why do you give it this rating?	
77	Record VERBATIM	N3d
88	Refused	N3d
99	Don't know	N3d
	If V1 = 1 THEN ASK; ELSE SKIP TO N3e	
N3d	Recommendation from an equipment vendor that sold you the equipment and/or installed it for you **[VENDOR_1]**	
#	Record 0 to 10 score (_______)	N3e
88	Refused	N3e
99	Don't know	N3e
N3e	Your previous experience with similar types of energy efficient projects?	
#	Record 0 to 10 score (_______)	N3f
88	Refused	N3f
99	Don't know	N3f
N3f	Your previous experience with <%UTILITY>'s program or a similar utility program?	
#	Record 0 to 10 score (_______)	N3g
88	Don't know	N3g
99	Refused	N3g
	NTG_TYPE >= 3 THEN ASK, ELSE N3h	
N3g	Information from the Program, Utility, or Program Administrator training course?	
#	Record 0 to 10 score (_______)	N3gg
88	Refused	N3h
99	Don't know	N3h
	IF N3g > 5, THEN ASK, ELSE N3h	
N3gg	What type of information was provided during the training?	
77	Record VERBATIM	N3ggg

88	Refused	N3h
99	Don't know	N3h
N3ggg	How, specifically, did this enter into your decision to install/delamp this equipment?	
77	RECORD VERBATIM	N3h
88	Don't know	N3h
99	Refused	N3h
N3h	Information from the Program, Utility, or Program Administrator Marketing materials?	
#	Record 0 to 10 score (_______)	N3hh
88	Refused	N3j
99	Don't know	N3j
	IF N3h > 5 and NTG_TYPE >= 2, THEN ASK	
N3hh	What type of information was provided that pertained to the project?	
77	Record VERBATIM	N3hhh
88	Refused	N3j
99	Don't know	N3j
	IF N3hh = 77, THEN ASK	
N3hhh	How, specifically, did this enter into your decision to install/delamp this energy efficient equipment?	
77	RECORD VERBATIM	N3j
88	Don't know	N3j
99	Refused	N3j
	IF NTG_TYPE >= 2	
N3j	Standard practice in your business/industry	
#	Record 0 to 10 score (_______)	N3k
88	Refused	N3k
99	Don't know	N3k
	If AP9 = 3 or AP9a = 3 THEN ASK; ELSE SKIP TO N3m	
N3l	Endorsement or recommendation by your account rep?	
#	Record 0 to 10 score (_______)	N3ll
88	Refused	N3m
99	Don't know	N3m
	IF N3l > 5 & NTG_TYPE >= 2 THEN ASK	
N3ll	What did they recommend?	

77	Record VERBATIM	N3lll
88	Refused	N3m
99	Don't know	N3m
	IF N3LL(77)	
N3lll	How specifically did this enter into your decision to install this project using energy efficient equipment?	
77	RECORD VERBATIM	N3m
88	Don't know	N3m
99	Refused	N3m
	IF NTG_TYPE >= 2, ASK	
N3m	Corporate policy or guidelines	
#	Record 0 to 10 score (________)	N3mm
88	Refused	N3n
99	Don't know	N3n
	IF N3m > 5, THEN ASK	
N3mm	How, specifically, did this enter into your decision to install/delamp this equipment?	
77	RECORD VERBATIM	N3n
88	Don't know	N3n
99	Refused	N3n
N3n	Payback or return on investment of installing this equipment	
#	Record 0 to 10 score (________)	N3o
88	Refused	N3o
99	Don't know	N3o
N3o	Improved product quality	
#	Record 0 to 10 score (________)	N3oo
88	Refused	N3p
99	Don't know	N3p
	IF N3o > 5, THEN ASK	
N3oo	How, specifically, did this enter into your decision to install/delamp this equipment?	
77	RECORD VERBATIM	N3p
88	Don't know	N3p
99	Refused	N3p
	IF FM050 = 12 AND NTG_TYPE = 4, THEN ASK, ELSE SKIP TO N3r	

N3p	Compliance with state or federal regulations such as Title 24, air quality, OSHA, or FDA regulations	
#	Record 0 to 10 score (________)	N3pp
88	Refused	N3r
99	Don't know	N3r
	IF N3p > 5, THEN ASK	
N3pp	How, specifically, did this enter into your decision to upgrade to energy efficient equipment?	
77	RECORD VERBATIM	N3r
88	Don't know	N3r
99	Refused	N3r
	ASK IF NTG_TYPE >= 3	
N3r	Compliance with your organization's normal remodeling or equipment replacement practices?	
#	Record 0 to 10 score (________)	N3rrr
88	Refused	N3s
99	Don't know	N3s
	IF AA3(2|10)&N3R(6||10);	
N3RRR	According to your organization's remodeling and equipment replacement policies, how often are you supposed to replace this type of equipment? [IF NEEDED: in terms of the number of years]	
# yrs	Record Number of Years	N3rr
88	Refused	N3rr
99	Don't know	N3rr
	IF N3r > 5, THEN ASK	
N3rr	How, specifically, did this enter into your decision to install/delamp this equipment?	
77	RECORD VERBATIM	N3s.
88	Don't know	N3s.
99	Refused	N3s.
N3s	Were there any other factors we haven't discussed that were influential in your decision to install/delamp this MEASURE?	
1	Nothing else influential	CC1
77	Record verbatim	N3ss
88	Refused	CC1
99	Don't know	CC1
	ASK IF N3s = 77	

N3ss	Using the same zero to 10 scale, how would you rate the influence of this factor?	
#	Record 0 to 10 score (_______)	CC1
88	Refused	CC1
99	Don't know	CC1
	CONSISTENCY CHECKS ON N3p, N3q and N3r	
	If NTG_TYPE = 4	
	IF AA3 = 8, AND N3p < 4, THEN ASK	
CC1	You indicated earlier that compliance with codes or regulatory policies was one of the reasons you did the project. However, just now you scored the importance of compliance with state or federal regulations or standards such as Title 24, air quality, OSHA, or FDA regulations in your decision making fairly low, why is that?	
77	RECORD VERBATIM	CC1a
88	Don't know	CC1a
99	Refused	CC1a
	IF AA3 ^= 8, and N3p > 7, THEN ASK	
CC1a	You indicated earlier that compliance with codes or regulatory policies was not one of the primary reasons you did the project. However, just now you scored the importance of compliance with state or federal regulations or standards such as Title 24,air quality, OSHA, or FDA regulations in your decision making fairly high, why is that?	
77	RECORD VERBATIM	CC3
88	Don't know	CC3
99	Refused	CC3
	IF AA3 = 2 or 10, AND N3r < 4, THEN ASK	
NCC3	You indicated earlier that a regularly scheduled retrofit was one of the reasons you did the project. However, just now you scored the importance of compliance with your company's regularly scheduled retrofit or equipment replacement in your decision making fairly low, why is that?	
77	RECORD VERBATIM	CC3a
88	Don't know	CC3a
99	Refused	CC3a
	IF AA3 ^= 2 and AA3 ^= 9 and AA3^=10 AND N3r > 7 THEN ASK	

NCC3a	You indicated earlier that a regularly scheduled retrofit was NOT one of the reasons you did the project. However, just now you scored the importance of compliance with your company's regularly scheduled retrofit or equipment replacement in your decision making fairly high, why is that?	
77	RECORD VERBATIM	P1
88	Don't know	P1
99	Refused	P1
	PAYBACK BATTERY	
	If INCENT <> 100 AND NTG_TYPE >= 2, THEN ASK; ELSE SKIP TO N41	
P1	What financial calculations does your company typically make before proceeding with the installation of energy efficient equipment like you installed through the program?	
1	Payback	P2A
2	Return on investment	P2B
77	Record VERBATIM	P3
88	Don't know	P3
99	Refused	P3
	If P1 = 1 THEN ASK; ELSE SKIP TO P2B	
P2A	What is your threshold in terms of the payback or return on investment your company uses before deciding to proceed with installing energy efficient equipment like you installed through the program? Is it…	
1	0 to 6 months	P3
2	6 months to 1 year	P3
3	1 to 2 years	P3
4	2 to 3 years	P3
5	3 to 5 years	P3
6	Over 5 years	P3
88	Don't know	P3
99	Refused	P3
	IF P1 = 2 THEN ASK	
P2B	What is your ROI?	
1	Record ROI____;	P3
P3	Did the rebate move your energy efficient equipment project within this acceptable range?	
1	Yes	P4
2	No	P3a

88	Don't know	P3a
99	Refused	P3a
	If P3 = 1 THEN ASK; ELSE SKIP TO P3A	
P4	On a scale of 0 to 10, with a zero meaning NOT AT ALL IMPORTANT and 10 meaning Very Important, how important in your decision was it that the project was in the acceptable range?	
#	Record 0 to 10 score (________)	P3a
88	Refused	P3a
99	Don't know	P3a
	CONSISTENCY CHECKS ON N3b and P3	
	IF P3 = 1, AND N3b < 5, THEN ASK	
P3a	The rebate seemed to make the difference between meeting your financial criteria and not meeting them, but you are saying that the rebate didn't have much effect on your decision, why is that?	
77	Record VERBATIM	P3e
88	Don't know	P3e
99	Refused	P3e
	IF P3 = 2, AND N3b > 5, THEN ASK	
P3e	The rebate didn't cause the installation of energy efficient equipment to meet your company's financial criteria, but you said that the rebate had an impact on the decision to install this energy efficient equipment. Why did it have an impact?	
77	Record VERBATIM	N41
88	Don't know	N41
99	Refused	N41
	ASK ALL.	
DISPLAY	Next, with regard to your decision to implement this energy efficient MEASURE instead of either less energy efficient or standard efficiency equipment, I would like you to rate the importance of the PROGRAM as opposed to other Non-program factors that may have influenced your decision such as...(SCAN BELOW AND READ TO THEM THOSE FACTORS WITH RATINGS OF 8 OR HIGHER THAT INFLUENCED THEIR DECISION)	
	(READ ITEMS WHERE THEY GAVE A RATING OF 8 or higher)	
	Program-related factors	
	<%N3B> Availability of the PROGRAM rebate	...@[%N3B>@
	<%N3G> Information from the Program, Utility, or Program Administrator training course?	...@[%N3G>@

	<%N3H> Information from the Program, Utility, or Program Administrator Marketing materials?	...@[%N3H>@
	<%N3L> Endorsement or recommendation by your account rep?	...@[%N3L>@
	Non-Program factors	
	<%N3A>The age or condition of the old equipment	...@[%N3A>@
	<%N3C>Information provided through the Facility or System AUDIT/>	...@[%N3C>@
	<%N3D> Equipment Vendor recommendation	...@[%N3D>@
	<%N3E> Previous experience with this measure	...@[%N3E>@
	<%N3F> Previous experience with this program	...@[%N3F>@
	<%N3J> Standard practice in your business/industry	...@[%N3J>@
	<%N3M> Corporate policy or guidelines	...@[%N3M>@
	<%N3N> Payback on investment.	...@[%N3N>@
	<%N3O> To improve production as a result of lighting,	...@[%N3O>@
	<%N3P> Compliance with state or federal regulations or standards such as Title 24, air quality, OSHA, or FDA regulations	...@[%N3P>@
	<%N3R> Compliance with normal maintenance or retrocommissioning policies or your companies regularly scheduled retrofit or lighting replacement	...@[%N3R>@
	IF N3B<8 and N3G<8 AND N3H<8 and N3I<8, THEN READ:	
	Just now, you provided low to medium scores for the importance of several program-related factors in your decision making.	
	IF N3A<8 and N3C<8 and N3D<8 and N3E<8 AND N3F<8 and N3J<8 and N3J<8 and N3M<8 AND N3N<8 AND N3O<8 and N3P<8 and N3R<8 THEN READ:	
	Just now, you provided low to medium scores for the importance of several non-program related factors in your decision making.	
	IF N3B<8 and N3G<8 AND N3H<8 and N3I<8 and N3A<8 and N3C<8 and N3D<8 and N3E<8 AND N3F<8 and N3J<8 and N3J<8 and N3M<8 AND N3N<8 AND N3O<8 and N3P<8 and N3R<8, THEN READ:	
	Just now, you provided low to medium scores for the importance of all of the program and non-program related factors in your decision making.	

DISPLAY	If you were given 10 points to award in total, how many points would you give to the importance of the program and how many points would you give to these other non-program factors?	
N41	How many of the ten points would you give to the importance of the PROGRAM in your decision?	
#	Record 0 to 10 score (_______)	N42
88	Refused	N42
99	Don't know	N42
N42	and how many points would you give to all of these other non-program factors?	
#	Record 0 to 10 score (_______)	N41P
88	Refused	N41P
99	Don't know	N41P
	If N41 NOT EQUAL TO 88 OR 99 and N42 NOT EQUAL TO 88 OR 99 , compute N41 + N42. IF N41+N42 DOES NOT EQUAL 10, display:	
	__We want these two sets of numbers to equal 10.	
	<%N41> for Program influence and	
	<%N42> for Non Program factors	
DISPLAY	Next, I would like for you to consider the importance of the PROGRAM in your decision to install your equipment ***at the time you did*** rather than waiting to install new equipment sometime in the future, regardless of the actual efficiency of the equipment you selected. Please rate the importance of the program on this timing decision as opposed to other non-program factors that may have influenced your decision.	
	If Needed - else skip…	
	If you were given 10 points to award in total, how many points would you give to the importance of the program and how many points would you give to these other non-program factors in your decision to install your equipment **at the time you did** rather than waiting to install new equipment sometime in the future.	
N41P	How many of the ten points would you give to the importance of the PROGRAM in your decision TO INSTALL YOUR EQUIPMENT AT THE TIME YOU DID?	
#	Record 0 to 10 score (_______)	N42P
88	Refused	N42P

99	Don't know	N42P
N42P	and how many points would you give to all of these other non-program factors?	
#	Record 0 to 10 score (_______)	REPLACE
88	Refused	REPLACE
99	Don't know	REPLACE
	If N41 NOT EQUAL TO 88 OR 99 and N42 NOT EQUAL TO 88 OR 99 , compute N41 + N42. IF N41+N42 DOES NOT EQUAL 10, display:	
	__We want these two sets of numbers to equal 10.	
	<%N41P> for Program influence and	
	<%N42P> for Non Program factors	
	ASK ALL.	
REPLACE	Was the installation of this measure....<%NTGMEASURE> ...a replacement of existing equipment or was it additional equipment you installed in your facility?	
1	Replace/Modification/Retrofit	DISPLAY
2	Add-on	DISPLAY
88	Refused	N6
99	Don't know	N6
DISPLAY	Now I would like you to think about the action you would have taken with regard to the installation of this equipment if the program had not been available.	
	IF REPLACE =1 THEN ASK; ELSE SKIP TO N5aa	
N5	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 energy efficient equipment that you did for this project regardless of when you would have installed it?	
#	Record 0 to 10 score (_______)	N5a
88	Refused	N5B
99	Don't know	N5B
	IF REPLACE =2 THEN ASK; ELSE SKIP TO N6	

N5aa	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 energy efficient equipment at the same time as you did?	
#	Record 0 to 10 score (_______)	N6
88	Don't know	N6
99	Refused	N6
	CONSISTENCY CHECKS	
	IF N3b > 7 and N5 > 7, THEN ASK	
N5a	When you answered ...<%N3B> ... for the question about the influence of the rebate, I would interpret that to mean that the rebate was quite important to your decision to install. Then, when you answered ..<%N5>... for how likely you would be to install the same equipment **without** the rebate, it sounds like the rebate was not very important in your installation decision. I want to check to see if I am misunderstanding your answers or if the questions may have been unclear. Will you explain in your own words, the role the rebate played in your decision to install this efficient equipment?	
77	Record VERBATIM	NN5aa
88	Don't know	NN5aa
99	Refused	NN5aa
NN5aa	Would you like for me to change your score on the importance of the rebate that you gave a rating of <%N3B> and/or change your rating on the likelihood you would install the same equipment without the rebate which you gave a rating of <%N5> and/or we can change both if you wish?	
1	No change	N5b
77	Record how they would rate rebate influence and how they would rate likelihood to install without the rebate	N5b
88	Don't know	N5b
99	Refused	N5b
	ASK IF REPLACE=1	
N5b	Using the same scale as before, if the program had not been available, what is the likelihood that you would have done this project at the same time as you did?	
#	Record 0 to 10 score (_______)	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY

	If N5b < 9 THEN ASK; ELSE SKIP TO N6	
N5bb	Why do you say that?	
77	Record VERBATIM	N6
88	Don't know	N6
99	Refused	N6
	ADDITIONAL BASELINE INPUT	
N6	Now I would like you to think one last time about what action you would have taken if the program had not been available. Which of the following alternatives would you have been MOST likely to do?	
1	Install/Delamped fewer units	N6aa
2	Install standard efficiency equipment or whatever required by code	N6aa
3	Installed equipment more efficient than code but less efficient than what you installed through the program	N6aa
4	Done nothing (keep existing equipment as is)	N6ba
5	Done the same thing I would have done as I did through the program	N6aa
6	Repair/rewind or overhaul the existing equipment	N7
77	Something else (specify what _____________)	N6ca
88	Don't know	N6ca
99	Refused	N6ca
	If N6 = 1,2,3,5 ASK, ELSE N6ba	
N6aa	Would you have [FILL IN RESPONSE TO N6 for N6 = 1,2, 3, 5] at the same time as you did under the program, within a year, or at a later time?	
1	Same time	N7
2	Within one year	N7
3	At a later time	N6ab
88	Don't know	N7
99	Refused	N7
N6ab	How many years later would it have been?	
77	Record VERBATIM	N7
88	Don't know	N6ac
99	Refused	N7
N6ac	Would it have been….	
1	Less than one year	N7
2	About a year	N7
3	A couple of years	N7

4	A few years	N7
5	More than four years	N7
88	Don't know	N7
99	Refused	N7
	If N6 = 4 THEN ASK, ELSE N6ca	
N6ba	How long would you have waited to replace your equipment?	
1	Less than one year	N7
2	About a year	N7
3	A couple of years	N7
4	A few years	N7
5	More than four years	N7
88	Don't know	N7
99	Refused	N7
	IF N6=77, 88, 99 THEN ASK, ELSE N7	
N6ca	Would you still have replaced your equipment at the same time as you did under the program, within a year, or at a later time?	
1	Same time	N7
2	Within one year	N7
3	At a later time	N6cb
88	Don't know	N7
99	Refused	N7
N6cb	How many years later would it have been?	
77	Record VERBATIM	N6
88	Don't know	N6cc
99	Refused	N6
N6cc	Would it have been….	
1	Less than one year	N7
2	About a year	N7
3	A couple of years	N7
4	A few years	N7
5	More than four years	N7
88	Don't know	N7
99	Refused	N7

CONSISTENCY CHECK		
	Ask if N6 = (1, 2, 3, 4) and ((N5 > 8 and N5b > 8) OR N5aa > 8)	
N7	In an earlier response, you said that if the program had not been available, there was a very high likelihood that you would have installed exactly the same equipment as you did through the program. However, just now you have indicated that you would not have installed the same equipment as you did without the benefit of the program. Can you explain to me why there is this difference?	
77	Record VERBATIM	N6a
88	Don't know	N6a
99	Refused	N6a
	Ask if N6(1);	
N6a	How many fewer units would you have installed/Delamped? (It is okay to take an answer such as ...HALF...or 10 percent fewer ... etc.)	
77	RECORD VERBATIM	ER2
88	Refused	ER2
99	Refused	ER2
	Ask if N6(3);	
N6b	Can you tell me what model or efficiency level you were considering as an alternative? (It is okay to take an answer such as … 10 percent more efficient than code or 10 percent less efficient than the program equipment)	
77	RECORD VERBATIM	ER2
88	Don't know	ER2
99	Refused	ER2
	Ask if N6(6);	
N6c	How long do you think the repaired equipment would have lasted before requiring replacement?	
77	RECORD VERBATIM	ER2
88	Don't know	ER2
99	Refused	ER2
	EARLY REPLACEMENT BATTERY	
	[IF N5b < 8 and A3 = 1, 4, 8, or 10 THEN ASK. ELSE SKIP TO PP1]	
DISPLAY	Earlier, when I asked you a question about why you decided to implement the project using high efficiency equipment, you gave	ER2

	reasons related to <A3> Now I would like to ask you some follow up questions regarding these responses you gave me.	
	IF REPLACE = 1 AND N6c IS UNRECORDED;	
ER2	How many more years do you think your equipment would have gone before failing and required replacement?	
77	___ Estimated Remaining Useful Life (in years)	ER6
88	Don't know	ER6
99	Refused	ER6
	IF AA3 = 4, THEN ASK	
ER6	How much downtime did you experience in the past year?	
77	______Downtime Estimate (in weeks)	ER9
88	Don't know	ER9
99	Refused	ER9
ER9	In your opinion, based on the economics of operating this equipment, for how many more years could you have kept this equipment functioning?	
Yrs	___ Estimated Remaining Useful Life	ER11
88	Don't know	ER11
99	Refused	ER11
	IF AA3 = 8, THEN ASK	
ER15	Can you briefly describe the specific code/regulatory requirements that this project addressed?	
77	RECORD VERBATIM	ER19
88	Don't know	ER19
99	Refused	ER19
	IF AA3 = 10, THEN ASK	
ER19	Can you briefly describe the specific company policies regarding regular/normal maintenance/replacement policy(ies) that were relevant to this project? Or briefly describe the specific company policies regarding regular equipment retrofits and remodeling?	
77	RECORD VERBATIM	PP1
88	Don't know	PP1
99	Refused	PP1
	PROCESS QUESTIONS - ASK ALL	
PP1	What do you believe the PROGRAM'S primary strengths are?	
77	Record VERBATIM	PP2

88	Don't know	PP2
99	Refused	PP2
PP2	What concerns do you have about the PROGRAM, if any? (IF NEEDED: What do you view as the primary features that need to be improved?)	
77	Record VERBATIM	PP4
88	Don't know	PP4
99	Refused	PP4
PP4	On a scale of 0 - 10, where 0 is completely dissatisfied and 10 is completely satisfied, how would you rate your OVERALL satisfaction with the <%PROGRAM>?	
#	Record 0 to 10 score (________)	PP5
88	Refused	PP5
99	Don't know	PP5
	IF PP4 < 4 THEN ASK; ELSE SKIP TO LT2	
PP5	Why do you say that?	
77	Record VERBATIM	LT2
88	Don't know	LT2
99	Refused	LT2
	LONG TERM INFLUENCE	
	If NTG_TYPE >= 2	
	IF N3f > 4, THEN ASK, ELSE OPERATING HOURS SECTION	
DISPLAY	Now I'd like you to think about your organization's experiences with %UTILITY's energy efficiency programs and efforts over the longer term, for example, over the past 5, 10, or even 20 years. In an earlier question, you indicated that your previous experience with utility energy efficiency programs was a factor that influenced your decision to implement this PROJECT. I would like to ask you a few questions about this experience.	LT2
LT2	For how many years have you been participating in %UTILITY's energy efficiency programs?	
# yrs	Record Number of Years	LT3
88	Refused	LT3
99	Don't know	LT3
LT3	During this time, how many times has your organization participated in these PROGRAM(s)?	

1	7 to 10 times, or more	CA6
2	4 to 7 times	CA6
3	2 to 4 times	CA6
4	less than 2 times	CA6
88	Refused	LT6
99	Don't know	LT6
	IF LT3 = 1, 2, 3 or 4, THEN ASK. ELSE LT8	
CA6	What type of equipment did you install through this (these) program(s)? [READ RESPONSE CATEGORIES]	
1	Indoor lighting	LT6
2	Cooling equipment	LT6
3	Natural gas equipment, such as water heater, furnace or appliances	LT6
4	Insulation or windows	LT6
5	Refrigeration	LT6
6	Industrial process equipment	LT6
7	Greenhouse heat curtains	LT6
8	Food service equipment	LT6
77	OPEN \SOMETHING OTHER (specify)	LT6
88	Refused	LT6
99	Don't Know	LT6
LT6	What factors led you to participate in these program(s)?	
77	Record VERBATIM	LT7
88	Refused	LT7
99	Don't know	LT7
LT7	And exactly how did that experience help to convince you to install this energy efficient equipment?	
77	Record VERBATIM	LT8
88	Refused	LT8
99	Don't know	LT8
	IF LT3 = 1 or 2, THEN ASK. ELSE GO TO OPERATING HOURS SECTION	
LT8	Have these programs had any long-term influence on your organization's energy efficiency related practices and policies that go beyond the immediate effect of incentives on individual projects? [DO NOT READ: Examples are causing them to add energy efficiency procurement policies, internal incentive or reward structures for improving energy efficiency, or adoption of energy management best practices.]	

