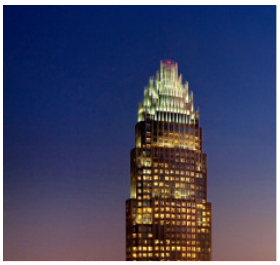
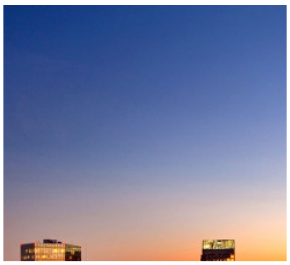
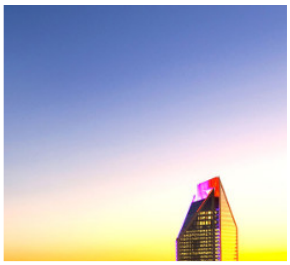
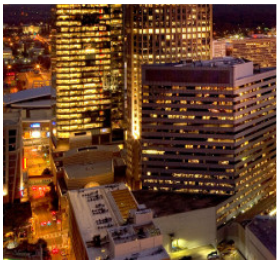

2015 NONRESIDENTIAL DOWNSTREAM ESPI DEEMED PIPE INSULATION IMPACT EVALUATION

Final Report

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California Public Utilities Commission

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1 EXECUTIVE SUMMARY

1.1 NEED FOR STUDY

This report documents the activities undertaken by the Nonresidential Downstream Pipe Insulation Impact Evaluation of the 2015 investor owned utilities' (IOUs') energy efficiency programs. The overall goal of this study is to perform an impact evaluation on specific deemed pipe insulation measures that were identified in the Efficiency Savings and Performance Incentive decision.[1]

In 2013, the California Public Utilities Commission (CPUC) developed the Efficiency Savings and Performance Incentive mechanism, which lays out various ways the IOUs can receive monetary incentives for the performance of their energy efficiency programs. One component of this mechanism is based on how much energy savings are derived over the life of the energy efficient equipment (lifecycle savings), or measures, that were installed through these programs.

The Efficiency Savings and Performance Incentive process identifies a list of energy efficiency measures that contribute the greatest levels of uncertainty among the portfolio of energy efficient measures offered by a given IOU. The CPUC and their consultants conduct research on these uncertain measures to estimate their lifecycle savings. A component of the Efficiency Savings and Performance Incentive mechanism then pays incentives to the IOUs based on these evaluated energy savings values.

1.2 ENERGY EFFICIENCY MEASURES STUDIED

This study evaluates one of the energy efficiency measure groups with high levels of uncertainty that were offered by the 2015 IOU energy efficiency programs: Nonresidential Pipe Insulation. Measures within the Pipe Insulation Hot Application measure group were ESPI measures under Southern California Gas' (SCG) energy efficiency programs. Prior to these evaluations, the IOU's submitted a claim for the amount of energy they believe the uncertain measures will save. The Pipe Insulation Hot Application measure group, among nonresidential market sectors, represents roughly 2.6% of the total gas energy (therm) savings claimed by all of SCG's program measures, over the life of the measures.

[1] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Shareholder+Incentive+Mechanism.htm

1.3 APPROACH

The Nonresidential Downstream Pipe Insulation Impact Evaluation study's objective is to evaluate SCG's energy savings claim for the Pipe Insulation Hot Application measure group in nonresidential market sectors, and to conduct research that develops revised estimates of savings. This study looks at the therm savings provided over the lifetime of the measures within this measure group. In order to develop a revised savings estimate, telephone surveys and on-site visits were conducted with a sample of customers that installed pipe insulation measures. The data collected as part of these activities include information on how the insulation was installed, and how the insulation affect the energy consumption of related equipment, such as boilers. These data are used to support the estimate of first year and lifecycle therm savings associated with the installed pipe insulation.

This evaluation then compares the initial savings claim made by SCG to this evaluation's results developed using the data collected on site. The initial savings claim is often times referred to as ex ante savings, because this is the savings value before (ex ante) the evaluation is conducted. The evaluation savings value is then referred to as the ex post savings, because this is the savings values developed after (ex post) the evaluation.

The ratio of the ex post (evaluation estimated) to ex ante (deemed program claim) savings is referred to as the "realization rate," or the rate at which ex ante savings are realized through the evaluation.

The evaluation also examines how successful the IOU programs were in influencing customers to install energy efficient measures that would not have been installed if the programs had not existed. Customers 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. Gross program savings is the total amount of savings, including the savings associated with free riders. Net program savings is the total amount of savings that is "net" of free ridership, or excluding savings associated with free riders. Therefore, the evaluation examines both the "gross" amount of savings derived among all participants, and the savings that is generated "net" of free riders.

This evaluation also developed estimates of the ratio between the net and gross levels of savings (the net-to-gross ratio or NTGR). To estimate the NTGR, the telephone survey includes several questions regarding the program's influence on the customer's decision to install the energy efficient equipment. The survey examines various factors related to the program and other non-program factors, as well as asking the customer what they would likely have done in the absence of the program.

These survey question responses determine how likely the program has influenced the customer's decision to install the measure, and conversely, how likely the participant was a free rider. The NTGR is estimated as the ratio of the savings that is net of free ridership to the total gross savings.

The ultimate goal of this evaluation is to estimate net lifecycle energy savings of the Pipe Insulation Hot Application measure group. This value is the savings estimated by the evaluation (ex post), which is generated by the program over the life of the measures (lifecycle) that are installed, minus (net) the free riders.

1.4 RESULTS

The results of this evaluation are summarized in the table below. Shown are the ex post and ex ante net lifecycle savings values (therms), the realization rates (ratio of ex post to ex ante), and the corresponding NTGR.

TABLE 1-1: EX ANTE AND EX POST NET LIFECYCLE THERM SAVINGS, REALIZATION RATES AND NTGRS

Energy Efficiency Measure Group	Net Lifecycle Therm Savings		Net Realization Rate (Ex Post/Ex Ante)	Net-to-Gross Ratio
	Ex Ante (Claimed)	Ex Post (Evaluated)		
Pipe Insulation Hot Application	2,953,840	2,996,536	101%	0.44

The evaluation team performed 25 telephone surveys and 19 on-site visits for customers who had installed pipe insulation measures. Overall, the evaluated net lifecycle ex post savings value compares well to SCG's claimed ex ante savings, with the ex post savings just 1% higher. There are numerous parameters that comprise the net savings values. Overall, the parameters that comprise the gross savings (therefore, including free riders) resulted in ex post gross savings that exceeded the ex ante claim by 41%. This was driven primarily by one customer in the on-site sample that resulted in very high ex post savings relative to the ex ante savings claim and the following:

Installation Rates

- All rebated insulation was determined to be 100% installed as tracked. However, the field auditors determined that 13% of the rebated insulated piping required minimally-compliant baseline insulation; this baseline adjustment resulted in a 2% reduction of the realization rate.

Operating Hours

- Boiler annual operating hours in large commercial and industrial facilities were found to be 6,552 and 6,106 hours per year, respectively.

Pipe Temperature

- The hot water bare pipe temperature was found to be 138°F and 134°F at commercial and industrial facilities, respectively. The medium-pressure steam bare pipe temperature was found to be 304°F and 258°F at commercial and industrial facilities, respectively.

Surrounding Air Temperature

- The hot water piping's surrounding air temperature was found to be 75°F and 71°F at commercial and industrial facilities, respectively. The medium-pressure steam piping's surrounding air temperature found to be 87°F and 79°F at commercial and industrial facilities, respectively.

Boiler Combustion Efficiency

- The hot water boiler combustion efficiency was found to be 88%, but no significant difference was found for the IOU-assumed medium-pressure steam boiler combustion efficiency of 83%.

Pipe Diameter

- The average diameter of insulated pipe was considerably higher for all customers and fluid types in the higher-diameter tier. Greater-than-assumed diameter leads to higher savings per insulated linear foot.

The ex ante NTGR, however, was about 40% higher than the ex post NTGR. Therefore, the overall net savings were about the same for ex post and ex ante.

1.5 RECOMMENDATIONS

Pipe insulation measures continue to provide reliable therm savings, which was verified by this evaluation. Overall, the ex post net lifecycle savings differed by only one percent from the ex ante claim.

Evaluators identified one recommendation as a result of this study—that a savings tier representing large-diameter piping is added to the program's tracking protocols. Currently the program features two savings tiers: one for piping less than 1" in diameter, and another for piping greater than or equal to 1" in diameter. Based on our findings in this study and the PY2013-14 evaluation, we recommend that a third savings tier is added for piping greater than or equal to 3" in diameter, to most accurately characterize the savings for a significant portion of the insulation rebated by the program.

While most of the customers that were visited on site had ex post savings that were in the general range of the ex ante savings claim, there was one customer in particular who's ex post savings significantly

exceeded the ex ante savings value (over 20 times greater). This site installed pipe insulation that was three times thicker, and on a pipe six times wider in diameter, that serviced a boiler that operated more than 3 times more hours than was assumed by the ex ante savings assumptions. In cases as extreme as this, customers should be encouraged to participate in the energy efficiency programs offered by SCG that allow for more customized calculations of energy savings, rather than those that apply a fixed, per-unit deemed savings value. If possible, programs should focus data collection on key parameters that will most greatly impact savings—boiler runtime, combustion efficiency, fluid temperature, and pipe diameter—in these custom cases.

1.6 CONTACT INFORMATION

The ED Project Manager for this study was Mr. Robert Hansen. Itron served as the Prime Contractor managing this study, led by Mr. Brian McAuley.

The following is Mr. Hansen and Mr. McAuley's contact information.

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2 INTRODUCTION AND OVERVIEW OF STUDY

This report documents the activities undertaken by the Nonresidential Downstream Pipe Insulation Impact Evaluation of the 2015 IOUs' energy efficiency programs.[2] The overall goal of this study is to perform an impact evaluation on specific deemed pipe insulation measures that were identified in the Efficiency Savings and Performance Incentive (ESPI) decision.[3]

This report is informed by Attachment 2 and 3 of the ESPI decision for program year (PY) 2015 and details the goals and objectives of the impact evaluation to meet those requirements. Likewise, the report will discuss the researchable issues, information on the measure groups evaluated as well as the data sources used, the approach for sampling, the verification analysis and the methods used to determine ex post energy impacts. Finally, the report will present the results and findings from the analysis that can then be used to update the NTGRs and gross/net first year and lifecycle savings for the measures detailed in the ESPI decision.

2.1 EVALUATION RESEARCH OBJECTIVES

The objective of the Nonresidential Pipe Insulation study was to perform a measure and/or measure-parameter impact evaluation, utilizing new primary evaluation data, in order to update existing gross and/or net savings estimates and inform future savings values for specific deemed pipe insulation measures identified in the ESPI decision. Attachment 2 of the ESPI decision provides an overview of the portfolio parameters that have been identified as potentially requiring ex post verification.

It is important to 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, with guidance from the CPUC, what measures and measure-parameters are subject to ex post evaluation. This determination is based on a number of factors, which will be presented in more detail throughout this report:

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[2] This report focuses on the Pipe Insulation Hot Application ESPI measure group that was identified for the 2015 program cycle.

[3] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Shareholder+Incentive+Mechanism.htm

- **Pipe Insulation – Hot Application** (SCG only)
  - The parameters associated with deemed measure verification for pipe insulation measures include: measure installation/verification, unit energy savings (UES), NTGRs, gross and net energy savings values, effective useful life (EUL), bare pipe temperature, ambient temperature, annual hours of operation and boiler combustion efficiency.

A number of research objectives have been targeted in order to develop net and gross ex post impacts for the measures detailed above. For this evaluation, a gross realization rate (GRR) approach has been utilized, where site-specific gross ex post impacts have been estimated from a sample of participants. These site-specific gross ex post impacts were then compared to the ex ante claim from the tracking data to develop a ratio of ex post to ex ante savings.

The following tasks have been performed, by collecting new primary data from participant phone surveys and/or on-site verification analyses, in order to develop the realization rates. A more detailed description of the impact methodologies follows in Section 4, given that the approach is site-specific and the objectives are predicated on the types of measures (or projects) being evaluated, but to summarize:

- Confirm installations (verification). This step includes on-site verification of measure installations that represent a significant percentage of ex ante claimed natural gas savings.
- Estimate baseline (pre-retrofit) and replacement (post-retrofit) pipe heat loss rates and operating hours to support the estimate of unit energy savings values.
- Estimate participant free-ridership to support the development of net-to-gross ratios and net savings values.
- Based on the above, estimate first year and lifetime gross and net ex post impacts (therm) for pipe insulation measures.

2.2 STUDIED MEASURE GROUPS

The Pipe Insulation Hot Application measure group listed on the ESPI uncertain list for 2015 are aggregate measures that are comprised of 19 unique measure names. As presented in Table 2-1, there were a variety of different measures associated with rebated pipe insulation. The "N" represents the number of sites in the population that participated and were rebated in 2015.

TABLE 2-1: PERCENTAGE OF 2015 LIFECYCLE EX ANTE GROSS THERMS SAVINGS FOR PIPE INSULATION HOT APPLICATION BY MEASURE NAME

Measure Name	N	Lifecycle Ex Ante Gross Therm Savings	Percent LC Therm Savings
Pipe Insulation - Industrial - Medium Pressure Steam >=15 Psi < 1" Pipe, Indoor	8	121,165	4%
Pipe Insulation - Industrial - Medium Pressure Steam >=15 Psi >= 1" Pipe, Indoor	12	1,185,654	37%
Pipe Insulation - Industrial - Medium Pressure Steam >=15 Psi >= 1" Pipe, Outdoor	5	1,055,907	33%
Pipe Insulation - Lg Com >=12 Hr - Low Pressure Steam <15 Psi >= 1" Pipe, Indoor	1	86,555	3%
Pipe Insulation - Lg Com >=12 Hr - Medium Pressure Steam >=15 Psi < 1" Pipe, Indoor	2	22,848	1%
Pipe Insulation - Lg Com >=12 Hr - Medium Pressure Steam >=15 Psi >= 1" Pipe, Indoor	7	511,168	16%
Pipe Insulation - Lg Com >=12 Hr - Medium Pressure Steam >=15 Psi >= 1" Pipe, Outdoor	1	170,866	5%
Pipe Insulation - Sm Com <12 Hr - Medium Pressure Steam >=15 Psi >= 1" Pipe, Indoor	1	84,111	3%
Total Hot Steam	**37**	**3,238,274**	**100%**
Pipe Insulation - Industrial - Hot Water < 1" Pipe, Indoor	1	97,135	6%
Pipe Insulation - Industrial - Hot Water < 1" Pipe, Outdoor	3	108,065	7%
Pipe Insulation - Industrial - Hot Water >= 1" Pipe, Indoor	12	628,874	39%
Pipe Insulation - Industrial - Hot Water >= 1" Pipe, Outdoor	1	25,577	2%
Pipe Insulation - Lg Com >=12 Hr - Hot Water < 1" Pipe, Indoor	3	1,675	0%
Pipe Insulation - Lg Com >=12 Hr - Hot Water < 1" Pipe, Outdoor	1	35,782	2%
Pipe Insulation - Lg Com >=12 Hr - Hot Water >= 1" Pipe, Indoor	11	180,581	11%
Pipe Insulation - Lg Com >=12 Hr - Hot Water >= 1" Pipe, Outdoor	3	472,186	29%
Pipe Insulation - Sm Com <12 Hr - Hot Water < 1" Pipe, Indoor	1	6,099	0%
Pipe Insulation - Sm Com <12 Hr - Hot Water >= 1" Pipe, Indoor	4	59,267	4%
Pipe Insulation - Sm Com <12 Hr - Hot Water >= 1" Pipe, Outdoor	1	1,838	0%
Total Hot Water	**41**	**1,617,079**	**100%**

Table 2-2 presents the hot steam and hot water pipe insulation measure's contribution to SCG's 2015 portfolio lifecycle gross ex ante therm savings (as well as the statewide (SW) contribution).

TABLE 2-2: PERCENTAGE OF 2015 EX ANTE FIRST YEAR AND LIFECYCLE GROSS THERMS SAVINGS

2015 ESPI Measure Group	Percent of First Year Gross Therm Savings		Percent of Lifecycle Gross Therm Savings	
	SW	SCG	SW	SCG
Pipe Insulation Hot Application	1.08%	2.99%	1.06%	2.63%

As evidenced above, the pipe insulation measures that were identified in the ESPI decision represent roughly 2.6% of SCG and 1.1% of statewide portfolio lifecycle portfolio ex ante therm savings, respectively. Given the contribution to ex ante savings and the uncertainty surrounding several of the impact parameters associated with this measure, the evaluation team has conducted phone interviews and on-site verification for a sample of the measures that were rebated in 2015. The evaluation team has used these data collection methods to estimate NTGRs and levels of free-ridership and has employed a gross realization rate (GRR) approach to estimate gross savings. The GRR refers to the approach of estimating site-specific savings values for a sample of participants, and developing a realization rate of savings (the ratio of aggregate ex post savings to aggregate ex ante savings for the sample) and applying the GRR to the ex ante savings value for the population to estimate ex post population level savings.