1	Yes	OPERATING HOURS SECTION
2	No	OPERATING HOURS SECTION
88	Refused	OPERATING HOURS SECTION
99	Don't know	OPERATING HOURS SECTION

	OPERATING HOURS	
DISPLAY	We are almost finished. The next few questions are to help us get a full understanding of your organization's operational hours.	
ALWAYS	Is your organization operation 24 hours a day, 7 days a week?	
1	Yes	HOLIDAYS
2	No	HOLIDAYS
88	Refused	HOLIDAYS
HOLIDAYS	Dose your facility closed for any holidays during the year? If so, which one(s)?	
1	New Year's Day - January 1	DAYS
2	Martin Luther King Jr. Day - January 18, 2010 (3rd Monday in January)	DAYS
3	President's Day - February 15, 2010 (3rd Monday in February)	DAYS
4	Memorial Day - May 31, 2010 (Last Monday in May)	DAYS
5	Independence Day - July 4th (Or Surrounding Monday/Friday if July 4 is a weekend)	DAYS
6	Labor Day - September 6, 2010 (First Monday in September)	DAYS
7	Thanksgiving - November 26, 2010 (4th Thursday in November)	DAYS
8	Day after Thanksgiving	DAYS
9	Christmas Eve - December 24	DAYS
10	Christmas Day - December 25	DAYS
66	NO HOLIDAY CLOSURES	DAYS

77	Other - Specify	DAYS
88	Refused	DAYS
99	Don't Know	DAYS
	Ask if ALWAYS = 2; else skip to OS_REC;	
DAYS	Is your facility closed any of the 7 days of the week? If so, which days are you CLOSED?	
1	Monday	MONDAY_OPEN
2	Tuesday	MONDAY_OPEN
3	Wednesday	MONDAY_OPEN
4	Thursday	MONDAY_OPEN
5	Friday	MONDAY_OPEN
6	Saturday	MONDAY_OPEN
7	Sunday	MONDAY_OPEN
66	Open EVERYDAY	MONDAY_OPEN
88	REFUSED	MONDAY_OPEN
99	DON'T KNOW	MONDAY_OPEN
	Ask if ALWAYS(2)&^DAYS(1); else skip to TUESDAY_OPEN;	
MONDAY_OPEN	What time do you open your facility on MONDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	MONDAY_CLOSE
88	REFUSED	MONDAY_CLOSE
99	DON'T KNOW	MONDAY_CLOSE
	IF MONDAY_OPEN(1||64)	
MONDAY_CLOSE	What time do you close your facility on MONDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	TUESDAY_OPEN
88	REFUSED	TUESDAY_OPEN
99	DON'T KNOW	TUESDAY_OPEN
	Ask if ALWAYS(2)&^DAYS(2); else skip to WEDNESDAY_OPEN;	
TUESDAY_OPEN	What time do you open your facility on TUESDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	TUESDAY_CLOSE
88	REFUSED	TUESDAY_CLOSE
99	DON'T KNOW	TUESDAY_CLOSE
	IF TUESDAY_OPEN(1||65)	
TUESDAY_CLOSE	What time do you close your facility on TUESDAY?	
	Record Time 1AM - 12:30 AM in 12 hour	WEDNESDAY_OPEN

	format by half hour as 1-24	
88	REFUSED	WEDNESDAY_OPEN
99	DON'T KNOW	WEDNESDAY_OPEN
	Ask if ALWAYS(2)&^DAYS(3); else skip to THURSDAY_OPEN;	
WEDNESDAY_OPEN	What time do you open your facility on WEDNESDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	WEDNESDAY_CLOSE
88	REFUSED	WEDNESDAY_CLOSE
99	DON'T KNOW	WEDNESDAY_CLOSE
	IF WEDNESDAY_OPEN(1||65)	
WEDNESDAY_CLOSE	What time do you close your facility on WEDNESDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	THURSDAY_OPEN
88	REFUSED	THURSDAY_OPEN
99	DON'T KNOW	THURSDAY_OPEN
	Ask if ALWAYS(2)&^DAYS(4); else skip to FRIDAY_OPEN;	
THURSDAY_OPEN	What time do you open your facility on THURSDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	THURSDAY_CLOSE
88	REFUSED	THURSDAY_CLOSE
99	DON'T KNOW	THURSDAY_CLOSE
	IF THURSDAY_OPEN(1||65)	
THURSDAY_CLOSE	What time do you close your facility on THURSDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	FRIDAY_OPEN
88	REFUSED	FRIDAY_OPEN
99	DON'T KNOW	FRIDAY_OPEN
	Ask if ALWAYS(2)&^DAYS(5); else skip to SATURDAY_OPEN;	
FRIDAY_OPEN	What time do you open your facility on FRIDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	FRIDAY_CLOSE
88	REFUSED	FRIDAY_CLOSE
99	DON'T KNOW	FRIDAY_CLOSE
	IF FRIDAY_OPEN(1||65)	
FRIDAY_CLOSE	What time do you close your facility on	

	FRIDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	SATURDAY_OPEN
88	REFUSED	SATURDAY_OPEN
99	DON'T KNOW	SATURDAY_OPEN
	Ask if ALWAYS(2)&^DAYS(6); else skip to SUNDAY_OPEN;	
SATURDAY_OPEN	What time do you open your facility on SATURDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	SATURDAY_CLOSE
88	REFUSED	SATURDAY_CLOSE
99	DON'T KNOW	SATURDAY_CLOSE
	IF SATURDAY_OPEN(1||65)	
SATURDAY_CLOSE	What time do you close your facility on SATURDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	SUNDAY_OPEN
88	REFUSED	SUNDAY_OPEN
99	DON'T KNOW	SUNDAY_OPEN
	Ask if ALWAYS(2)&^DAYS(7); else skip to DIFF_SCHEDULE;	
SUNDAY_OPEN	What time do you open your facility on SUNDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	SUNDAY_CLOSE
88	REFUSED	SUNDAY_CLOSE
99	DON'T KNOW	SUNDAY_CLOSE
	IF SUNDAY_OPEN(1||65)	
SUNDAY_CLOSE	What time do you close your facility on SUNDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	DIFF_SCHEDULE
88	REFUSED	DIFF_SCHEDULE
99	DON'T KNOW	DIFF_SCHEDULE
DIFF_SCHEDULE	Some organizations have different schedules for certain times of the year. Does your organization maintain a different schedule for certain months of the year?	
1	Yes	MONTHS
2	No	OS_REC
88	REFUSED	OS_REC
99	DON'T KNOW	OS_REC

	Ask if DIFF_SCHEDULE = 1; Else skip to OS_REC;	
MONTHS	Which months of the year does the schedule vary from the times I just recorded?	
1	January	ALT_DAYS
2	February	ALT_DAYS
3	March	ALT_DAYS
4	April	ALT_DAYS
5	May	ALT_DAYS
6	June	ALT_DAYS
7	July	ALT_DAYS
8	August	ALT_DAYS
9	September	ALT_DAYS
10	October	ALT_DAYS
11	November	ALT_DAYS
12	December	ALT_DAYS
88	REFUSED	ALT_DAYS
99	DON'T KNOW	ALT_DAYS
ALT_ALWAYS	Is your organization operation 24 hours a day, 7 days a week?	
1	Yes	HOLIDAYS
2	No	HOLIDAYS
88	Refused	HOLIDAYS
	If ^ALT_ALWAYS(1) then ask; Else skip to OS_REC;	
ALT_DAYS	During this alternate schedule, is your facility closed any of the 7 days of the week? If so, which days are you CLOSED?	
1	Monday	ALT_MONDAY_OPEN
2	Tuesday	ALT_MONDAY_OPEN
3	Wednesday	ALT_MONDAY_OPEN
4	Thursday	ALT_MONDAY_OPEN
5	Friday	ALT_MONDAY_OPEN
6	Saturday	ALT_MONDAY_OPEN
7	Sunday	ALT_MONDAY_OPEN
66	Open EVERYDAY	ALT_MONDAY_OPEN
88	REFUSED	ALT_MONDAY_OPEN
99	DON'T KNOW	ALT_MONDAY_OPEN
	Ask if DIFF_SCHEDULE(1)&^ALT_DAYS(1); else skip to ALT_TUESDAY_OPEN;	
ALT_MONDAY_OPEN	For the alternate schedule, what time do you open your facility on MONDAY?	
	Record Time 1AM - 12:30 AM in 12 hour	ALT_MONDAY_CLOSE

	format by half hour as 1-24	
88	REFUSED	ALT_MONDAY_CLOSE
99	DON'T KNOW	ALT_MONDAY_CLOSE
	IF ALT_MONDAY_OPEN(1||64)	
ALT_MONDAY_CLOSE	What time do you close your facility on MONDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_TUESDAY_OPEN
88	REFUSED	ALT_TUESDAY_OPEN
99	DON'T KNOW	ALT_TUESDAY_OPEN
	Ask if DIFF_SCHEDULE(1)&^ALT_DAYS(2); else skip to ALT_WEDNESDAY_OPEN;	
ALT_TUESDAY_OPEN	What time do you open your facility on TUESDAY during your alternate schedule?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_TUESDAY_CLOSE
88	REFUSED	ALT_TUESDAY_CLOSE
99	DON'T KNOW	ALT_TUESDAY_CLOSE
	IF ALT_TUESDAY_OPEN(1||65)	
ALT_TUESDAY_CLOSE	What time do you close your facility on TUESDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_WEDNESDAY_OPEN
88	REFUSED	ALT_WEDNESDAY_OPEN
99	DON'T KNOW	ALT_WEDNESDAY_OPEN
	Ask if DIFF_SCHEDULE(1)&^ALT_DAYS(3); else skip to ALT_THURSDAY_OPEN;	
ALT_WEDNESDAY_OPEN	What time do you open your facility on WEDNESDAY during your alternate schedule?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_WEDNESDAY_CLOSE
88	REFUSED	ALT_WEDNESDAY_CLOSE
99	DON'T KNOW	ALT_WEDNESDAY_CLOSE
	IF ALT_WEDNESDAY_OPEN(1||65)	
ALT_WEDNESDAY_CLOSE	What time do you close your facility on WEDNESDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_THURSDAY_OPEN
88	REFUSED	ALT_THURSDAY_OPEN
99	DON'T KNOW	ALT_THURSDAY_OPEN
	Ask if DIFF_SCHEDULE(1)&^ALT_DAYS(4); else skip to ALT_FRIDAY_OPEN;	
ALT_THURSDAY_OPEN	What time do you open your facility on	

	THURSDAY during your alternate schedule?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_THURSDAY_CLOSE
88	REFUSED	ALT_THURSDAY_CLOSE
99	DON'T KNOW	ALT_THURSDAY_CLOSE
	ALT_THURSDAY_OPEN(1||65)	
ALT_THURSDAY_CLOSE	What time do you close your facility on THURSDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_FRIDAY_OPEN
88	REFUSED	ALT_FRIDAY_OPEN
99	DON'T KNOW	ALT_FRIDAY_OPEN
	Ask if DIFF_SCHEDULE(1)&^ALT_DAYS(5); else skip to ALT_SATURDAY_OPEN;	
ALT_FRIDAY_OPEN	What time do you open your facility on FRIDAY during this alternate schedule?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_FRIDAY_CLOSE
88	REFUSED	ALT_FRIDAY_CLOSE
99	DON'T KNOW	ALT_FRIDAY_CLOSE
	IF ALT_FRIDAY_OPEN(1||65)	
ALT_FRIDAY_CLOSE	What time do you close your facility on FRIDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_SATURDAY_OPEN
88	REFUSED	ALT_SATURDAY_OPEN
99	DON'T KNOW	ALT_SATURDAY_OPEN
	Ask if DIFF_SCHEDULE(1)&^ALT_DAYS(6); else skip to ALT_SUNDAY_OPEN;	
ALT_SATURDAY_OPEN	I recorded that during your alternate schedule you are also open on Saturday. What time do you open your facility on SATURDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_SATURDAY_CLOSE
88	REFUSED	ALT_SATURDAY_CLOSE
99	DON'T KNOW	ALT_SATURDAY_CLOSE
	IF ALT_SATURDAY_OPEN(1||65)	
ALT_SATURDAY_CLOSE	What time do you close your facility on SATURDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_SUNDAY_OPEN
88	REFUSED	ALT_SUNDAY_OPEN

99	DON'T KNOW	ALT_SUNDAY_OPEN
	Ask if DIFF_SCHEDULE(1)&^ALT_DAYS(7); else skip to OS_REC;	
ALT_SUNDAY_OPEN	I recorded that during your alternate schedule you are also open on Sunday. What time do you open your facility on SUNDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	ALT_SUNDAY_CLOSE
88	REFUSED	ALT_SUNDAY_CLOSE
99	DON'T KNOW	ALT_SUNDAY_CLOSE
	IF ALT_SUNDAY_OPEN(1||65)	
ALT_SUNDAY_CLOSE	What time do you close your facility on SUNDAY?	
	Record Time 1AM - 12:30 AM in 12 hour format by half hour as 1-24	CLOSING SECTION
88	REFUSED	CLOSING SECTION
99	DON'T KNOW	CLOSING SECTION

	CLOSING	
	Ask if V1(1)	
Vendor_Name	Earlier you stated that you had a vendor/contractor that helped you with the installation of the <%MEASURE> that was installed through the <%UTILITY> 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 B ON-SITE DATA COLLECTION INSTRUMENTS

- Ag Sprinkler On-Site Form
- Pipe Insulation On-Site Form
- Gas Fryer On-Site Form
- Refrigeration On-Site Form
- Process Boiler On-Site Form

AG SPRINKLER ON-SITE FORM

PHONE AND ON-SITE INSTRUMENT

PG&E and the State of California are conducting a research study to assess the energy savings performance of the irrigation conversion like the one that occurred at your farm. My company, ERS, has been contracted to analyze the energy savings associated with irrigation conversion projects in order to improve PG&E's energy efficiency programs. As part of the program assessment, we are reaching out to past participants to collect some information that will be helpful in determining actual energy savings.

1. Introduction:
    - 1.1. According to our records, the project involved the conversion of [X] acres to a micro-nozzle irrigation system. Is this correct?
        - 1.1.1. [If no] Can you estimate the number of acres that underwent the irrigation conversion and were rebated by PG&E?
    - 1.2. Our records also indicate that the farm is located at [ADDRESS], [CITY]. Is this correct?
        - 1.2.1. [If no] Where is the farm located?
    - 1.3. When did the irrigation project occur?
    - 1.4. PG&E classified the project as a [MICRO or DRIP] conversion. Can you elaborate on what was actually installed through this project?
2. Crop Details
    - 2.1. What types of crops are currently grown on this acreage?
        - 2.1.1. [If tree crops] About how old are the trees that are irrigated using the new system?
3. Irrigation Details
    - 3.1. At what month of the year does the crop growing season begin?
    - 3.2. What month of the year does the crop growing season end?
    - 3.3. Does irrigation occur outside the growing season?
        - 3.3.1. [If yes] At what month of the year does irrigation begin?
        - 3.3.2. [If yes] At what month does irrigation end?
    - 3.4. Is the acreage divided into multiple sets for irrigation?
        - 3.4.1. [If yes] How many sets?
    - 3.5. About how many times per month, on average, is each set irrigated over the course of the growing season?
        - 3.5.1. [Alternative] During the hottest/driest month, how many times is each set irrigated?

3.6. For how many hours is each set typically irrigated at a time?

3.7. What is the source of the irrigation water? (e.g. district water main, well, other (please elaborate), unknown)

3.8. How many pumps supply the water for the new irrigation system?

3.9. What is the total pumping horsepower for the new irrigation system?

3.10. How are the irrigation pumps controlled? (e.g. constant speed, two-speed, soft start, VFD, other (please elaborate))

3.11. About what discharge pressure (in psi) do the irrigation pumps currently operate at?

4. Micro System Details

4.1. Can you provide the make and model of the nozzles installed?

4.2. Do you recall the rated gallons-per-minute or gallons-per-hour of the nozzles?

4.2.1. [For tree crops] Can you estimate the number of trees per acre?

4.2.2. [For tree crops] How many nozzles are used per tree?

4.2.3. [Non-tree crops] Can you estimate the number of nozzles per acre?

5. Pre-project details

5.1. Was the farm's acreage divided into similar sets before the project?

5.1.1. [If no] How was the acreage divided before the project?

5.2. Were similar crops grown at the farm before the new irrigation system was installed?

5.2.1. [If no] What crops were grown before the project?

5.3. [If either pre or post is a tree crop] How old were the trees at the time of the project?

5.4. What type of irrigation system was in place before the project? (e.g. flood, furrow, sprinkler, drip)

5.4.1. [If sprinkler] Do you recall the make, model, or nozzle color of the old sprinkler nozzles?

5.4.2. [If flood/furrow] About how many inches deep did you flood the field during each irrigation?

5.5. [If different crop] At what month of the year did the old crop's growing season begin?

5.6. [If different crop] At what month of the year did the old crop's growing season end?

5.7. [If different crop] Did irrigation occur outside of the growing season?

5.7.1. [If yes] In which month did the old crop's irrigation begin?

5.7.2. [If yes] In which month did the old crop's irrigation end?

5.8. About how many times per month, on average, was each set irrigated over the course of the old crop's growing season?

5.8.1. [Alternative] During the hottest/driest month, how many times was each set irrigated?

5.9. For how many hours was each set typically irrigated at a time?

5.10. Did the irrigation water come from a different source before the project?

5.10.1. [If yes] What was the source of the irrigation water?

5.11. Was the irrigation pumping plant any different before the project?

5.11.1. [If yes] How many irrigation pumps supplied the water before the project?

5.11.2. [If yes] What was the total horsepower of the irrigation pumps?

5.11.3. [If yes] How were the irrigation pumps controlled? (e.g. constant speed, two-speed, soft start, VFD, other (please elaborate))

5.11.4. [If yes] Was the old pump powered by a PG&E electric meter?

5.12. About what pressure (in psi) did the irrigation pumps operate at before the project?

6. Program Questions

6.1. Why did you decide to participate in this program (In your own words)?

6.2. Did you decide to install these sprinklers BEFORE or AFTER you became aware of the program?

6.3. Could you please rate the importance of the following factors that might have influenced your decision to install these sprinklers through the program. Using a scale of 0 to 10, where 0 means not at all important and 10 means extremely important.

6.3.1. Age or condition of the old sprinklers

6.3.2. Availability of the incentive

6.3.3. Information provided from an audit of the facility

6.3.4. Recommendation from a vendor

6.3.5. Previous experience with an EE project

6.3.6. Previous experience with a utility program

6.3.7. Program training course

6.3.8. Program marketing materials

6.3.9. Standard practice

6.3.10. Suggestion by your account rep

6.3.11. Payback

6.3.12. Regular maintenance/replacement

6.3.13. Other factors?

6.4. What financial calculations does your organization make before proceeding with a project such as this one? Payback? Return on investment?

6.4.1. What is the required threshold in terms of payback or return on investment?

6.5. Was the rebate critical in moving the project within this range?

6.6. How important was it that payback be within this acceptable range on a scale of 0-10?

6.7. When deciding on this project, how important were program-related factors (e.g. rebate, audit, payback) in comparison to non-program factors (e.g. age/condition of equipment, previous program experience, corporate policy)? Please indicate a percentage of importance for either type of factor (i.e. 60% program-related, 40% non-program related).

6.8. If the program had not been available, what is the likelihood that you would have installed the same equipment as you did?

6.9. If the program had not been available, what is the likelihood that you would have installed the equipment at the same time as you did?

6.10. If the program had not been available what is the probability in percentage likelihood that you would have installed the equipment within one year?

6.11. If the program had not been available what is the probability in percentage likelihood that you would have installed the equipment within three years?

6.12. If the program had not been available what is the probability in percentage likelihood that you would have installed the equipment within five years?

6.13. What would you have done had the program not been available?

PIPE INSULATION ON-SITE FORM

ON-SITE INSTRUMENT

CPUC ESPI Pipe Insulation Prescriptive Measure Study

General Info	
Visit Date & Time	
Field Engineer	
Facility Name	
Address	
Contact	
Phone	

Site Visit Preparation Checklist
□ Identify and check out loggers needed
□ Bring site visit kit, gloves, combustion analyzer, IR gun
□ Confirm site visit date/time/location
□ Ask battery of pre-visit questions with site contact
□ Does facility have additional safety requirements?
□ Will boiler be running for combustion tests?
□ Verify insulated runs of pipe and their accessibility
□ Loggers to be shipped back? Confirm with site contact

Logger Deployment Info

Logger #	Run #	Time In	Time Out	Location	Notes

Boiler Information	
Make/Model	
Fuel Type	
Input (MBH)	
Output (MBH)	
Nameplate efficiency	

Run #1	Fluid	Pipe Size (in)	Insulation Qty (ft)	Insulation Size (in)	Pipe Material*	Insulation Material**	Insulation Quality†	Insulation Age††	% Required by OSHA	
Tracked				N/A	N/A	N/A	N/A	N/A	Pipe/Fluid Temp (F)	
On-Site									Insul. Temp (F)	
Pre-case									Ambient Temp (F)	

Run #2	Fluid	Pipe Size (in)	Qty (ft)	Insulation Size (in)	Pipe Material*	Insulation Material**	Insulation Quality†	Insulation Age††	% Required by OSHA	
Tracked				N/A	N/A	N/A	N/A	N/A	Pipe/Fluid Temp (F)	
On-Site									Insulation Temp (F)	
Pre-case									Ambient Temp (F)	

Run #3	Fluid	Pipe Size (in)	Qty (ft)	Insulation Size (in)	Pipe Material*	Insulation Material**	Insulation Quality†	Insulation Age††	% Required by OSHA	
Tracked				N/A	N/A	N/A	N/A	N/A	Pipe/Fluid Temp (F)	
On-Site									Insulation Temp (F)	
Pre-case									Ambient Temp (F)	

Run #4	Fluid	Pipe Size (in)	Qty (ft)	Insulation Size (in)	Pipe Material*	Insulation Material**	Insulation Quality†	Insulation Age††	% Required by OSHA	
Tracked				N/A	N/A	N/A	N/A	N/A	Pipe/Fluid Temp (F)	
On-Site									Insulation Temp (F)	
Pre-case									Ambient Temp (F)	

Run #5	Fluid	Pipe Size (in)	Qty (ft)	Insulation Size (in)	Pipe Material*	Insulation Material**	Insulation Quality†	Insulation Age††	% Required by OSHA	
Tracked				N/A	N/A	N/A	N/A	N/A	Pipe/Fluid Temp (F)	
On-Site									Insulation Temp (F)	
Pre-case									Ambient Temp (F)	

Run #6	Fluid	Pipe Size (in)	Qty (ft)	Insulation Size (in)	Pipe Material*	Insulation Material**	Insulation Quality†	Insulation Age††	% Required by OSHA	
Tracked				N/A	N/A	N/A	N/A	N/A	Pipe/Fluid Temp (F)	
On-Site									Insulation Temp (F)	
Pre-case									Ambient Temp (F)	

* Examples include cast iron, various grades of steel, copper, etc.
** Examples include fiberglass, cellular glass, polystyrene
† Good / Fair / Poor
†† Use increments of 5 years for estimation

OSHA Standard 1910.261(k)(11): All exposed steam and hot water pipes within 7 feet of the floor or working platform or within 15 inches measured horizontally from stairways, ramps, or fixed ladders shall be covered with an inulating material, or guarded in such a way as to prevent contact.

Operational Information

- What are the facility's typical hours of operation?
- Is the metering period representative of typical operation?
- Does the facility operate on holidays? Indicate holidays with no operation.
- Does facility operation/production vary throughout the year? Please indicate fluctuation by season or by month.
- Is there enough variation in facility operation to affect energy usage?

System Diagram(s) (Identify different pipe runs, loads, parent boilers, logger locations)

Data Collection
- ❑ Inspect bare pipe and insulation properties including length, diameter, thickness, material, etc.
- ❑ Review invoices (if possible) and tracked pipe runs with facility contact before walkthrough
- ❑ Gather information on facility's boiler plant including nameplate data and end uses

Spot Measurements
- ❑ Request permission to meter bare pipe temperature by puncturing small hole in insulation
- ❑ Spot measurements of bare pipe surface, insulation surface and surrounding air temperatures
- ❑ Spot readings of gauge pressures and temperatures
- ❑ Spot measurement of boiler combustion efficiency

Logger Deployment
- ❑ Deploy temperature probe loggers on bare pipe surface, insulation surface and surrounding area
- ❑ Ensure that loggers are deployed near the midpoint of a representative pipe run

Baseline
- ❑ Survey site staff for information on project baseline and preexisting conditions at facility
- ❑ Was insulation installed on preexisting or new pipes? Use backside to elaborate further
- ❑ Note percentage of pipe previously insulated, if applicable
- ❑ Inspect preexisting pipe insulation material, thickness and condition at facility (where available)
- ❑ Examine piping layout to ensure it does not require insulation per OSHA requirements*

Facility Operating Conditions
- ❑ Survey site staff for information on facility's operating schedule and seasonal variation
- ❑ Request production data if system operation varies with production

Checkout
- ❑ Summarize what loggers were deployed and their locations
- ❑ Ensure that facility staff agrees that boiler is operating as it was before
- ❑ Provide contact information via business card
- ❑ Arrange logger shipment (via prepaid box) on a given date OR schedule retrieval date

Baseline and spillover questions:

• Was the incented insulation installed on new pipes? Indicate % new pipes in overall project.

• Were the preexisting pipes insulated? Indicate % insulated and its details.

• Are pipes required to be insulated per OSHA (see footnote on other side). For each run, estimate % requiring insulation.

• Discuss any OSHA requirement and how the facility would have complied absent the IOU program.

• Was additional pipe insulation installed that was not incented? Gather details on this insulation and the facility decisions behind its install.

GAS FRYER ON-SITE FORM

Gas Fryer On-site Data Collection Form

Project Information			
IOU			
ApplicationCode or ProjectID			
Program ID			
Program Name			
Point of Sale Purchase?			
IOU Claim ID(s)	Measure 1:		
	Measure 2:		
	Measure 3:		
	Measure 4:		
	Measure 5:		
	Measure 6:		
IOU Measure Description	Measure 1:		
	Measure 2:		
	Measure 3:		
	Measure 4:		
	Measure 5:		
	Measure 6:		
Number of Units Installed	Measure 1:		
	Measure 2:		
	Measure 3:		
	Measure 4:		
	Measure 5:		
	Measure 6:		
Project Application date			
Project Installation Date			Engineer update below as needed [ENTER]:
Business Name			
Business Street Address			
Business City			
Customer Contact Name			
Customer Contact Phone Number			
Customer Contact E-mail Address			
Vendor Business Name			
Vendor Contact Name			
Vendor Contact Phone Number			
Vendor Contact E-mail Address			
Site Information			
Assigned Engineer Name			
Assigned Engineer Firm			
Site Visit Consent Granted Y/N			
Date of First On-Site Visit			
Logger(s) Deployed Y/N			
Date of Second On-Site Visit (if applicable)			

Gas Fryer On-site Data Collection Form

Business Activity

[Circle One Below]	What is the main business ACTIVITY at this facility?	
1	Offices (non-medical)	
2	Restaurant/Food Service	
3	Food Store (grocery/liquor/convenience)	
4	Agricultural (farms, greenhouses)	
5	Retail Stores	
6	Warehouse	
7	Health Care	
8	Education	
9	Lodging (hotel/rooms)	
10	Public Assembly (church, fitness, theatre, library, museum, convention)	
11	Services (hair, nail, massage, spa, gas, repair)	
12	Industrial (food processing plant, manufacturing)	
13	Laundry (Coin Operated, Commercial Laundry Facility, Dry Cleaner)	
14	Condo Assoc./Apartment Mgr (Garden Style, Mobile Home Park, High-rise, Townhouse)	
15	Public Service (fire/police/postal/military)	
77	Other / Record Business Activity [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

Food Service Type

[CIRCLE ONE BELOW]	Which of the following types of restaurants or food service best describes this facility?	
1	Fast Food or Self Service	
2	Specialty/Novelty Food Service	
3	Table Service	
4	Bar/Tavern/Nightclub/Brew Pub or Microbrewery/Other entertainment	
5	Caterer	
6	Cafeteria	
7	Other / Record Food Service [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

Holiday Schedule

[Check All that Apply]	During what holidays is the facility closed?	
	New Year's Eve	
	New Year's Day	
	New Year's Day Celebrated	
	Martin Luther King Day	
	Presidents' Day	
	St. Patrick's Day	
	Easter Sunday	
	Memorial Day	
	Flag Day	
	July 4th	
	July 4th Celebrated	
	Labor Day	
	Columbus Day	
	Veteran's Day	
	Thanksgiving	
	Thanksgiving Friday	
	Christmas Eve	
	Christmas Day	
	Christmas Day Celebrated	
	Other / Record Additional Holiday Closures [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

Provide define any additional closures or periods of limited operations [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Measure Replacement Battery (<u>This data is required/critical for the unit we are monitoring</u>)

Application # ___________________________ <=== Enter Application Code

[Circle One Entry]	[Answer for Measure #1] Did the new gas fryer replace an existing fryer?	[Circle One Entry]	[Answer for Measure #2] Did the new gas fryer replace an existing fryer?	[Circle One Entry]	[Answer for Measure #3] Did the new gas fryer replace an existing fryer?
1	Replaced existing fryer	1	Replaced existing fryer	1	Replaced existing fryer
2	Added the new gas fryer	2	Added the new gas fryer	2	Added the new gas fryer
3	New construction	3	New construction	3	New construction
88	Refused	88	Refused	88	Refused
99	Don't know	99	Don't know	99	Don't know

Provide additional comments as needed [ENTER] ===>

[Ask remaining questions for any gas fryer that replaced an existing unit]

[Circle One Entry]	[Answer for Measure #1] Was the replaced fryer a gas or electric fryer?	[Circle One Entry]	[Answer for Measure #2] Was the replaced fryer a gas or electric fryer?	[Circle One Entry]	[Answer for Measure #3] Was the replaced fryer a gas or electric fryer?
1	Existing gas fryer	1	Existing gas fryer	1	Existing gas fryer
2	Existing electric fryer	2	Existing electric fryer	2	Existing electric fryer
88	Refused	88	Refused	88	Refused
99	Don't know	99	Don't know	99	Don't know

Provide additional comments as needed [ENTER] ===>

(Circle One Entry)	[Answer for Measure #1] Approximately how old was the fryer that was removed and replaced? Would you say...	(Circle One Entry)	[Answer for Measure #2] Approximately how old was the fryer that was removed and replaced? Would you say...	(Circle One Entry)	[Answer for Measure #3] Approximately how old was the fryer that was removed and replaced? Would you say...
1	Less than 5 years old	1	Less than 5 years old	1	Less than 5 years old
2	Between 5 and 10 years old	2	Between 5 and 10 years old	2	Between 5 and 10 years old
3	Between 10 and 15 years old	3	Between 10 and 15 years old	3	Between 10 and 15 years old
4	More than 15 years old	4	More than 15 years old	4	More than 15 years old
5	Stated age _______ years	5	Stated age _______ years	5	Stated age _______ years
88	Refused	88	Refused	88	Refused
99	Don't know	99	Don't know	99	Don't know

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Measure Replacement Battery (Continued part 2)

Application # ___________________________ <=== Enter Application Code

[Answer for Measure #1]		[Answer for Measure #2]		[Answer for Measure #3]	
[Circle One Entry]	How would you describe the removed fryer's condition? Would you say it was in…	**[Circle One Entry]**	How would you describe the removed fryer's condition? Would you say it was in…	**[Circle One Entry]**	How would you describe the removed fryer's condition? Would you say it was in…
1	Poor condition	**1**	Poor condition	**1**	Poor condition
2	Fair condition	**2**	Fair condition	**2**	Fair condition
3	Good condition	**3**	Good condition	**3**	Good condition
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

[Answer for Measure #1]		[Answer for Measure #2]		[Answer for Measure #3]	
[Circle One Entry]	What was the main reason you replaced the existing fryer	**[Circle One Entry]**	What was the main reason you replaced the existing fryer	**[Circle One Entry]**	What was the main reason you replaced the existing fryer
1	Equipment was not functioning adequately	**1**	Equipment was not functioning adequately	**1**	Equipment was not functioning adequately
2	Purchased as part of a general facility renovation	**2**	Purchased as part of a general facility renovation	**2**	Purchased as part of a general facility renovation
3	Wanted improved performance or functionality	**3**	Wanted improved performance or functionality	**3**	Wanted improved performance or functionality
4	Other / Provide Related Commentary Below:	**4**	Other / Provide Related Commentary Below:	**4**	Other / Provide Related Commentary Below:
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Measure Replacement Battery (Continued part 3)

Application # ___________________________ <=== Enter Application Code

[Ask IF answer above is 3 or 4]

[Circle One Entry]	[Answer for Measure #1] At the time of replacement, was the program or rebate important or influential in your decision to replace the existing fryer?	[Circle One Entry]	[Answer for Measure #2] At the time of replacement, was the program or rebate important or influential in your decision to replace the existing fryer?	[Circle One Entry]	[Answer for Measure #3] At the time of replacement, was the program or rebate important or influential in your decision to replace the existing fryer?
1	Yes	**1**	Yes	**1**	Yes
2	No	**2**	No	**2**	No
3	Other / Provide Related Commentary Below:	**3**	Other / Provide Related Commentary Below:	**3**	Other / Provide Related Commentary Below:
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

[Ask IF answer above is 1 or 3]

(Circle One Entry)	[Answer for Measure #1] If not for the program/rebate, approximately how much longer would you have continued to use the replaced fryer? Would you say...	(Circle One Entry)	[Answer for Measure #2] If not for the program/rebate, approximately how much longer would you have continued to use the replaced fryer? Would you say...	(Circle One Entry)	[Answer for Measure #3] If not for the program/rebate, approximately how much longer would you have continued to use the replaced fryer? Would you say...
1	Within a one-year period	**1**	Within a one-year period	**1**	Within a one-year period
2	Between 2 and 3 years	**2**	Between 2 and 3 years	**2**	Between 2 and 3 years
3	4 or more years	**3**	4 or more years	**3**	4 or more years
4	Stated _______ years	**4**	Stated _______ years	**4**	Stated _______ years
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Measure Installation Verification (This data is required/critical for the unit we are monitoring)

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Circle One Entry] Were the gas fryer units found to be installed and operable at the time of the on-site inspection?

1	Yes	
2	No	
3	Other / Provide Related Commentary [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

[If 2/No above, then provide additional comments]

Provide additional comments to explain [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Equipment Specifications (This data is required/critical for the unit we are monitoring)

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[ENTER EQUIPMENT SPECIFICATIONS]

Manufacturer ___________________________
Make ___________________________
Model ___________________________

[Circle One per Line or Write Down Units if Different]

Input Rating ___________________________	Btu/hr kBtu/hr Mbtu/hr
Output Rating ___________________________	Btu/hr kBtu/hr Mbtu/hr
Year of manufacture ___________________________	
Number of relevant program units installed and operable _________________	

Provide additional comments as needed [ENTER] ===>

[ENTER GENERAL EQUIPMENT CHARACTERIZATION]

[Circle One per Line]

Fryer type; counter top or freestanding floor model?	Countertop model Freestanding floor model
Number of vats per fryer unit	1 2 3 4 5 6 Other ___________
Estimated pounds or gallons of oil per vat ___________________________	Pounds Gallons
Width per vat in inches ___________________________	Inches
Depth per vat in inches ___________________________	Inches
Height per vat in inches _________________	Inches

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Fryer Pre-heat (This data is required/critical for the unit we are monitoring)

Measure # ____________________________
Application # ____________________________
IOU Measure Description ____________________________
Number of units installed # ____________________________

[Randomly select 1 unit and 1 vat in a given unit, and record information accordingly]

[Circle One Entry] On average how many times per day is the gas fryer vat pre-heated following a period where it is off?

1	Once	
2	Twice	
3	More than twice / Provide Related Commentary [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

Approximately how long does it normally take to pre-heat the gas fryer vat?

Minutes ____________________________

[ALTERNATIVELY Circle One Entry] Approximately how long does it normally take to pre-heat the gas fryer vat?

1	Less than 15 minutes
2	15 to 30 minutes
3	30 to 45 minutes
3	More than 45 minutes

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Fryer Operational Settings (This data is required/critical for the unit we are monitoring)

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Record information for one randomly selected vat in a gas fryer unit]

[ENTER EQUIPMENT OPERATION DETAILS]	**[Circle One per Line]**		
Minimum temperature during idle operation ___________________________	Deg. F	Deg. C	N/A if same as cooking setting
Minimum temperature range prior to cooking _________________	Deg. F	Deg. C	N/A if same as cooking setting
Cooking temperature setting ___________________________	Deg. F	Deg. C	
How long does it take to reach cooking min from idle temp ___________	Minutes	N/A if cooking temp setting is maintained	

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Fryer Schedule of Operation (This data is required/critical for the unit we are monitoring)

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Record information for one randomly selected vat in a gas fryer unit]

Day vs Night	**[Circle applicable days]**	Below, record hours of operation for the selected gas fryer vat (military)
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Fryer Food Loads (This data is required/critical for the unit we are monitoring)

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Record information for across all vats in a given randomly selected gas fryer unit]

[Below, estimate total pounds fried in THIS fryer (all vats) for circled days; up to 4 distinct variations by day of the week; account for all 8 days of the week]

[Check all that apply]	Identify the foods that are fried in this fryer each day	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
	French fries				
	Chicken tenders				
	Chicken pieces				
	Fish				
	Other seafood				
	Chips				
	Vegetables				
	Egg rolls and other horduevers				
	Donuts				
	Other /[ENTER] ___________________________________				

Provide additional comments as needed [ENTER] ===>

[Check all that apply]	Identify the foods that are fried in this fryer each day	Below, estimate cooking time PER BATCH fried in THIS fryer (in minutes)	Below, estimate pounds PER BATCH fried in THIS fryer	
	French fries			Ask
	Chicken tenders			Ask
	Chicken pieces			Ask
	Fish			Ask
	Other seafood			Ask
	Chips			Ask
	Vegetables			Ask
	Egg rolls and other horduevers			Ask
	Donuts			Ask
	Other /[ENTER] ___________________________________			Ask

Provide additional comments as needed [ENTER] ===>

[Below, estimate total batches fried in THIS fryer (all vats) for circled days; up to 4 distinct variations by day of the week; account for all 8 days of the week]

[Check all that apply]	Identify the foods that are fried in this fryer each day	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
	French fries				
	Chicken tenders				
	Chicken pieces				
	Fish				
	Other seafood				
	Chips				
	Vegetables				
	Egg rolls and other horduevers				
	Donuts				
	Other /[ENTER] ___________________________________				

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

BASELINE Equipment Specifications

Application # ___________________________

[Record information for one randomly selected vat in a gas fryer unit]

[ENTER EQUIPMENT SPECIFICATIONS FOR **NON-PROGRAM** GAS FRYER]

	[Circle One per Line or Write Down Units if Different]
Manufacturer ___________________________	
Make ___________________________	
Model ___________________________	
Input Rating ___________________________	Btu/hr kBtu/hr Mbtu/hr
Output Rating ___________________________	Btu/hr kBtu/hr Mbtu/hr
Year of Manufacture ___________________________	
Estimated number of years in service _________________	

Number of non-program gas fryer units installed and operable ____________

Provide additional comments as needed [ENTER] ===>

[ENTER GENERAL EQUIPMENT CHARACTERIZATION FOR **NON-PROGRAM** GAS FRYER]

	[Circle One per Line]
Fryer type; counter top or freestanding floor model?	Countertop model Freestanding floor model
Number of vats per fryer unit	1 2 3 4 5 6 Other ___________
Estimated pounds or gallons of oil per vat ___________________________	Pounds Gallons
Width per vat in inches ___________________________	Inches
Depth per vat in inches ___________________________	Inches
Height per vat in inches _________________	Inches

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

BASELINE Fryer Pre-heat

[Randomly select 1 unit and 1 vat in a given unit, for a **NON-PROGRAM** GAS FRYER, and record information accordingly]

[Circle One Entry] On average how many times per day is the gas fryer vat pre-heated following a period where it is off?

1	Once	
2	Twice	
3	More than twice / Provide Related Commentary [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

Approximately how long does it normally take to pre-heat the gas fryer vat?

Minutes ___________________________

[ALTERNATIVELY Circle One Entry] Approximately how long does it normally take to pre-heat the gas fryer vat?

1	Less than 15 minutes
2	15 to 30 minutes
3	30 to 45 minutes
3	More than 45 minutes

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

Baseline Fryer Operational Settings

[Record information for one randomly selected vat in a **NON-PROGRAM** GAS FRYER unit]
[ENTER EQUIPMENT OPERATION DETAILS]

	[Circle One per Line]		
Minimum temperature during idle operation ___________________________	Deg. F	Deg. C	N/A if same as cooking setting
Minimum temperature range prior to cooking _________________	Deg. F	Deg. C	N/A if same as cooking setting
Cooking temperature setting ___________________________	Deg. F	Deg. C	
How long does it take to reach cooking min from idle temp ___________	Minutes	N/A if cooking temp setting is maintained	

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

Baseline Fryer Schedule of Operation

[Record information for one randomly selected vat in a **NON-PROGRAM** GAS FRYER unit]

Day vs Night	[Circle applicable days]	Below, record hours of operation for the selected gas fryer vat (military)
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		
AM	M T W T F S S H	
PM		

Provide additional comments as needed [ENTER] ===>	

Gas Fryer On-site Data Collection Form

BASELINE Fryer Food Loads

[Randomly select 1 unit for a **NON-PROGRAM** GAS FRYER, and record information accordingly]

[Below, estimate total pounds fried in THIS fryer (all vats) for circled days; up to 4 distinct variations by day of the week; account for all 8 days of the week]

[Check all that apply]	Identify the foods that are fried in this fryer each day	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
	French fries				
	Chicken tenders				
	Chicken pieces				
	Fish				
	Other seafood				
	Chips				
	Vegetables				
	Egg rolls and other horduevers				
	Donuts				
	Other /[ENTER] ___________________________________				

Provide additional comments as needed [ENTER] ===>

[Check all that apply]	Identify the foods that are fried in this fryer each day	Below, estimate cooking time PER BATCH fried in THIS fryer (in minutes)	Below, estimate pounds PER BATCH fried in THIS fryer	
	French fries			Ask
	Chicken tenders			Ask
	Chicken pieces			Ask
	Fish			Ask
	Other seafood			Ask
	Chips			Ask
	Vegetables			Ask
	Egg rolls and other horduevers			Ask
	Donuts			Ask
	Other /[ENTER] ___________________________________			Ask

Provide additional comments as needed [ENTER] ===>

[Below, estimate total batches fried in THIS fryer (all vats) for circled days; up to 4 distinct variations by day of the week; account for all 8 days of the week]

[Check all that apply]	Identify the foods that are fried in this fryer each day	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
	French fries				
	Chicken tenders				
	Chicken pieces				
	Fish				
	Other seafood				
	Chips				
	Vegetables				
	Egg rolls and other horduevers				
	Donuts				
	Other /[ENTER] ___________________________________				

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Metering (for flue gas temperature -- this data is required/critical for the unit we are monitoring)

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Record information for one randomly selected vat in a gas fryer unit]
[ENTER METERING SPECIFICATIONS AND DATES]

[Circle One per Line]

Manufacturer ___________________________			
Make ___________________________			
Model ___________________________			
Logger ID ___________________________			
Logger instalation date ___________________________			
Logger installation time (military) ___________________________			
Logger removal date _________________			
Logger extraction date completed _________________			
Spot reading flue gas temp _________________	Deg. F	Deg. C	N/A if not taken
Simultaneous reading logger, flue gas temp _________________	Deg. F	Deg. C	N/A if not taken

Provide additional comments as needed and **LOGGER LOCATION** to inform retrieval [ENTER] ===>

Gas Fryer On-site Data Collection Form

EE Metered Vat Fryer Food Loads (This data is required/critical for the unit we are monitoring)

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Check if single vat fryer and SKIP table]	If the unit is a single vat fryer then we don't need redundant information filled in
	Yes, single vat fryer

	[Record information for selected metering vat in a given randomly selected gas fryer unit]	**[Below, estimate total pounds fried in THIS fryer VAT for circled days; up to 4 distinct variations by day of the week; account for all 8 days of the week]**			
[Check all that apply]	Identify the foods that are fried in this fryer each day	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
	French fries				
	Chicken tenders				
	Chicken pieces				
	Fish				
	Other seafood				
	Chips				
	Vegetables				
	Egg rolls and other horduevers				
	Donuts				
	Other /[ENTER] ___________________________________				

Provide additional comments as needed [ENTER] ===>

Gas Fryer On-site Data Collection Form

Baseline Metering (for flue gas temperature)

Application # ___________________________

[Record information for one randomly selected metering vat in a gas fryer unit]

[ENTER METERING SPECIFICATIONS AND DATES FOR **NON-PROGRAM** GAS FRYER]

Manufacturer ___________________________
Make ___________________________
Model ___________________________
Logger ID ___________________________
Logger instalation date ___________________________
Logger installation time (military) ___________________________
Logger removal date _________________
Logger extraction date completed _________________
Spot reading flue gas temp _________________ Deg. F Deg. C N/A if not taken
Simultaneous reading logger, flue gas temp _________________ Deg. F Deg. C N/A if not taken

Provide additional comments as needed and **LOGGER LOCATION** to inform retrieval [ENTER] ===>

Gas Fryer On-site Data Collection Form

Baseline Metered Vat Fryer Food Loads

[Check if single vat fryer and SKIP table]	If the unit is a single vat fryer then we don't need redundant information filled in
	Yes, single vat fryer

[Record information for one randomly selected vat in a gas fryer unit]

[ENTER METERING SPECIFICATIONS AND DATES FOR **NON-PROGRAM** GAS FRYER]

[Below, estimate total pounds fried in THIS fryer VAT for circled days; up to 4 distinct variations by day of the week; account for all 8 days of the week]

[Check all that apply]	Identify the foods that are fried in this fryer each day	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H
	French fries				
	Chicken tenders				
	Chicken pieces				
	Fish				
	Other seafood				
	Chips				
	Vegetables				
	Egg rolls and other horduevers				
	Donuts				
	Other /[ENTER] ___________________________________				

Provide additional comments as needed [ENTER] ===>

REFRIGERATION ON-SITE FORM

Non-Residential Deemed Refrigeration Measure Data Collection On-Site Survey Form

General Site Information (from phone survey & IOU tracking database)

Itron SiteID	«TrackSiteID»

Corporate (Multi-Site) Name	«CONTACT»		
Business Name (Tracking Data)	«Business»		
Actual Business Name	«OS_Business»		
Service Address	«ADDRESS»		
City	«CITY»	Zip Code	«ZipCode»
CORRECTIONS TO SITE INFORMATION			
Revised Corp. (Multi-Site) Name			
Revised Business Name			
Revised Service Address			
Revised City		Revised Zip	

Site Contact Information

PS Completion Date:		Length (min)		Respondent:	«OS_NAME1»	Date of Install:	

	Contacted	Contact Name	Phone Number	Alternate Phone	Email Address
OS Primary	☐	«LOG_NAME1»	«LOG_PHONE»		
OS Back-up	☐				
OS Other	☐				

Note: Use the "Contacted" check box to indicate the actual contact(s) for the site visit.

Scheduling Notes/Special Instructions for On-site Visit: ____________________

____

____

Survey Tracking Information

Survey Company:		Assigned Surveyor's Initials:	
Survey Travel Mileage:	miles	Total Travel Time	hrs
Survey Duration (24 hr clock)	Start:	Survey Duration (24 hr clock)	End:
Total Onsite Time	hrs	Total Time to Fill Out Survey Form	hrs

	Date:	Initials
Field survey completed:	__ __ / __ __ / __ __	__ __ __
Survey received from surveyor:	__ __ / __ __ / __ __	__ __ __
Initial QC check completed:	__ __ / __ __ / __ __	__ __ __
Survey sent back to surveyor (*if needed*):	__ __ / __ __ / __ __	__ __ __
Received from surveyor (*if needed*):	__ __ / __ __ / __ __	__ __ __
Itron QC completed:	__ __ / __ __ / __ __	__ __ __
Data entry (DE) completed:	__ __ / __ __ / __ __	__ __ __
Logger extraction DE complete:	__ __ / __ __ / __ __	__ __ __
Follow-up Logger Extraction DE complete:	__ __ / __ __ / __ __	__ __ __

Site ID # ________________

Nonresidential Deemed Refrigeration Measure Onsite Survey Form Form MEAS_SUM

IOU Tracking Data Measure Summary Sheet

This is a summary of all of the measures implemented at this site as extracted from the IOU tracking database. All of the measures listed here should also be found on the measure-level verification forms.

Measure Category	Meas ID	Measure Code	IOU MeasureName	Unit Basis	Rebated # of Units	Reference Meas Code
«MeasureCategory»	«MeasureID»	«MeasCode»	«MeasureName»	«NormUnit»	«Quantity»	

Lighting Other Description

Measure Code	Revised MeasureName Description	Rebated # of Units

Phone Survey Self-Reported Measure Counts for Calculated kWh Measures

CATI Measure Category-RebatedUnits-UnitBasis	Self Report # of Units

Site & Business Characteristics

Fields in this table will be populated as much as possible with data from the phone survey. However, any fields that are blank should be completed during the on-site verification. Any fields that are incorrect should also be corrected.

Electric Utility	PGE SCE SDGE SMUD LADWP OT ______________________________		
Gas Utility	PGE SCG SDGE AllElec/None Propane LBGO SWG OT __________________________		
Is this premise owner-occupied (**O**) or leased (**L**)?	*CC4*	Revised	O L
How many full-time equivalent employees work at this premise?	*FM070*	Revised	
What is the total occupied floor area of this premise? (exclude prkg garage)	*CC2a / CC2b* ft^2	Revised	__________ft^2
-- If the premise has an enclosed parking garage, what is the floor area?	__________ft^2		
What percent of the total floor area is heated or cooled?	*CC2c / CC2d* %	Revised	__________%
How many buildings are part of this premise?			
What year was the majority of the facility built?	*CC8*	Revised	
Cooling Type: 1=No A/C 2=Split-System 3=PkgRooftop 4=PTAC/PTHP 5=EvapCool 6=Chiller 7=IndivAC/HP 8=WLHP OT=Other		Revised	
Heating Fuel Type: 1=Electric 2=Gas 3=Both 4=Propane 5=None OT=Other		Revised	
What kind of site is this? **P** = Part of a bldg **B** = Single building **SM** = Small multi-building **CM** = Campus (multi-bldg, subsampled bldgs) **OT** = Other __________________________			
For single, stand-alone buildings or partial buildings: Number of stories/floors			

Premise-Level Schedule Definitions

Standard Holidays *(check all that apply)* ☐ N/A

Indicate below which, if any, standard holidays that the business is closed or operation deviates drastically from normal/typical operations, and indicate on Form BUS_HRS what the holiday operation hours are. Indicate any additional holidays in the comment block.

New Year's Eve	☐	July 4th Celebrated	☐
New Year's Day	☐	Labor Day	☐
New Year's Day Celebrated	☐	Columbus Day	☐
Martin Luther King Day	☐	Veterans' Day	☐
Presidents' Day	☐	Thanksgiving	☐
St. Patrick's Day	☐	Thanksgiving Friday	☐
Easter Sunday	☐	Christmas Eve	☐
Memorial Day	☐	Christmas Day	☐
Flag Day	☐	Christmas Day Celebrated	☐
July 4^{th}	☐	Caesar Chavez Day	☐
Other (1) ____________________	☐	Other (2)____________________	☐

Site ID # ___________________

Nonresidential Deemed Refrigeration Measure Onsite Survey Form Form BUS_HRS page __ of __

Business Schedule

Primary Business Hours

Define typical operation for all Day Types listed below and specify hours in military time (00 to 24). For partial (i.e. not full) operation days, also indicate the approximate % of full operation as Partial Op %.

Day Type	From Phone Survey	Corrected Business Hours	Closed All Day?	Open 24 hrs?	PartialOp%
Monday	from ________ to ________	from ________ to________			
Tuesday	from ________ to ________	from ________ to________			
Wednesday	from ________ to ________	from ________ to________			
Thursday	from ________ to ________	from ________ to________			
Friday	from ________ to ________	from ________ to________			
Saturday	from ________ to ________	from ________ to________			
Sunday	from ________ to ________	from ________ to________			
Holidays	from ________ to ________	from ________ to________			

Seasonal Operation Business Hours – Time Period 2 ☐ N/A

Day Type	From Phone Survey	Corrected Business Hours	Closed All Day?	Open 24 hrs?	PartialOp%
Monday	from ________ to ________	from ________ to________			
Tuesday	from ________ to ________	from ________ to________			
Wednesday	from ________ to ________	from ________ to________			
Thursday	from ________ to ________	from ________ to________			
Friday	from ________ to ________	from ________ to________			
Saturday	from ________ to ________	from ________ to________			
Sunday	from ________ to ________	from ________ to________			
Holidays	from ________ to ________	from ________ to________			

Seasonal Operation Business Hours – Time Period 3 ☐ N/A

Day Type	Business Hours	Closed All Day?	Open 24 hrs?	PartialOp%
Monday	from ________ to________	Y N	Y N	
Tuesday	from ________ to________	Y N	Y N	
Wednesday	from ________ to________	Y N	Y N	
Thursday	from ________ to________	Y N	Y N	
Friday	from ________ to________	Y N	Y N	
Saturday	from ________ to________	Y N	Y N	
Sunday	from ________ to________	Y N	Y N	
Holidays	from ________ to________	Y N	Y N	

Site ID # ________________

Nonresidential Deemed Refrigeration Measure Onsite Survey Form Form PREM_SKETCH, page __ of __

Premise/Site-Plan Sketch

This sketch should provide a high-level view of the premise and its surroundings as it is actually configured. Attach site plans and floor plans available from other sources. Sketch all buildings and the closest streets/roadways in both directions. Mark the orientation of True North. Use multiple sheets/drawings if necessary. Also indicate the "front" or primary entrance for each building. A site map or site plans can be used in place of this, as long as streets can be shown.