2.3 OVERVIEW OF IMPACT EVALUATION APPROACH

For pipe insulation measures, the general approach used to estimate ex post gross savings values was 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 processes by way of calculating the heat loss rates for bare and insulated pipe runs using NAIMA's 3E Plus pipe insulation software program. Metered data characterizes specific parameters included in the following formula:

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

Where:

ΔQ = annual energy savings (in therms/ft). This parameter represents the ex post savings objective of this study.

t = annual operating time, in hours. Metered data on pipe surface temperature indicates when the insulated pipe transmits heated fluid. Metered data, gathered over 2-8 weeks, was extrapolated to represent a full year, after accounting for any seasonal variations determined from facility staff interviews. For long spans of insulated pipe, installed meters were deployed as close to the pipe span's midpoint as possible.

Q_p = Heat Loss Rate from Bare (or Previously-Insulated) Pipe[4] (Btu/hr/ft). Bare pipe experiences heat loss from convection and radiation processes. Both convection and radiation heat losses are primarily dependent on the following parameters: pipe diameter, pipe surface temperature, and ambient air temperature, the latter two of which were determined from interval metered data. Other pipe and insulation parameters were collected during the site visit. Remaining relevant parameters such as pipe conductivity and pipe emissivity were referenced from a heat transfer resource[5] based on material type.

Q_i = Heat Loss Rate from Insulated Pipe (Btu/hr/ft). Insulated pipe experiences convection and radiation heat transfer processes to the environment, as described above, but these processes are limited by the reduced rate of conduction heat transfer between the pipe and insulating material rather than through the pipe alone. Key insulation characteristics such as thickness and material were confirmed during each site visit. The insulation's surface temperature was spot-measured during site visits, and relevant insulation parameters (conductivity and emissivity) were referenced from manufacturer data.

E_b = Combustion efficiency (%) of the boiler being used to generate the hot water or steam in the pipe. Combustion efficiency was spot-measured during each site visit or referenced from manufacturer testing data.

$C_{btu} = \frac{100{,}000\ \text{Btu}}{1\ \text{therm}}$ = energy conversion factor (1 therm = 100,000 Btu).

To develop the site-specific estimates of savings, each of the above parameters is informed by metered and/or collected data from site inspections. The remainder of this report will discuss how these were generated for the ESPI Pipe Insulation Hot Application measure groups along with 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 presents the methods used for estimating each individual impact parameter, including the installation rate, the various temperature values, and the pre- and post-operating hours.
- Section 5 presents the net-to-gross analysis and resulting NTGRs.

[4] Should the affected pipe have required insulation per OSHA guidelines, the baseline reflects the minimum level of insulation needed to comply. Information on OSHA compliance and minimum insulation requirements were gathered through discussions with facility staff.

[5] An example resource is: *Introduction to Heat Transfer*, Frank Incropera and David DeWitt, John Wiley & Sons, Inc., New York, NY, 2002.

- Section 6 presents the final study results, including a discussion of how the UES values were applied to the population to develop gross and net realization rates and total population level ex post energy savings values.
- Section 7 summarizes the key findings from this evaluation study.
- Appendix A presents the participant telephone survey instrument.
- Appendix B presents the on-site survey instrument.
- Appendix C presents the phone survey banners.
- Appendix D presents the site reports and discrepancy analysis.
- Appendix E presents supporting materials for the net-to-gross analysis.
- Appendix AA presents the standardized high level savings for both gross and net first year and lifecycle.
- Appendix AB presents the standardized per unit savings for both gross and net first year and lifecycle.
- Appendix AC presents the summary of recommendations for the Response to Recommendations.

3 DATA SOURCES AND DATA COLLECTION

3.1 DATA SOURCES

A number of data sources were utilized to support the development of each impact parameter in order to develop the ex post impacts, installation rates and NTGRs for the ESPI Pipe Insulation Hot Application measure group researched in this study. As discussed in Section 2, the impacts associated with the pipe insulation measure rely exclusively on new primary on-site data collection: (1) engineering on-site assessments to evaluate the gross impacts associated with those measures and (2) new phone surveys to generate NTGRs. The various sources of data are discussed in more detail below.

3.1.1 On-Site Audits

Verification data was collected to support installation rates, pipe characteristics (length, diameter, material), and insulation characteristics (length, thickness, material). The onsite involved collecting spot-reads on a number of parameters affecting insulation savings, including fluid pressure and temperature (via gauge readings), boiler combustion efficiency (via spot combustion analyzer) and insulation surface temperature (via infrared temperature gun). Both spot and long-term measurements of bare pipe temperature as well as insulation surface temperature occurred at similar sections of the pipe run, at the pipe run's midpoint when possible. Field staff noted the installed insulation quality by inspecting the insulation for gaps and contact with the pipe wall.

Self-report data was also gathered on the pre-existing pipe configuration insulation condition to help define the baseline condition. Data was gathered on pre-existing insulation quality, such as missing sections, gaps, or sagging, through interviews with facility staff. If possible, pre-existing insulation quality was assessed by examining areas of the facility that did not receive a recent pipe insulation enhancement.

Information on the layout of affected pipes was also noted. Specifically, OSHA[6] 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 measured horizontally from stairways, ramps, or fixed ladders shall be covered with a thermal insulating material or otherwise guarded against contact." This study assessed if these safety compliance measures apply to any of the projects selected in this sample.

[6] From California OSHA T8CCR 3308: http://archive.org/stream/gov.ca.ccr.08.3/ca.ccr.08.3_djvu.txt

3.1.2 Installation Time of Use Temperature Loggers

As part of each on-site visit, a sampling of insulated pipe(s) was monitored for a period of two to eight weeks, depending on facility schedule and variability, to gather interval data to support key energy savings parameters. Specifically, type-K temperature probes[7] with HOBO data loggers[8] were deployed directly onto the pipe's exterior surface to inform fluid temperature and boiler operating hour parameters. In order to achieve accurate temperature results, field staff carefully removed a small section of the rebated insulation to allow direct contact between the bare piping and thermocouple. Thorough in-field testing was performed by the auditor to ensure that the temperature data was similar to the fluid temperature observed from gauge readings. The thermocouple was kept in place using thermal tape and collected data over a period of 4-6 weeks. At the conclusion of the metering period, the small removed section of insulation was replaced and secured with additional tape.

HOBO ambient temperature loggers[9] were deployed among a selection of facility spaces with insulated pipe in order to monitor the ambient air temperature, which factors into the pipe heat loss equation.

3.1.3 Participant Phone Survey

A phone survey was conducted to recruit customers for the on-site visit, as well as collect data useful for the net-to-gross (NTG) analysis and various other components of the evaluation. One other key use of the phone survey was to gather information on annual operating hours and schedule variability of facility boiler(s) prior to the site visit. This information allowed the field team to more accurately estimate the logging interval and duration to maximize data resolution. A copy of the participant phone survey script is included in Appendix A.

3.2 PHONE SURVEY AND ON-SITE VERIFICATION DESIGN AND DATA COLLECTION

As presented in Table 2-2, pipe insulation measures represent 1.1% of statewide lifecycle ex ante therm savings and roughly 2.6% within SCG alone. These measures represent a total of 78 unique site-measures that were rebated in 2015 (Table 2-1). Given the significance in ex ante savings and the variety of measures associated with the Pipe Insulation Hot Application measure group, the evaluation team developed the sample design around two key stratification schemes – the fluid type and the customer type. Table 3-1 presents the sample design for both the on-site and phone survey along with the achieved

[7] The TC6-K Beaded Thermocouple Sensor is accurate to within ±4°F over a range of 32° to 900°F.

[8] The HOBO U12-014 Thermocouple Logger is accurate to within ±7.2°F over a range of 32° to 2282°F.

[9] The HOBO U12-013 Temp/RH/2 External Data Logger is accurate to within ±0.63°F from 32° to 122°F.

number of completes by these stratification schemes (or strata). These summaries represent site-measures, in that one unique site may have installed pipe insulation on multiple runs of piping varying in length and pipe diameter. Likewise, some facilities have both hot water and steam boilers. Given the low number of participating sites, the evaluation team issued a data request to SCG to garner more specific customer contact information than is available in the Customer Information System (CIS) and tracking data, along with account representative information (where available). Also presented are the total number of unique sites that were evaluated and the percentage of each segment's lifecycle savings that is represented by the sample.

TABLE 3-1: PHONE SURVEY AND ON-SITE VERIFICATION SAMPLE SIZES

Fluid Type	Customer Type	Phone Survey			On-Site Verification		
		Quota	Collected	% Lifecycle Savings Sampled	Quota	Collected*	% Lifecycle Savings Sampled
Steam	Agricultural/Industrial	10	5	40%	5	5	58%
	Commercial	5	5	49%	5	3	28%
Hot Water	Agricultural/Industrial	5	6	37%	5	5	34%
	Commercial	5	9	40%	5	9	78%
All	**All**	**25**	**25**	**40%**	**20**	**19**	**51%**

* The column sums up to more than the total because some participants installed multiple measures across various strata.

Overall, the evaluation conducted 25 phone surveys across all sampled strata. Given difficulties in recruiting (especially in the hot steam – agricultural/industrial sector), the evaluation team extended the phone quotas for other segments beyond what was initially planned. Overall, the phone survey completes represented roughly 40% of the total ex ante lifecycle therm savings for pipe insulation measures. Twenty-five customers that participated in the phone survey were targeted for on-site verification, resulting in a sample of 19 unique on-site verifications.

Participating customers often featured more than one unique pipe run insulated with SCG assistance. When possible, field engineers independently assessed each unique pipe run at each project in the sample of 19 sites. Therefore, this study assessed 50 distinct pipe insulation observations at the 19 participating facilities in the evaluation sample. This represented 22 unique site-strata and, overall, 51% of the total ex ante lifecycle therm savings for pipe insulation measures. Because the phone survey focused only on a limited number of pipe insulation projects per customer and the on-site verifications evaluated all projects, the on-site sample represents more of the segment's lifecycle savings (51%) than the phone survey (40%).

Table 3-2 below presents the total number of unique sites that were sampled by measure name and the percentage of ex ante savings that were sampled.

TABLE 3-2: PERCENTAGE OF 2015 SAMPLED LIFECYCLE EX ANTE GROSS THERMS SAVINGS FOR PIPE INSULATION HOT APPLICATION BY MEASURE NAME

Measure Name	n	Lifecycle Ex Ante Gross Therm Savings	Percent LC Therm Savings
Pipe Insulation - Industrial - Medium Pressure Steam >=15 Psi < 1" Pipe, Indoor	3	45,046	37%
Pipe Insulation - Industrial - Medium Pressure Steam >=15 Psi >= 1" Pipe, Indoor	4	459,251	39%
Pipe Insulation - Industrial - Medium Pressure Steam >=15 Psi >= 1" Pipe, Outdoor	2	866,707	82%
Pipe Insulation - Lg Com >=12 Hr - Low Pressure Steam <15 Psi >= 1" Pipe, Indoor	1	86,555	100%
Pipe Insulation - Lg Com >=12 Hr - Medium Pressure Steam >=15 Psi < 1" Pipe, Indoor			
Pipe Insulation - Lg Com >=12 Hr - Medium Pressure Steam >=15 Psi >= 1" Pipe, Indoor	1	49,232	10%
Pipe Insulation - Lg Com >=12 Hr - Medium Pressure Steam >=15 Psi >= 1" Pipe, Outdoor			
Pipe Insulation - Sm Com <12 Hr - Medium Pressure Steam >=15 Psi >= 1" Pipe, Indoor	1	84,111	100%
Pipe Insulation - Industrial - Hot Water < 1" Pipe, Indoor			
Pipe Insulation - Industrial - Hot Water < 1" Pipe, Outdoor	2	89,915	83%
Pipe Insulation - Industrial - Hot Water >= 1" Pipe, Indoor	5	203,208	32%
Pipe Insulation - Industrial - Hot Water >= 1" Pipe, Outdoor			
Pipe Insulation - Lg Com >=12 Hr - Hot Water < 1" Pipe, Indoor	1	709	42%
Pipe Insulation - Lg Com >=12 Hr - Hot Water < 1" Pipe, Outdoor	1	35,782	100%
Pipe Insulation - Lg Com >=12 Hr - Hot Water >= 1" Pipe, Indoor	5	74,836	41%
Pipe Insulation - Lg Com >=12 Hr - Hot Water >= 1" Pipe, Outdoor	3	472,186	100%
Pipe Insulation - Sm Com <12 Hr - Hot Water < 1" Pipe, Indoor	1	6,099	100%
Pipe Insulation - Sm Com <12 Hr - Hot Water >= 1" Pipe, Indoor	1	1,674	3%
Pipe Insulation - Sm Com <12 Hr - Hot Water >= 1" Pipe, Outdoor	1	1,838	100%

4 GROSS IMPACT METHODOLOGY

This section provides an overview of the methods used to estimate the key impact parameters, the ex post gross impacts and the NTGRs for the ESPI deemed Pipe Insulation Hot Application measure group identified for PY 2015.

4.1 OVERVIEW OF APPROACH

The primary objective of the Nonresidential Downstream Pipe Insulation Impact Evaluation study is 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 pipe insulation measure identified in the ESPI decision. Researched parameters, including operating hours, bare pipe temperature, surrounding temperature, boiler combustion efficiency, installation rates, RULs and estimates of free ridership, can be used to assess ex post performance for PY 2015.

More specifically, these parameter level results will be aggregated in order to develop therm unit energy savings (UES) values and net-to-gross ratios (NTGRs) for the pipe insulation measures identified in Appendix 3 of the ESPI decision.

As discussed in more detail below, the impact parameter estimates were developed at different levels of segmentation in order to generate ex post gross impacts by market segment and pipe characteristic. For example, operating hours were generated by market segment, whereas bare pipe temperature and surrounding air temperature values were generated by fluid type. Unless otherwise indicated, all parameter-level averages have been weighted by insulation length (in feet) among the various segments of interest.

This section discusses, in detail, the inputs that were used to develop these parameter estimates. They also inform the general approach that was used to develop the unit energy savings (UES) values, as well as the site-specific ex post therm savings, and ultimately the GRRs.

4.2 INSTALLATION RATES

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 19 pipe insulation projects in the sample, the field auditors found the pipe insulation to be 100% installed as tracked, through visual inspection, spot measurement, and review of project invoices. However, the field auditors also found that 13% of the rebated insulated piping required insulation to minimally comply with OSHA. Table 4-1 breaks down the installation rate into each of the categories described above.