Premise/Site-Plan sketch comments:

___

___

___

Premise/Site-Plan Sketch

Premise/Site-Plan sketch comments:

Site ID # ________________

Nonresidential Deemed Refrigeration Measure Onsite Survey Form Form HRSCHD, page __ of __

Hourly Operation Schedules –Refrigeration Cases

Use this form if equipment operation is independent of Business Hours as indicated on Form BUS_HRS. Use one block for each end use. Indicate the applicable daytypes for each day type schedule, and account for all day types including holidays. Specify the % of max. occupancy or equipment-on for all time periods, and be sure to accurately capture transition periods. Pay attention to lighting control type as a separate schedule is needed for different control types.

Hour	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12

Schedule #___ End Use:_____ LtgCtrlType:_____ Description_________________

Applicable DayTypes		% Equipment On Temp Setpoint											
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												

Schedule #___ End Use:_____ LtgCtrlType:_____ Description_________________

Applicable DayTypes		% Equipment On Temp Setpoint											
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												

Schedule #___ End Use:_____ LtgCtrlType:_____ Description_________________

Applicable DayTypes		% Equipment On Temp Setpoint											
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												

Site ID # ________________

Nonresidential Deemed Refrigeration Measure Onsite Survey Form
Form HRSCHD, page __ of __

Hour	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12

Schedule #___ End Use:_____ LtgCtrlType:_____ Description_________________

Applicable DayTypes		**%** Equipment On Temp Setpoint											
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												

Schedule #___ End Use:_____ LtgCtrlType:_____ Description_________________

Applicable DayTypes		**%** Equipment On Temp Setpoint											
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												

Schedule #___ End Use:_____ LtgCtrlType:_____ Description_________________

Applicable DayTypes		**%** Equipment On Temp Setpoint											
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												
M T W T F S S H	AM												
	PM												

Logger Installation Form

Use this table to record information for installed measurement devices such as lighting loggers.

Installation Date		**Extraction Date**	
Installer's Initials		**Extraction Initials**	
Scheduled Extraction Date			

Installation

Logger Serial Number					
Primary or Backup Logger?	**P B**	**P B**	**P B**	**P B**	**P B**
Case Temperature	**MT HT**	**MT HT**	**MT HT**	**MT HT**	**MT HT**
Case Control Type					
Spot Measured Humidity					
Spot Measured Temperature					
Placement Description Include building, floor, room #, etc. and be descriptive enough that it can be located for extraction.					
Schedule #					

Extraction

Logger Intact? See Legend Belo	**Y N L** ***P***	**Y N L** ***P***	**Y N L** ***P***	**Y N L** ***P***	**Y N L** ***P***
Logger Tested "OK" (On/Off)	**Y N** NA	**Y N** NA	**Y N** NA	**Y N** NA	**Y N** NA
% "ON" Time	%	%	%	%	%
Extraction Comments					
Logger Date&Time (HH:MM)					
Computer Date&Time (HH:MM)					
Alternate Extraction Date					

Logger Intact: "Y" – If logger is as originally installed, does <u>not</u> appear to be tampered with, and display indicates the logger is working **Logger Tested "OK"** – <u>If Logger Intact was "Y"</u> then <u>is it</u> properly logging the light ON/OFF, "Y" or "N"? <u>If Logger Intact was "N"</u> use "NA"

Logger Installation Form (continued)

Use this table to record information for installed measurement devices such as lighting loggers.

Installation

Logger Serial Number					
Primary or Backup Logger?	**P B**	**P B**	**P B**	**P B**	**P B**
Case Temperature	**MT HT**	**MT HT**	**MT HT**	**MT HT**	**MT HT**
Lighting Control Type					
Spot Measured Humidity					
Spot Measured Temperature					
Placement Description Include building, floor, room #, etc. and be descriptive enough that it can be located for extraction.					
Schedule #					

Extraction

Logger Intact? (L=Lost/missing)	**Y N L** *P*	**Y N L** *P*	**Y N L** *P*	**Y N L** *P*	**Y N L** *P*
Logger Tested "OK" (On/Off)	**Y N** NA	**Y N** NA	**Y N** NA	**Y N** NA	**Y N** NA
% "ON" Time	%	%	%	%	%
Extraction Comments					
Logger Date&Time (HH:MM)					
Computer Date&Time (HH:MM)					
Alternate Extraction Date					

Logger Intact: "Y" – If logger is as originally installed, does <u>not</u> appear to be tampered with, and display indicates the logger is working

Logger Tested "OK" – <u>If Logger Intact is "Y"</u> then is it properly logging the light ON/OFF, "Y" or "N"? <u>If Logger Intact is "N"</u> use "NA"

Installation Form (continued)

Use this table to record information for installed measurement devices such as lighting loggers.

Installation

Logger Serial Number					
Primary or Backup Logger?	**P B**	**P B**	**P B**	**P B**	**P B**
Case Temperature	**MT HT**	**MT HT**	**MT HT**	**MT HT**	**MT HT**
Case Control Type					
Spot Measured Humidity					
Spot Measured Temperature					
Placement Description Include building, floor, room #, etc. and be descriptive enough that it can be located for extraction.					
Schedule #					

Extraction

Logger Intact? (L=Lost/missing)	**Y N L** *P*	**Y N L** *P*	**Y N L** *P*	**Y N L** *P*	**Y N L** *P*
Logger Tested "OK" (On/Off)	**Y N** NA	**Y N** NA	**Y N** NA	**Y N** NA	**Y N** NA
% "ON" Time	%	%	%	%	%
Extraction Comments					
Logger Date&Time (HH:MM)					
Computer Date&Time (HH:MM)					
Alternate Extraction Date					

Logger Intact: "Y" – If logger is as originally installed, does not appear to be tampered with, and display indicates the logger is working

Logger Tested "OK" – If Logger Intact is "Y" then is it properly logging the light ON/OFF, "Y" or "N"? If Logger Intact is "N" use "NA"

LED Case Lighting Measures

IOU Tracking Data	Measure Category	«LEDMeasCat»	
	Measure Code	«LEDMeasCode»	
	Measure Name	«LEDMeasName»	
	Rebated #of Units	«LEDQuant»	
	IOU Unit Basis	*«LEDUnit»*	
	Correct Unit Basis (if incorrect above above)		
	Can Rebated measures be clearly identified?	Y N	
Visual Inspection	Refg LED Type (tube or strip)		
	Glass-door display Dases: # of doors		
	Length of LED/ # of tubes per door		
	Total length of LEDs/ # of LEDS		
	Open Display Cases: # of rows (shelves of lighting)		
	Total length/# of tubes per row		
	Total length/# of tubes per case		
Verification Counts	**(A) Installed & Operational length of LEDs (ex post quantity)**		
	-- Was sub sampling or estimation used?	**Y N**	
	-- # of tubes burned out in partial operation fixtures		
	(B) # of Non-Operable (broken/entire fixture burned-out) Units in place		
	(C) # of Rebated Units in Storage/Spares		
Physical Inspection Data	*Check box if Fixtures are NOT accessible (explain in comments)*	☐	
	Number of units physically inspected		
	Fixture Wattage:		
	Fixture Make/Manufacturer		
	Fixture Model Number		
Baseline System Summary Data (Observed or Self-Reported)	Is post-installation operation the same as pre-retrofit operation?	**Y N**	**B SC E**
	-- If pre-retrofit operation was different, specify Sched #		
	Control type Code		**B SC E**
	Lamp Type Code		**B SC E**
	(If LF Baseline) - Tube Length and Diameter (e.g. 4ft T12)		**B SC E**
	# Lamps/door		**B SC E**
	Lamp Wattage		**B SC E**
	If **NOT** LF Baseline: Fixture Description		**B SC E**
Observed versus Rebated # of Units is: E=Equal M=More L=Less OT (describe)		**E M L OT**	
If Disposition Not Equal: Site Contact/Self-Report Questions	Self-Reported # of units onsite		
	Others purchased since rebated units installed		
	(D) # of units located at Other Affiliated Sites		
Failed (and Replaced) Rebated Units (Indirect/Self-Report)	How long did units typically operate before failure (months)?		
	(E) # of rebated units that Failed, but were replaced w/different tech		
	# of rebated units that Failed but were replaced in-kind (Ref)		
Removed Rebated Units (Indirect/Self-Report)	**(F)** # of rebated units that were Removed and not replaced		
	-- When were the units removed? (month/year if possible)		
	-- Describe why units were removed **in comments**		
(Sum A-F) Total # of units accounted for on-site		**(reqd)**	
Total # of units (A-F) MORE	# that were rebated by other programs/projects?		
	# that were obtained from OTHER means (explain in comments)?		
Total # of units (A-F) LESS	# of rebated units, other site contact explanation (note in comments)		
	# of rebated units, unaccounted for		

LED Fixture - Activity Area Assignment Table (AAAT) Measure Code: _________

*Use the AAAT below to associate lighting units to Refrigerator case types, equipment oper. Schedules, and lighting loggers. The values in the "Represented # of Units" column must add up to the **total # of Installed and Operational** units in the table above.*

- *If ONLY FIXTURE **DENT LL**: Only fill out **AAAT** below.*
- *If **DENT LL & (DENT CT or HOBO)**: Fill out **AAAT** with logger info **&** the **HIGHBAY** Form for Panel Metering*
- *If ONLY **PANEL METERING**: Check **N/A** box and only fill out **HIGHBAY** Form.*

***Circle all that apply:** (If Verify Only, circle 'NA', and fill out AAAT)*

Metering Type:	DENT LL	DENT CT	HOBO	NA

☐ **N/A**

Refrig. #	Sched #	Item #	Control Type Code	Repres. Length/ # of units	% of Total Inst&Op. Units (Ref)	Primary Logger S/N	Ref. Logger	Back-up Logger S/N	Comments
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%		☐		
					%	<= Total # of Installed & Operational Units check *(no data entry)*			

Refrigeration Equipment	Refrigeration Itron #		1		
	Remote Refrigeration or Self Contained		RR SC	RR SC	RR SC
	Case Temperature	**LT** = Low (Ice Cream /Frozen **MT** = Medium (Fresh Meat / **HT** = High (Produce/Prep Areas) **OT** = Other (describe)	LT MT HT OT	LT MT HT OT	LT MT HT OT
	IF SC	Case Make/Manufacturer			
		Case Model Number			
		Number of Cases			
	IF RR	Compressor Type			
		Number of Compressors			
		Compressor Make			
		Compressor Model Number			
		CondenserType			
		Condenser Make/Manufacturer			
		Mocdel Number			

Baseline Characterization

Please describe why these lights were changed to LEDs instead of any other lighting technology	
Approximate age of existing lighting sy stem prior to retrofit (years)	
Condition of original fixtures prior to retrofit (**G**ood, **F**air, **P**oor)	**G F P**
What % of original fixtures were completely burned out?	
What % of original fixtures were partially burned out?	
On a scale of 1-10, Please rate the following topics on their level of influence for retrofitting the lighting fixtures:	
Burned out fixtures	
Adequate lighting levels	
Major Renovation / Re-Modeling	
Safety of Occupants	
Productivity of Occupants	
Other (*describe in comments*)	
Considering all of the influential factors above, in the absence of an energy efficiency rebate program: How long would you have continued to operate the original fixtures before replacing them? (years)	

Comments: ____

____

____

____

Panel Meter - Circuit Spot Measurement Table: (REFERENCE ONLY – NO DATA ENTRY)

Note 1: Fill this table out, then fill out the ***Consolidated Logging Circuit Table*** below.

Circuit Label #	**Case Temp**	**Phase**	**# of Cases Controlled** ***(DD)***	**# Doors per Case** ***(EE)***	**Amps per Door** **(FF)**	**Amps per Frame** **(GG)**	*(DD*EE*FF) +(GG*DD)* **Calc. Circuit Amps** ***(HH)***	**Measured Circuit Amps** ***(II)***	**PF** ***(JJ)***	**Measured Volts** ***(KK)***	**Measured Amps** ***(LL)***	**Measured Parasitic Amps** ***(MM)***	**Comments**

Panel Meter – Consolidated Logging Circuit Table: (REFERENCE ONLY – NO DATA ENTRY)

Note 1: After each circuit measurement is recorded in the table above, fill out the table below; here you can roll up >1 circuit into <u>a single CT channel</u> (if on the same phase).
Note 2: You will copy **<u>ALL</u>** values from the table below into their fields on the ***Panel Meter – Final Spot Measurement and Logging*** form*.*
Note 3: The "**<u>Item #</u>**" below should correlate to the "**<u>Item #</u>**" on the ***Panel Meter – Final Spot Measurement and Logging*** form.
Note 4: Confirm ASH controls are forced on before metering checks

	From table above		*DCT or HOBO*		*(HOBO)*	*From applicalbe fields in table above*					*From applicalbe fields in table above*				
Item # ***(A)***	**<u>Circuit Label #*(s)*</u>** ***(B)***	**Phase** ***(C)***	**Logger Type** ***(X)***	**Logger ID** ***(Y)***	**CT Channel #** ***(Z)***	**Total Cases Controlled** ***(D)***	**# Doors per Case** ***(E)***	**Amps per Door** ***(F)***	**# Amps Not Working** ***(G)***	**Sum Circuit Amps** ***(H)***	**Sum Meas. Amps** ***(I)***	**Avg.** ***PF*** **(J)**	**Avg. Meas. Volts** ***(K)***	**Sum** ***Meas. Amp*** ***(L)***	**Sum Parasitic Amps** ***(M)***

Panel Meter – Final Spot Measurement and Logging – (DATA ENTRY

Breaker Circuit and Point of Control (POC) Assessment							
Panel Meter Item #:	***(A)***						
Associated Measure Code(s)							
IOU Unit Basis							
Panel number/identifier (if applicable)							
Circuit Label Number(s):	***(B)***						
Phase of Circuit(s):	***(C)***	A B C		A B C		A B C	
Fixture Verification and Nominal Watt Calculation							
Circuit(s) tested (On/Off)?		Y N		Y N		Y N	
# of Rebated **Units** on Circuit(s)							
# of Cases controlled by Circuit(s):	***(D)***						
# of Doors per Case:	***(E)***						
Rated Door Amps:	***(F)***						
Rated frame Amps:	***(G)***						
# of Innoperable doors:	***(H)***						
Total Nominal Rebated Circuit(s) Amps: ***((D*E*F)+(G*D))-(F*H)***	***(I)***						
Spot Measurements							
Max Measured Wattage: (with all doors on Circuit ON):	***(J)***		G N		G N		G N
Power Factor: *(if 2 circuits on 1 CT, average the PF)*:	***(K)***						
Measured Circuit(s) Voltage: (to Ground or Neutral):	***(L)***						
Max Measured Amperage: (with all doors 'ON'):	***(M)***						
% Meas. vs. Calc. Watts: ***(K/H*100)***; Is this between 90-110%?		%	Y N	%	Y N	%	Y N
Non-Rebated or Parsitic Loads							
Do Non-Rebated or Parasitic Loads exist on this Circuit?		Y N DK		Y N DK		Y N DK	
Is the parasitic load Constant or Variable?		C V NA		C V NA		C V NA	
Parasitic Wattage: (only if a contant parasitic load):	***(N)***						
Logger Information							
Logger Type: ***(DCT** = DENT CT, **H**=HOBO)*	***(X)***	DCT H		DCT H		DCT H	
Primary Logger S/N:	***(Y)***						
Logger Channel #	***(Z)***						
Reference Logger:		☐		☐		☐	
Reference Channel:		☐		☐		☐	
CT Amp size							
Logger Installation Comments							

Panel Meter – Final Spot Measurement and Logging – (DATA ENTRY)

Breaker Circuit and Point of Control (POC) Assessment				
Panel Meter Item #:	***(A)***			
Associated Measure Code(s)				
IOU Unit Basis				
Panel number/identifier (if applicable)				
Circuit Label Number(s):	***(B)***			
Phase of Circuit(s):	***(C)***	A B C	A B C	A B C
Fixture Verification and Nominal Watt Calculation				
<u>Circuit(s)</u> tested (On/Off)?		Y N	Y N	Y N
# of Rebated **<u>Units</u>** on Circuit(s)		`		
# of <u>Cases</u> controlled by <u>Circuit(s):</u>	***(D)***			
# of <u>Doors per Case</u>:	***(E)***			
Rated Door Wattage:	***(F)***			
Rated frame wattage:	***(G)***			
# of <u>Innoperable doors</u>:	***(H)***			
Total Nominal <u>Rebated</u> Circuit(s) Watts: ***((D*E*F)+(G*D))-(F*G)***	***(H)***			
Spot Measurements				
Max Measured <u>Wattage:</u> (with <u>all</u> doors on Circuit ON):	***(I)***	G N	G N	G N
Power Factor: *(if 2 circuits on 1 CT, average the PF)*:	***(J)***			
Measured Circuit(s) <u>Voltage:</u> (to Ground or Neutral):	***(K)***			
Max Measured <u>Amperage:</u> (with <u>all</u> doors 'ON'):	***(L)***			
% Meas. vs. Calc. Watts: ***(I/H*100)***; Is this between 90-110%?		% Y N	% Y N	% Y N
Non-Rebated or Parsitic Loads				
Do Non-Rebated or Parasitic Loads exist on this Circuit?		Y N DK	Y N DK	Y N DK
Is the parasitic load Constant or Variable?		C V NA	C V NA	C V NA
Parasitic Wattage: (only if a <u>contant</u> parasitic load):	***(M)***			
Logger Information				
Logger Type: *(**DCT** = DENT CT, **H**=HOBO)*	***(X)***	DCT H	DCT H	DCT H
Primary Logger S/N:	***(Y)***			
Logger Channel #	***(Z)***			
Reference Logger:		☐	☐	☐
Reference Channel:		☐	☐	☐
CT Amp size				
Logger Installation Comments				

Anti- Sweat Heater Controls Measures

IOU Tracking Data	Measure	«ASHMeasCat»
	Measure Code	«ASHMeasCode»
	Measure Name	«ASHMeasName»
	Rebated #of Units	«ASHQuant»
	IOU Unit Basis	«ASHUnit»
	Correct Unit Basis (if incorrect above above)	
	Can Rebated measures be clearly identified?	Y N
Visual Verification Data	HVAC Typical Schedule # (cooling | heating)	|
	Indoor Humidity Setpoint	
	# of doors per case	
	Length of case	
	Number of cases	
	Number of ASH controls	
Physical Inspection	Door heater sticker present	**Y N**
	Sticker Amps (per door)	
	Sticker Volts	
	Frame heater sticker present	**Y N**
	Frame Sticker Amps	
	Frame Sticker Volts	
	Controller Make/ Manufacturer	
	Controller Model Number	
	Refrigeration Type	**SC RR**
HVAC Inspection Data	HVAC Make/Manufacturer	
	HVAC Model	
	HVAC Type (*psz, ssz etc.*)	
	Dehumidification strategy (dessicant cooling/dx)	
Verification Counts	**Installed & Operational length of cases (ex post quantity)**	
	-- Was sub sampling or estimation used?	**Y N**

Baseline System Summary Data (Observed or Self-Reported)	Did the doors have existing ASH prior to the retrofit?	**Y N**	**B SC E**
	Were there existing ASH controls?	**Y N**	**B SC E**
	If existing controls, approximately how old were they? (years)		**B SC E**
	Approximate age of existing cases (years)		**B SC E**
Observed versus Rebated # of Units is: **E=Equal M=More L=Less OT (describe)**		**E M L OT**	

Baseline Sources:

- **B** – Baseline equipment (includes physical inspection, documentation, or building/energy management system)
- **SC** – Site Contact
- **E** – Engineering estimate

Total # of units (A-F) MORE than Rebated # of Units	# that were rebated by other programs/projects?	
	# that were obtained from OTHER means (explain in comments)?	
Total # of units (A-F) LESS than Rebated # of Units	# of rebated units, other site contact explanation (note in comments)	
	# of rebated units, unaccounted for	

ASH Controls - Case Assignment Table (CAT) Measure Code: _________

Use the CAT below to associate loggers to Refrigerator case types, equipment oper. Schedules and case temperatures. The values in the "Represented # of Units" column must add up to the ***total # of Installed and Operational*** *units in the table above.*

Refrig. case temp	Item #	Length of Units	% of Total Inst&Op. Units (Ref)	Primary Logger S/N	Ref. Logger	Back-up Logger S/N	Comments
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%		☐		
			%	<= Total # of Installed & Operational Units check *(no data entry)*			

General Comments

Item #	Form Name	Comments

Site ID # ___________________

CPUC 2013-14 Non-Residential Downstream Onsite Verification Survey Form Form PHOTO_LOG, page __ of __

Site Photo Log

Record site photo information here including the PhotoID (i.e. digital file name) and a brief description of the photo where needed. Site Photos should include the site entrance and entire building, rebated measures, and close-up photos of nameplates, lamp codes, and other make/model identification. Refer to the training manual for more on what photos to take. Photo/file naming conventions is SiteID_Item# or SiteID 00# (e.g. PGE_056789_1.jpg, PGE_056789 001.jpg).

Item #	Description/Comments/Measure Code *(no data entry)*
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	

Incentive Payment

My signature acknowledges that I received a participation incentive in the form of a $____ gift card for the survey effort.

Print Name		**Date Received**	
Gift Card Company		**Gift Card Serial #**	
Signature			

PROCESS BOILER ON-SITE FORM

Process Boiler On-Site Data Collection Form

Project Information			
IOU			
ApplicationCode or ProjectID			
Program ID			
Program Name			
Point of Sale Purchase?			
IOU Claim ID(s)	Measure 1:		
	Measure 2:		
	Measure 3:		
	Measure 4:		
	Measure 5:		
	Measure 6:		
IOU Measure Description	Measure 1:		
	Measure 2:		
	Measure 3:		
	Measure 4:		
	Measure 5:		Put units from tracking system below
	Measure 6:		<NormUnit>
Number of Units Installed	Measure 1:		
	Measure 2:		
	Measure 3:		
	Measure 4:		
	Measure 5:		
	Measure 6:		
Project Application date			
Project Installation Date			Engineer update below as needed [ENTER]:
Business Name			
Business Street Address			
Business City			
Customer Contact Name			
Customer Contact Phone Number			
Customer Contact E-mail Address			
Vendor Business Name			
Vendor Contact Name			
Vendor Contact Phone Number			
Vendor Contact E-mail Address			

Site Information	
Assigned Engineer Name	
Assigned Engineer Firm	
Site Visit Consent Granted Y/N	
Date of First On-Site Visit	
Flue Gas Measured Y/N	
Date of Flue Gas Measurement (if applicable)	

Process Boiler On-Site Data Collection Form

Business Activity

[Circle One Below]	What is the main business ACTIVITY at this facility?	
1	Offices (non-medical)	
2	Restaurant/Food Service	
3	Food Store (grocery/liquor/convenience)	
4	Agricultural (farms, greenhouses)	
5	Retail Stores	
6	Warehouse	
7	Health Care	
8	Education	
9	Lodging (hotel/rooms)	
10	Public Assembly (church, fitness, theatre, library, museum, convention)	
11	Services (hair, nail, massage, spa, gas, repair)	
12	Industrial (food processing plant, manufacturing)	
13	Laundry (Coin Operated, Commercial Laundry Facility, Dry Cleaner)	
14	Condo Assoc./Apartment Mgr (Garden Style, Mobile Home Park, High-rise, Townhouse)	
15	Public Service (fire/police/postal/military)	
77	Other / Record Business Activity [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>	
Provide specifics on activity [ENTER] ===>	
(i.e., industrial bakery or commercial greenhouse)	

Process Boiler On-Site Data Collection Form

Holiday Schedule

[Check All that Apply]	During what holidays is the facility closed?	
	New Year's Eve	
	New Year's Day	
	New Year's Day Celebrated	
	Martin Luther King Day	
	Presidents' Day	
	St. Patrick's Day	
	Easter Sunday	
	Memorial Day	
	Flag Day	
	July 4th	
	July 4th Celebrated	
	Labor Day	
	Columbus Day	
	Veteran's Day	
	Thanksgiving	
	Thanksgiving Friday	
	Christmas Eve	
	Christmas Day	
	Christmas Day Celebrated	
	Other / Record Additional Holiday Closures [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

Provide define any additional closures or periods of limited operations [ENTER] ===>

Process Boiler On-Site Data Collection Form

EE Measure Replacement Battery

Application # ___________________________   <=== Enter Application Code

[Circle One Entry]	[Answer for Measure #1] Did the new gas boiler replace an existing boiler?	[Circle One Entry]	[Answer for Measure #2] Did the new gas boiler replace an existing boiler?	[Circle One Entry]	[Answer for Measure #3] Did the new gas boiler replace an existing boiler?
1	Replaced existing boiler	**1**	Replaced existing boiler	**1**	Replaced existing boiler
2	Added the new gas boiler	**2**	Added the new gas boiler	**2**	Added the new gas boiler
3	New construction	**3**	New construction	**3**	New construction
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

[Ask remaining questions for any gas boiler that replaced an existing unit]

[Circle One Entry]	[Answer for Measure #1] Was the replaced boiler a gas or electric boiler?	[Circle One Entry]	[Answer for Measure #2] Was the replaced boiler a gas or electric boiler?	[Circle One Entry]	[Answer for Measure #3] Was the replaced boiler a gas or electric boiler?
1	Existing gas boiler	**1**	Existing gas boiler	**1**	Existing gas boiler
2	Existing electric boiler	**2**	Existing electric boiler	**2**	Existing electric boiler
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

(Circle One Entry)	[Answer for Measure #1] Approximately how old was the boiler that was removed and replaced? Would you say...	(Circle One Entry)	[Answer for Measure #2] Approximately how old was the boiler that was removed and replaced? Would you say...	(Circle One Entry)	[Answer for Measure #3] Approximately how old was the boiler that was removed and replaced? Would you say...
1	Less than 5 years old	**1**	Less than 5 years old	**1**	Less than 5 years old
2	Between 5 and 10 years old	**2**	Between 5 and 10 years old	**2**	Between 5 and 10 years old
3	Between 10 and 15 years old	**3**	Between 10 and 15 years old	**3**	Between 10 and 15 years old
4	More than 15 years old	**4**	More than 15 years old	**4**	More than 15 years old
5	Stated age _______ years	**5**	Stated age _______ years	**5**	Stated age _______ years
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

Process Boiler On-Site Data Collection Form

EE Measure Replacement Battery

Application # ___________________________ <=== Enter Application Code

[Circle One Entry]	[Answer for Measure #1] How would you describe the removed boilers condition? Would you say it was in…	[Circle One Entry]	[Answer for Measure #2] How would you describe the removed boilers condition? Would you say it was in…	[Circle One Entry]	[Answer for Measure #3] How would you describe the removed boilers condition? Would you say it was in…
1	Poor condition	**1**	Poor condition	**1**	Poor condition
2	Fair condition	**2**	Fair condition	**2**	Fair condition
3	Good condition	**3**	Good condition	**3**	Good condition
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

[Circle One Entry]	[Answer for Measure #1] What was the main reason you replaced the existing boiler?	[Circle One Entry]	[Answer for Measure #2] What was the main reason you replaced the existing boiler?	[Circle One Entry]	[Answer for Measure #3] What was the main reason you replaced the existing boiler?
1	Equipment was not functioning adequately	**1**	Equipment was not functioning adequately	**1**	Equipment was not functioning adequately
2	Purchased as part of a general facility renovation	**2**	Purchased as part of a general facility renovation	**2**	Purchased as part of a general facility renovation
3	Wanted improved performance or functionality	**3**	Wanted improved performance or functionality	**3**	Wanted improved performance or functionality
4	Other / Provide Related Commentary Below:	**4**	Other / Provide Related Commentary Below:	**4**	Other / Provide Related Commentary Below:
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

Existing equipt meeting needs
Functionality of existing equipment
Maintenance requirements/records
Performance of boilers/controls

Process Boiler On-Site Data Collection Form

EE Measure Replacement Battery

Application # ____________________________ <=== Enter Application Code

[Ask IF answer above is 3 or 4]

[Answer for Measure #1]		[Answer for Measure #2]		[Answer for Measure #3]	
[Circle One Entry]	At the time of replacement, was the program or rebate important or influential in your decision to replace the existing boiler?	**[Circle One Entry]**	At the time of replacement, was the program or rebate important or influential in your decision to replace the existing boiler?	**[Circle One Entry]**	At the time of replacement, was the program or rebate important or influential in your decision to replace the existing boiler?
1	Yes	**1**	Yes	**1**	Yes
2	No	**2**	No	**2**	No
3	Other / Provide Related Commentary Below:	**3**	Other / Provide Related Commentary Below:	**3**	Other / Provide Related Commentary Below:
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

[Ask IF answer above is 1 or 3]

[Answer for Measure #1]		[Answer for Measure #2]		[Answer for Measure #3]	
(Circle One Entry)	If not for the program/rebate, approximately how much longer would you have continued to use the replaced boiler? Would you say...	**(Circle One Entry)**	If not for the program/rebate, approximately how much longer would you have continued to use the replaced boiler? Would you say...	**(Circle One Entry)**	If not for the program/rebate, approximately how much longer would you have continued to use the replaced boiler? Would you say...
1	Within a one-year period	**1**	Within a one-year period	**1**	Within a one-year period
2	Between 2 and 3 years	**2**	Between 2 and 3 years	**2**	Between 2 and 3 years
3	4 or more years	**3**	4 or more years	**3**	4 or more years
4	Stated _______ years	**4**	Stated _______ years	**4**	Stated _______ years
88	Refused	**88**	Refused	**88**	Refused
99	Don't know	**99**	Don't know	**99**	Don't know

Provide additional comments as needed [ENTER] ===>

Process Boiler On-Site Data Collection Form

EE Measure Installation Verification

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Circle One Entry] Was the gas boiler found to be installed and operable at the time of the on-site inspection?

1	Yes	
2	No	
3	Other / Provide Related Commentary [ENTER] ====>	

Provide additional comments as needed [ENTER] ===>

[If 2/No above, then provide additional comments]

Provide additional comments to explain [ENTER] ===>

Process Boiler On-Site Data Collection Form

EE Boiler Specifications

Measure # ___________________________	
Application # ___________________________	**Circle units from the project info tab below**
IOU Measure Description ___________________________	**<NormUnit>**
Number of units installed # ___________________________	kBtuh Mbtuh

[ENTER EQUIPMENT SPECIFICATIONS]

Manufacturer ___________________________	
Make ___________________________	
Model ___________________________	**[Circle One per Line or Write Down Units if Different]**
Input Rating ___________________________	Btu/hr kBtu/hr Mbtu/hr hp/unit
Output Rating ___________________________	Btu/hr kBtu/hr Mbtu/hr hp/unit
Output Pressure ___________________________	PSIG
Boiler Efficiency ___________________________	%
Efficiency Source	CR AQ FG NP OT
Related parameters ___________________________	% excess air % 02 %CO2
High-efficiency condensing boiler?	Y N
Does boiler use superheat?	Y N
Percent utility gas ___________________________	%
Year of manufacture ___________________________	

Provide additional comments as needed [ENTER] ===>

[ENTER EQUIPMENT LOAD CHARACTERIZATION]

	[Circle One per Line]
Boiler type; water heating or steam?	Water heating Steam
Supply temperature ___________________________	Deg. F
Return temperature ___________________________	Deg. F
Outside air temperature ___________________________	Deg. F
Cumulative runtime ___________________________	Hours of runtime since installation

Provide additional comments as needed [ENTER] ===>

Process Boiler On-Site Data Collection Form

EE Boiler Schedule of Operation

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

[Record information for the boiler measure # entered above]

Day vs Night	[Circle applicable days]	Below, record boiler schedule of operation (military)	Daily boiler runtime in hours	Write-in source for runtime	Daily boiler hot water/steam output in pounds	Write-in source for output
AM	M T W T F S S H					
PM						
AM	M T W T F S S H					
PM						
AM	M T W T F S S H					
PM						
AM	M T W T F S S H					
PM						
AM	M T W T F S S H					
PM						

Provide additional comments as needed [ENTER] ===>

Process Boiler On-Site Data Collection Form

EE Boiler Loads

Measure # ___________________________
Application # ___________________________
IOU Measure Description ___________________________
Number of units installed # ___________________________

	[Record information for the boiler measure # entered above]	[Below, estimate total boiler load for circled days; up to 4 distinct variations by day of the week; account for all 8 days of the week]				[Below, provide relevant units]	[Below, provide relevant size]	[Below, provide additional info]
[Check all that apply]	Identify the daily boiler loads using any of the following possible options	M T W T F S S H	M T W T F S S H	M T W T F S S H	M T W T F S S H	For example, loads, pallets, tons, sqft	For example, 10 cubic ft, 800 pounds	For example, whey, dried, setpoint temp/humidity
	Laundry processed							
	Processed vegetable oil							
	Ice cream produced							
	Cooking ingredients produced							
	Other product produced ______________________							
	Poultry processed							
	Meat processed							
	Nuts processed							
	Other product processed ______________________							
	Packaging produced							
	Figs produced							
	Personal care products produced							
	Cheese produced							
	Greenhouse heated/humidified							
	Building heated							
	Building water heating loads							
	Dishes cleaned							
	Other /[ENTER] ___________________________________							

Provide additional comments as needed [ENTER] ===>

Process Boiler On-Site Data Collection Form

[Explain in detail how the boiler is used to process or produce the products noted in previous page/ above.]

APPENDIX C ESPI MEASURE MAPPING

PA	Measure Group/ ESPI Measure	Measure Description
PGE	Ag Irrigation	Sprinkler to Drip irrigation - Field/Vegs (well and non well)
PGE	Food Service	Insulated Holding Cabinet, Full-Size
PGE	Food Service	Commercial Rack Oven - Gas
PGE	Food Service	Commercial Steam Cooker-Electric
PGE	Food Service	Commercial Steam Cooker-Gas
PGE	Food Service	Commercial Kitchen Demand Ventilation Controls
PGE	Food Service	Commercial Full-Size Convection Oven (Gas)
PGE	Food Service	Commercial Full-Size Convection Oven (Electric)
PGE	Food Service	Commercial Fryer (Gas)
PGE	Food Service	Commercial Fryer (Electric)
PGE	Food Service	Commercial Combination Oven/Steamer < 15 pan capacity (Electric)
PGE	Food Service	Commercial Combination Oven/Steamer < 15 pan capacity (Gas)
PGE	Food Service	Commercial Conveyor Oven - Gas
PGE	Food Service	Commercial Combination Oven/Steamer 15 to 28 pan capacity (Gas)
PGE	Food Service	Commercial Combination Oven/Steamer > 28 pan capacity (Gas)
PGE	Food Service	ENERGY STAR GRIDDLE - GAS Per Len. Ft
PGE	Food Service	ENERGY STAR GRIDDLE - ELECTRIC Per Len. Ft
PGE	Food Service	Insulated Holding Cabinet, Half-Size
PGE	Pipe Insulation Hot Application	Pipe Insulation High-Pressure Steam 15 psig, pipe diameter 1
PGE	Pipe Insulation Hot Application	Pipe Insulation High-Pressure Steam 15 psig , pipe diameter <1
PGE	Pipe Insulation Hot Application	Pipe Insulation Hot Water 120-200 F, pipe diameter 1
PGE	Pipe Insulation Hot Application	Pipe Insulation Low-Pressure Steam <15psig, pipe diameter <1
PGE	Pipe Insulation Hot Application	Pipe Insulation Low-Pressure Steam <15 psig, pipe diameter 1
PGE	Process Boiler	Steam Process Boiler
PGE	Process Boiler	Steam Boiler (> 2500 kBtuh, 80.0 Et, OA Reset from 140 to 165 F)
PGE	Process Boiler	Water Process Boiler
PGE	Refrigeration Case LED Lighting	Lin Ft T3 LED Ltbar > 5ft Unit No Occ Sens Ctrl Replace Mult Lamp Profile
PGE	Refrigeration Case LED Lighting	Lin Ft T3 LED Ltbar <= 5ft Unit No Occ Sens Ctrl Replace Mult Lamp Profile
PGE	Refrigeration Case LED Lighting	Refrig Case Ltg-Tier 2 LED Lightbar <= 5-Foot Unit No Occ Sensor Control

PA	Measure Group/ ESPI Measure	Measure Description
PGE	Refrigeration Case LED Lighting	Refrig Case Ltg-Tier 2 LED Lightbar > 5-Foot Unit No Occ Sensor Control
PGE	Refrigeration Case LED Lighting	Lin Ft T1 LED Ltbar > 5ft Unit No Occ Sens Ctrl Replace Mult Lamp Profile
PGE	Refrigeration Case LED Lighting	Lin Ft T2 LED Ltbar > 5ft Unit No Occ Sens Ctrl Replace Mult Lamp Profile
PGE	Refrigeration Case LED Lighting	Refrig Case Ltg-Tier 1 LED Lightbar > 5-Foot Unit No Occ Sensor Control
PGE	Refrigeration Case LED Lighting	Refrig Case Ltg-Tier 1 LED Lightbar <= 5-Foot Unit No Occ Sensor Control
PGE	Refrigeration Case LED Lighting	Refrig Case Ltg-Tier 3 LED Lightbar > 5-Foot Unit No Occ Sensor Control
PGE	Refrigeration Case LED Lighting	Lin Ft T1 LED Ltbar <= 5ft Unit No Occ Sens Ctrl Replace Mult Lamp Profile
PGE	Refrigeration Case LED Lighting	Lin Ft T2 LED Ltbar <= 5ft Unit No Occ Sens Ctrl Replace Mult Lamp Profile
PGE	Refrigeration Case LED Lighting	Refrig Case Ltg-Tier 3 LED Lightbar <= 5-Foot Unit No Occ Sensor Control
PGE	Refrigeration Case Replacement	Low Temperature High Efficiency Display Case with Special Door
PGE	Refrigeration Case Replacement	New Medium Temperature Display Case with Doors
PGE	Refrigeration Case Replacement	Low temp Narrow Coffin to Reach-in
PGE	Refrigeration Case Replacement	Medium Temperature Open Case, Standard Efficiency to High Efficiency
PGE	Refrigeration Case Replacement	New Low Temperature Display Case with Doors
PGE	Refrigeration Evaporator EC Motors	Walk-in Freezer Evaporator Fan ECM Motor replacing Shaded Pole Motor
PGE	Refrigeration Evaporator EC Motors	Display Case Cooler Evaporator Fan ECM Motor replacing Shaded Pole Motor
PGE	Refrigeration Evaporator EC Motors	Refrig: Evaporator Fan Controller
PGE	Refrigeration Evaporator EC Motors	Walk-in Cooler Evaporator Fan ECM Motor replacing Shaded Pole Motor
PGE	Refrigeration Evaporator EC Motors	Motor: ECM Evaporator Display Case
PGE	Refrigeration Evaporator EC Motors	Display Case Freezer Evaporator Fan ECM Motor replacing Shaded Pole Motor
PGE	Water Heating Boiler	Hot water Boiler (> 2500 kBtuh, 94.0 Et, condensing, OA reset from 140 to 165 F)
PGE	Water Heating Boiler	Hot water Boiler (300-2500 kBTUh, 85.0% thermal efficiency, forced draft)
PGE	Water Heating Boiler	Hot water Boiler (300-2500 kBTUh, 94.0% thermal efficiency, condensing)
PGE	Water Heating Boiler	High efficiency DHW Boiler (>75 MBTU/hr)
PGE	Water Heating Boiler	Large Domestic Hot Water Boiler

PA	Measure Group/ ESPI Measure	Measure Description
PGE	Water Heating Boiler	Large Condensing Domestic Hot Water Boiler
SCE	Food Service	1/2 Size <= 0.2 KW Insulated Holding Cabinet replacing ENERGY STAR Holding Cabinet
SCE	Food Service	Boilerless and Connectionless Steamer
SCE	Food Service	Cooking Efficiency > 80% Electric Fryer
SCE	Food Service	Cooking Efficiency =60% Commercial Electric Combination <15 Pans Oven
SCE	Food Service	Cooking Efficiency =60% Commercial Electric Combination 15 to 28 Pans Oven
SCE	Food Service	Electric Griddle
SCE	Food Service	Full Size <= 0.4 KW Insulated Holding Cabinet replacing ENERGY STAR Holding Cabinet
SCE	Refrigeration Case LED Lighting	(1) 48in Medium Temp Reach-in Display Cases Shelf LED replacing (1) 48in T8 Linear Fluorescent
SCE	Refrigeration Case LED Lighting	(1) 72in Retrofits in Medium Temp Reach-in Display Cases LED replacing (1) 72in T12 Linear Fluorescent
SCE	Refrigeration Case LED Lighting	(1) 72in Retrofits in Medium Temp Reach-in Display Cases LED
SCE	Refrigeration Case LED Lighting	(1) 60in Retrofits in Medium Temp Reach-in Display Cases LED replacing (1) 60in T8 Linear Fluorescent
SCE	Refrigeration Case LED Lighting	(1) 60in Retrofits in Low Temp Reach-in Display Cases LED replacing (1) 60in T8 Linear Fluorescent
SCE	Refrigeration Case LED Lighting	(1) 60in Retrofits in Medium Temp Reach-in Display Cases LED replacing (1) 60in T12 Linear Fluorescent
SCE	Refrigeration Case LED Lighting	(1) 48in Medium Temp Reach-in Display Cases Canopy LED replacing (2) 48in T8 Linear Fluorescent
SCE	Refrigeration Case Replacement	Low Temperature High Efficiency Display Case with Special Door
SCG	Food Service	Commercial Kitchen Exhaust Demand Control Ventilation
SCG	Food Service	EER Commercial Combination Oven-Gas <15 pan capacity
SCG	Food Service	EER Commercial Combination Oven-Gas 15-28 pan capacity
SCG	Food Service	EER Commercial Combination Oven-Gas >28 pan capacity
SCG	Food Service	EER Commercial Fryer-Gas
SCG	Food Service	EER Commercial Rack Oven-Gas
SCG	Food Service	EER Commercial Steamer-Gas
SCG	Food Service	EER Commercial Griddle-Gas per foot
SCG	Food Service	EER Commercial Gas Conveyor Oven Large
SCG	Food Service	EER Commercial Full-Size Convection Oven-Gas
SCG	Food Service	Commercial Griddle-Gas per foot
SCG	Food Service	Commercial Full-Size Convection Oven-Gas
SCG	Food Service	Commercial Fryer-Gas
SCG	Food Service	Commercial Rack Oven-Gas

PA	Measure Group/ ESPI Measure	Measure Description
SCG	Food Service	Commercial Steamer-Gas
SCG	Food Service	Commercial Combination Oven-Gas >28pan capacity
SCG	Food Service	Commercial Combination Oven-Gas 15-28 pan capacity
SCG	Food Service	Commercial Combination Oven-Gas <15 pan capacity
SCG	Pipe Insulation Hot Application	Pipe Insulation - Sm Com <12 hr - Medium Pressure steam >=15 psi < 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Sm Com <12 hr - Low pressure steam <15 psi >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Sm Com <12 hr - Low pressure steam <15 psi < 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Hot Water >= 1"" pipe, Outdoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Hot Water < 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Sm Com <12 hr - Medium pressure steam >=15 psi >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Sm Com <12 hr - Hot Water < 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Hot Water >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Medium pressure steam >=15 psi >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Medium Pressure steam >=15 psi < 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Low pressure steam <15 psi >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Low pressure steam <15 psi < 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Hot Water >= 1"" pipe, Outdoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Sm Com <12 hr - Medium Pressure steam >=15 psi < 1"" pipe, Outdoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Low pressure steam <15 psi >= 1"" pipe, Outdoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Low pressure steam <15 psi >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Hot Water < 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Medium pressure steam >=15 psi >= 1"" pipe, Outdoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Medium pressure steam >=15 psi >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Hot Water >= 1"" pipe, Indoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Medium Pressure steam >=15 psi < 1"" pipe, Outdoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Industrial - Low pressure steam <15 psi < 1"" pipe, Outdoor

PA	Measure Group/ ESPI Measure	Measure Description
SCG	Pipe Insulation Hot Application	Pipe Insulation - Sm Com <12 hr - Hot Water >= 1"" pipe, Outdoor
SCG	Pipe Insulation Hot Application	Pipe Insulation - Lg Com >=12 hr - Hot Water < 1"" pipe, Outdoor
SCG	Process Boiler	ProcessBoiler-Steam-(>=83%CE)
SCG	Process Boiler	ProcessBoiler-Water-Tier1(>=85%CE)
SCG	Refrigeration Case Replacement	Medium Temperature Reach-In Display Case
SCG	Tank Insulation Hot Application	Tank Insulation - High Temperature Applic. (LF) 2 in, Indoor
SCG	Tank Insulation Hot Application	Tank Insulation - High Temperature Applic. (LF) 2 in, Outdoor
SCG	Water Heating Boiler	CommercialBlr-DWH-Large(>200MBtuh)-Tier1(>=84%TE)
SCG	Water Heating Boiler	CommercialBlr-DWH-Large(>200MBtuh)-Tier2(>=90%TE)
SCG	Water Heating Boiler	CommercialBlr-DWH-Small(<=200MBtuh)-Tier1(>=84%EF)
SDGE	Food Service	Food Service - Gas Combination Oven < 15 Pans Oven (Eff>=30)
SDGE	Food Service	Food Service - Gas Combination Oven 15 to 28 Pans Oven (Eff>=30)
SDGE	Food Service	Food Service - Convection Oven-Gas
SDGE	Food Service	Food Service-Commercial Gas Rack Oven- Double, Cooking Efficiency >= 50%
SDGE	Food Service	Food Service-Commercial Gas Large Vat Fryer, Cooking Efficiency >= 50%
SDGE	Food Service	Food Service - Commercial Gas Fryer
SDGE	Food Service	Food Service - Griddle-Gas
SDGE	Food Service	Food Service - Commercial Electric Fryer
SDGE	Refrigeration Case LED Lighting	Lighting - Premium Tier 6 foot Case Door
SDGE	Refrigeration Case LED Lighting	Lighting - Premium Tier 5 foot Case Door

APPENDIX D NET-TO-GROSS SUPPORTING MATERIAL

This appendix includes the following documents:

- Net-to-Gross Algorithm
- The Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers, developed by the Nonresidential Net-to-Gross Working Group in October 2012, which describes the algorithm used to estimate the NTGRs. This method has been used for the 2013-15 ESPI nonresidential impact evaluations.
- The verbatim responses to the three survey questions used to develop PAI-3, as requested by PG&E in their comments to the draft report on 3/21/19.
- The verbatim responses to two questions regarding the life of refrigeration cases, LED101i and LED101j, as requested by PG&E in their comments to the draft report on 3/21/19.

NET-TO-GROSS ALGORITHM

The NTGR algorithm is based on five survey questions, as shown below.

N2	Did your organization make the decision to install this new equipment before or, after, or at the same time as you became aware of that rebates [IF NEEDED: to reduce the cost of the measure] were available through the PROGRAM?
1	Before
2	After
3	Same time

	If you were given 10 points to award in total, how many points would you give to the importance of the program and how many points would you give to these other non-program factors?
N41	How many of the ten points would you give to the importance of the PROGRAM in your decision?
#	Record 0 to 10 score (_______)

REPLACE	Was the installation of this measure....<%NTGMEASURE> ...a replacement of existing equipment or was it additional equipment you installed in your facility?
1	Replace/Modification/Retrofit
2	Add-on

N5	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 energy efficient equipment that you did for this project regardless of when you would have installed it?
#	Record 0 to 10 score (_______)

N5aa	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 energy efficient equipment at the same time as you did?
#	Record 0 to 10 score (_______)

The PAI-2 score utilizes the N2 and N41 questions, and is calculated as:

If N2 = after, then PAI-2 = N41/2

Else PAI-2 = N41

The PAI-3 score utilizes the REPLACE, N5 and N5aaquestions, and is calculated as:

If REPLACE = 1, then PAI-3 = 10 – N5

Else PAI-3 = 10 – N5aa

Finally, the NTGR is calculated as the average of these two scores, divided by 10:

NTGR = ((PAI-2 + PAI-3)/2)/10

Note that is only one PAI score is available, then the NTGR equals that PAI score divided by 10.

Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers

Prepared for the Energy Division, California Public Utilities Commission

By

The Nonresidential Net-To-Gross Ratio Working Group

October 16, 2012

Table of Contents

Acknowledgments

As part of the evaluation of the 2010-12 energy efficiency programs designed and implemented by the four investor-owned utilities (Pacific Gas & Electric Company, Southern California Edison Company, Southern California Gas Company, and San Diego Gas and Electric Company) and third parties, the Energy Division of the California Public Utilities Commission (CPUC) re-formed the nonresidential net-to-gross ratio working group that was originally formed during the PY2006-2008 evaluation. The main purpose of this group was to furtherrefine and improve the standard net-to-gross methodological framework that was developed during the PY2006-2008 evaluation cycle. This framework includes decision rules, for integrating in a systematic and consistent manner the findings from both quantitative and qualitative information in estimating net-to-gross ratios. The working group, listed alphabetically, is composed of the following evaluation professionals:

- Jennifer Fagan, Itron, Inc.
- Nikhil Gandhi, Strategic Energy Technologies, Inc.
- Kay Hardy, Energy Division, CPUC
- Jeff Hirsch, James J. Hirsch & Associates
- Richard Ridge, Ridge & Associates
- Mike Rufo, Itron, Inc.
- Claire Palmgren, KEMA
- Valerie Richardson, KEMA
- Philippus Willems, PWP, Inc.

A public webinar was conducted to obtain feedback from the four investor-owned utilities and other interested stakeholders. The questionnaire was then pre-tested and, based on the pre-test results, finalized in December 2011.

1. Overview of the Large Nonresidential Free Ridership Approach

The methodology described in this section was developed to address the unique needs of Large Nonresidential customer projects developed through energy efficiency programs offered by the four California investor-owned utilities and third-parties. This method relies exclusively on the Self-Report Approach (SRA) to estimate project and program-level Net-to-Gross Ratios (NTGRs), since other available methods and research designs are generally not feasible for large nonresidential customer programs. This methodology provides a standard framework, including decision rules, for integrating findings from both quantitative and qualitative information in the calculation of the net-to-gross ratio in a systematic and consistent manner. This approach is designed to fully comply with the *California Energy Efficiency Evaluation: Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals* (Protocols) and the *Guidelines for Estimating Net-To-Gross Ratios Using the Self-Report Approaches* (Guidelines)**.**

This approach preserves the most important elements of the approaches previously used to estimate the NTGRs in large nonresidential customer programs. However, it also incorporates several enhancements that are designed to improve upon that approach, for example:

- The method incorporates a 0 to 10 scoring system for key questions used to estimate the NTGR, rather than using fixed categories that are assigned weights.

- The method asks respondents to jointly consider and rate the importance of the many likely events or factors that may have influenced their energy efficiency decision making, rather than focusing narrowly on only their rating of the program's importance. This question structure more accurately reflects the complex nature of the real-world decision making and should help to ensure that all non-program influences are reflected in the NTGR assessment in addition to program influences.

It is important to note that the NTGR approach described in this document is a general framework, designed to address all large nonresidential programs. In order to implement this approach on a program-specific basis, it also needs to be customized to reflect the unique nature of the individual programs.