TABLE 4-1: INSTALLATION RATES FOR PIPE INSULATION – HOT APPLICATION

Measure group	Sites*	Received Rate	Failure Rate	Storage Rate	Removal Rate	Code-Mandated Rate	Installation Rate
Pipe Insulation – Hot Application	19	100%	0.0%	0.0%	0.0%	13.1%	86.9%

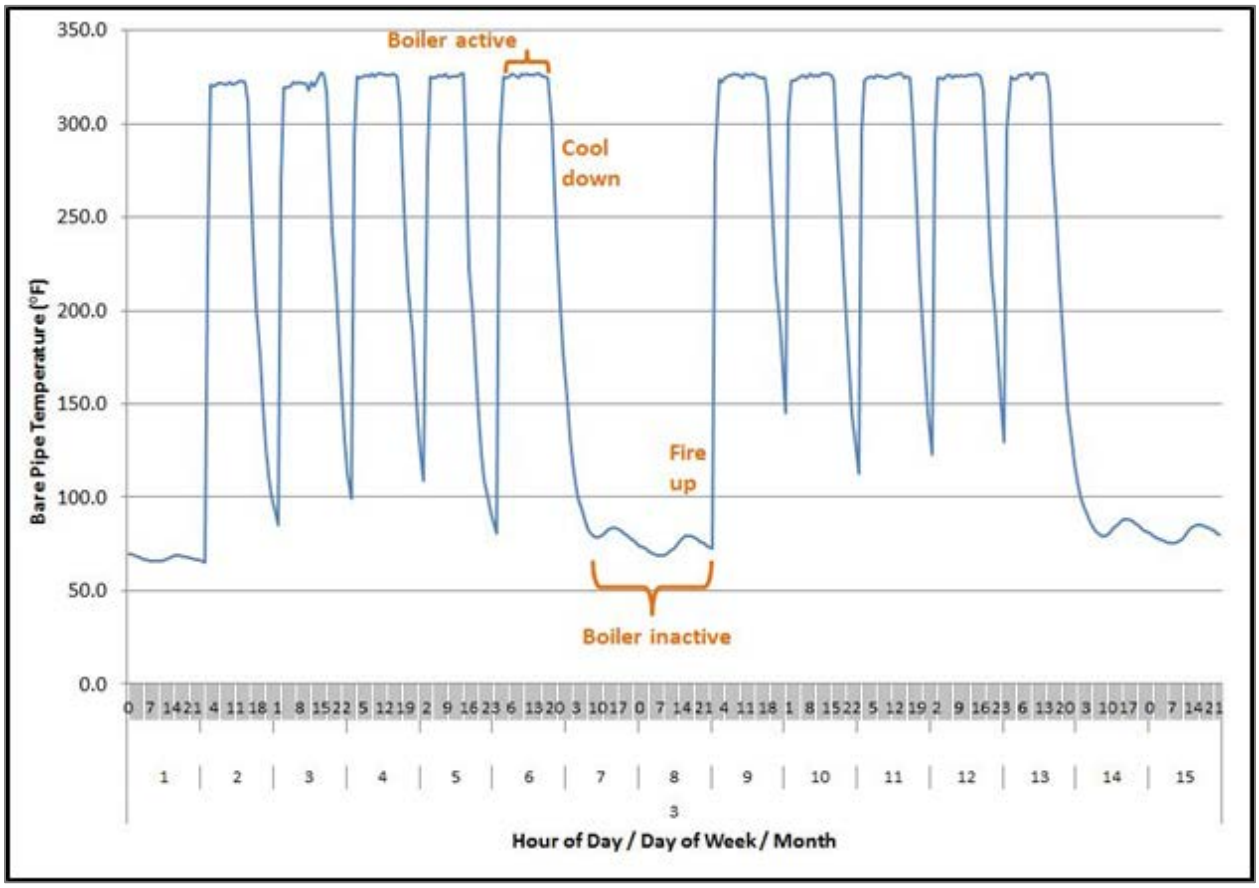
* The term 'site' is used synonymously with 'project' in this report.

4.3 OPERATING HOUR ANALYSIS

One of the primary inputs to the gross savings calculations is the number of annual hours that the insulated pipe is heated. This section will discuss the development of the annual operating hours value through analysis of temperature logger data.

As mentioned in Section 3.1.2 and will be expanded upon in Section 4.4.1, type-K temperature loggers were installed on representative sections of insulated pipe at sampled facilities. These loggers not only provide information on key temperature inputs in the heat loss calculation but also indicate when the monitored pipe was heated, providing insight into the parent boiler's operating schedule. An example analysis of operating hours from temperature data is illustrated in Figure 4-1; the analysis considered the "boiler active" periods as the operating hours over the metering period. Operating hours were calculated empirically by identifying a threshold temperature (300°F in the case of Figure 4-1) and assuming that the boiler was operating whenever the metered temperature exceeded that value.

FIGURE 4-1: EXAMPLE ANALYSIS OF OPERATING HOURS FROM TEMPERATURE DATA



Because loggers were not installed for a full year, the logger data needed to be extrapolated out to a full year of 8,760 hours. In general, the analysis calculated the ratio between the number of hours the insulated pipe was heated over the metering period and the total number of hours in the metering period; this ratio was applied to 8,760 hours to determine the total number of annual hours that the insulated pipe was heated.

While on site, the field auditors gathered information on any seasonal changes in facility operation (e.g., a vineyard that featured an increase in shifts during the grape harvest); these seasonal effects were considered in the extrapolation on a case-by-case basis. Industrial customers typically quantified seasonal effects through an estimate in the weekly number of shifts by season, whereas commercial customers typically indicated changes in hours open.

The final step after extrapolating each individual logger to an annual operating hours value is to aggregate each logger to a customer type. IOUs classify participating customers as small commercial, large

commercial, and industrial, each with a unique ex ante annual operating hour assumption. Table 4-2 compares the ex ante operating hours assumption with the ex post finding for each customer type.

TABLE 4-2: COMPARISON OF EX ANTE AND EX POST ANNUAL OPERATING HOURS BY CUSTOMER TYPE

Customer Type	Sites	Observations†	Ex Ante Operating Hours	Mean Ex Post Operating Hours	Ex Post Standard Deviation (Hours)
Small Commercial	3	6	2,425	7,003	2,495
Large Commercial	8	17	4,380	6,552	3,125
Industrial	8	27	7,752	6,106	2,648

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

Commercial customers were found to operate more than assumed within IOU deemed savings, by 189% and 50% for small commercial and large commercial, respectively. However, industrial boilers were found to operate for 21% fewer hours. As sampled projects often featured multiple different unique pipe runs, the evaluation team assessed over twice as many observations as sites in the sample.

4.4 TEMPERATURE ANALYSIS

In addition to indicating the boiler operating schedule, deployed temperature loggers also provided valuable data on key temperatures influencing the hourly heat loss. This section will discuss the use of metered data in characterizing bare pipe temperatures and surrounding air temperatures among a sample of participating customers.

4.4.1 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 three methods:

- **Data metering** – The type-K thermocouple loggers described in Section 3.1.2 provided interval data on bare pipe temperature throughout the 2- to 8-week metering period. Loggers were configured to collect data at 5 minute intervals throughout the duration of the metering period.
- **Gauge readings and spot-measurement** – Field auditors supplemented long-term metered data with 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** – 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 heat loss calculation tool determined the average bare pipe temperature when the pipe was heated (i.e., during "boiler active" periods of Figure 4-1). As IOUs classify heating processes based on fluid temperature and pressure, Table 4-3 compares ex ante bare pipe temperature assumptions with ex post findings for three fluid categories: hot water, low-pressure steam, and high-pressure steam.

TABLE 4-3: 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	27	150.0	135.6	22.2
Low-Pressure Steam	3	243.0	222.9	0.0
Medium-Pressure Steam	20	328.0	270.5	68.2

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

Hot water and medium-pressure steam piping, which account for the most significant shares of total measure group savings, featured lower bare pipe temperatures than reflected within IOU deemed savings assumptions. Please note that only three low-pressure steam runs were encountered in the sample of projects, due to the low number of low-pressure steam piping in the participant population.

Evaluators further assessed variation in hot water and medium-pressure steam bare pipe temperature as a function of customer type, as summarized in Table 4-4. Each of the customer-fluid permutations resulted in an ex post bare pipe temperature lower than the ex ante assumption.

TABLE 4-4: 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	18	150.0	138.3	20.2
Medium-Pressure Steam	3	328.0	304.8	65.5
Industrial				
Hot Water	9	150.0	133.6	26.2
Medium-Pressure Steam	17	328.0	258.3	69.8

* 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.

4.4.2 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 a combination of three methods:

- **Data metering** – Air temperature loggers were deployed at a representative location near the insulated pipe, providing interval data on surrounding air temperature throughout the 2- to 8-week metering period.
- **Gauge readings and spot-measurement** – Field auditors supplemented long-term metered data with spot readings of surfaces near the deployed equipment using infrared temperature guns.
- **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 heat loss calculation tool determined the average bare pipe temperature when the pipe was heated (i.e., during "boiler active" periods of Figure 4-1). Any seasonal adjustment, such as weather fluctuation for insulated pipe located outdoors, was factored into the extrapolation on a case-by-case basis. As most insulated pipe was assumed to be located indoors, IOUs assumed a surrounding air temperature of 75°F for all customer types and fluid types. Table 4-5 presents evaluator findings in surrounding temperature as a function of fluid type.

TABLE 4-5: 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	27	75.0	72.7	11.5
Low-Pressure Steam	3	75.0	93.4	0.0
Medium-Pressure Steam	20	75.0	81.4	7.5

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

Evaluators determined surrounding air temperature to be slightly lower than the ex ante assumption for hot water piping, while medium-pressure steam was found to feature a surrounding air temperature 9% higher than the ex ante assumption. The comparatively low number of low-pressure steam observations resulted in a weighted average surrounding temperature significantly higher than hot water and medium-pressure steam values. Field engineers often encountered insulated piping in boiler rooms or industrial spaces not mechanically cooled; each of the surrounding air temperatures for low-pressure steam piping were above 93°F on average.

Evaluators further assessed variation in hot water and medium-pressure steam surrounding air temperatures as a function of customer type, as summarized in Table 4-6. Other than hot water piping at industrial facilities, each of the customer-fluid permutations resulted in an ex post surrounding air temperature higher than the ex ante assumption of 75°F.

TABLE 4-6: 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	17	75.0	75.3	11.1
Medium-Pressure Steam	3	75.0	87.1	1.7
Industrial				
Hot Water	10	75.0	70.8	12.9
Medium-Pressure Steam	17	75.0	79.4	7.9

* 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.

4.5 COMBUSTION EFFICIENCY ANALYSIS

Finally, pipe insulation savings are dependent on the combustion efficiency of the boiler generating the heated fluid. Field auditors collected relevant information related to boiler combustion efficiency using a combination of two methods:

- **Combustion efficiency measurement and skin loss estimate** – Field auditors spot-measured the combustion efficiency of boiler(s) with insulated pipes.
- **Equipment nameplate reference and research** – Not all boilers were accessible for a combustion efficiency measurement. In some cases, the field auditors collected nameplate information on the affected boiler(s) and researched manufacturer's combustion efficiency testing data.

IOUs assumed combustion efficiencies based on fluid type. Table 4-7 compares ex ante combustion efficiency estimates with ex post values by fluid type.

TABLE 4-7: COMPARISON OF EX ANTE AND EX POST COMBUSTION EFFICIENCIES BY FLUID TYPE

Fluid Type	Observations†	Ex Ante Combustion Efficiency	Mean Ex Post Combustion Efficiency	Ex Post Combustion Efficiency Standard Deviation
Hot Water	27	82.0%	88.1%	6.2%
Low-Pressure Steam	3	83.0%	80.0%	0.0%
Medium-Pressure Steam	20	83.0%	83.4%	2.3%

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

Medium-pressure steam boilers were found to feature an average combustion efficiency nearly identical to the ex ante assumption, while low-pressure steam boilers showed 3% lower efficiency than the ex ante value, leading to additional Pipe Insulation Hot Application measure group savings. Conversely, hot water boilers achieved 6% higher efficiency than the ex ante assumption, reducing savings for hot water projects. Of the 27 hot water observations in the sample, evaluators found 10 instances of insulated piping connected to a high-efficiency condensing boiler.

4.6 DEVELOPMENT OF EX POST GROSS IMPACTS

The annual operating hours, bare pipe heat loss rate, insulated pipe heat loss rate, and boiler combustion efficiency parameter estimates are then applied to the hourly heat loss equation for all customer type and fluid type combinations. Table 4-8 presents the unit energy savings (UES) values as a function of customer type and fluid type. UES values were generated for all sites in the sample, some of which featured both hot water and steam piping, leading to two UES values for a single project; therefore, the Table 4-8 site count is greater than the overall sample of 19 projects. 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).

TABLE 4-8: 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)	2	0.75"	77.9	3,873	96.0%	1.5
Hot Water (>1" Pipe)	3	1.43"	93.3	6,604	93.4%	5.8
Low-Pressure Steam (≤1" 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.
Medium-Pressure Steam (≤1" Pipe)	0	N.D.	N.D.	N.D.	N.D.	N.D.
Medium-Pressure Steam (>1" Pipe)	1	10.00"	227.9	8,760	81.8%	179.3
Large Commercial						
Hot Water (≤1" Pipe)	2	0.75"	50.6	8,760	97.0%	2.2
Hot Water (>1" Pipe)	10	4.28"	66.1	6,956	85.4%	11.6
Low-Pressure Steam (≤1" Pipe)	0	N.D	N.D.	N.D.	N.D.	N.D.
Low-Pressure Steam (>1" Pipe)	3	9.00"	129.5	1,923	80.0%	16.4
Medium-Pressure Steam (≤1" Pipe)	0	N.D	N.D.	N.D.	N.D.	N.D.
Medium-Pressure Steam (>1" Pipe)	2	2.50"	186.3	8,752	85.0%	36.3
Industrial						
Hot Water (≤1" Pipe)	2	1.18"	74.7	8,102	84.6%	5.3
Hot Water (>1" Pipe)	8	2.43"	51.4	7,810	90.3%	5.6
Low-Pressure Steam (≤1" 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.
Medium-Pressure Steam (≤1" Pipe)	3	1.06"	133.8	5,047	84.9%	6.3
Medium-Pressure Steam (>1" Pipe)	14	3.16"	182.1	4,301	83.5%	21.5

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

Below are some observations regarding the UES data:

- At commercial facilities, medium-pressure steam UES values exceed the deemed savings value assumed by the IOUs[10], due to higher-than-anticipated annual operating hours and larger-than-anticipated pipe diameter. Conversely, at industrial facilities, the medium-pressure steam UES values are lower than those assumed by IOUs, due to lower-than-anticipated temperature differences and annual operating hours. Please note the low observation count for medium-pressure steam piping at commercial facilities, particularly that with greater than 1" diameter at small commercial facilities, which featured an unusually large pipe diameter and subsequently high UES value.

[10] Per SCG workpaper SCGWP110812A Revision #2, dated August 12, 2009.

- Hot water piping generally led to lower UES values than those assumed by the IOUs, with the lone exception being hot water piping with greater than 1" diameter at large commercial facilities.
- Low-pressure steam piping was only observed in three runs, each of which featured greater than 1" pipe at large commercial facilities. The UES value was slightly lower than the IOU assumption of 18.2 therm/foot due to lower-than-anticipated operating hours. However, consideration should be given when adopting this or any other UES finding that represents a small number of pipe runs.

5 NET TO GROSS ANALYSIS

The phone interviews conducted for this evaluation served not only to verify the installation of rebated pipe insulation measures and to collect site-specific information useful for the gross analysis, but also to acquire information about the influence of the program on the purchase of the pipe insulation measures. The questions asked of interviewees were designed to gather information that allowed the evaluation team to estimate participant free-ridership to support the development of net-to-gross ratios (NTGRs) and net savings values. A standard battery of NTG questions were asked of customers who purchased and installed the pipe insulation through SCG's program.

The approach for estimating NTGRs for these customers was based on the large non-residential free-ridership approach developed by the NTGR Working Group and documented in the *Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Non-residential Customers*.

The resulting NTGRs were calculated as the average of three program attribution indices (PAI) known as PAI-1, PAI-2, and PAI-3. Each index represents the highest response or the average of several responses given to one or more questions about the decision to install a program measure. Each index takes on a value between zero and one. The larger the value, the more attribution the program is given to having influenced the customer to install the sprinkler measures, and therefore a higher NTG value.

- **Program Attribution Index 1 (PAI–1)** reflects the influence of the most important of various program-related elements in the customer's decision to select a given program measure. PAI-1 is calculated as the highest program influence factor divided by the sum of the highest program influence factor and the highest non-program influence factor. Some example non-program factors are: previous experience with the measure, recommendation from an engineer, standard practice, corporate policy, compliance with rules or regulations, organizational maintenance or equipment replacement policies and "other – specify." Payback is treated as a program influence factor if the rebate/incentives played a major role in meeting payback criteria, but is treated as a non-program influence factor if it did not play a major role in meeting payback criteria.
- **Program Attribution Index 2 (PAI–2)** captures the perceived importance of program factors (including rebate/incentives, recommendation, and training) relative to non-program factors in the decision to implement the specific measure that was eventually adopted or installed. This index is determined by asking respondents to assign importance scores to 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 had made the decision to install the measure before

learning about the program. The final score is divided by 10 to be put into decimal form, thus making it comparable with PAI-1.

- **Program attribution index 3 (PAI–3)** captures the likelihood of various actions the customer might have taken at the given time and in the future if the program had not been available (the counterfactual). This index is calculated as 10 minus the stated likelihood, between 0 and 10, that the respondent would have installed the same measure in the absence of the program. The final score is divided by 10 to put into decimal form, thus making it comparable with PAI-1 and PAI-2.

The NTGR was estimated as an average of these three indices. If one of the indices was not available (generally due to respondents giving a "don't know" or "refusal" response), then the NTGR was estimated as the average of the two available indices. If two or more indices were missing, results were discarded from the calculation.

Table 5-1 presents the ex post NTGR scores that were developed – using the above methodology – weighted by ex post lifecycle therms. Also presented are the ex ante NTG ratios. Overall, the ex post NTGRs are approximately 29% less than the ex ante value (weighted by ex post lifecycle therms). The relative precision of the ex post estimate is 9% at the 90% confidence interval.