2. Basis for SRA in Social Science Literature

The social sciences literature provides strong support for use of the methods used in the SRA to assess program influence. As the *Guidelines* notes,

> More specifically, the SRA is a mixed method approach that involves asking one or more key participant decision-makers a series of structured and open-ended questions about whether they would have installed the same EE equipment in the

absence of the program as well as questions that attempt to rule out rival explanations for the installation (Weiss, 1972; Scriven, 1976; Shadish, 1991; Wholey et al., 1994; Yin, 1994; Mohr, 1995). In the simplest case (e.g., residential customers), the SRA is based primarily on quantitative data while in more complex cases the SRA is strengthened by the inclusion of additional quantitative and qualitative data which can include, among others, in-depth, open-ended interviews, direct observation, and review of program records. Many evaluators believe that additional qualitative data regarding the economics of the customer's decision and the decision process itself can be very useful in supporting or modifying quantitatively-based results (Britan, 1978; Weiss and Rein, 1972; Patton, 1987; Tashakkori and Teddlie, 1998).[1]

More details regarding the philosophical and methodological underpinnings of this approach are in Ridge, Willems and Fagan (2009), Ridge, Willems, Fagan and Randazzo (2009) and Megdal, Patil, Gregoire, Meissner, and Parlin (2009). In addition to these two articles, Appendix A provides an extensive listing of references in the social sciences literature regarding the methods employed in the SRA.

3. FREE RIDERSHIP ANALYSIS BY PROJECT TYPE

There are three levels of free-ridership analysis. The most detailed level of analysis, the **Standard – Very Large Project** NTGR, is applied to the largest and most complex projects (representing 10 to 20% of the total) with the greatest expected levels of gross savings[2] The **Standard** NTGR, involving a somewhat less detailed level of analysis, is applied to projects with moderately high levels of gross savings. The least detailed analysis, the **Basic** NTGR, is applied to all remaining projects. Evaluators must exercise their own discretion as to what the appropriate thresholds should be for each of these three levels.

4. SOURCES OF INFORMATION ON FREE RIDERSHIP

There are five sources of free-ridership information in this study. Each level of analysis relies on information from one or more of these sources. These sources are described below.

1. **Program Files**. As described in previous sections of this report, programs often maintain a paper file for each paid application. These can contain various pieces of information which are relevant to the analysis of free-ridership, such as letters written by the utility's customer representatives that document what the customer had planned to do in the absence of the rebate and explain the customer's motivation for implementing the efficiency measure. Information on the measure payback with and without the rebate may also be available.

[1] *Guidelines for Estimating Net-To-Gross Ratios Using the Self-Report Approaches*, October 15, 2007, pg. 3.

[2] Note that we do not refer to an Enhanced level of analysis, since this is defined by the Protocols to involve the application of two separate analysis approaches, such as billing analysis or discrete choice modeling.

2. **Decision-Maker Surveys**. When a site is recruited, one must also determine who was involved in the decision-making process which led to the implementation of measures under the program. They are asked to complete a Decision Maker survey. This survey obtains highly structured responses concerning the probability that the customer would have implemented the same measure in the absence of the program. First, participants are asked about the timing of their program awareness relative to their decision to purchase or implement the energy efficiency measure. Next, they are asked to rate the importance of the program versus non-program influences in their decision making. Third, they are asked to rate the significance of various factors and events that may have led to their decision to implement the energy efficiency measure at the time that they did. These include:

    - the age or condition of the equipment,
    - information from a feasibility study or facility audit
    - the availability of an incentive or endorsement through the program
    - a recommendation from an equipment supplier, auditor or consulting engineer
    - their previous experience with the program or measure,
    - information from a program-sponsored training course or marketing materials provided by the program
    - the measure being included as part of a major remodeling project
    - a suggestion from program staff, a program vendor, or a utility representative
    - a standard business practice
    - an internal business procedure or policy
    - stated concerns about global warming or the environment
    - a stated desire to achieve energy independence.

    In addition, the survey obtains a description of what the customer would have done in the absence of the program, beginning with whether the implementation was an early replacement action. If it was not, the decision maker is asked to provide a description of what equipment would have been implemented in the absence of the program, including both the efficiency level and quantities of these alternative measures. This is used to adjust the gross engineering savings estimate for partial free ridership, as discussed in Section 5.2.

    This survey contains a core set of questions for **Basic** NTGR sites, and several supplemental questions for both **Standard and Standard – Very Large** NTGR sites For example, if a Standard or Standard-Very Large respondent indicates that a financial calculation entered highly into their decision, they are asked additional questions about their *financial criteria* for investments and their rationale for the current project in light of them. Similarly, if they respond that a *corporate policy* was a primary consideration in their decision, they are asked a series of questions about the specific policy that led to their adoption of the installed measure. If they indicate the installation was a *standard practice*, there are supplemental questions to understand the origin and evolution of that standard practice within their organization. These questions are intended to provide a deeper understanding of the decision making process and the likely level of program influence versus these internal policies and procedures. Responses to these questions also serve as a basis for consistency checks to investigate conflicting answers regarding the relative importance of the program and other elements in influencing the decision. In addition, **Standard – Very Large** sites may receive additional detailed probing on various aspects of their installation decision based on industry- or technology-specific issues, as determined by review of other information sources. For Standard-Very Large sites all these data are used to construct an internally consistent "story" that supports the NTGR calculated based on the overall information given.

3. **Vendor Surveys**. A Vendor Survey is completed for all **Standard** and **Standard-Very Large** NTGR sites that utilized vendors, and for **Basic** NTGR sites that indicate a high level of vendor influence in the decision to implement the energy efficient measure. For those sites that indicate the vendor was very influential in decision making, the vendor survey results enter directly into the NTGR scoring. The vendor survey findings are also be used to corroborate Decision Maker findings, particularly with respect to the vendor's specific role and degree of influence on the decision to implement the energy efficient measure. Vendors are queried on the program's significance in their decision to recommend the energy efficient measures, and on their likelihood to have recommended the same measure in the absence of the program. Generally, the vendors contacted as part of this study are contractors, design engineers, distributors, and installers.

4. **Utility and Program Staff Interviews**. For the Standard and Standard-Very Large NTGR analyses, interviews with utility staff and program staff are also conducted. These interviews are designed to gather information on the historical background of the customer's decision to install the efficient equipment, the role of the utility and program staff in this decision, and the name and contact information of vendors who were involved in the specification and installation of the equipment.

5. **Other information**. For **Standard – Very Large Project** NTGR sites, secondary research of other pertinent data sources is performed. For example, this could include a review of standard and best practices through industry associations, industry experts, and information from secondary sources (such as the U.S. Department of Energy's Industrial Technologies Program, Best Practices website URL, http://www1.eere.energy.gov/industry/bestpractices/). In addition, the Standard- Very Large NTGR analysis calls for interviews with other employees at the participant's firm, sometimes in other states, and equipment vendor experts from other states where the rebated equipment is being installed (some without rebates), to provide further input on standard practice within each company.

Table 1 below shows the data sources used in each of the three levels of free-ridership analysis. Although more than one level of analysis may share the same source, the amount of information that is utilized in the analysis may vary. For example, all three levels of analysis obtain core question data from the Decision Maker survey.

Table 1: Information Sources for Three Levels of NTGR Analysis

	Program File	Decision Maker Survey Core Question	Vendor Surveys	Decision Maker Survey Supplemental Questions	Utility & Program Staff Interviews	Other Research Findings
Basic NTGR	√	√	√[1]		√[2]	
Standard NTGR	√	√	√[1]	√	√	
Standard NTGR - Very Large Projects	√	√	√[3]	√	√	√

[1]Only performed for sites that indicate a vendor influence score (N3d) greater than maximum of the other program element scores (N3b, N3c, N3g, N3h, N3l).

[2]Only performed for sites that have a utility account representative

[3]Only performed if significant vendor influence reported or if secondary research indicates the installed measure may be becoming standard practice.

A copy of the complete survey forms (with lead-in text and skip patterns) are available upon request.

5. NTGR FRAMEWORK

The Self-Report-based Net-to-Gross analysis relies on responses to a series of survey questions that are designed to measure the influence of the program on the participant's decision to implement program-eligible energy efficiency measure(s). Based on these responses, a NTGR is derived based on responses to a set of "core" NTGR questions.

5.1. NTGR Questions and Scoring Algorithm

A self-report NTGR is computed for all NTGR levels using the following approach. Adjustments may be made for **Standard – Very Large** NTGR sites, if the additional information that is collected is inconsistent with information provided through the Decision Maker survey.

The NTGR is calculated as an average of three scores. Each of these scores represents the highest response or the average of several responses given to one or more questions about the decision to install a program measure.

- **Program attribution index 1 (PAI–1) score** that reflects the influence of the **most important** of various program and program-related elements in the customer's decision to select the specific program measure at this time. Program influence through vendor recommendations is also incorporated in this score.

- **Program attribution index 2 (PAI–2) score** that captures the perceived importance of the program (whether rebate, recommendation, training, or other program intervention) relative to non-program factors in the decision to implement the specific measure that was eventually adopted or installed. This score is determined by asking respondents to assign importance values to both the program and most important non-program influences so that the two total 10. The program influence score is adjusted (i.e., divided by 2) if respondents say they had already made their decision to install the specific program qualifying measure before they learned about the program.

- **Program attribution index 2 (PAI–3) score** that captures the likelihood of various actions the customer might have taken at this time and in the future if the program had not been available (the counterfactual).

When there are multiple questions that feed into the scoring algorithm, as is the case for both the **PAI-1** and **PAI-3** scores, the maximum score is always used. The rationale for using the maximum value is to capture the most important element in the participant's decision making. Thus, each score is always based on the strongest influence indicated by the respondent. However, high scores that are inconsistent with other previous responses trigger consistency checks and can lead to follow-up questions to clarify and resolve the discrepancy.

The calculation of each of the above scores is discussed below. For each score, the associated questions are presented and the computation of each score is described.

5.1.1. PAI–1 score

For the Decision Maker, the questions asked are:
I'm going to ask you to rate the importance of the program as well as other factors that might influence your decision to implement [MEASURE.] Think of the degree of importance as being shown on a scale with equally spaced units from 0 to 10, where 0 means not at all important and 10 means very important, so that an importance rating of 8 shows twice as much influence as a rating of 4.

Now, using this 0 to 10 rating scale, where 0 means "Not at all important" and 10 means "Very important," please rate the importance of each of the following in your decision to implement this specific [MEASURE] at this time.

- Availability of the PROGRAM rebate

- Information provided through a recent feasibility study, energy audit or other types of technical assistance provided through PROGRAM

- Information from PROGRAM training course

- Information from other PROGRAM marketing materials
- Suggestion from program staff
- Suggestion from your account rep
- Recommendation from a vendor/supplier (If a score of greater than 5 is given, a vendor interview is triggered)

For the Vendor, the questions asked (if the interview is triggered) are:
I'm going to ask you to rate the importance of the [PROGRAM] in influencing your decision to recommend [MEASURE] to [CUSTOMER] and other customers. Think of the degree of importance as being shown on a scale with equally spaced units from 0 to 10, where 0 means not at all important and 10 means very important, so that an importance rating of 8 shows twice as much influence as a rating of 4.

1. Using this 0 to 10 scale where 0 is 'Not at all important" and 10 is "Very Important," how important was the PROGRAM, including incentives as well as program services and information, in influencing your decision to recommend that CUSTOMER install the energy efficiency MEASURE at this time?

2. And using a 0 to 10 likelihood scale, where 0 denotes "not at all likely" and 10 denotes "very likely," if the PROGRAM, including incentives as well as program services and information, had not been available, what is the likelihood that you would have recommended this specific energy efficiency MEASURE to CUSTOMER?
3. Now, using a 0 to 100 percent scale, in what percent of sales situations did you recommend MEASURE before you learned about the [PROGRAM]?
4. And using the same 0 to 100 percent scale, in what percent of sales situations do you recommend MEASURE now that you have worked with the [PROGRAM]?
5. And, using the same 0 to 10 scale where 0 is "Not at all important" and 10 is "Very important", how important in your recommendation were:
   a. Training seminars provided by UTILITY?
   b. Information provided by the UTILITY website?
   c. Your firm's past participation in a rebate or audit program sponsored by UTILITY?

If the Vendor interview is triggered, a score is calculated that captures the highest degree of program influence on the vendor's recommendation. This score (VMAX) is calculated as the MAXIMUM value of the following:
1. The response to question 1
2. 10 minus the response to question 2
3. The response to question 4 minus the response to question 3, divided by 10
4. The response to question 5a.
5. The response to question 5b.
6. The response to question 5c.

Note that vendors are asked an additional question regarding other ways that their recommendations regarding the measure might have been influenced. Their responses are not used in the direct calculation of the NTGR but are potentially useful in making adjustments to the core NTGR.

The PAI–1 score is calculated as:
The highest program influence score divided by the sum of the highest program influences (i.e., the responses to the first six decision maker questions) plus the highest non-program influence score, multiplied by 10. and, if the vendor interview has been triggered, the VMAX score multiplied by the score the decision makers assigned to the vendor recommendation.

5.1.2. PAI–2 score

The questions asked are:

1. Did you learn about PROGRAM BEFORE or AFTER you decided to implement the specific MEASURE that was eventually adopted or installed?

2. Now I'd like to ask you a last question about the importance of the program to your decision as opposed to other factors that may have influenced your decision. Again using the 0 to 10 rating scale we used earlier, where 0 means “Not at all important” and 10 means “Very important,” please rate the overall importance of PROGRAM versus the most important of the other factors we just discussed in your decision to implement the specific MEASURE that was adopted or installed. This time I would like to ask you to have the two importance ratings -- the program importance and the non-program importance -- total 10.

The PAI–2 score is calculated as:
The importance of the program, on the 0 to 10 scale, to question 2. This score is reduced by half if the respondent learned about the program after the decision had been made.

5.1.3. PAI–3 Score

The questions asked are:

1. Now I would like you to think about the action you would have taken with regard to the installation of this equipment if the &PROGRAM had not been available.
Using a likelihood scale from 0 to 10, where 0 is “Not at all likely” and 10 is “Extremely likely”, if PROGRAM had not been available, what is the likelihood that you would have installed exactly the same program-qualifying efficiency equipment that you did in this project?

The PAI-3 score is calculated as:

10 minus the likelihood of installing the same equipment

5.1.4. The Core NTGR

The self-reported core NTGR in most cases is simply the average of the PAI-1, PAI-2, and PAI-3 scores, divided by 10. The one exception to this is when the respondent indicates a 10 in 10 probability of installing the same equipment at the same time in the absence of the program, in which case the NTGR is based on the average of the PAI-2 and PAI-3 scores only.

5.2. Data Analysis and Integration

The calculation of the Core NTGR is fairly mechanical and is based on the answers to the closed-ended questions. However, the reliance of the Standard NTGR – Very Large on more information from so many different sources requires more of a case study level of effort. The SRA Guidelines point out that a case study is one method of assessing both quantitative and qualitative data in estimating a NTGR. A case study is an organized presentation of all these data available about a particular customer site with respect to all relevant aspects of the decision to install the efficient equipment. In such cases where multiple interviews are conducted eliciting both quantitative and qualitative data and a variety of program documentation has been collected, one will need to integrate all of this information into an internally consistent and coherent story that supports a specific NTGR.

The following data sources should be investigated and reviewed as appropriate to supplement the information collected through the decision maker interviews.

- Account Representative Interview
- Utility Program Manager/Staff Interview
- Utility Technical Contractor Interview
- Third party Program Manager Interview
- Evaluation Engineer Interview
- Gross Impact Site Plan/Analysis Review
- Corporate Green/Environmental Policy Review (if mentioned as important)
- Corporate Standard Practice Review (if mentioned as important)
- Industry Standard Practice Review (if mentioned as important)
- Corporate payback review (if mentioned as important)
- Review relevant codes and standards, including regulatory requirements
- Review industry publications, websites, reports such as the Commercial Energy Use Survey, historical purchase data of specific measures etc.

As detailed in the Self-Report NTGR Guidelines, when complementing the quantitative analysis of free-ridership with additional quantitative and qualitative data from multiple respondents and other sources, there are some basic concerns that one must keep in mind. Some of the other data – including interviews with third parties who were involved in the decision to install the energy efficient equipment – may reveal important influences on the customer's decision to install the qualifying program measure. When one chooses to incorporate other data, one should keep the following principles in mind: 1) the method chosen should be balanced. That is, the method should allow for the possibility that the other influence can either increase or decrease the NTGR calculated from the decision maker survey responses, 2) the rules for deciding which customers will be examined for potential other influences should be balanced. In the case of Standard –Very Large interviews, all customers are subject to such a review, so that the pool of customers selected for such examination will not be biased towards ones for whom the evaluator believes the external influence will have the effect of influencing the NTGR in only one direction, 3) the plan for capturing other influences should be based on a well-conceived causal framework. The onus is on the evaluator to build a compelling case using a variety of quantitative and/or qualitative data for estimating a customer's NTGR.

Establishing Rules for Data Integration

Before the analysis begins, the evaluation team should establish, to the extent feasible, rules for the integration of the quantitative and qualitative data. These rules should be as specific as possible and be strictly adhered to throughout the analysis. Such rules might include instructions regarding when the NTGR based on the quantitative data should be overridden based on qualitative data, how much qualitative data are needed to override the NTGR based on quantitative data, how to handle contradictory information provided by more than one person at a given site, how to handle situations when there is no decision-maker interview, when there is no appropriate decision-maker interview, or when there is critical missing data on the questionnaire, and how to incorporate qualitative information on deferred free-ridership.

One must recognize that it is difficult to anticipate all the situations that one may encounter during the analysis. As a result, one may refine existing rules or even develop new ones during the initial phase of the analysis. One must also recognize that it is difficult to develop algorithms that effectively integrate the quantitative and qualitative data. It is therefore necessary to use judgment in deciding how much weight to give to the quantitative versus qualitative data and how to integrate the two. The methodology and estimates, however, must contain methods to support the validity of the integration methods through preponderance of evidence or other rules/procedures as discussed above.

For the **Standard-Very Large** cases in the large Nonresidential programs, the quantitative data used in the NTGR Calculator (which calculates the "core" NTGR), together with other information collected from the decision maker regarding the installation decision, form the initial basis for the NTG "story" for each site. Note that in most cases, supplemental data such as tracking data, program application files and results of interviews with program/IOU staff and vendors, will have been completed before the decision maker is contacted and will help guide the non-quantitative questioning in the interview. In practice, this means that most potential inconsistencies between decision maker responses and other sources of information should have been resolved before the interview is complete and data are entered into the NTGR Calculator. For example, if a company has an aggressive "green" policy widely promoted on its website that is not mentioned by the decision makers, the interviewer will ask the respondent to clarify the role of that policy in the decision. Conversely, if the decision maker attributes the decision to install the equipment to a new company wide initiative rather than the program, yet there is no evidence of such an initiative reported by program staff, vendors, or the company's website, the decision maker will be asked to explain the discrepancy so that his or her responses can be changed if needed.

In some cases, however, it may be necessary to modify or override one of the scores contributing to the overall NTGR or the NTGR itself. Before this is done all quantitative and qualitative data will be systematically (and independently) analyzed by two experienced researchers who are familiar with the program, the individual site and the social science theory that underlies the decision maker survey instrument. Each will determine whether the additional information justifies modifying the previously calculated NTGR score, and will present any recommended modifications and their rationale in a well-organized manner, along with specific references to the supporting data. Again, it is important to note that the other influences can have the effect of either increasing or decreasing the NTGR calculated from the decision maker survey responses, and one should be skeptical about a consistent pattern of "corrections" in one direction or another.

Sometimes, *all* the quantitative and qualitative data will clearly point in the same direction while, in others, the *preponderance* of the data will point in the same direction. Other cases will be more ambiguous. In all cases, in order to maximize reliability, it is essential that more than one person be involved in analyzing the data. Each person must analyze the data separately and then compare and discuss the results. Important insights can emerge from the different ways in which two analysts look at the same set of data. Ultimately, differences must be resolved and a case made for a particular NTGR. Careful training of analysts in the systematic use of rules is essential to insure inter-rater reliability[3].

Once the individual analysts have completed their review, they meet to discuss their respective findings and present to the other the rationale for their recommended changes to the Calculator-derived NTGR. Key points of these arguments will be written down in summary form (e.g., Analyst 1 reviewed recent AQMD ruling and concluded that customer would have had to install the same measure within 2 years, not 3, thereby reducing NP score from 7.8 to 5.5) and also presented in greater detail in a workpaper so that an independent reviewer can understand and judge the data and the logic underlying each NTGR estimate. Equally important, the CPUC will have all the essential data to enable them to replicate the results, and if necessary, to derive their own estimates.

The outcome of the reconciliation by two analysts determines the final NTGR for a specific project. Again, the reasoning behind the "negotiated" final value must be thoroughly documented in a workpaper, while a more concise summary description of the rationale can be included in the NTGR Calculator workbook (e.g., Analyst 1 and Analyst 2 agreed that the NTGR score should have been higher than the calculated value of 0.45

[3] Inter-rater reliability is the extent to which two or more individuals (coders or raters) agree. Inter-rater reliability addresses the consistency of the implementation of a rating system.

because of extensive interaction between program technical staff and the customer, but they disagreed on whether this meant the NTGR should be .6 or .7. After discussion, they agreed on a NTGR of .65 as reflecting the extent of program influence on the decision).

In summary, it has been decided that supplemental data from non-core NTG questions collected through these surveys should be used in the following ways in the California Large Nonresidential evaluations:

- Vendor interview data will be used at times in the direct calculation of the NTGR. It will also be used to provide context and confirming/contradictory information for Standard-Very Large decision maker interviews.

- Qualitative and quantitative information from other sources (e.g., industry data, vendor estimates of sales in no-program areas, and other data as described above) may be used to alter core inputs only if contradictions are found with the core survey responses. Since judgments will have to be made in deciding which information is more compelling when there are contradictions, supplemental data are reviewed independently by two senior analysts, who then summarize their findings and recommendations and together reach a final NTGR value.

- Responses will also be used to construct a NTGR "story" around the project; that is they will help to provide the context and rationale for the project. This is particularly valuable in helping to provide guidance to program design for future years. It may be, for example, that responses to the core questions yield a high NTGR for a project, but additional information sources strongly suggest that the program qualifying technology has since become standard practice for the firm or industry, so that free ridership rates in future years are likely to be higher if program rules are not changed.

- Findings from other non-core NTGR questions (e.g., Payback Battery, Corporate Policy Battery) are also be used to **cross-check the consistency** of responses to core NTGR questions. When an inconsistency is found, it is presented to the Decision Maker respondent who is then be asked to explain and resolve it if they can. If they are not able to do so, their responses to the core NTGR question with the inconsistency may be overridden by the findings from these supplemental probes. These situations are handled on a case-by-case basis; however consistency checks are programmed into the CATI survey instrument used for the Basic and Standard cases.

Finally, some analysis of additional information beyond the close-ended questions that are used to calculate the Core NTGR could be done for the **Standard NTGR**. For example information regarding the financial criteria used to make capital investments, corporate policy regarding the purchase of energy efficiency equipment or the influence of standard practice in the same industry as the participant could be taken into account and used to make adjustments to the Core NTGR in a manner similar what is done for the Standard – Very Large NTGR.

5.3. Accounting for Partial Free Ridership

Partial free-ridership can occur when, in the absence of the program, the participant would have installed something more efficient than the program-assumed baseline efficiency but not as efficient as the item actually installed as a result of the program.

In situations where there is partial free ridership, the assumed baseline condition is affected. Absent partial free ridership, the assumed baseline would normally be based on existing equipment (in early replacement cases), on code requirements (in normal replace on burnout cases), or on a level above current code (e.g., this could be a market average or value purposefully set above code minimum but below market average; in this case, the definition and requirement would typically be defined by a specific program's baseline rules). In some cases, there may be a "dual" baseline (more specifically, a baseline that changes over the measure's EUL) if the project involves early replacement plus partial free ridership. In such cases, the baseline basis for estimating savings is the existing equipment over the remaining useful life (RUL) of the equipment, and then a baseline of likely intermediate efficiency equipment (e.g., code or above) for the remainder of the analysis period (i.e., the period equal to the EUL-RUL). When there is partial free ridership, the baseline equipment that would have been installed absent the program is of an intermediate efficiency level (resulting in lower energy savings than that assumed by the program if the program took in situ equipment efficiency as the basis for savings over the entire EUL). A related issue with respect to determination of the appropriate baseline is whether the adjustment made, if any, from the in situ or otherwise claimed baseline in the ex ante calculation, is whether the adjustment applies to the gross or net savings calculation.

Assignment of Partial Free Ridership Effects to Gross versus Net. In past evaluations, partial free ridership impacts have principally been incorporated into the net-to-gross ratio. This is because most partial free ridership is induced by market conditions, rather than by non-market factors. Market conditions refer primarily to standard adoption of a technology by a particular market segment or end user as a result of competitive market forces or other end user-specific factors. The key determining principle with respect to application of the adjustment to the net-to-gross ratio is whether there is a level of efficiency, below the efficiency of the measure for which savings are paid and claimed, but above what is required by code or minimum program baseline requirements that the end user would have implemented anyway without the program. Conditions that cause this adjustment to be made to gross savings rather than the net-to-gross ratio may include factors such as

- changing baseline equipment to meet changed business circumstances (such as increased production/throughput, changes in occupancy, etc.);
- compliance with environmental regulations, indoor air quality requirements, safety requirements; or
- the need to address an operational problem.

Each project should be examined separately for partial free ridership and a determination should be made based on the unique circumstances of each installation of whether an adjustment to gross savings or the net-to-gross ratio is warranted.

Data Collection Procedures. Information is gathered on partial free ridership using the following questions asked as part of the decision maker NTGR survey.

1. Now I would like you to think one last time about what action you would have taken if the program had not been available. Supposing that you had not installed the program qualifying equipment, which of the following alternatives would you have been MOST likely to do?
    a. Install fewer units
    b. Install standard efficiency equipment or whatever required by code
    c. Install equipment more efficient than code but less efficient than what you installed through the program
    d. repair/rewind or overhaul the existing equipment
    e. do nothing (keep the existing equipment as is)
    f. something else (specify what _____________)

2. (IF FEWER UNITS) How many fewer units would you have installed? (It is okay to take an answer such as ...HALF...or 10 percent fewer ... etc.)