TABLE 5-1: EX ANTE AND EX POST NET-TO-GROSS RATIOS FOR PIPE INSULATION MEASURES WEIGHTED BY EX POST THERMS

Measure Group	Weighting Factor	n	Ex Ante NTG	Mean Ex Post NTG	Ex Post NTG Relative Precision
Pipe Insulation – Hot Application	Lifecycle Therms	25	0.62	0.44	9%

Table 5-2 also presents the ex post NTGR along with the average program attribution scores for the 25 customers. Each of these scores are presented at the measure group level and are weighted by lifecycle ex post therm savings.

TABLE 5-2: INFLUENCE SCORES FOR PIPE INSULATION MEASURES

Measure Group	n	Ex Post NTG	Mean PAI1	Mean PAI2	Mean PAI3
Pipe Insulation – Hot Application	25	0.62	0.44	0.49	0.47

The weighted PAI1 index across the sample of participants is 0.44 which suggests that, on average, program participants scored the highest non-program factor slightly greater than the highest program factor. The 0.49 PAI2 score suggests, on average, that program participants perceived the importance of non-program related factors the same as program factors. In other words, given 10 points to allocated

between program and non-program factors, participants allocated equal points to program factors and non-program factors. The PAI3 score, on average, is similar to the PAI2 score. The 0.47 score suggests, on average, that customers were equally likely to have installed the same equipment had the program not been available compared to those that would not have installed the same equipment.

6 EVALUATION RESULTS

This section presents the gross and net realization rates for first year and lifecycle therm savings, as well as aggregate ex post population-level savings for first year and lifecycle therms.

6.1 GROSS FIRST YEAR REALIZATION RATES

Once all the UES values have been created, as discussed in Section 4, 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. Specifically, the Gross Realization Rate (GRR) for customer-fluid type segment j is estimated as:

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

Where:

Gross_Ex_Post_Impact$_{i,j}$ is the site-specific gross ex-post impact estimate for customer i, in the population, who is in customer-fluid type segment j.

Gross_Ex_Ante_Impact$_{i,j}$ is the site-specific gross ex-ante impact estimate for customer i, in the population, who is in customer-fluid type segment j.

Table 6-1 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 6-1: 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 - Steam	5	124,637	108,597	87%
Agricultural/Industrial - Hot Water	5	26,648	23,033	86%
Commercial - Steam	2	12,344	17,876	145%
Commercial - Hot Water	9	53,920	76,385	142%
Census Site*	1	7,646	165,316	2,162%

* One site in the Commercial – Steam segment had much greater realized savings than other sites in that segment. This site was removed from that segment and only represents itself.

As discussed throughout Section 4, 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.

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

- Lower-than-anticipated annual operating hours—21% lower than assumed within IOU deemed savings, per Table 4-2—primarily reduced the ex post annual therm savings for agricultural and industrial projects.
- Table 4-4 indicated that field auditors determined a weighted average medium-pressure steam bare pipe temperature of 258°F as compared with the IOU assumption of 328°F. Table 4-6 indicated an evaluated surrounding air temperature of 79°F as compared with the IOU assumption of 75°F. These differences in bare pipe and surrounding air temperatures further reduced the ex post savings for medium-pressure steam piping, due to the high prevalence of medium-steam pipe runs at industrial facilities.
- As noted earlier in Section 2.3 and 4.1 , if the insulated pipe is proximate to work areas, an OSHA minimum compliance baseline is appropriate; field auditors determined that 13% of evaluated insulated pipe at industrial facilities required an OSHA-compliant baseline, thereby reducing ex post savings further.
- 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 43% higher-diameter than the IOU assumption of 1.7", and industrial medium-steam piping 85% higher-diameter. Higher diameter pipe leads to higher baseline heat loss rates, leading to higher therm savings for insulated pipe.

For **commercial** facilities, evaluated savings were 45% and 42% higher than reported by IOUs, for steam and hot water piping, respectively. The following factors led to these savings differences:

- Table 4-2 indicates that evaluators determined 50% and 189% higher annual operating hours at large and small commercial facilities, respectively, as compared with the IOU assumption.
- Additionally, insulated pipe at commercial facilities was generally of higher diameter with thicker insulation than assumed by the IOU; each of these factors drove the evaluated savings higher than the ex ante estimate.

- Conversely, nearly a third of the commercial pipe runs encountered in the sample of 19 projects was medium-pressure steam piping. The lower-than-anticipated bare pipe temperature and higher-than-anticipated surrounding air temperature for medium-pressure steam piping led to lower ex post therm savings.
- Hot water piping was prevalent at commercial facilities, and evaluators determined an average hot water boiler efficiency of 88%, 6% higher than assumed within ex ante savings calculations. This higher-than-anticipated boiler efficiency led to lower ex post therm savings.

Table 6-2 presents the aggregate first year gross realization rates along with the corresponding ex ante and ex post first year therms savings for the Pipe Insulation Hot Application measure group. The corresponding relative precision at the 90% confidence interval is also provided.

TABLE 6-2: AGGREGATE FIRST YEAR GROSS THERMS SAVINGS FOR PIPE INSULATION HOT APPLICATION

PA	First Year Gross Therm Savings			
	Ex Ante Savings	Ex Post Savings	GRR	RP
SCG	441,396	621,752	141%	31%

Figure 6-1 illustrates the relative shares that each discrepancy category contributed to the overall realization rate of 141%. 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 41% higher than ex ante.

FIGURE 6-1: COUNTS AND GRR MAGNITUDES BY DISCREPANCY CATEGORY

Discrepancy Category	Negative Impact		Positive Impact	
	# Instances	GRR Impact	GRR Impact	# Instances
Difference in ambient temperature	1	-7.0%	0.0%	0
Difference in boiler efficiency	4	-4.2%	0.0%	0
Difference in fluid temperature	10	-76.7%	22.3%	3
Difference in operating hours	10	-179.4%	73.8%	6
Incorrect baseline - OSHA requirement	4	-21.5%	0.0%	0
Incorrect insulation thickness	1	-0.4%	29.8%	1
Incorrect pipe diameter	1	-10.3%	227.9%	8
Unknown	6	-13.2%	0.0%	1
Total	**37**	**-313%**	**354%**	**19**

6.2 LIFECYCLE GROSS REALIZATION RATES

Table 6-3 presents the lifecycle gross realization rates along with the corresponding ex ante and ex post first year therms savings for the Pipe Insulation Hot Application measure group. The corresponding relative precision at the 90% confidence interval is also included. Lifecycle savings values are equal to the first year savings multiplied by the EUL. Because this study did not evaluate the EULs, the ex ante EUL of 11 years was used. Therefore, first year and lifecycle realization rates are identical.

TABLE 6-3: AGGREGATE LIFECYCLE GROSS THERMS SAVINGS FOR PIPE INSULATION HOT APPLICATION

PA	Lifecycle Gross Therm Savings			
	Ex Ante Savings	Ex Post Savings	GRR	RP
SCG	4,855,353	6,839,276	141%	31%

6.3 NET FIRST YEAR REALIZATION RATES

Net savings are estimated in a manner similar to the gross savings. Gross ex post impacts are multiplied by the corresponding NTGRs to calculate net savings values. Net 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. Specifically, the Net Realization Rate (NRR) for PA-Measure segment j is estimated as:

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

Where:

$Net\_Ex\_Post\_Impact_{i,j}$ is the site-specific net ex-post impact estimate for customer i, in the population, who is in PA-Measure segment j.

$Net\_Ex\_Ante\_Impact_{i,j}$ is the site-specific net ex-ante impact estimate for customer i, in the population, who is in PA-Measure segment j.

Table 6-4 presents the therm first year net realization rates. Also shown are the aggregate ex post and ex ante savings value for SCG that were used to develop the realization rate.

TABLE 6-4: AGGREGATE FIRST YEAR NET THERM SAVINGS FOR PIPE INSULATION HOT APPLICATION

PA	First Year Net Therm Savings			
	Ex Ante Savings	Ex Post Savings	NRR	RP
SCG	268,531	272,412	101%	32%

The NRRs differ for the same reasons discussed above for GRRs; however, they are also influenced by differences between ex post and ex ante NTGRs. As presented above, the ex post NTGR value was less than the ex ante NTG value. This results in a first year NRR that is less than the first year GRR.

6.4 LIFECYCLE NET REALIZATION RATES

Net lifecycle realization rates are estimated in a similar way as gross lifecycle realization rates, by looking at the ratio of the evaluated ex post net lifecycle savings to the ex ante net lifecycle savings. The approach is identical to that for the gross lifecycle realization rates, but using net savings instead of gross. Table 6-5 presents those results.

TABLE 6-5: AGGREGATE LIFECYCLE NET THERM SAVINGS FOR PIPE INSULATION HOT APPLICATION

PA	Lifecycle Net Therm Savings			
	Ex Ante Savings	Ex Post Savings	NRR	RP
SCG	2,953,840	2,996,536	101%	32%

The overall GRR and NRR values and corresponding relative precisions presented above, indicate that the ex ante deemed savings values are fairly reliable. It should be expected that the actual savings for a given project may vary from the ex ante values. From year to year, the different set of participants should be expected to yield varying results. The recommendations section provides more information on suggested changes to developing ex ante savings values.

7 CONCLUSIONS

This section presents findings and conclusions of this research study.

Conclusion 1 [Section 6]: The average diameter of insulated pipe was considerably higher for all customers and fluid types in the higher-diameter tier. The PAs separated pipe insulation measures by diameter: less than 1" (0.7" average assumed in IOU calculations) and greater than or equal to 1" (1.7" average assumed in IOU calculations). Evaluators determined a greater average diameter for the latter tier, for all fluid-customer permutations: large commercial hot water (4.3" diameter on average), large commercial medium-pressure steam (2.5"), industrial hot water (2.4"), and industrial medium-pressure steam (3.2"). Greater-than-assumed diameter leads to higher savings per insulated linear foot.

Recommendation 1 [All PAs]: An additional savings tier for large-diameter piping should be added to the tracking protocol for pipe insulation measures. Currently, the program includes two savings tiers based on pipe diameter: less than 1" diameter piping, and greater than or equal to 1" diameter piping. However, both in the PY2013-14 evaluation and this study, evaluators found that a significant portion of rebated piping (approximately 62% by pipe length in PY2015) had a diameter of 3" or greater. Higher-diameter piping leads to higher thermal mass and heat losses, and therefore higher savings after insulation. The evaluation team therefore recommends that the program incorporate a large-diameter tier, for piping greater than or equal to 3" in diameter, for future program tracking to ensure more accurate savings estimation.

Conclusion 2 [Section 4.2]: All rebated insulation was determined to be 100% installed as tracked. Field auditors determined that all rebated insulation was installed and operable via visual inspection, spot measurement, and review of project invoices. However, field auditors also determined that 13% of the rebated insulated piping required minimally-compliant baseline insulation[11].

Conclusion 3 [Section 4.3]: Affected boilers at participating large commercial facilities operate 50% more than assumed within IOU deemed savings values, while affected boilers at participating industrial facilities operate 21% less. Boilers at large commercial facilities were assumed to operate 4,380 hours per year, but evaluators determined that they operate 6,552 hours per year. Boilers at industrial facilities were assumed to operate 7,752 hours per year, but evaluators determined that they operate 6,106 hours per year.

[11] 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 4 [Section 4.4.1]: Ex post bare pipe temperatures were lower than ex ante assumptions for all customer type-fluid type permutations. The hot water bare pipe temperature was found to be 138°F and 134°F at commercial and industrial facilities, respectively, as compared with the ex ante assumption of 150°F. The medium-pressure steam bare pipe temperature was found to be 304°F and 258°F at commercial and industrial facilities, respectively, as compared with the ex ante assumption of 328°F.

Conclusion 5 [Section 4.4.2]: Surrounding air temperatures exceeded the PA assumption for steam piping but were identical or slightly below the IOU assumption for hot water piping. Evaluators determined that insulated hot water piping features an average surrounding air temperature of 75°F and 71°F at commercial and industrial facilities, respectively. Medium-pressure steam piping features an average surrounding air temperature of 87°F and 79°F at commercial and industrial facilities, respectively. IOU deemed savings values reflected a surrounding air temperature assumption of 75°F for all fluid segments.

Conclusion 6 [Section 4.5]: Hot water boilers at participating facilities feature a combustion efficiency 6% higher than assumed within IOU deemed savings values. Evaluators determined that hot water boilers feature a combustion efficiency of 88% on average, as compared with the IOU assumption of 82%. Evaluators determined no significant difference from the IOU assumption of 83% for medium-pressure steam boilers.

Conclusion 7 [Section 4.7]: The evaluation team surveyed 25 participating customers and determined a net-to-gross ratio of 0.44. This value is less than the current program assumption of 0.62 reflected in reported data.

APPENDIX A PHONE SURVEY INSTRUMENT

Participant Survey for CPUC
2015 Commercial Evaluation

INTRODUCTION AND FINDING CORRECT RESPONDENT

OUTCOME1

This is _____ calling on behalf of the CPUC, from ITRON CONSULTING. 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 Itron Consulting. 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...I was told that would be you.
...Your organization participated in <%UTILITY>'s <%PROGRAM> by installing lighting equipment around 2013 or 2014.

Through this program, your oganization installed....
<%CUSTOM_MEASURE>
<%QTY_1> ... <%UNITS_1> ... <%MEASURE_1>
<%QTY_2> ... <%UNITS_2> ... <%MEASURE_2>
<%QTY_3> ... <%UNITS_3> ... <%MEASURE_3>

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>
<%QTY_1> ... <%UNITS_1> ... <%MEASURE_1>
<%QTY_2> ... <%UNITS_2> ... <%MEASURE_2>
<%QTY_3> ... <%UNITS_3> ... <%MEASURE_3>
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

DISPLAY

If you need to provide validation for this survey, provide the following contact name and number: Mona Dzvova (LAST NAME PRONOUNCED 'ZOVA'), (415) 703-1231, and the following website: **www.cpuc.ca.gov/eevalidation**

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
88	REFUSED	FM050

99	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
99	Don't know	FM050

FM050 What is the main business ACTIVITY at this facility? [DO NOT READ]

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]

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]

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]

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]

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]

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]

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]

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]

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]

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]

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]	
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]	
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]

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]

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]

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?

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?

1	Spanish	CC2a
2	Chinese	CC2a
3	Korean	CC2a
4	Vietnamese	CC2a
5	Japanese	CC2a
6	Hindi	CC2a
77	OPEN	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	CC8
2	Somewhat active – we approve decisions and provide some input and review	CC8
3	Slightly active – we have a voice but it's not the dominant voice	CC8
4	Not active at all – we're part of a larger firm	CC8
5	Not active at all – our firm doesn't get involved in these issues	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	CC12a
6666	Never Remodeled	CC12a
8888	Refused	CC11a
9999	Don't know	CC11a

Ask if CC11 in (88, 99); else skip to CC12a

CC11a	Would you say the last remodeling was done …. [READ RESPONSES.]	
1	Between 2010 and present	CC12a
2	Between 2006 and end of 2009	CC12a
3	Between 2000 and the end of 2005	CC12a
4	During the 1990s	CC12a
5	Before the 1990s	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 2012?	
1	Increase in square footage	BC100
2	Decrease in square footage	BC110
3	Stayed the same	CA15
88	Refused	CA15

99	Don't know	CA15

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	2012	V1
2	2013	V1
3	2014	V1
88	Refused	V1
99	Don't know	V1

ROLE OF CONTRACTORS

V1 Did you use a contractor/vendor to install any of the 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
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
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
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?
N33 !___Do you have a cell phone number for him/her?\,

77	RECORD NAME, Phone, Email, etc.	A1b
88	Refused	A1b
99	Don't know	A1b

PIPE INSULATION

ASK IF PIPE = 1; else skip to NEXT BATTERY
DISPLAY In the next section we'll be discussing the pipe insulation present at your facility.

ASK IF ^UNRECORDED(PI_INSTDT); ELSE GO TO DISPLAY/PI1a
PI1 We'd like to confirm that new pipe insulation was installed at your facility on approximately <%PI_INSTDT>. Is this correct?

1	Yes	PI3
2	No	DISPLAY; PI1a
88	Refused	DISPLAY; PI1a
99	Don't know	DISPLAY; PI1a

ASK IF ^UNRECORDED(PI_CHKDT) & UNRECORDED(PI_INSTDT)
DISPLAY Our records indicate that your company received a rebate for the pipe insulation installed through the program in <%PI_CHKDT>.

ASK IF (^UNRECORDED(PI_CHKDT) & UNRECORDED(PI_INSTDT)) | PI1(2)

PI1a In what year did you install the pipe insulation?

1	2013	PI1b
2	2014	PI1b
88	Refused	PI3
99	Don't know	PI3

ASK IF PI1A(1||2)

PI1b And what month? {If they can not recall month, try to get the season.}

1	January	PI3
2	February	PI3
3	March	PI3
4	April	PI3
5	May	PI3
6	June	PI3
7	July	PI3
8	August	PI3
9	September	PI3
10	October	PI3
11	November	PI3
12	December	PI3
13	Fall	PI3
14	Winter	PI3
15	Spring	PI3
16	Summer	PI3
88	Refused	PI3
99	Don't know	PI3

PI3 Our records indicate that <%PI_QTY> feet of pipe insulation was installed at your facility. Is this about right?

1	Yes	PI7
2	No	PI3a
88	Refused	PI3a
99	Don’t know	PI3a

ASK IF PI3(2||99)

PI13a How many total linear feet of pipe insulation is present at your facility? Your best estimate is okay.

66	No pipe insulation	Sprinklers_Ag
77	Total linear feet of pipe insulation	PI7
88	Refused	P13aa

99	Don't know	P13aa

ASK IF PI3a = 88,99

P13aa Can you estimate what percent of the pipes present at your facility were insulated through the program?

1	Total linear feet of pipe insulation:	PI7
2	Percentage of pipe insulation replaced:	PI7
101	Refused	PI7
102	Don't know	PI7

ASK IF PI3a <> 66;

PI7 Was the pipe insulation installed on new pipes or was it a retrofit of older pipes or both?

1	ONLY NEW	PI7b
2	ONLY OLDER	PI7b
3	BOTH NEW AND OLDER	P17a
88	Refused	PI8
99	Don't know	PI8

ASK IF PI7 = 3; else skip

PI7a What percentage of the pipe insulation was installed on new pipes?

Record	(record percentage)	PI7b
77	Other	PI7b
101	Refused	PI7b
102	Don't know	PI7b

ASK IF PI7(2|3);

PI7b How many years old were the pipes receiving the pipe insulation?

Record	(record in # of years)	PI8
77	Other	PI8
88	Refused	PI8
99	Don't know	PI8

PI8 Was insulation already present on the pipes before the insulation was installed through the program?

1	Yes	P21
2	No	P25
77	Other	P25
88	Refused	P25
99	Don’t know	P25

ASK IF PI8(1);

P21 Was the existing insulation removed and replaced, or was additional insulation added to existing insulation?

1	old insulation removed and replaced	P23
2	Additional insulation added over old insulation	P23
3	Both	P23
88	Refused	P23
99	Don't know	P23

P23 What condition was your old pipe insulation in at the time of the replacement?

1	Good	P25
2	Fair	P25
3	Poor	P25
4	Not a replacement	P25
88	Refused	P25
99	Don't know	P25

ASK ALL

P25 Are boilers present at your facility?

1	Yes	P27
2	No	P33
77	Other [Record Verbatim]	P33
88	Refused	P33
99	Don't know	P33

ASK IF PI25(1)

P27 Have the boilers been repaired or replaced since you installed the pipe insulation through the program?

1	Yes	P29
2	No	P33
77	Other [Record Verbatim]	P33
88	Refused	P33
99	Don't know	P33

ASK IF PI27(1)

P29 How long ago in months was the most recent boiler repair or replacement?

#	Record DATE or # of months ago	P33
77	Other [Record Verbatim]	P33
88	Refused	P33
99	Don't know	P33

ASK IF PI3A<>66666

P33 Whose idea was it to install new pipe insulation?

1	Me or someone at my facility	P35
2	Contractor	P35
3	Utility company contact	P35
4	Manufacturer	P35
77	Other (specify)	P35
88	Refused	P35
99	Don't know	P35

P35 What percentage of the pipe insulation cost would you estimate the program rebate covered?

1	Rebate covered all of the cost	P37
2	Rebate covered most of the cost	P37
3	Rebate covered less than half of the cost	P37
4	Other	P37
88	Refused	P37
99	Don't know	P37

P37 How effective was the new pipe insulation in reducing your natural gas bill? Would you say there were…

1	Considerable gas savings	P39
2	Some gas savings	P39
3	No noticeable savings	P39
88	Refused	P39
99	Don't know	P39

P39 Have you noticed any problems with the pipe insulation since the installation?

1	Yes	P40
2	No	NTGCHECK4
88	Refused	NTGCHECK4
99	Don't know	NTGCHECK4

ASK IF P39(1)

P40 What problems have you noticed since the pipe insulation was installed?

77	RECORD RESPONSE	NTGCHECK4
88	Refused	NTGCHECK4
99	Don't know	NTGCHECK4

NTGCHECK4 GO TO NTG BATTERY IF NTGPIPES = 1; ELSE CONTINUE

NET TO GROSS

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.

A3 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	N2
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 equip were too high	N2
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	N2
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

N2 Did your organization make the decision to install this new equipment before or after you became aware of rebates/cost reduction available through the PROGRAM?

1	Before	N3a
2	After	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/cost reduction

#	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 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

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 A3(2|10)&N3R(6||10);

N3RRR What is your normal cycle in number of years for which you typically retrofit your equipment to comply with your organization@'s normal remodeling or equipment replacement practices?

# 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 A3 = 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 A3 ^= 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 A3 = 2 or 10, AND N3r < 4, THEN ASK

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

NCC3 equipment replacement in your decision making fairly low, why is that?

77	RECORD VERBATIM	CC3a
88	Don't know	CC3a
99	Refused	CC3a

IF A3 ^= 2 and A3 ^= 9 and A3^=10 AND N3r > 7 THEN ASK

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

NCC3a equipment replacement in your decision making fairly high, why is that?

77	RECORD VERBATIM	N33
88	Don't know	N33
99	Refused	N33

PAYBACK BATTERY

If INCENT <> 100 AND NTG_TYPE >= 2, THEN ASK; ELSE SKIP TO N33

What financial calculations does your company typically make before proceeding with the installation of energy efficient equipment like you

P1 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

What is your threshold in terms of the payback or return on investment your company uses before deciding to proceed with installing energy efficient

P2A 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 0 meaning Not At All Important and a 10 meaning a Very Important, how important in your decision was it that the project was now 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	N33
88	Don't know	N33
99	Refused	N33

IF N3A(8||10) | N3D(8||10) | N3E(8||10) | N3F(8||10) | N3J(8||10) | N3M(8||10) | N3N(8||10) | N3O(8||10) | N3P(8||10) | N3R(8||10);

DISPLAY Next, I would like you to rate the importance of the PROGRAM in your decision to implement this MEASURE as opposed to other factors that may have influenced your decision such as...(SCAN BELOW AND READ TO THEM THOSE ITEMS WHERE THEY GAVE A RATING OF 8 or higher)

<%N3A> Age or condition of old equipment,	...@[%N3A>@

<%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>@

DISPLAY If you were given 10 points to award in total, how many points would give to the importance of the program and how many points would you give to these other 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 factors?\

#	Record 0 to 10 score (_____)	N41a
88	Refused	N41a
99	Don't know	N41a

If N41 <> 88 and N41 <> 99 and N42 <> 88 and N42 <> 99, computer N41 + N42. While N41+N42 <> 10, display:
__We want these two sets of numbers to equal 10.
<%N41> for Program influence and
<%N42> for Non Program factors

IF DELAMP <> 1;
REPLACE Was the installion of this measure....<%NTGMEASURE> ...a replacement of existing equipment or was it additional equipment you installed in your facility?

1	Replace	DISPLAY
2	Add-on	DISPLAY
88	Refused	DISPLAY
99	Don't know	DISPLAY

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) | DELAMP == 1

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 in this project?

#	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

DEFERRED FREE RIDERSHIP FOLLOW-UP

DISPLAY If N5b < 9; ELSE SKIP TO N6

DISPLAY Next, I'd like to ask a couple of questions to help us estimate at what point in the future you would definitely have replaced your existing equipment. We understand that you can't know exactly when you would have done this, especially so far into the future. We're just trying to get a sense of how long you think the current equipment or process would have kept serving your company's needs before you had to or chose to replace it. TD1

TD1 If the program had not been available, how likely is it that you would have replaced your existing equipment within one year of when you did?

1	Definitely would have (1.0 probability)	N9bb
2	Probably would have (0.75 probability)	TD2
3	50-50 chance (0.50 probability)	TD2
4	Probably not (0.25 probability)	TD2
5	Definitely not (0.0 probability)	TD2

IF TD1 = 2, 3, 4, 5 ASK TD2, ELSE GO TO N9bb

TD2 If the program had not been available, how likely is it that you would have replaced your existing equipment within three years of when you did?

1	Definitely would have (1.0 probability)	N9bb
2	Probably would have (0.75 probability)	TD3
3	50-50 chance (0.50 probability)	TD3
4	Probably not (0.25 probability)	TD3
5	Definitely not (0.0 probability)	TD3

IF TD2 = 2, 3, 4, 5 ASK TD3; ELSE GO TO N6

TD3 If the program had not been available, how likely is it that you would have replaced your existing equipment within five years of when you did?

1	Definitely would have (1.0 probability)	N9bb
2	Probably would have (0.75 probability)	N9bb
3	50-50 chance (0.50 probability)	N9bb
4	Probably not (0.25 probability)	N9bb
5	Definitely not (0.0 probability)	N9bb

CONSISTENCY CHECK ON AGE

IF (N3a > 6 AND TD3 = 3, 4 or 5) THEN ASK; ELSE SKIP TO N6

Earlier when I asked about the influence of the age/condition of the old equipment on your decision to install this new equipment, you gave me a rating of <%N3A> out of ten. I would interpret this to mean that the age/condition was quite influential in your decision to install this new equipment when you did. Perhaps I have either recorded something incorrectly or maybe you could explain in your own words the role the age/condition of the existing equipment played in your decision to install this new energy efficient equipment.

N9bb

77	Record VERBATIM	N6
88	Don't know	N6
99	Refused	N6

ADDITIONAL BASELINE INPUT

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?

N6

1	Install/Delamped fewer units	N7
2	Install standard efficiency equipment or whatever required by code	N7
3	Installed equipment more efficient than code but less efficient than what you installed through the program	N7
4	Done nothing (keep existing equipment as is)	N7
5	Done the same thing I would have done as I did through the program	N7
6	Repair/rewind or overhaul the existing equipment	N7
77	Something else (specify what _____)	N7
88	Don't know	N7
99	Refused	N7

Ask if N6 = (1, 2, 3, 4) and (N5 > 8 and N5b > 8 OR N5aa > 8)

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?

N7

77	Record VERBATIM	N6a
88	Don't know	N6a
99	Refused	N6a

Ask if N6(1);

How many fewer units would you have installed/Delamped? (It is okay to take an answer such as ...HALF...or 10 percent fewer ... etc.)

N6a

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 SP1]

DISPLAY Earlier, when I asked you a question about why you decided to implement the project using high efficiency equipment, you gave reasons related to <A3> Now I would like to ask you some follow up questions regarding these responses you gave me. ER2

IF REPLACE(1);

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 A3 = 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 A3 = 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 A3 = 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 PP5A

PP5	Why do you say that?	
77	Record VERBATIM	PP5A
88	Don't know	PP5A
99	Refused	PP5A

PP5A	Using the same 0 - 10 scale, how would you rate your OVERALL satisfaction with the performance of the energy efficient measures you had installed?	
#	Record 0 to 10 score (_____)	PP5B
88	Refused	PP6

99	Don't know	PP6

IF PP5A < 6 THEN ASK; ELSE SKIP TO PP6

PP5B Why do you say that?

77	Record VERBATIM	PP6
88	Don't know	PP6
99	Refused	PP6

PP5C Using the same 0 - 10 scale, how would you rate your OVERALL satisfaction with the quality of the installers' work?

#	Record 0 to 10 score (_____)	PP5D
88	Refused	PP5E
99	Don't know	PP5E

PP5D Why do you say that?

77	Record VERBATIM	PP5E
88	Don't know	PP5E
99	Refused	PP5E

PP5E From your perspective, what if anything could be done to improve the quality of the installers' work?

77	Record VERBATIM	PP6
88	Don't know	PP6
99	Refused	PP6

In qsl: IF ^UNRECORDED(IMPLEMENTER);

ASK IF %IMPLEMENTER = "a local government", "state government", or "an independent firm"; ELSE PP10

PP6 The program you participated in was run by %IMPLEMENTER. Has your organization participated in energy efficiency programs run by <%UTILITY> in the past three years?

1	Yes	PP8
2	No	PP10
88	Refused	PP10
99	Don't know	PP10

ASK IF PP6=1

PP8 Please consider your recent experience with the PROGRAM run by %IMPLEMENTER versus your past experience with the program run by <%UTILITY>. Are there any differences between the two that stand out? Any there attributes or services that seemed better in one or the other?

1	No differences	PP10

77	Yes, Record DIFFERENCES	PP10
88	Don't know	PP10
99	Refused	PP10

ASK IF IOU_PROG = 1 (utility administered program); ELSE PP12

PP10 The program you participated in was run by <%UTILITY>. Have you participated in programs run by governments, institutions, or other independent firms in the past three years? (select all that apply)

1	Local Government	PP14
2	State Government or Institution	PP14
3	Independent Firm	PP12
88	Refused	PP16
99	Don't know	PP16

ASK IF PP10 = 3;

PP12 Please consider your experiences with the program run by an independent firm versus your recent experience with the program run by an independent firm versus your recent experience with <%UTILITY>'s program. Are there any differences between the two that stand out? Are there attributes or services that seemed better in one or the other? (NOTE: SPECIFY WHICH ENTITY IS REFERRED TO IN EACH COMMENT)

1	No differences	PP16
77	Yes, RECORD DIFFERENCES	PP16
88	Refused	PP16
99	Don't know	PP16

ASK if PP10 in (1, 2)

PP14 Please consider your experiences with the program run by a government or institution versus your recent experience with <%UTILITY>'s PROGRAM. Are there any differences between the two that stand out? Are there attributes that seemed better in one or the other? (NOTE: SPECIFY WHICH ENTITY IS REFERRED TO IN EACH COMMENT)

77	Yes, Record VERBATIM	PP16
78	No differences	PP16
88	Refused	PP16
99	Don't know	PP16

ASK if PP6 = 1 AND PP10 = 1, 2 or 3. ELSE PP3

PP16 Which entity, the <%UTILITY> program or the <%IMPLEMENTER> <%PP10> program was more effective in supporting your organization's decision making process?

1	%IMPLEMENTER	PP18
2	%UTILITY	PP18
3	Very little difference	PP18
88	Refused	PP18

99	Don't know	PP18

If PP16 in (1, 2) then ask; else skip to PP20

PP18 How significant was this difference, would you say…

1	Very Significant	PP20
2	Somewhat Significant	PP20
3	Not very significant	PP20
88	Refused	PP20
99	Don't know	PP20

PP20 Which entity had a better technical understanding of the energy use at your facility and provided the best technical assistance in specifying the project?

1	%IMPLEMENTER	PP22
2	%UTILITY	PP22
3	Very little difference	PP22
88	Refused	PP22
99	Don't know	PP22

If PP20 in (1, 2) then ask; else skip to PP24

PP22 How significant was this difference, would you say…

1	Very Significant	PP24
2	Somewhat Significant	PP24
3	Not Very Significant	PP24
88	Refused	PP24
99	Don't know	PP24

PP24 Which entity was more effective in supporting you through the application process

1	%IMPLEMENTER	PP26
2	%UTILITY	PP26
3	Very little difference	PP26
88	Refused	PP26
99	Don't know	PP26

If PP24 in (1, 2) then ask; else skip to PP3;

PP26 How significant was this difference, would you say…

1	Very Significant	PP3
2	Somewhat Significant	PP3
3	Not very significant	PP3
88	Refused	PP3
99	Don't know	PP3

PP3	Do you have any comments on the current incentive structure of the PROGRAM?	
1	No	ID1
77	Yes - RECORD COMMENTS_____	ID1
88	Don't know	ID1
99	Refused	ID1

LONG TERM INFLUENCE
If NTG_TYPE >= 2
IF N3f > 4, THEN ASK, ELSE CCC12A

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||4);

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

LT8 **IF LT3 = 1 or 2, THEN ASK. ELSE CCC12A.**
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	LT9
2	No	CC12A
88	Refused	CC12A
99	Don't know	CC12A

LT9 **If LT8 = 1 then ask; else skip to CA2;**
Has your organization developed a specification policy for the selection of energy efficient equipment? [EXAMPLES... REQUIREMENTS THAT ALL NEW FLUORESCENT LIGHTING SYSTEMS USE ELECTRONIC BALLAST, OR THAT ALL NEW MOTORS BE PREMIUM EFFICIENCY]

1	Yes	LT10
2	No	LT10
88	Refused	LT10
99	Don't know	LT10

LT10 Has your organization assigned responsibility for controlling energy usage and costs to any of the following?

1	An in-house staff person	LT11
2	A group of staff	LT11
3	An outside contractor	LT11
4	NONE OF THESE	LT11
88	Refused	LT11
99	Don't know	LT11

LT11 Does your organization have any internal incentive or reward policies for business units or staff responsible for managing energy costs?