3. (IF MORE EFFICIENT THAN CODE) Can you tell me what model or efficiency level you were considering as an alternative? (It is okay to take an answer such as … 10 percent more efficient than code or 10 percent less efficient than the program equipment)

4. (IF REPAIR/REWIND/OVERHAUL) How long do you think the repaired/rewound/refurbished equipment would have lasted before requiring replacement?

In addition, these same partial free ridership questions should be asked during the on-site audit for a given project. This latter interview will be conducted by the project engineers. The collected information helps the gross impact and NTG analysis teams gain a more complete understanding of the true project baseline and equipment selection decision. These decision maker questions are included in the Excel version of the CATI-based Standard and Basic decision maker survey instrument as well as in the Standard-Very Large instrument.

Data Analysis and Integration Procedures. In cases where partial free ridership is found and it is determined that the adjustment should be made to the net-to-gross ratio, the following procedure should be used:

On the net side, the adjustment is based on the intermediate baseline indicated by the decision maker for the time period in which the intermediate equipment would have been installed. The calculation of energy saved under this intermediate baseline is done, and then divided by the savings calculated under the in situ baseline. The resulting ratio is then multiplied by the initial NTGR which was previously calculated using only the ‘core’ scoring inputs. The effect of this adjustment is to reduce the NTGR further to reflect the effects of the revealed partial free ridership.

In all cases, the Gross Impacts and NTG analysis teams will need to carefully coordinate their calculations to ensure that they are not inadvertently adjusting the savings twice for the same partial free ridership, i.e., through adjustments both to the gross savings calculation and to the NTG ratio.

6. NTGR INTERVIEW PROCESS

The NTGR surveys are conducted via telephone interviews. Highly-trained professionals with experience levels that are commensurate with the interview requirements should perform these interviews. Basic and Standard level interviews should be conducted by senior interviewers, who are highly experienced conducting telephone interviews of this type. Standard - Very Large interviews should be completed by professional consulting staff due to the complex nature of these projects and related decision making processes. More than likely, these will involve interviews of several entities involved in the project including the primary decision maker, vendor representatives, utility account executives, program staff and other decision influencers, as well as a review of market data to help establish an appropriate baseline.

All but the Standard -Very Large interviews should be conducted using computer-aided telephone interview (CATI) software. Use of a CATI approach has several advantages: (1) the surveys can be customized to reflect the unique characteristics of each program, and associated program descriptions, response categories, and skip patterns; (2) it drastically reduces inaccuracies associated with the more traditional paper and pencil method; and (3) the process of checking for inconsistent answers can be automated, with follow up prompts triggered when inconsistencies are found.

7. COMPLIANCE WITH SELF-REPORT GUIDELINES

The proposed NTGR framework fully complies with all of the CPUC/ED and the MECT’s Guidelines for Estimating Net-to-Gross Ratios Using the Self-Report Approach.

Appendix A

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Verbatim Responses to the Three Survey Questions Used to Develop PAI-3

case_id	utility	strata_desc	ntgmeasure	PAI3	replace	n5	n5aa
180200237	PGE	BOIL_PGE	PROCESS BOILER	6	Replace/Modification/Retrofit	4	.
180200442	PGE	BOIL_PGE	PROCESS BOILER	0	Add-on	.	10 Extremely likely
180200481	PGE	BOIL_PGE	PROCESS BOILER	0	Add-on	.	10 Extremely likely
180200005	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	3	Replace/Modification/Retrofit	7	.
180200021	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	5	Replace/Modification/Retrofit	5	.
180200024	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200027	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	8	Add-on	.	2
180200031	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	6	Replace/Modification/Retrofit	4	.
180200039	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200055	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	8	Replace/Modification/Retrofit	2	.
180200062	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200070	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	8	Add-on	.	2
180200084	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200195	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200221	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200244	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200535	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	5	Add-on	.	5
SaveMart	PGE	FOOD_PGE_DOWNSTREAM	FOOD SERVICE EQUIPMENT	10	Add-on	3	0 Not at all likely
180200023	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	5	Replace/Modification/Retrofit	5	.
180200068	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	.	DON'T KNOW	.	.
180200149	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200345	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200346	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	1	Replace/Modification/Retrofit	9	.
180200361	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	7	Replace/Modification/Retrofit	3	.
180200365	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	3	Replace/Modification/Retrofit	7	.
180200421	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200429	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	4	Replace/Modification/Retrofit	6	.
180200447	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	3	Add-on	.	7
180200455	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200456	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200463	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200467	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	3	Replace/Modification/Retrofit	7	.
180200522	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200531	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	5	Replace/Modification/Retrofit	5	.
180200534	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	1	Replace/Modification/Retrofit	9	.
180200536	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200549	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	.	Add-on	.	.
180200550	PGE	FOOD_PGE_MIDSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	.
180200004	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	3	Replace/Modification/Retrofit	7	.
180200038	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	7	Replace/Modification/Retrofit	3	.
180200063	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	8	Replace/Modification/Retrofit	2	.
180200135	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200157	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200187	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	8	Replace/Modification/Retrofit	2	.
180200224	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200291	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	6	Replace/Modification/Retrofit	4	.
180200350	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	2	Replace/Modification/Retrofit	8	.
180200363	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200415	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200432	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200445	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200453	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	10	Add-on	.	0 Not at all likely
180200457	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200525	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	3	Replace/Modification/Retrofit	7	.

Verbatim Responses to the Three Survey Questions Used to Develop PAI-3

case_id	utility	strata_desc	ntgmeasure	PAI3	replace	n5	n5aa
180200527	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200546	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200555	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200556	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200567	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	4	Replace/Modification/Retrofit	6	.
180200572	PGE	RLED_PGE_DI	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
180200054	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	4	Replace/Modification/Retrofit	6	.
180200056	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200089	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	3	Replace/Modification/Retrofit	7	.
180200174	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200270	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200434	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200452	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	2	Replace/Modification/Retrofit	8	.
180200498	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	5	Add-on	.	5
180200537	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	2	Replace/Modification/Retrofit	8	.
180200541	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	.	Replace/Modification/Retrofit	.	.
180200569	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	5	Replace/Modification/Retrofit	5	.
SaveMart	PGE	RLED_PGE_DOWNSTREAM	REFRIGERATION CASE LED LIGHTING	7	Replace/Modification/Retrofit	3	0 Not at all likely
180200134	SCG	BOIL_SCG	PROCESS BOILER	3	Add-on	.	7
180200194	SCG	BOIL_SCG	PROCESS BOILER	10	Add-on	.	0 Not at all likely
180200465	SCG	BOIL_SCG	PROCESS BOILER	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200547	SCG	BOIL_SCG	PROCESS BOILER	0	Add-on	.	10 Extremely likely
180200562	SCG	BOIL_SCG	PROCESS BOILER	4	Replace/Modification/Retrofit	6	.
180200124	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200220	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200241	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	4	Replace/Modification/Retrofit	6	.
180200259	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200282	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	.
180200299	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	.	DON'T KNOW	.	.
180200319	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200320	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	.
180200321	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	5	Replace/Modification/Retrofit	5	.
180200339	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200344	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200349	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200354	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200376	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	10	Add-on	.	0 Not at all likely
180200431	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	8	Replace/Modification/Retrofit	2	.
180200436	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	8	Replace/Modification/Retrofit	2	.
180200464	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	.
180200466	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	7	Replace/Modification/Retrofit	3	.
180200483	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200492	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200495	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200519	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200526	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200529	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200538	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	8	Replace/Modification/Retrofit	2	.
180200543	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	9	Replace/Modification/Retrofit	1	.
Albertson	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	5
In-N-Out	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	10 Extremely likely	10 Extremely likely
SOUTHERN	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	6
SaveMart	SCG	FOOD_SCG_DOWNSTREAM	FOOD SERVICE EQUIPMENT	10	Add-on	3	0 Not at all likely
180200098	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	3	Replace/Modification/Retrofit	7	.

Verbatim Responses to the Three Survey Questions Used to Develop PAI-3

case_id	utility	strata_desc	ntgmeasure	PAI3	replace	n5	n5aa
180200116	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200125	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200126	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200127	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	.
180200142	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200150	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	.	Replace/Modification/Retrofit	.	.
180200171	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	5	Add-on	.	5
180200219	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	6	Replace/Modification/Retrofit	4	.
180200230	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200232	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	8	Replace/Modification/Retrofit	2	.
180200247	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	4	Replace/Modification/Retrofit	6	.
180200264	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	.	Replace/Modification/Retrofit	.	.
180200286	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	5	Replace/Modification/Retrofit	5	.
180200297	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	.
180200303	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	7	Replace/Modification/Retrofit	3	.
180200312	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200331	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Add-on	.	10 Extremely likely
180200338	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200343	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200348	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	2	Replace/Modification/Retrofit	8	.
180200360	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	7	Replace/Modification/Retrofit	3	.
180200367	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200368	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	3	Replace/Modification/Retrofit	7	.
180200369	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	5	Add-on	.	5
180200385	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	6	Add-on	.	4
180200393	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200400	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200402	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200406	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	7	Replace/Modification/Retrofit	3	.
180200407	SCG	FOOD_SCG_UPSTREAM	FOOD SERVICE EQUIPMENT	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200000	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	2	Replace/Modification/Retrofit	8	.
180200013	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200017	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200057	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	7	Replace/Modification/Retrofit	3	.
180200071	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200073	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	10	Replace/Modification/Retrofit	0 Not at all likely	.
180200179	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200183	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	.	DON'T KNOW	.	.
180200185	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200283	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	3	Replace/Modification/Retrofit	7	.
180200296	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	0	Replace/Modification/Retrofit	10 Extremely likely	.
180200340	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	2	Replace/Modification/Retrofit	8	.
180200374	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	8	Replace/Modification/Retrofit	2	.
180200532	SDGE	RLED_SDGE	REFRIGERATION CASE LED LIGHTING	6	Replace/Modification/Retrofit	4	.

Verbatim Responses to the Two Survey Questions: Life of Refrigeration Cases, LED101i and LED101j

case_id	led101i	led101j
	Approximately how old are the Refrigerator Cases with the lighting that was removed and replaced with <REFLEDLIGHTING_MEASURE>?	How many years do you anticipate are left in the refrigerated case itself until you will replace the entire case?
180200000	1	2
180200004	2	99
180200013	1	99
180200017	2	20
180200038	1	99
180200054	2	8
180200056	1	10
180200057	4	20
180200063	2	5
180200071	3	20
180200073	99	3
180200089	4	7
180200135	1	10
180200157	4	2
180200174	4	99
180200179	2	15
180200183	2	99
180200185	3	99
180200187	2	20
180200224	3	99
180200270	2	20
180200283	1	5
180200291	2	10
180200296	4	20
180200340	3	99
180200350	4	99
180200363	1	5
180200374	4	99
180200415	2	5
180200432	4	99
180200434	2	99
180200445	2	15
180200452	1	8
180200453	4	99
180200457	99	99
180200498	2	99
180200525	99	99
180200527	4	99
180200532	1	20
180200537	4	15
180200541	99	99
180200546	99	99
180200555	4	15
180200556	2	5
180200567	3	99
180200569	2	2
180200572	3	99

APPENDIX E RESPONSE TO COMMENTS

Submitted by	Section	Topic	Page	Comment	Evaluator Response
Energy Solutions	3.2	Foodservice Measure Group	p.3-7	Southern California Gas Company (SoCalGas) offers foodservice measures via two program delivery channels, deemed and midstream/point-of-sale, not upstream as the report indicates. Energy Solutions is the third-party implementer for SoCalGas' midstream channel. The midstream program is called the "SoCalGas Foodservice Point-of Sale (POS) Instant Rebates Program" (Program). The Program is similar in design to the midstream POS program that PG&E delivers.	Acknowledged. However, upstream is the label used in the tracking system for this subset of claims.
Energy Solutions	3.1	Program Manager Interviews	p.3-2	The draft report indicates that no midstream foodservice program managers were interviewed. We believe that this oversight may have contributed to some of the misrepresentations and inaccuracies in the evaluation. Energy Solutions would be happy to make our program managers available for future interviews.	Thank you for this input.
Energy Solutions	4	Gross Impact Evaluation	Various	Can the evaluator please provide the specific detailed data collected for each of the SoCalGas midstream sites sampled, including address, business name, business type, phone numbers, names of individuals who they worked with onsite? We understand this data cannot be shared publicly, however without it we are unable to provide a thorough review of the evaluation and the conclusions reached.	A map of evaluation ID to SCG claim ID has been provided to SCG. Please coordinate with SCG on related customer details. However, we do have some concerns that willing participants in our evaluation study, might now be subject to additional scrutiny from Energy Solutions, based in part on information they shared with us, or that we otherwise obtained during our evaluation efforts. We hope that you will be sensitive to this potential additional burden on this subset of participants. We inquired with SCG about the intended use of the ID map provided. SCG stated that "simply get more context behind the Impact Evaluation and the overall sample that was used." The evaluation team therefore believes that SCG might object to Energy Solutions conducting follow-up activities with participants from our sample.
Energy Solutions	Appendix A	Telephone Survey	Various	Can the evaluator please provide the specific verbatim responses collected for each of the SoCalGas midstream customers surveyed, as well as information from the customers' program applications, such as business name, equipment make and model, invoice date, and number of units? Can the evaluator please also provide a question map for the telephone survey instrument that maps each question to the NTG scoring algorithm, as well as any other mapping mechanism that indicated the purpose or use of each individual question? As above, this detailed data will allow us to provide a more thorough review of the evaluation and the conclusions reached to determine if they are appropriate for the market and the program design.	The evaluation team will not provide participant-sourced responses to the telephone survey, as these data were collected with an understanding of anonymity. Regarding participant data, please coordinate with SCG to obtain any such data. Please refer to Appendix D to obtain an understanding of the NTGR scoring algorithm and framework. Given limited time available for evaluators to comment on responses and update the report as needed for final posting on 4/1/2019, it is unlikely that the evaluation team can facilitate rapid data delivery to Energy Solutions. Note that the evaluation team will be delivering all evaluation data to the CPUC in the coming months. It would likely be most feasible to direct requested portions of the data to Energy Solutions at that time; but likely in an anonymized fashion. It is also possible that the CPUC and SCG would have some say in how any such data is used/transferred to a given third-party implemneter like Energy Solutions.
Energy Solutions	5.3	Zero Savers	p.5-31 to 5-34	Energy Solutions does not believe that it is appropriate to assign a very low or 0.0 realization rate for the SoCalGas sites identified as partial or zero savers. These zero assignments do not take into account a variety of market factors what we are very familiar with as implementers. Those factors include the common practice of moving fryers to different locations and the resale market. Moving Fryers: In the population of customers that participated in the 2017 Instant Rebates Program we have come to understand that it is common for customers who own more than one restaurant to move an operational fryer to one of their other locations when needed. Restaurant operators do this because it is relatively easy to move and install a fryer and it allows for minimal disruption to their operations, as fryers are commonly a critical part of many quick serve and full-service restaurants. Inspection results conducted by SoCalGas for the 2017 Instant Rebates program indicate that approximately 40% of equipment that was initially not found by inspectors was moved by the operators to another eligible SoCalGas site (note, this excludes inspections where the equipment was not found because it had not yet been installed – which in 2017 was the other most common reason equipment wasn't found). Additionally, the following information may be useful: - Due to the midstream program design in 2017, the program participants were predominantly independently owned restaurants and small regional chain restaurants who purchased their equipment from cash and carry equipment dealers. Due to the characteristics of this population group, moving equipment among locations is likely more common among small independent operators than medium or large chains. - In our experience implementing the Program, and other very similar midstream POS fryer programs in other states in the US, there is a small percentage (1-3%) of units as determined by third party inspections that are true "failed" inspections. This is usually comprised of the following situations: businesses shut down, the equipment is not at the address indicated on the application and we simply cannot track it down, error made when application was submitted, the equipment was somehow damaged, or the equipment is onsite but not installed (customer stocking it in case of burnout). Resale Market: There is a sizable foodservice equipment resale market in Southern California. When foodservice enterprises fail, which is quite common, equipment is often re-used by another foodservice business that moves into the same location or it ends up with a re-seller. In either case, the equipment circulates back into use and continues to save energy for its owner. It is our understanding the impact of the resale market will be studied as part of the fryer ISP report that the IOUs have been tasked with completing in 2019. In conclusion, it is common for equipment both to be moved to new locations and to be resold. In both cases the equipment continues to provide energy saving benefits. We request that the zero saver projects be revisited and the discounts be reduced to account for these common industry practices.	The evaluation team was lenient on this point by providing partial credit to the program for zero savers, in an effort to be as fair as possible to the program, given existing CPUC policy surrounding evaluation treatment for conditions such as those we observed in the field during verification. CPUC policy dictates that evaluators evaluate the as-found condition, and strictly prohibits any forecasting to predict future savings and conditions. This includes fryers that may have been moved and fryers that may have been sold into a secondary market. However, we do agree with Energy Solutions that the cooking equipment market may represent a special case and that perhaps the above mentioned policy guidance could be revisited for this and other special circumstances. There is precedence in the industry for special verification accounting of equipment that are moved/installed at more than one facility and perhaps other factors -- such as mid-stream lighting programs. The evaluation team is not aware of any such precedence for California programs. Furthermore, the fact that within-program inspections are only successful at finding 40% of equipment at the site of record for a sample of installations suggests that greater accuracy in tracking of this information is needed.

Submitted by	Section	Topic	Page	Comment	Evaluator Response
Energy Solutions	5.3	Baseline Models	various	Can the evaluator please provide make, model number, and performance ratings (idle rate, pre-heat energy, and heavy load cooking efficiency) for the 11 baseline models used to derive the average baseline efficiency? Used, refurbished fryers make up a significant portion of the market; were any used refurbished fryers part of the 11 baseline models tested? Also, the method of determining baseline fryer efficiency is inconsistent with the method of determining the measure case efficiency for fryers in the evaluation. The evaluation stated that the ex-ante method of calculating fryer efficiency based on average QPL efficiency metrics does not take market adoption into account. This reasoning should also apply to the calculation of ex-post baseline fryer efficiency metrics to properly account for the market weighting of popular baseline models. We request that the evaluator account for the market weighting of baseline models and account for used refurbished equipment in determining average baseline fryer efficiency metrics.	The conditions of data sharing preclude us from providing the requested information. The condition of data transfer stipulated that we "use the attached database for workpaper review purposes only and do not distribute it for any other purposes." We believe that all units tested for performance are new. The evaluation team does not have data surrounding market share of baseline equipment, but we do support obtaining market data for the purpose of workpaper updates and using the resulting data for weighting, as described in this comment from Energy Solutions. However, whether or not used equipment should be included in the resulting average is yet to be determined. The markets served by the program likely differ to some extent from those served by secondary used equipment markets.
Energy Solutions	5.3	Operating Assumptions	various	Can the evaluator please provide information on the sample sites used to develop operating assumptions? Some of the sites have low run hours, and it appears that these may be seasonal operations or businesses that own a fryer but do not regularly operate it. Each sample is being evenly weighted to determine average operating assumptions, but this does not account for the business type distribution across the state. With such a low sample population, utilizing even weighting across each sample (12 samples in Table 5-51), operational assumptions derived from this evaluation are not statistically accurate. In the SoCalGas Instant Rebates Program in 2017, the most common building types were restaurant fast food (33%), restaurant sit down (49%), education primary and secondary (6%). The draft evaluation highlighted two specific building types sampled, catering and assisted living. In 2017 catering was included in our assembly category (along with religious buildings), which were 5% of the program and assisted living represented 0.33% of the program. We request that the evaluator update operational assumptions to more accurately reflect business type distribution.	As discussed above, we request that Energy Solutions coordinate with SCG surrounding provision and use of any sample-level data. The evaluation team pulled a random sample of applications from the available population of PY2017 gas fryer projects, forming a sample frame of 50 projects from which the evaluation team recruited and evaluated 20 projects. The conditions in the sample frame represent the population and the resulting sample represents both the frame and population. Roughly seven of these SCG projects were partial- or full-zero savers, and so did not contribute to the development of operational parameters discussed in report Section 5.3.7. Given that the pull was random and that operating parameters represent a single fryer vat from each of 12 sample points, no weighting is necessary, and we conclude that the results were developed using a statistically valid approach.
Energy Solutions	5.3	Fryer Efficiency	various	The evaluation utilizes only two models of high efficiency fryer for determining measure case fryer efficiency, both with the same oil capacity. Although these fryer models are popular, they do not provide a full representation of the fryers on the market. SoCalGas lists 191 qualifying fryer models on their QPL, and manufacturers would not make that many distinct models if only two models were being purchased. Chain restaurants often utilize larger fryers with higher efficiency. These are not represented in the evaluation.	As discussed above, the evaluation team concludes that the randomly selected sample represents the population and sample frame. Had the resulting sample included other make and model equipment, those equipment also would have been represented in the evaluation sample-level results.
Energy Solutions	5.3	Zero Savers	p.5-31 to 5-34	For the two most common economy fryers rebated through the Program, the manufacturers offer a 1-year (or longer) manufacturer parts and labor warranty. There were two zero saver sites that could possibly have fallen within those manufacturer warranty periods.	The evaluation team is not aware of any precedence in California policy for accounting for warranty for the purposes of establishing equipment useful life. For the two projects noted by Energy Solutions the evaluation team truncated the EUL, to best represent that the failed equipment were removed and no longer operational. The evaluation team believes this is the most appropriate treatment.
Energy Solutions	6	NTG Battery	various	As mentioned previously, the bulk of customers that participate in the SoCalGas Instant Rebates Program are smaller independent operators with restaurant fast food and restaurant sit down building types. The NTG scoring algorithm does not appear to weigh the survey responses from various customer types according to their representation in the Program. We highly recommend that scoring be weighted to more accurately reflect the customers participating in the Program.	The sample frame was divided into large chains and other participants. A census was attempted on the large chains. A stratified random sample was attempted on the remaining population as shown in Table 3-10 of the report. We have clarified this in the report. Furthermore, the completed surveys were weighted accordingly, so that the large chains only represented their portion of the population.
Energy Solutions	6	NTG Battery	various	Energy Solutions believes that the NTG survey and analysis is not accurate nor does it represent the full program sphere of influence of the Instant Rebates Program on the fryer market. The Program's logic model focuses on overcoming two key market barriers – knowledge of cost savings (ROI)and low stocking of program-eligible high efficiency equipment. To overcome both barriers, the Program invests in developing strong relationships with foodservice equipment dealers and providing training to dealers and their sales staff. In this Program, dealers provide point-of-sale rebates directly to the customers when they make their purchase. By 2017, the Program had made significant inroads with its top 4 participating dealers (representing 80 percent of program participation for fryers). Each of these dealers had made changes to their stocking practices to achieve the following: program-qualified models were almost always in stock, displayed on the sales floor, and identified prominently with Program marketing materials highlighting rebate amount and often total purchase price (after rebate), which was typically within $0-200 of the baseline efficient models. In some cases, dealers moved baseline (nonprogram eligible models) to the rear or sides of display area and reduced stock of some baseline models. Each of the top dealers reported significant growth in the program-eligible models that they sold after making these changes. Two dealers in particular were able to transition over 95% of their economy fryer sales to program-eligible models in 2017 due to program influence. Over the past five years, Energy Solutions has collected evidence of dealers significantly changing their stocking and sales practices as a direct result of the program. No dealers were contacted as part of this impact evaluation. The customer telephone interviews also do not ask customers about the influence of the dealers on their purchase choices. There is a section in the survey about contractor influence; however, contractors do not play a significant role in the fryer sales through the Program channel. Most customers purchase directly from the equipment dealers. They may choose to engage a contractor to install their equipment, but that would be a separate interaction. We request that the evaluator take into account the influence of foodservice equipment dealers stocking and upselling in their analysis on program attribution.	Thank you for your comment. Due to the relatively limited timeline under which this study was performed, incorporating market actor interviews into the NTGR approach was not feasible. Therefore, the evaluation team used the existing NTGR survey battery that was used and approved by the CPUC for the 2013, 2014 and 2015 Program Year ESPI impact Evaluations,and went through rigourous public review. As part of that framework, questions were asked about the influence of the vendor that sold the equipment, and if the rebate brought the equipment into their acceptable range of ROI, and an open ended question was provided for any other influential factors. In general, respondents did not find the vendor to be highly influential relative to other decision factors. For PY2018, the NTGR approach is expected to be revised and we will take this into consideration.