1	Yes	LC7
2	No	CA2
88	Refused	CA2
99	Don't know	CA2

Ask if LT11(1)

LC7 How do these incentive/reward structures work?

77	OPEN/Record	CA2
88	Refused	CA2
99	Don't know	CA2

CA2 In marketing materials or in communications with customers, does your company highlight the ways in which your business is environmentally conscious?

1	Yes	RETURN TO REMAINDER OF SURVEY
2	No	RETURN TO REMAINDER OF SURVEY
77	OPEN\RECORD OTHER	RETURN TO REMAINDER OF SURVEY
88	Refused	RETURN TO REMAINDER OF SURVEY
99	Don't know	RETURN TO REMAINDER OF SURVEY

ONSITE RECRUITING

TO SCHEDULE INSTALLATION OF MONITORING EQUIPMENT

If LOGGER= 1; Else Skip to Comment1

DISPLAY In order to improve this program's performance, <%UTILITY> would also like to make an accurate measurement of the energy savings associated with the energy efficient equipment installed by collecting and analyzing information from selected customers. If you agree to participate, Itron, on behalf of <%UTILITY>, will come to your business to install monitoring devices on your equipment to record when the equipment is in use. The monitoring devices will be installed in an unobtrusive place and would be removed by us at the end of the research project. We expect the site visit to take about two hours. We'll come back and remove the LOG_REC

monitoring devices within 3-6 months. Note, the electric use data will be used strictly for the study of the <%PROGRAM> and will not affect your electric service at all. You will need to sign a brief participation agreement.

LOG_REC Are you interested in participating in this project?

1	Yes	LOG_NAME
2	No	Comment1
88	Refused	Comment1
99	Don't know	Comment1

ASK IF LOG_REC(1)

LOG_NAME May I have the name of the person that our technician should contact to make an appointment? LOG_PHONE

LOG_PHONE What would be the most convenient phone number for our technecian to contact ....<%LOG_NAME>? LOG_ALT

LOG_ALT In the even that ....<%LOG_NAME> ... is unavailable, would there be an alternate contact that we could schedule an appointment with? LOG_PH_ALT

LOG_PH_ALT What would be the most convenient phone number to reach this person? LOG_NOTE

LOG_NOTE Are there any notes that would facilitate our technician@'s ability to make an appointment? For example, are some days of the week better for making contacts, are early mornings better or are afternoons better?

66	No Notes	OS_NAME1
77	Record Notes	OS_NAME1

IF ONSITE = 1

TO SCHEDULE ONSITE VERIFICATION

COMMENT1 As we've discussed, the <%PROGRAM> is an important component of the California Public Utilities Commission's ongoing efforts to save energy and reduce emissions affecting climate change. In order to improve this program's performance, the CPUC would like to make an accurate measurement of the energy savings associated with energy efficiency equipment installed by collecting and analyzing information from selected customers. Your input to this research is extremely important. By receiving a rebate through the <%PROGRAM>, your firm has agreed to allow verification of the installation of the equipment rebated through the program.

OS_NAME1 Our verification technician will need to meet a facilities representative of your company. This should be either the manager of the facility or part of the facilities staff.

May I please have the name of the person who our technician can call you to set up an appointment time?

1	Same as for logger	HB_Lift
77	Record Name	OS_PHONE1
99	Don't know	T&T

IF OS_NAME1(77)

OS_PHONE1 May I also have the best phone number for the technician to reach this person?

&OS_PHONE1	PHONE FOR PRIMARY CONTACT	OTHER
88	Refused	T&T
99	Don't know	T&T

OTHER Is there another person that the engineer might speak with at your company, if this primary person is not available?

&OTHER	Get name	OS_NAME2
88	Refused	T&T
99	Don't know	T&T

OS_NAME2 May I please have their name so our technician can call them at another time?

&OS_NAME2	Get name	OS_PHONE2
88	Refused	T&T
99	Don't know	T&T

OS_PHONE2 May I also have the best phone number for the technician to reach them?

&OS_PHONE2	Get phone number	HB_Lift
88	Refused	T&T
99	Don't know	T&T

Ask if HIGHBAY = 1 or (HB1 > 12 and HB1<>66 and HB1<>88 and HB1<>99) or HB2 = 1 or HB1a = 1; Else skip to OS_Business

HB_Lift Do you have some form or a lift or ladder available to reach the lighting at your facility that is located 13ft or more above ground?

1	Yes	OS_Business
2	No	OS_Business
88	Refused	T&T
99	Don't know	T&T

OS_Business Do you have a sign or business name other than <%BUSINESS> that our technicians should look for when they visit your site?

1	Yes	OS_Bus_Name
2	No	Vendor_Name
88	Refused	T&T
99	Don't know	T&T

Ask if OS_BUSINESS(1)

OS_Bus_Name What is the sign or business name they should be looking for?

1	Get name	Vendor_Name

VISIT_NOTES DO NOT READ.....If you have any special notes about the on@-site visit or the installation of loggers, add these notes here.

1	No additional notes	Vendor_Name
77	Record Notes	Vendor_Name

Ask if V1(1)

Vendor_Name Earlier you stated that you had a vendor/contractor that helped you with the installation of the lighting equipment that was installed through the 2010-2012 <%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 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.

APPENDIX C PHONE SURVEY BANNERS

	SCE PIPE
<FM050> What is the main business activity at this facility?	
Offices (non-medical)	0.61
Restaurant / Food Service	2.25
Agricultural (farms, greenhouses)	5.06
Health Care	29.41
Education	7.81
Lodging (hotel, rooms)	4.76
Public Assembly (church, fitness, theatre, library, museum, convention)	0.28
Industrial (food processing plant, manufacturing)	36.83
Laundry (coin operated, commercial laundry facility, dry cleaner)	5.04
Condo Assoc. / Apartment Mgr. (garden style, mobile home park, highrise, townhouse)	5.68
Other	2.27
n	*25*
<FM050G> Which of the following types of health care centers best describes this facility?	
Hospital	100.00
n	*1*
<FM050I> Which of the following types of lodging best describes this facility?	
Hotel	36.70
Resort	63.30
n	*2*
<FM050J> Which of the following types of public assembly buildings best describes this facility?	
Library / Museum	29.44
Community Center / Activity Center	70.56
n	*2*
<FM050L> Which of the following types of buildings best describes this facility?	
Assembly / Light Manufacturing	21.82
Food Processing Plant	59.04
Industrial Process	19.14

	SCE PIPE
n	*6*
<HOLIDAYS> Does your facility close for any holidays during the year, and if so, which ones?	
New Years Day	48.34
Martin Luther King Jr. Day	18.95
President's Day	10.07
Memorial Day	49.87
Independence Day (July 4th)	49.87
Labor Day	49.87
Thanksgiving	53.16
Day After Thanksgiving	47.51
Christmas Eve	39.67
Christmas Day	55.09
Easter	0.00
Mother's Day	0.00
Veterans Day	0.00
Columbus Day	0.00
No holiday closures	44.91
Other	5.44
Refused	0.00
Don't know	0.00
n	*25*
<CC2A> What is the total square footage at this facility?	
Between 5,000 and 10,000 sq ft	2.25
Between 10,000 and 25,000 sq ft	0.80
Between 25,000 and 50,000 sq ft	12.30
Between 50,000 and 75,000 sq ft	14.26
Between 75,000 and 100,000 sq ft	0.59
Over 100,000 sq ft (ag. area)	31.33
Don't Know	38.47
n	*25*
<CC2B> Would you say that the floor area is...	
Between 25,000 and 50,000 sq ft	8.56
Over 100,000 sq ft (Ag area)	86.91

	SCE PIPE
DON'T KNOW	4.54
n	*6*
<CC2C> Is the entire floor area of this facility heated or cooled?	
YES	49.84
NO	50.16
n	*25*
<CC2D> What percentage of the floor area is heated or cooled at this facility?	
0 Percent	13.19
Between 0 and 15 Percent	23.85
Between 15 and 30 Percent	11.49
Between 30 and 45 Percent	41.38
Between 45 and 60 Percent	10.09
n	*10*
<CC3A> Is your space heated using electricity or gas?	
Electricity	30.12
Gas	43.78
Both Gas and Electricity	26.10
n	*24*
<G1> Which of the following natural gas equipment is present at you facility? Do you have a	
Water Heater	93.44
Gas Furnace	79.23
Gas Boiler	98.26
Gas Stove	66.30
Gas Clothes Dryer	11.61
Gas Grill	0.00
Industrial Gas Equipment (lab, manufacturing)	0.00
Gas Oven	0.00
Propane Powered	0.00
Fryer	0.00
No natural gas	0.61
Other	0.30

	SCE PIPE
Refused	0.00
Don't Know	0.00
n	*19*

<C0> About what percentage of your operating costs does energy account for?

1 to 2 percent	3.01
3 to 5 percent	11.07
6 to 10 percent	7.02
11 to 15 percent	9.71
16 to 20 percent	11.13
21 to 50 percent	7.74
Over 51 percent	8.41
DON'T KNOW	41.90
n	*25*

<CC4> Does your business own, lease or manage the facility?

Own	73.45
Lease/Rent	24.26
Manage	2.29
n	*25*

<C5> How many locations does your organization have. Is it....

This facility only	35.38
2 to 4 locations	51.49
5 to 10 locations	3.60
11 to 25 locations	0.20
More than 25 locations	9.34
n	*25*

<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…

Very active – involved in all phases and have veto power	84.59
Somewhat active - we approve decisions and provide some input and review	11.13
Slightly active - we have a voice, but it's not the dominant voice	4.28
n	*25*

	SCE PIPE
<CC8> In what year was your facility built?	
After 2000	10.33
In the 1990s	17.94
1980s	25.14
1970s	5.04
1960s	1.77
1950s	3.06
Before 1950	4.51
Don't Know	32.22
n	*25*
<CC10> If Don't know, would you say it was...	
1970's	10.22
1960's	2.24
1950's	3.78
Before 1950	82.53
DON'T KNOW	1.23
n	*5*
<CC11> In what year was this facility last remodeled?	
Between 2008 and present	67.69
Between 2000 and 2007	25.66
Don't Know	6.65
n	*25*
<CC11A> Would you say the last remodeling was done …	
Between 2010 and present	24.15
Don't Know	75.85
n	*3*
<CC12a> In what year was this organization established at this location?	
Between 2009 and present	34.89
Between 2006 and 2008	2.04
Between 2000 and 2005	5.08
In the 1990s	5.24
1980s	6.62

	SCE PIPE
1970s	1.02
1960s	7.81
1950s	0.79
Before 1950	4.51
Don't Know	32.02
n	*25*
<CC12b> If Don't know, would you say it was…	
Between 2006 and end of 2009	5.45
In the 1990s	1.24
In the 1970s	10.28
Before 1960	83.03
n	*4*
<V1> Now I would like to find out, did you use a contractor/vendor to install the measures that were installed through the Program?	
YES	74.92
NO	16.19
DON'T KNOW	8.89
n	*25*
<V2> How did you come into contact with the contractor/vendor?	
They contacted you	13.91
You contacted them	53.35
You had worked with them before	31.69
Contractor	1.05
n	*21*
<V2A> In relation to this project, did the vendor/contractor approach you about your energy efficient equipment retrofit/installation?	
YES	2.02
NO	76.74
DON'T KNOW	21.24
n	*9*

	SCE PIPE
<V2B> On a scale of 0 - 10, with 0 being very unlikely and 10 being very likely. How likely is it that your organization would have retrofitted/installed this equipment had the contractor/vendor not contacted you?	
3	18.62
4	0.75
7	5.40
10 VERY LIKELY	71.59
ZERO NOT AT ALL LIKELY	3.65
n	*5*
<V3> Did the contractor/vendor tell you about or recommend the program?	
YES	37.41
NO	62.59
n	*21*
<V4> Prior to coming into contact with the contractor/vendor, did your organization have plans to replace/install this equipment?	
YES	92.76
NO	7.24
n	*9*
<V4A> On a scale of 0 - 10, with 0 being very unlikely and 10 being very likely, how likely is it that your organization would have retrofitted/installed this equipment had the contractor/vendor not recommended it?	
2	20.09
6	0.07
10 VERY LIKELY	60.44
ZERO NOT AT ALL LIKELY	19.41
n	*9*
<V4B> On a scale of 0 - 10, with 0 being very unlikely and 10 being very likely, how likely is it that your organization would have installed this equipment with the same level of efficiency if the contractor/vendor had not recommended to do so?	

	SCE PIPE
2	20.09
5	0.07
6	1.42
8	2.57
10 VERY LIKELY	30.02
DON'T KNOW	45.84
n	*9*
<V40> On a scale of 0 - 10, with 0 being very unlikely and 10 being very likely, how important was the input from the contractor you worked with in deciding which specific equipment to install? Was it …	
7	1.42
8	0.07
9	25.23
10 EXTREMELY IMPORTANT	15.42
ZERO NOT AT ALL IMPORTANT	57.86
n	*9*
<AP9> How did you FIRST learn about the Utility's program?	
Account representative	55.99
Program representative	5.68
Utility or program website	0.81
Word of mouth	11.13
Contractor	3.34
Result of an audit	8.55
Industrial affiliate	7.81
Other	0.08
Don’t Know	6.62
n	*25*
<AP9A> How ELSE did you learn about Utility's program?	
Bill Insert	4.74
Program Literature	0.00
Account Representative	2.17
Program Approved Vendor	0.00
Program Representative	0.84
Utility or Program Website	28.47

	SCE PIPE
Trade Publication	0.00
Conference	0.00
Newspaper Article	0.00
Word of Mouth	0.00
Previous experience with it	0.00
Company used it at other locations	0.00
Contractor	0.09
Result of an audit	0.00
Part of larger expansion or remodeling effort	0.00
Television	0.00
No Other Sources	55.33
Other	3.02
Refused	0.00
Don't Know	8.36
Television	0.00
n	*24*

<N33> You mentioned that you have an Utility 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?

Don't have account rep	7.48
Record information	68.63
Refused	0.00
Don't Know	23.89
n	*9*

<ID0> To the best of your knowledge, has the facility located at this address received a Utility-sponsored energy audit within the past 3 years?

YES	33.36
NO	57.73
DON'T KNOW	8.91
n	*25*

<PI3> Our records indicate that <QTY> feet of pipe insulation was installed at your facility. Is this about right?

Yes	100.00

	SCE PIPE
n	*25*

<PI7> Was the pipe insulation installed on new pipes or was it a retrofit of older pipes or both?

Only new	30.99
Only older	49.52
Both new and older	19.49
n	*25*

<PI8> Was insulation already present on the pipes before the insulation was installed through the program?

Yes	77.35
No	22.65
n	*15*

<PI21> Was the existing insulation removed and replaced, or was additional insulation added to existing insulation?

Old insulation removed and replaced	68.39
Both	31.61
n	*11*

<PI23> What condition was your old pipe insulation in at the time of the replacement?

Fair	4.29
Poor	95.71
n	*11*

<PI25> Are boilers present at your facility?

Yes	88.15
No	11.85
n	*25*

<PI27> Have the boilers been repaired or replaced since you installed the pipe insulation through the program?

Yes	22.54
No	77.46
n	*23*

	SCE PIPE
<PI29> How long ago in months was the most recent boiler repair or replacement?	
3	10.22
6	33.30
14	3.96
16	8.79
17	0.41
29	0.98
48	42.34
n	*7*
<PI33> Whose idea was it to install new pipe insulation?	
Me or someone at my facility	68.95
Contractor	15.53
Utility Company Contact	5.30
Manufacturer	0.00
Others - specify	12.03
Refused	0.00
Don't Know	6.62
n	*25*
<P35> What percentage of the pipe insulation cost would you estimate the program rebate covered?	
Rebate covered most of the cost	15.61
Rebate covered less than half of the cost	72.80
Don't Know	11.59
n	*25*
<P37> How effective was the new pipe insulation in reducing your natural gas bill? Would you say there were…	
Considerable gas savings	33.95
Some gas savings	53.51
Don't Know	12.54
n	*25*

	SCE PIPE
<P39> Have you noticed any problems with the pipe insulation since the installation?	
No	100.00
n	*25*
<N2> Did your company make the decision to install measure before or after you became aware of rebates/cost reduction available through the program?	
Before	52.45
After	37.94
DON'T KNOW	9.61
n	*25*
<N3A> On a scale of 1-10 please rate the age or condition of the old measure?	
1 NOT AT ALL IMPORTANT	7.81
5	3.31
6	8.65
8	12.11
9	26.67
10 EXTREMELY IMPORTANT	21.18
ZERO NOT AT ALL IMPORTANT	9.54
DON'T KNOW	10.74
n	*25*
<N3B> On a scale of 1-10 please rate the availability of the program rebate/cost reduction	
5	10.30
6	6.62
7	12.25
8	35.08
9	1.75
10 EXTREMELY IMPORTANT	20.75
ZERO NOT AT ALL IMPORTANT	2.13
DON'T KNOW	11.13
n	*25*

	SCE PIPE
<N3BB> Why do you give it this rating?	
Cost effectiveness/Payback	100.00
n	*3*
<N3CC> Why do you give it this rating?	
Learned about own energy usage	70.34
Other	29.66
n	*2*
<N3D> On a scale of 1-10, how important was a recommendation from the equipment vendor that sold you the measure and/or installed it	
3	1.36
5	5.90
7	35.49
8	8.98
9	9.17
10 EXTREMELY IMPORTANT	25.75
ZERO NOT AT ALL IMPORTANT	13.35
n	*21*
<N3E> On a scale of 1-10 please rate your previous experience with energy efficient projects?	
2	0.40
7	19.46
8	40.54
9	5.24
10 EXTREMELY IMPORTANT	19.05
ZERO NOT AT ALL IMPORTANT	15.32
n	*25*
<N3F> On a scale of 1-10 please rate your previous experience with the Utility the program or a similar Utility program?	
2	5.44
5	0.72
6	2.03
7	39.43
8	10.17

	SCE PIPE
9	0.20
10 EXTREMELY IMPORTANT	20.79
ZERO NOT AT ALL IMPORTANT	21.22
n	*25*

<N3H> On a scale of 1-10 please rate information from the program or Utility marketing materials?

3	1.02
5	13.08
6	7.71
7	2.84
8	50.80
10 EXTREMELY IMPORTANT	4.10
ZERO NOT AT ALL IMPORTANT	12.04
DON'T KNOW	8.41
n	*25*

<N3HH> What type of information was provided that pertained to the project?

Flyer / Brochure / Pamphlets	0.00
Program Approved Vendor	0.00
Complete overview / documentation / seminar / training	0.00
Proposal costs / Estimate Quotes	12.13
Rebates / Discounts / Incentives	82.42
To reduce energy use/power outages	0.00
Account representative	5.45
Information about new technology	0.00
The website	0.00
Other	0.00
Refused	0.00
Don’t Know	0.00
n	*4*

<N3HHH> How, specifically, did this enter into your decision to install this equipment?

To reduce energy costs	63.72
100% paid for	0.00

	SCE PIPE
Program Approved Vendor	0.00
Complete overview / documentation / seminar / training	0.00
To improve equipment performance	0.00
To reduce energy use /power outages	0.00
Because of the rebate	18.71
Did not effect	0.00
Other	17.58
Refused	0.00
Don't Know	0.00
n	*4*

<N3J> On a scale of 1-10 please rate standard practice in your business/industry?

5	15.40
8	57.91
10 EXTREMELY IMPORTANT	26.69
n	*7*

<N3L> On a scale of 1-10, how important was a suggestion by your account representative?

5	15.66
7	8.23
8	49.48
9	1.89
10 EXTREMELY IMPORTANT	24.74
n	*9*

<N3LL> What did they recommend?

Replacement of lighting	7.56
To reduce energy costs	0.00
No recommendation	0.00
Rebates / Discounts / Incentives	92.44
100% paid for	0.00
Recommendation of low pressure nozzles / sprinklers	0.00
Other	0.00
Refused	0.00
Don't Know	0.00

	SCE PIPE
n	*3*

<N3LLL> How, specifically, did this enter into your decision to install this equipment?

To reduce energy costs	7.56
To reduce energy use / power outages	0.00
To replace old / outdated equipment	0.00
Played an important role/decision	0.00
To protect the environment	0.00
100% paid for	0.00
Did not effect	0.00
Because of the rebate	0.00
Other	92.44
Refused	0.00
Don't Know	0.00
n	*3*

<N3M> How, specifically, did this enter into your decision to install this equipment?

8	48.65
10 EXTREMELY IMPORTANT	39.86
ZERO NOT AT ALL IMPORTANT	11.49
n	*7*

<N3MM> How, specifically, did this enter into your decision to install this equipment?

Cost effectiveness	66.47
To reduce energy use / power outages	0.00
100% paid for	0.00
To protect the environment	0.00
To improve the comfort level of the facility	0.00
To replace old / outdated equipment	0.00
Did not effect	0.00
Decision made by management	17.39
Rebate / incentive	0.00
Following official mandates	0.00
Because of a recommendation	0.00

	SCE PIPE
Other	16.14
Refused	0.00
Don't Know	0.00
n	*5*
<N3N> Please rate the degree of importance of payback or return on investment of installing this equipment…?	
5	3.96
6	0.40
7	14.05
8	37.74
9	2.03
10 EXTREMELY IMPORTANT	32.19
ZERO NOT AT ALL IMPORTANT	9.63
n	*25*
<N3O> Please rate the degree of importance of improving quality?	
5	5.54
6	7.02
7	9.20
8	37.73
9	3.21
10 EXTREMELY IMPORTANT	30.30
ZERO NOT AT ALL IMPORTANT	1.94
DON'T KNOW	5.06
n	*25*
<N3OO> How, specifically, did this enter into your decision to install this equipment?	
To reduce energy costs	6.06
To reduce energy use / power outages	2.82
100% paid for	0.00
To update to the latest technology	2.00
To replace old / outdated equipment	16.49
To improve visibility / plant safety	0.00
Had process problems and were seeking a solution	0.00
No change in appearance / lighting	0.00

	SCE PIPE
To improve the comfort level of the facility	9.62
To protect the environment	3.44
New lights had longer life span	0.00
Did not effect	0.90
For the rebate	0.00
Other	58.66
Refused	0.00
Don't Know	0.00
n	*20*

<N3SS> Using the same zero to 10 scale, how would you rate the influence of this factor?

2	35.34
5	0.06
10 EXTREMELY IMPORTANT	64.60
n	*6*

<P1> What financial calculations does your company typically make before proceeding with the installation of equipment like you installed through the program?

Payback	62.94
Return on Investment (ROI)	51.35
To reduce energy costs	0.00
To improve equipment performance	0.00
100% paid for	0.00
To reduce energy use / power outages	0.00
To replace old / outdated equipment	0.00
Other	0.00
Refused	0.00
Don't Know	0.00
n	*7*

<P2A> What is the threshold in terms of the payback or return on investment your company requires before deciding to proceed with an investment?

3 to 5 years	22.69
Over 5 years	77.31

	SCE PIPE
n	*2*
<P3> Did the rebate move your project within this acceptable range?	
YES	77.47
NO	16.51
DON'T KNOW	6.02
n	*7*
<P4> On a scale of 0 to 10, with a 10 meaning a "Very Important" and a 0 meaning "Not at all important", how important in your decision was it that the project was now in the acceptable range?	
8	62.80
10 VERY IMPORTANT	37.20
n	*4*
<P3E> Why did it have an impact?	
To replace old / outdated equipment	0.00
100% paid for	0.00
Other	100.00
Refused	0.00
Don't Know	0.00
n	*1*
<N41> How many of the ten points would you give to the importance of the program in your decision?	
2	0.20
3	3.60
4	0.08
5	41.30
6	3.44
7	33.21
8	10.36
9	7.81
n	*25*
<N42> And how many points would you give to all of these other factors?	
1	7.81

	SCE PIPE
2	10.36
3	33.21
4	3.44
5	41.30
6	0.08
7	3.60
8	0.20
n	*25*

<N41p> How many of the ten points would you give to the importance of the program in your decision?

0	14.05
1	0.08
2	0.20
3	0.01
5	21.68
6	5.06
7	30.19
8	13.37
9	13.09
10	2.27
n	*25*

<N42p> And how many points would you give to all of these other factors?

0	2.27
1	13.09
2	13.37
3	30.19
4	5.06
5	21.68
7	0.01
8	0.20
9	0.08
10	14.05
n	*25*

	SCE PIPE
<N5> Using a likelihood scale from 0 to 10, what is the likelihood that you would have installed exactly the same equipment that you did in this project?	
1 NOT AT ALL LIKELY	4.43
3	11.00
6	58.01
7	4.96
8	1.05
9	0.02
10 EXTREMELY LIKELY	20.54
n	*11*
<N5AA> Using a likelihood scale from 0 to 10, what is the likelihood that you would have installed exactly the same equipment at the same time as you did?	
1 NOT AT ALL LIKELY	15.32
2	9.34
3	15.44
5	6.08
9	1.88
10 EXTREMELY LIKELY	51.94
n	*14*
<N5A> Will you explain in your own words, the role the rebate played in your decision to install this efficient equipment?	
To reduce energy costs	4.40
Would have done it anyway without the rebate	95.60
n	*2*
<N5B> 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?	
1 NOT AT ALL LIKELY	4.43
4	11.00
6	62.97
8	0.22
9	0.02
10 EXTREMELY LIKELY	21.37

	SCE PIPE
n	*11*

<TD1> If the program had not been available, how likely is it that you would have replaced your existing equipment within one year of when you did?

Definitely would have within one year	0.05
Probably would have within one year	6.53
50-50 chance you would within one year	87.78
Definitely not within one year	5.63
n	*6*

<TD2> If the program had not been available, how likely is it that you would have replaced your existing equipment within three years of when you did?

Definitely would have within three years	20.54
Probably would have (within three years)	73.82
Probably not (within three years)	5.64
n	*5*

<TD3> If the program had not been available, how likely is it that you would have replaced your existing equipment within five years of when you did?

Probably would have (within five years)	92.91
50-50 chance you would (within five years)	7.09
n	*2*

<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?

Installed fewer units	8.42
Installed standard efficiency equipment or whatever required by code	30.02
Installed equipment more efficient than code but less efficient than what you installed through the program	2.27
Installed equipment on as needed basis and by affordability (when equipment burned out, budget,...)	10.62
Done nothing (keep the existing equipment as is)	26.87
Done the exact same thing you did through the program	3.05

	SCE PIPE
Don't know	18.76
n	*25*
<N6A> How many fewer units would you have installed?	
0-9%	0.00
10-19%	39.11
20-29%	0.00
30-39%	0.00
40% or less	0.00
50% or less	60.89
70% or less	0.00
0	0.00
Other	0.00
Refused	0.00
Don't Know	0.00
n	*3*
<N6B> Can you tell me what model or efficiency level you were considering as an alternative?	
Other	100.00
Refused	0.00
Don't Know	0.00
n	*1*
<PP1> What do you believe the program's primary strengths are?	
To reduce energy costs	0.02
Rebates / Discounts / Incentives	58.02
To replace old / outdated equipment	0.00
To reduce energy use/power outages	13.13
To protect the environment	0.00
No charge to the company	0.00
To update / upgrade to the latest technology	0.00
Professional Installation / Good Rating	0.00
To improve equipment performance	3.01
Assistance for small business/business owners	4.42
Increasing awareness that the program was available	0.00
Other	17.05

	SCE PIPE
Refused	0.00
Don't Know	6.62
n	*25*
<PP2> What concerns do you have about the program, if any?	
No concerns / None	90.95
Highly Satisfied with program / High Ratings on program	0.00
Not satisfied with service / Could have done something better	0.00
Recommending other options based on experience	0.00
Concerns / Questions from customer	0.00
Other	9.05
Refused	0.00
Don't Know	0.00
n	*25*
<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 the program?	
5	0.72
7	5.64
8	38.93
9	5.04
10 COMPLETELY SATISFIED	43.06
DON'T KNOW	6.62
n	*25*
<PP5A> Using the same 0 - 10 scale, how would you rate your OVERALL satisfaction with the performance of the energy efficient measures you had installed?	
7	0.20
8	22.24
9	31.64
10 COMPLETELY SATISFIED	45.93
n	*25*
<PP5C> Using the same 0 - 10 scale, how would you rate your OVERALL satisfaction with the quality of the installers' work?	

	SCE PIPE
6	2.25
7	0.98
8	49.41
9	3.70
10 COMPLETELY SATISFIED	43.66
n	*25*
<PP5D> Why do you say that?	
Professional Installation/Good Rating	85.00
Questions/concerns from customer	2.45
Installed themselves	5.06
Other	0.08
DON'T KNOW	7.40
n	*25*
<PP5E> From your perspective, what if anything could be done to improve the quality of the installers' work?	
None	83.65
Professional Installation/Good Rating	5.44
Not satisfied with service/Could have done something better	3.31
Concerns/opinoins/Questions realating to installer's work	0.20
DON'T KNOW	7.40
n	*25*
<PP10> The program you participated in was run by IOU, have you participated in programs run by governments, institutions, or other independent firms in the past three years? (select all that apply)	
Local Government	0.29
State Government or Institution	11.23
Independent Firm	13.68
No other government programs	71.51
Refused	0.00
Don't Know	3.29
n	*25*

	SCE PIPE
<PP12> Please consider your experiences with the program run by an independent firm versus your recent experience with the Utility run program. Are there any differences between the two that stand out? Are there attributes or services that seemed better in one or the other?	
No differences	57.06
Other	42.94
Refused	0.00
Don't Know	0.00
n	*3*
<PP14> Please consider your experiences with the program run by a government or institution versus your recent experience with the Utility run program. Are there any differences between the two that stand out? Are there attributes that seemed better in one or the other?	
No differences	81.66
PG&E was simpler / easier to work with. Recommended.	0.00
Edison offers better service and support. Recommended.	0.00
SDG&E was quicker / easier to work with. Recommended.	0.00
SoCalGas was simpler / easier to work with. Recommended.	0.71
Other	17.63
Refused	0.00
Don't Know	0.00
n	*6*
<PP18> How significant was this difference, would you say…	
Very significant	16.51
Somewhat significant	83.49
n	*6*
<PP22> How significant was this difference, would you say…	
Very significant	97.80
Somewhat significant	2.20
n	*5*
<PP26> How significant was this difference, would you say…	
Very significant	100.00
n	*3*

	SCE PIPE
<PP3> Do you have any comments on the current incentive structure of the program?	
No Comments	88.16
Highly Satisfied with program / High Ratings on program	5.46
Recommending other options based on experience	0.00
Questions / Concerns from customer	1.02
Not satisfied with service / Could have done something better	0.00
Other	5.37
Refused	0.00
Don't Know	0.00
n	*25*
<LT3> During this time, how many times has your organization participated in this (these) program(s)?	
7 to 10 times, or more	30.24
2 to 4 times	54.01
DON'T KNOW	15.75
n	*6*
<CA6> What type of equipment did you install through this (these) program(s)?	
Indoor Lighting	0.00
Cooling Equipment	0.00
Natural Gas Equipment (water heater / furnace / appliances)	29.70
Insulation or Windows	0.00
Refrigeration	0.00
Industrial Process Equipment	0.00
Greenhouse Heat Curtains	11.24
Food Service Equipment	0.00
Outdoor Lighting	0.00
Occupancy Sensors	0.00
Thermostats	0.00
Outdoor Lighting	0.00
Irrigation Equipment	17.34
LED Lighting	0.00
Solar Panel	0.00

	SCE PIPE
HVAC	64.11
Other	17.34
Refused	0.00
Don't Know	0.00
n	*5*
<LT6> What factors led you to participate in this (these) program(s)?	
To reduce energy costs	21.91
To reduce energy use / power outages	0.00
To get a rebate from the program	59.23
Word of Mouth	0.00
Program Approved Vendor	0.00
To update to the latest technology	0.00
To replace old / outdated equipment	0.00
To improve equipment performance	0.00
To improve the comfort level of the facility	0.00
To improve efficiency and effectiveness	0.00
Free program	0.00
Other	68.62
Refused	0.00
Don't Know	0.00
n	*6*
<LT7> And exactly how did that experience help to convince you to install this install this equipment?	
Positive experience	10.41
To reduce energy use / power outages	0.00
To improve the comfort level of the facility	0.00
To reduce energy costs	0.00
Rebates / Discounts / Incentives / ROI	59.23
To improve equipment performance	0.00
To update to the latest technology	0.00
100% paid for	0.00
Not satisfied with service / Could have done something better	0.00
Other	14.61
Refused	0.00
Don't Know	15.75

	SCE PIPE
n	*6*
<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?	
YES	79.63
DON'T KNOW	20.37
n	*3*
<LT9> Has your organization developed a specification policy for the selection of energy-efficient equipment?	
YES	60.66
NO	39.34
n	*2*
<LT10> Has your organization assigned responsibility for controlling energy usage and costs to any of the following?	
An in-house staff person	39.34
NONE OF THESE	60.66
n	*2*
<LT11> Does your organization have any internal incentive or reward policies for business units or staff responsible for managing energy costs?	
NO	100.00
n	*2*
<CA2> In marketing materials or in communications with customers, does your company highlight the ways in which your business is environmentally conscious?	
YES	91.47
NO	8.53
n	*25*
<A3A_OTH> Would you say that the number of units installed through the program were …?	
Less than 10 units	7.71