Submitted by	Section	Topic	Page	Comment	Evaluator Response
Energy Solutions	Appendix A	Telephone Survey	various	We believe that the telephone survey instrument has a number of flaws that resulted in inaccurate or unrepresentative responses from customers. Below is a summary of those concerns. - The use of specific foodservice terms, such as "restaurant supply firm," "contractor," and "vendor." It appears that the survey uses these 3 terms interchangeably, which is not standard practice in the food service industry and likely created confusion. - Various questions use the terms "used," "food being cooked," and "on" to describe the state of operation of the fryer. These terms are not defined, and they make the questions unclear as they can easily be interchanged. - Another term usage that introduces concern is the use of the phrase "install this new equipment." (Page A-36, questions N2 and N3). These are critical questions because they are asking when the customer decided to participate in the program. The question does not distinguish between deciding to "install this new equipment" and deciding to purchase and install a program-eligible fryer model. Customers very commonly decide to purchase a new fryer in advance of going to the store to buy one. Only then, after being influenced at the store location by Program information, the sales person, price, availability of rebate, etc, do they make the decision on what specific model to purchase. The ambiguity of the words used likely resulted in inaccurate responses. - The order of questions presented does not prioritize obtaining thoughtful responses to the critical NTG questions. There is a whole series of questions not necessary for foodservice customers that may cause significant survey fatigue. Critical questions should be asked as early as possible. - The questions that ask customers about the influence of the program on their purchase "at the time you did" are very confusing. Particularly for customers who have already indicated that they made their purchase as ROB, the responses to these questions should be eliminated. For a foodservice customer purchasing a new fryer to replace one that is no longer working, these questions will likely be misunderstood and provide unrepresentative responses. - It is unclear how some open ended question responses are documented, since both response options are given but the prompt indicates the question is open ended. We believe that it is likely that survey fatigue and overly complex and confusion questions resulted in attribution scoring that is not representative of customers true experiences with the Programs.	Thank you for your comment. Due to the relatively limited timeline under which this study was performed, the evaluation team used the existing NTGR survey battery that was used and approved by the CPUC for the 2013, 2014 and 2015 Program Year ESPI impact Evaluations,and went through rigourous public review. For PY2018, the NTGR approach is expected to be revised and evaluators will solicit input from the IOUs as part of this process.
Energy Solutions	Appendix B	On-site Form	various	The Gas Fryer Onsite Form does not appear to collect information from site managers or ask questions about the relevancy of the testing period compared to their full annual operation. Foodservice establishments can have seasonal fluctuations in both menu and throughput. In program participation data, we commonly rebate submittals dip in the first quarter of the year. In conversations with dealers we have learned that the first quarter is historically lower for sales for restaurants. Thus, equating the up to three week testing period that was used to represent the full annual operation may underestimate equipment operation.	The evaluation data collection effort collected information on the following: weekly operating schedule (including hours of fryer operation per day, by day of the week), and data surrounding facility closures, such as holidays). The evaluation, however, relied most extensively on the schedule data supported by the flue gas temperature metering data, as described in Section 4 of the report. However, it is also true that the evaluation applied evaluator discretion in throwing out outlier days from the analysis, where operations on a given day were different than usual. Typically this was done for instances where schedules were shorted due to holidays or other special circumstances that were thought to be atypical of normal operations.
SCG	p.4-16			The NAIMA 3E Plus insulation software uses process temperature and not bare surface temperature to calculate savings. Measured bare pipe surface temperatures can be lower due to corrosion on pipe surfaces and other factors. Please consider revising the report to explain why an adjustment factor is, or is not, appropriate at this phase of the project or in future efforts.	We acknowledge this uncertainty but believe it to be minimal. The affected pipes were typically composed of cast iron or stainless steel, which both feature very high conductivity values. We estimate the difference between process temperature and pipe surface temperature to be within 1%.
SCG	p. 6-5			NTG values for Pipe Insulation Hot Application, Process Boilers, Water Heating Boilers, can the evaluation team comment if it is appropriate to use the estimated values in the report or the default value of 0.6 until more reliable results can be obtained? (Page 6-5).	We would defer to the DEER/Ex Ante Update team to make this decision, but would recommend using PY2013-15 data along with these results for Pipe Insulation.
SCG	Overall			SoCalGas appreciates the effort that went into this report, however, SoCalGas would like to point out that the results from this evaluation should not be solely relied upon to inform any final determinations and policy decisions for fryers, such as removal of this measure from the uncertain measures list or updating DEER values. This evaluation report should be used in conjunction with research that is being conducted for fryers to inform DEER and workpaper updates and default savings values (as mandated by the CPUC in recent dispositions to the IOUs/PAs). Some of the research that is being conducted by SoCalGas to estimate the savings from fryers includes: [1] updating of the Statewide Food Service Workpapers, [2] Updating the efficiency baseline based on the ISP study, [3] defining market share and customer preferences, and [4] persistence and EUL studies.	Thank you for your comment. We agree that is important to rely on multiple sources to make better informed measure-based determinations and policy decisions.
SCG	p.3-7			In general, SoCalGas feels that the current study results are not representative of the entire population of fryers and, from Table 5-53, seems to focus exclusively on small users. We note that the small gross impact sample size of 20 (selected randomly from a population of over 2,000 fryers spread over several NAICS codes) does not include a representative share of higher usage chain restaurants that use larger more efficient fryers. SoCalGas recommends that the CPUC to keep the gas fryer measures on the ESPI/uncertain measures list with current workpaper defaults as modified by ex ante dispositions until the research being conducted by SoCalGas and other PAs is finalized in 2019, and additional research on larger volume users can be conducted that yields reliable results	For the gross impact sample, the evaluation pulled randomly from the gas fryer population, without accomodation for any strata, including NAICS or chain versus independent restaurants. In theory this should yield a representative sample of participants, but SCG raises concerns surrounding nonresponse bias surrounding chain restaurants. As noted above, to address potential nonresponse bias the evaluation team first pulled a sample frame of 50 points and then recruited participants from that frame, yielding a response rate of 20 out of 50 points. Furthermore, to address this comment the evaluation team examined whether or not this approach to sampling successfuly captured chain restaurants in the sample. We examined the disposition of 20 points and found that it does indeed include several chain accounts.

Submitted by	Section	Topic	Page	Comment	Evaluator Response
SCG	Table 5-53			SoCalGas believes that the sample size is biased toward small customers with low usage causing much lower gross savings estimates and lower installation rates/persistence because of the ease in reaching these customers as compared to customers in larger, busier operations with more complex organizational structures. Please provide more information as to the methodology used to select the samples for the fryers used in this Impact Evaluation. That is, does this Impact Evaluation target a certain type of restaurants (i.e., size of operation, type of operation, chain-restaurants, etc.), is it completely random, is it stratified in any way, does it consider weighted averages across NAICS codes or fryer size, etc.?	As noted above, the gross impact sample was selected randomly, without any special consideration of strata or weighting. In theory this should yield a representative sample, but here again SCG raised concerns surrounding the potential for nonresponse bias in the resulting sample. Please refer to the response above for a discussion of both the sampling approach and the resulting sample disposition.
SCG	p.5-57			The food throughput in SoCalGas' work papers are based on an average across a diverse population of end uses, and is 33% higher than what is used in the report. A lower food throughput results in a lower fuel flow to the burner and introduces variability into the savings calculations. Depending on how the sample was developed, it is possible that the data in the "reliable information [that]was obtained," could have been the result of a population of smaller customers? Please provide more information behind the decision to use a throughput of 100 lbs. as opposed to 150 lbs.	The modeling exercise in Section 5.3.8 of the report has no bearing on the ex-post gross impact evaluation results, but was used to illustrate the robustness of the ex-ante model, and to explore the explanatory power of evaluation-derived modeling parameters in explaining the lower than desired gross impact realization rate of 0.37 for SCG. This includes the reference to a 100 pound per day food load versus 150 pounds. While the evaluation did collect data on food load, an independent estimate of that parameter was neither derived nor used as a factor contributing to the ex-post gross impact result for SCG. However, the evaluation did generally find that the ex-ante-based 150 pound per day food load was directionally high relative to reported food loads by participants. However, the evaluation did not seek to quantify this difference.
SCG	p.8-8			SoCalGas' account executives, field technicians and staff at the Food Service Center have been working with the all customers to evaluate their needs and encourages them to purchase the higher efficiency models. To better understand the NTG values and recommendations noted, SoCalGas would like for the final report to have a detailed write up related to the methodology used to select the samples for the report.	As discussed above, the food service measure group population was divided into two populations - large chain accounts and other. A census was attempted on large chain accounts. For the remaining population, participants were segmented as shown in Table 3-10. A random sample was selected within each of those 9 populations. No other process was implemented to select specific customer types/segments. The report was revised to reflect this.
SCG	Table 3-2			The installation rates and zero savers seem very high for this measure. Please provide the field notes for the food service, pipe insulation and process boiler inspections conducted as part of this Impact Evaluation so that SoCalGas can verify the serial/model numbers and other installation details from the field visits with our files. Were measures that are listed as ineligible in fact eligible in prior cycles and at the date of the project application?	For the food service (gas fryer) measure please refrer to Table 5-35 and the imbedded explanation. For the process boiler measure please refer to Table 5-18 (although this is for a relevant PG&E point). For SCG points in the gross impact sample, neither installation rate nor zero savers were found to be an issue. For pipe insulation the installation rate was found to be 95.3 percent in the gross impact evaluation sample. Given limited time available for evaluators to comment on responses and update the report as needed for final posting on 4/1/2019, it is unlikely that the evaulation team can facilitate rapid data delivery to SCG. Note that the evaluation team will be delivering all evaluation data to the CPUC in the coming months. It would likely be most feasible to direct requested portions of the data to SCG at that time; but possibly in an anonymized fashion. It is also possible that the CPUC would have some say in how any such data is used/transferred to SCG.
PG&E	Executive summary	Review	1	The draft report does not include an Executive Summary, which is a critical part of the report. When will stakeholders be provided a complete draft for review, including executive summary, before the final report is published?	The final report includes an executive summary. Unfortunately, the executive summary was not ready for stakeholder review prior to the posting of the final report for this cycle.
PG&E	3.2.1	Process Boilers	5-19	In 2017, program delivery was deemed downstream. In 2018, the program delivery was changed to midstream. We expect that the distributors will provide a more accurate assessment of eligible products.	Acknowledged.
PG&E	3.2.1	Agricultural Irrigation	5-15	Report stated: "Prior cycles had allowed low-pressure nozzles or "micronozzles" as high-efficiency replacements but have since been sunset, as reflected in the current PG&E workpaper." This is incorrect. The low-pressure nozzles was a different energy efficiency measure offered by PG&E, but it has been sunset.	We agree that the two measures are distinct. Since the ESPI evaluations involve assessment of measure *groups* , we thought it relevant to provide context on similar measures from the agricultural irrigation measure group evaluated in prior cycles.

Submitted by	Section	Topic	Page	Comment	Evaluator Response
PG&E	5.1.3	Refrigerator Case LED Lighting	5-14	In the NTG battery there are questions that concern RUL of refrigeration cases for participants. Do the answers to these questions support the DEER assumption of 1/3 of EUL being used to calculate lifetime savings? If not, would the evaluator suggest that this assumption should be revisited?	The study was not designed to estimate the RUL of refrigeration cases. We also would not recommend using these values to develop an RUL as it is difficult to predict how much longer equipment would last, which is supported by the fact that nearly half the respondents were not able to answer this question. Furthermore, the EUL is based both on failures, as well as removals. Removals may be common for this type of equipment, and retrofits may also be done in batch such that when one or two cases fail, all may be replaced. Regardless, the response to the question regarding the current age (which we think is more accurate than looking at expected remaining life) indicates the retrofitted units were about 10 years old. With an EUL of 16 years, this implies an RUL of close to 1/3rd the EUL. Please note that there are plans to conduct an EUL study, but that has not been planned out yet so we do not know what measures will be covered.
PG&E	5.4	Agricultural Irrigation	5-64	Evaluator used average coincidence factor of 0.37 from the 2015 Nonresidential Downstream ESPI Sprinkler Impact Study. PG&E conducted an internal study in 2016 of agricultural pumping and found an average coincidence factor of 0.55. The sample size of this study was from 6,280 pump locations in PG&E service territory. We would be happy to share further information and data from this study.	We look forward to obtaining more information from PG&E's study, as it may support future PY2018-19 measure evaluations (e.g., agricultural pumping).
PG&E	Appendix A	Refrigerator Case LED Lighting NTG Survey	A-24	Can the evaluator please provide the verbatim answers and number of nonresponses to the following questions: "How many years do you anticipate are left in the refrigerated case itself until you will replace the entire case?" and "Approximately how old are the refrigerator cases with the lighting that was removed and replaced with <_2>? Would you say..."	We have provided in Appendix D, a list of the responses to these 2 questions (LED101I and LED101J).
PG&E	Appendix A	NTG Battery	All	What are the evaluator's thoughts concerning survey fatigue and how it may affect the accuracy of responses to NTG surveys? Does the evaluator believe that improvements and/or simplifications to the NTG battery are possible and, if so, would they support a reconvening of the NTG Working Group?	Survey fatigue could be possible, however we do allow respondents to partially complete surveys and to reschedule the remaining questions for another time to help lessen perceived participant burden. In general, every effort is made to complete the survey as efficiently as possible. Although we are uncertain about a reconvening of the NTG Working Group, we do plan to make additional revisions to the NTG approach and plan to solicit input from the PAs.
PG&E	5.3.8	Gas Fryers	5-55	We would like to thank the evaluator for going into such detailed analysis on the discrepancy factors between modeled and observed energy consumption.	Thank you for this input.
PG&E	Various	Relative Precision	Various	Relative Precision is included with evaluated values throughout the report, but not in every case is an associated confidence interval included. Is relative precision always calculated at the 90% confidence interval?	Relative Precision is calculated at the 90% confidence interval in the report. We will clarify in the report.
PG&E	Various	Relative Precision	Various	Relative precision values range widely throughout the report. For clarity, can the evaluator please clearly define relative precision in the executive summary and also include an explanation of how it was calculated, why it was chosen over confidence interval, and how readers should interpret the results at different values of relative precision?	The relative precision is calculated as the confidence interval divided by the mean. Confidence intervals can easily be backed out by multiplying the relative precision by the mean value. Relative precison is an industry standard measurement, and the smaller the relative percentage value the more precise the mean result. We will make some edits to the report to address this comment.
PG&E	Various	All	Various	Waterfall graphics are presented in different formats and decimals/percentages are not consistent. Can the evaluator please update these so that they all follow the same format?	The pipe insulation and agricultural irrigation graphics are presented differently for two reasons: 1) these measures featured a few more categories that were illustrated horizontally to avoid a cluttered vertical waterfall graph; and 2) in the case of the pipe insulation measure, the graphic shows the positive and negative contributions within each category, which cancelled each other out in some cases.
PG&E	Appendix A	NTG Battery	Various	Can the evaluator please provide the verbatim results of the PAI-3 questionnaires as well as their accompanying scores?	We have provided in Appendix D a table of three survey questions that comprise PAI-3 (REPACE, N5 and N5aa)
PG&E	Appendix A	NTG Battery	Various	Can the evaluator please provide a breakout summary of how many participants they surveyed for midstream attribution and how many participants they surveyed for downstream attribution segmented by program category?	These values are provided in Table 6-2, along with the NTGRs.
PG&E	Appendix A	NTG Battery	Various	Can the evaluator please provide the verbatim responses to any question that explored how corporate energy efficiency or sustainability policy incentivized participant action? This information would be valuable as PAs continue to improve screening methods.	Only three customers responded to Question N3M, which asks the customer to rate the influence of a corporate policy or guidelines on their decision to install their equipment. They rate the influence on a 0 to 10 scale, where 10 is extremely influential. Of the three that responded to this question two rated the influence a 10 and one a 9. This question was only asked of customers whose rebate exceeded a certain threshold, which is why so few were asked the question. This was done to help shorten the survey length.

Submitted by	Section	Topic	Page	Comment	Evaluator Response
PG&E	Gas Fryers	Zero Savers	Various	Failed enterprises are an all too often occurrence in the food service industry. However, the claimed program equipment does circulate back into use by way of the used equipment market, so PG&E believes that assigning a few months' worth of savings for these installations likely understates their true savings. Undercapitalized hard to reach entities likely do not purchase new EE equipment, so the secondary market provides them an opportunity to acquire EE equipment. Also, PG&E would like to mention that when we receive these studies for review that refer to projects with generalized names, it does not allow us to follow up and offer evidence to refute what is claimed. We appreciate that these details can't be included in public reports, but we need to get this supplemental information to conduct a thorough review. This is also important to us as we need to follow up with the dealers that sold these zero savings projects to customers that claim they never purchased the equipment and to take corrective action if needed. This is a critical issue and by providing more specific information the evaluator can help us understand why this happened and take steps to prevent it from happening in the future. PG&E's hypothesis is that some of the not-in-use fryers may be due to aggressive annual sales events at some our larger distributors. Some offered pricing under $600/vat which may have led to a few participants not wanting to pass up a great deal rather than buying a fryer they absolutely needed at the time. We may require moderate incentive adjustments to prevent this from occurring in the future. In conclusion, PG&E requests additional consideration to reduce the discount of the zero saver projects as this equipment will find its way back into use through the used equipment market. PG&E also requests that supplementary details on these zero savers be provided that will allow us to conduct follow up inquiries and improve our programs.	The evaluation team was lenient on this point by providing partial credit to the program for zero savers, in an effort to be as fair as possible to the program, given existing CPUC policy surrounding evaluation treatment for conditions such as those we observed in the field during verification. CPUC policy dictates that evaluators evaluate the as-found condition, and strictly prohibits any forecasting to predict future savings and conditions. This includes fryers that may have been sold into a secondary market. However, we do agree with PG&E that the cooking equipment market may represent a special case and that perhaps the above mentioned policy guidance could be revisited for this and other special circumstances. There is precedence in the industry for special verification accounting of equipment that are moved/installed at more than one facility and perhaps other factors -- such as mid-stream lighting programs. The evaluation team is not aware of any such precedence for California programs.
PG&E	Gas Fryers	Operating Assumptions	4-8	PG&E's Chain QSR restaurants have much different operating inputs (hours of operation, pounds of food cooked, equipment efficiencies, etc.) than its independent restaurants. PG&E agrees that our instant rebate program introduced a much higher proportion of independent food service operators to our programs than our workpaper assumptions used, which should lead to lower operating hours and pounds of food per day cooked. When our program began the customer mix was weighted much more heavily towards national chain QSR operations. PG&E would like to request the information that informed operation parameters so we can better understand both the evaluation and how to improve program delivery.	Given limited time available for evaluators to comment on responses and update the report as needed for final posting on 4/1/2019, it is unlikely that the evaluation team can facilitate rapid data delivery to PG&E. Note that the evaluation team will be delivering all evaluation data to the CPUC in the coming months. It would likely be most feasible to direct requested portions of the data to PG&E at that time; but possibly in an anonymized fashion. It is also possible that the CPUC would have some say in how any such data is used/transferred to PG&E.
PG&E	Gas Fryers	NTG Battery	Various	PG&E believes the results of the current attribution survey inaccurately discounts program savings claims. For context, there were no ENERGYSTAR fryers stocked by local dealers in northern California and less than five units sold during the first seven years of this program to small independent restaurant operators. The nature of this NTG survey does not seem to recognize the attribution that this program should be receiving. PG&E absolutely agrees that there is the potential for a higher incidence of free ridership occurring with chain account customers that can calculate the value of efficiency and have the buying power to reduce the incremental costs. For PG&E these customers represented less than 20% of program volume in 2017 and should not have weighed significantly in NTG outcomes. However, independent operators are heavily driven by cost, and we find in many cases our program must compete with the used equipment market and the cheapest, most inefficient fryers available on the market. The instant rebate program brought a better fryer into to the price range of the cheap economy fryers that were being sold. A conversation with any of PG&E's participating food service dealers should give a clearer picture of program attribution. These Independent restaurants simply would not have paid $1,500-$2,000 for these fryers when there was a $700 inefficient fryer right next to it on the salesfloor. PG&E's dealers in many cases are forced to buy ten EE fryers at a time to get the best cost so they can price them competitively. They would not do that without the program because a high percentage of these customers would opt for the $700 fryer, so the high volume achieved by the program would not occur and the EE product volume would collapse as dealers stop stocking EE fryers. NTG surveys as they are currently designed do not properly account for the entire market dynamics surrounding these programs. Also, without knowing who answered each survey and what their specific answers were that led to these results we cannot assess if NTG attribution between independent and chain operators is properly weighted. PG&E believes there is a real need to develop a better way to determine program attribution, especially for midstream programs. No program can withstand an improperly assessed attribution method. It is extremely easy for a participant to claim they would have purchased the EE option when not faced by the decision of paying twice the price at the time they were making their purchasing decision. IOU Instant rebate programs serve a very high percentage of very small hard to reach customers and perhaps should be receiving special NTG consideration for being one of the few programs that addresses the needs of California's small underrepresented businesses. Unfortunately, these results could force PG&E to close this program. As we have asked in other comments, we request that the evaluation team revisit its attribution results, update scores where necessary, and clearly state any limitations on the certainty of findings.	Thank you for your comments. The current NTG framework relies primarily on responses from project decisionmakers. They are asked about the importance of the equipment vendor in their decision and if they score that highly, a vendor interview is conducted and the scoring is adjusted based on what the vendor says. We believe this approach addresses many of the concerns you raise, but are also open to revisiting it during the 2018 evaluation. For this 2017 evaluation, we have revisited the attribution results and do not feel any changes are warranted. As with any self-report approach, there is always some level of uncertainty in the findings.

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PG&E	5.5	Pipe Insulation	5-66	Table 5-57 calculates lifecycle savings using an EUL of 11 years. Since pipe insulation is an add-on measure, the life used in CET calculations is the lesser of the EUL of the add-on component (insulation) and the RUL of the host equipment (pipe). PG&E's 2017 ex ante workpaper data uses a life of 3.7 years, or 1/3 of the 11-year pipe insulation EUL from DEER due to a lack of an appropriate DEER EUL ID for the host equipment. That may likely have resulted in an underestimation of lifecycle savings. The DEER Resolution E-4952 released in 2018 now clarifies that the appropriate host RUL value for commercial pipe insulation measures to be 5 years.	Evaluators applied the pipe insulation EUL per workpaper SCGWP110812A Revision 3, which applied to PY2017 measures. In addition to the DEER source mentioned by PG&E, EUL varies widely across sources. This DEER EUL of 5 years for the pipe insulation implies an EUL for the host equipment of 15 years (where the RUL of the host equipment is set equal to the default 1/3 of the host equipment EUL). The evaluation team believes that this implied host equipment EUL of 15 years for pipes is low, as the piping itself is typically only changed or removed in major renovations or facility changes. The current SCG workpaper (Revision 4) acknowledges such: "Various studies and source show that piping life expectancy is of over 20 years." The evaluation team conclusion is that the host equipment implied is likely the water heater; and given that this measure addresses long pipe runs, and not just insulation near the water heater, we believe that the water heater is not a reasonable host equipment choice. That is, the vast majority of the pipe insulation would not be disturbed by water heater replacement, and would therefore likely remain in place following water heater replacement. The evaluation team believes that an 11 year EUL for pipe insulation is therefore a more accurate estimate, as it implies an EUL for the piping itself of 33 years. Furthermore, DEER Resolution E-4952 was not adopted until 2018, and since this is a PY2017 evaluation, the evaluation chooses to not accept the associated 5 year EUL guidance for commercial pipe insulation.
PG&E	Gas Fryers	Program Recommendatio ns	Various	Recommendations suggest verification be performed to ensure the installation of qualifying equipment. PG&E regularly conducts random verifications to ensure installation as well as nameplate verification to ensure that products are installed and meet program qualifications. What additional controls does evaluator suggest?	The evaluation team is suggesting that a more rigorous verification process be established in order to correct what appears to be a problem. This might include a higher verification sampling rate in order to get a better handle on how extensive the problem is and where it is occuring. Depending on what you find, you might also focus efforts on known problem areas, or perhaps learn about where the problems are (through verification) and then focus efforts, until the issue is resolved/corrected.
PG&E	Process Boilers	Recommendatio n PB1	8-3	Every process boiler application requires that the application include the combustion efficiency test that is created upon commissioning. This would not be included in submitted savings claims as this is a deemed program and these values are set in the workpaper. MBTUH input * Ex-ante savings estimate = savings claim. If the suggestion is that other factors be included it would most likely not be possible in the deemed program environment. Please clarify what additional data you would like PAs to consider collecting.	Based on our observations during this evaluation, we believe that process boilers are better suited as a quasi-prescriptive (partially-deemed) measure rather than a fully deemed measure. Each process (end-use) the boilers were observed to be serving was different across the IOUs' sample and across both PAs; to that effect, using process-specific capacity/ load factor values is helpful to accurately characterize the measure savings. Therefore, we believe that the PAs need to reconsider this measure's savings estimation and provide room for some customization. Additionally, if the PAs are already collecting combustion efficiency test results, those should be used to calculate the measure savings. Using the deemed values, which are in turn based on averages from previous studies, etc., will likely be misrepresenting the true savings acheived by the program.
PG&E	Process Boilers	Recommendatio n PB3	8-4	Adding monitoring/EMS to these boiler projects can be considered. EMS systems could help with program evaluation efforts, but PAs have historically encountered persistence issues that result in measures that fail to reach their theoretical savings potential.	Acknowledged; if persistence issues are purely related to the EMS measures, the PAs should, at a minimum, consider implementing a separate EMS upgrades program that is sold to process boilers participants as an add-on measure component.
PG&E	Process Boilers	NTG Battery	Various	The current attribution process seems not to recognize that it is unlikely that someone would pay an incremental cost to achieve energy savings and then claim that an entire project was driven by this incremental improvement. This oversight creates considerable discounts against all PA savings claims. We agree that free riders exist and need to be considered in savings calculations. PG&E would like to ask if the evaluation team knows different methods of determining attribution in use today that may weigh these factors more accurately, and if so, whether they can they be considered?	Thank you for the comment. We are not aware of any such method. However, we would like to note that we will be re-examining the NTG approach for PY2018.
PG&E	Gas Fryers	Zero Savers	5-33	PA would like to comment on conclusions made regarding one of the Zero Saver sites that was a supermarket chain location where the customer claimed the program fryer was defective and removed. Please note that this chain does not normally procure their equipment from local sources. The large inefficient kettle/pressure fryer that was found onsite during this evaluation is this supermarket's standard fryer. PG&E does not believe that the claimed program fryer was installed and removed because it did not work. Is it possible the reason given why the fryer was not there was misunderstood. It would seem more likely that their original kettle/pressure fryer broke and they purchased the economy grade EE fryer as an emergency replacement at a local distributor until the replacement for their standard spec fryer arrived. PG&E agrees that this is still a zero saver but believes the evaluation team may be incorrectly extrapolating quality issues for program EE fryers that are higher performing and higher quality than what would have been purchased otherwise. In this case, the non-program pressure fryer that was found in place costs over $10,000 while the Program Fryer the customer claimed defective and was therefore removed costs $750. It is uncharacteristic of large supermarket chains where capital is not an issue to divert from their normal procurement process and convert from spec grade equipment that could be characterized as a Mercedes to the equivalent of a Yugo. The results uncovered at this site evaluation are an anomaly and PG&E believes they should be treated as such in the evaluation.	After learning that the fryer at this site was not a program qualifying model, the evaluation team followed up with the store manager to find out more about the program unit -- and learned that is was installed, but did not operate properly, and following multiple attempts to repair the program fryer, the store replaced it roughly 2.5 months following installation. The evaluation team has no reason to believe we misinterpreted this self-report from the customer. However, we do appreciate the input and acknowledge that it is possible we may have misunderstood what the customer was trying to tell us.