	SCE PIPE
Between 11 and 50 units	13.16
50 to 100 units or	3.10
More than 100 units	58.17
DON'T KNOW	17.85
n	*12*

APPENDIX D SITE REPORTS

ID*	Sector	Facility Type	NAICS Facility Code	Indoor / Outdoor	Fluid Type	Pipe Size	Pipe Qty (ft)	Pipe Size (in)	Insulation Thickness (in)	Boiler Eff.	Process Temp (F)	Ambient Temp (F)	Operating Hours	Bare Pipe Heat Loss (Btu/hr/ft)	Insulated Pipe Heat Loss (Btu/hr/ft)	Evaluated Savings (MMBtu/ yr)	Reported Savings (MMBtu/ yr)	GRR
1	LGCOM	COM	RtL	Indoor	Low Steam	>=1	50	10	1.5	80%	222.9	93.4	1,923	832	69	92	43	215%
	LGCOM	COM	RtL	Indoor	Low Steam	>=1	25	14	1.5	80%	222.9	93.4	1,923	1,074	94	59	21	276%
	LGCOM	COM	RtL	Indoor	Low Steam	>=1	847	3	1.5	80%	222.9	93.4	1,923	286	29	387	723	54%
2	LGCOM	COM	Htl	Outdoor	HW	>=1	183	2.5	2	97%	125.6	63.4	8,760	89	8	134	197	68%
	LGCOM	COM	Htl	Outdoor	HW	<1	33	0.75	2	97%	122.3	83.2	8,760	22	3	5	6	85%
	LGCOM	COM	Htl	Outdoor	HW	<1	549	0.75	2	97%	125.6	63.4	8,760	36	5	155	325	48%
3	INDUSTRIAL	IND	MLI	Indoor	Med. Steam	>=1	288	1.25	1	85%	258.0	92.1	2,914	198	32	148	753	20%
	INDUSTRIAL	IND	MLI	Indoor	Med. Steam	>=1	30	1.25	1	85%	258.0	92.1	2,914	198	32	15	78	20%
	INDUSTRIAL	IND	MLI	Indoor	Med. Steam	>=1	60	1.25	1	85%	258.0	92.1	2,914	198	32	31	157	20%
	INDUSTRIAL	IND	MLI	Indoor	Med. Steam	>=1	60	1.25	1	85%	258.0	92.1	2,914	198	32	31	157	20%
	INDUSTRIAL	IND	MLI	Indoor	Med. Steam	<1	186	1.25	1	85%	146.8	91.3	2,914	50	9	24	251	10%
4	SMCOM	COM	EUn	Indoor	Med. Steam	>=1	935	10	3	82%	314.2	86.3	8,760	1,756	104	16,532	765	2162%
5	LGCOM	COM	ECC	Outdoor	HW	>=1	1,333	6	1.5	85%	153.6	63.4	2,800	308	27	1,234	1,432	86%
	LGCOM	COM	ECC	Outdoor	HW	>=1	119	6	1.5	85%	153.6	83.8	2,800	236	24	83	45	183%
6	SMCOM	COM	OfL	Outdoor	HW	>=1	22	2	0.5	85%	165.6	67.0	3,022	117	31	1	17	9%

ID*	Sector	Facility Type	NAICS Facility Code	Indoor / Outdoor	Fluid Type	Pipe Size	Pipe Qty (ft)	Pipe Size (in)	Insulation Thickness (in)	Boiler Eff.	Process Temp (F)	Ambient Temp (F)	Operating Hours	Bare Pipe Heat Loss (Btu/hr/ft)	Insulated Pipe Heat Loss (Btu/hr/ft)	Evaluated Savings (MMBtu/ yr)	Reported Savings (MMBtu/ yr)	GRR
7	INDUSTRIAL	IND	Asm	Outdoor	Med. Steam	>=1	833	6	2	85%	341.7	63.0	8,760	1,401	128	10,931	4,024	272%
	INDUSTRIAL	IND	Asm	Outdoor	Med. Steam	<1	111	0.75	1	85%	341.7	75.0	8,760	243	42	230	150	153%
	INDUSTRIAL	IND	Asm	Outdoor	Med. Steam	>=1	226	2	2	85%	341.7	75.0	8,760	512	43	1,092	591	185%
	INDUSTRIAL	IND	Asm	Outdoor	HW	<1	265	0.75	1	85%	138.5	63.0	8,651	40	14	72	269	27%
	INDUSTRIAL	IND	Asm	Outdoor	HW	>=1	184	2	1.5	85%	138.5	75.0	8,651	69	9	112	124	90%
	LGCOM	IND	Asm	Outdoor	HW	>=1	2,480	3	1.5	85%	138.5	63.0	8,651	118	22	2,416	2,664	91%
8	INDUSTRIAL	COM	OfL	Indoor	HW	>=1	20	2	1	82%	111.0	82.9	4,333	26	6	2	8	29%
	INDUSTRIAL	COM	OfL	Indoor	HW	>=1	10	1.5	1	82%	111.0	82.9	4,333	22	5	1	4	23%
9	LGCOM	COM	Htl	Indoor	HW	>=1	171	6	1.5	86%	145.1	94.5	8,760	107	16	157	65	241%
	LGCOM	COM	Htl	Indoor	HW	>=1	786	6	1.5	86%	114.9	88.4	8,760	52	8	351	300	117%
10	INDUSTRIAL	AG	SCn	Outdoor	Med. Steam	>=1	731	4	2	83%	251.6	88.8	1,413	484	34	560	3,855	15%
11	INDUSTRIAL	AG	SCn	Outdoor	HW	>=1	459	3	4	82%	111.2	60.0	4,463	84	5	197	548	36%
	INDUSTRIAL	AG	SCn	Outdoor	HW	<1	40	4	4	82%	156.4	87.3	4,463	163	8	34	27	124%
12	INDUSTRIAL	IND	MLI	Indoor	HW	>=1	233	4	1	84%	195.2	88.9	8,376	279	32	574	157	365%
	INDUSTRIAL	IND	MLI	Indoor	HW	>=1	233	4	1	84%	173.6	88.9	8,376	210	25	431	157	274%
13	INDUSTRIAL	COM	OfL	Indoor	Med. Steam	>=1	9	6	2	80%	292.8	82.1	4,457	979	63	46	23	196%
	INDUSTRIAL	COM	OfL	Indoor	Med. Steam	>=1	9	4	2	80%	292.8	82.1	4,457	677	47	32	23	135%
	INDUSTRIAL	COM	OfL	Indoor	Med. Steam	>=1	51	3	2	80%	292.8	82.1	4,457	534	39	141	132	106%
	INDUSTRIAL	COM	OfL	Indoor	Med. Steam	>=1	12	2	2	80%	292.8	82.1	4,457	372	30	23	31	73%
	INDUSTRIAL	COM	OfL	Indoor	Med. Steam	>=1	190	1.5	2	80%	292.8	82.1	4,457	303	25	294	494	60%
	INDUSTRIAL	COM	OfL	Indoor	Med. Steam	>=1	180	1	2	80%	292.8	82.1	4,457	217	22	195	468	42%
	INDUSTRIAL	COM	OfL	Indoor	Med. Steam	<1	6	0.75	2	80%	185.0	84.4	2,470	68	8	1	8	14%

ID*	Sector	Facility Type	NAICS Facility Code	Indoor / Outdoor	Fluid Type	Pipe Size	Pipe Qty (ft)	Pipe Size (in)	Insulation Thickness (in)	Boiler Eff.	Process Temp (F)	Ambient Temp (F)	Operating Hours	Bare Pipe Heat Loss (Btu/hr/ft)	Insulated Pipe Heat Loss (Btu/hr/ft)	Evaluated Savings (MMBtu/ yr)	Reported Savings (MMBtu/ yr)	GRR
14	INDUSTRIAL	COM	OfL	Indoor	HW	>=1	150	2	1	85%	138.8	92.7	8,219	49	9	44	101	44%
15	LGCOM	COM	ECC	Indoor	HW	>=1	169	1.5	1	94%	111.6	81.6	3,149	23	5	11	65	16%
	LGCOM	COM	ECC	Indoor	HW	>=1	42	2	1	94%	111.6	81.6	3,149	29	6	3	16	20%
16	INDUSTRIAL	IND	Asm	Indoor	Med. Steam	>=1	482	2	2	83%	77.8	77.8	-	132	18	0	1,260	0%
	INDUSTRIAL	IND	Asm	Indoor	HW	>=1	1,895	2	1.5	95%	117.9	77.8	8,423	39	6	548	1,280	43%
17	SMCOM	COM	OfS	Indoor	HW	<1	257	0.75	0.5	96%	156.2	72.8	3,873	47	14	34	31	111%
	SMCOM	COM	OfS	Indoor	HW	<1	257	0.75	0.5	96%	145.2	72.8	3,873	39	12	29	31	92%
	SMCOM	COM	OfS	Indoor	HW	>=1	36	1.25	1	96%	165.2	71.0	7,699	81	16	19	4	434%
	SMCOM	COM	OfS	Indoor	HW	>=1	36	1.25	1	96%	160.2	71.0	7,699	76	15	18	4	405%
18	LGCOM	COM	Hsp	Indoor	HW	>=1	233	4	1	80%	146.7	96.9	8,368	112	13	187	89	211%
	LGCOM	COM	Hsp	Indoor	HW	>=1	233	4	1	80%	140.4	96.0	8,013	98	12	156	89	175%
19	LGCOM	COM	RtS	Indoor	Med. Steam	>=1	152	3	2	85%	337.2	89.1	8,753	683	53	983	224	439%
	LGCOM	COM	RtS	Indoor	Med. Steam	>=1	152	2	2	85%	214.0	89.5	8,753	188	17	267	224	119%

* ID Corresponding to Trackside ID in the table below

ID	tracksiteID
1	SCG_TRK_900_0000002066
2	SCG_TRK_928_0000004137
3	SCG_TRK_922_0000006640
4	SCG_TRK_913_0000006777
5	SCG_TRK_906_0000045248
6	SCG_TRK_934_0000047601
7	SCG_TRK_907_0000049897
8	SCG_TRK_900_0000052931
9	SCG_TRK_928_0000059812
10	SCG_TRK_930_0000060205
11	SCE_NRF_930_0000065103
12	SCE_NRF_902_0000101480
13	SCE_NRF_902_0000187640
14	SCE_NRF_928_0000205983
15	SCE_NRF_902_0000279257
16	SCE_NRF_917_0000412817
17	SCE_NRF_917_0000438244
18	SCE_NRF_928_0000526332
19	SCE_NRF_906_0001328926

Industrial		Negative Impact		Positive Impact		Overall	
Discrepancy Category	**Explanation of Discrepancy**	**# Instances**	**GRR Impact**	**GRR Impact**	**# Instances**	**GRR Impact**	**# Instances**
Difference in boiler efficiency	The evaluators found that the facility's boiler efficiency was different than the program's deemed value.	1	0.0%	0.0%	0	0.0%	1
Difference in fluid temperature	The evaluators found that the average fluid temperature was different than the program's deemed value.	7	-38.9%	11.1%	2	-27.8%	9
Difference in operating hours	The evaluators found that the boiler plant's hours of operation were different than the program's deemed value.	5	-101.2%	17.3%	2	-83.9%	7
Incorrect baseline - OSHA requirement	The evaluators found that a portion of the installed insulation was mandatory per OSHA requirements; this mandate resulted in an adjusted baseline, which reduced the savings.	1	-0.3%	0.0%	0	-0.3%	1
Incorrect pipe diameter	The evaluators found that the pipe which received insulation was of a different diameter than the program's deemed value.	1	-6.5%	113.6%	3	107.1%	4
Unknown	Uncharacterizable discrepancy.	3	-8.3%	0.0%	0	-8.3%	3
	Total	**18**	**-155%**	**142%**	**7**	**-13%**	**25**

Large Commercial		Negative Impact		Positive Impact		Overall	
Discrepancy Category	**Explanation of Discrepancy**	**# Instances**	**GRR Impact**	**GRR Impact**	**# Instances**	**GRR Impact**	**# Instances**
Difference in ambient temperature	The evaluators found that the average ambient space temperature was different than the program's deemed value.	1	-8.4%	0.0%	0	-8.4%	1
Difference in boiler efficiency	The evaluators found that the facility's boiler efficiency was different than the program's deemed value.	3	-5.0%	0.0%	0	-5.0%	3
Difference in fluid temperature	The evaluators found that the average fluid temperature was different than the program's deemed value.	3	-18.3%	0.1%	1	-18.2%	4
Difference in operating hours	The evaluators found that the boiler plant's hours of operation were different than the program's deemed value.	5	-23.3%	44.3%	4	21.0%	9
Incorrect baseline - OSHA requirement	The evaluators found that a portion of the installed insulation was mandatory per OSHA requirements; this mandate resulted in an adjusted baseline, which reduced the savings.	3	-25.4%	0.0%	0	-25.4%	3
Incorrect insulation thickness	The evaluators found that the installed insulation thickness was different than the program's deemed value.	1	-0.5%	33.8%	1	33.3%	2
Incorrect pipe diameter	The evaluators found that the pipe which received insulation was of a different diameter than the program's deemed value.	0	0.0%	73.2%	5	73.2%	5
Unknown	Uncharacterizable discrepancy.	3	-30.4%	3.4%	1	-27.0%	4
	Total	**19**	**-111%**	**155%**	**12**	**44%**	**31**

Overall		Negative Impact		Positive Impact		Overall	
Discrepancy Category	**Explanation of Discrepancy**	**# Instances**	**GRR Impact**	**GRR Impact**	**# Instances**	**GRR Impact**	**# Instances**
Difference in ambient temperature	The evaluators found that the average ambient space temperature was different than the program's deemed value.	1	-0.9%	0.0%	0	-0.9%	1
Difference in boiler efficiency	The evaluators found that the facility's boiler efficiency was different than the program's deemed value.	4	-0.5%	0.0%	0	-0.5%	4
Difference in fluid temperature	The evaluators found that the average fluid temperature was different than the program's deemed value.	10	-9.7%	2.8%	3	-6.9%	13
Difference in operating hours	The evaluators found that the boiler plant's hours of operation were different than the program's deemed value.	10	-22.6%	9.3%	6	-13.3%	16
Incorrect baseline - OSHA requirement	The evaluators found that a portion of the installed insulation was mandatory per OSHA requirements; this mandate resulted in an adjusted baseline, which reduced the savings.	4	-2.7%	0.0%	0	-2.7%	4
Incorrect insulation thickness	The evaluators found that the installed insulation thickness was different than the program's deemed value.	1	-0.1%	3.8%	1	3.7%	2
Incorrect pipe diameter	The evaluators found that the pipe which received insulation was of a different diameter than the program's deemed value.	1	-1.3%	28.7%	8	27.4%	9
Unknown	Uncharacterizable discrepancy.	6	-1.7%	0.0%	1	-1.7%	7
	Total	**37**	**-39%**	**45%**	**19**	**5%**	**56**

APPENDIX E NTG MATERIALS

NET-TO-GROSS APPENDIX MATERIALS

This appendix includes the following documents:

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 net-to-gross ratios and corresponding program attribution index scores for all interview respondents.

An example calculation for a NTGR score. Note that an excel version of this calculator was posted to the Commercial PCG Basecamp project on January 30th, 2017.

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

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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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Pipe Insulation Net-to-Gross Ratios and Program Attribution Indices

TracksiteID	NTGR	PAI1	PAI2	PAI3
SCE_NRF_902_0000101480	0.22	4.12	2.50	0.00
SCE_NRF_902_0000187640	0.63	5.00	7.00	7.00
SCE_NRF_902_0000279257	0.30	5.00	2.00	2.00
SCE_NRF_906_0001328926	0.73	5.00	8.00	9.00
SCE_NRF_907_0000486895	0.36	5.71	3.00	2.00
SCE_NRF_917_0000341399	0.25	5.00	2.50	0.00
SCE_NRF_917_0000412817	0.25	5.00	2.50	0.00
SCE_NRF_917_0000438244	0.22	5.00	1.50	0.00
SCE_NRF_928_0000205983	0.20	5.00	1.00	0.00
SCE_NRF_928_0000526332	0.67	5.00	6.00	9.00
SCE_NRF_930_0000065103	0.40	5.00	6.00	1.00
SCG_TRK_900_0000002066	0.35	5.00	2.50	3.00
SCG_TRK_900_0000052931	0.30	5.00	4.00	0.00
SCG_TRK_906_0000004242	0.57	5.00	5.00	7.00
SCG_TRK_906_0000041994	0.39	6.67	5.00	0.00
SCG_TRK_906_0000045248	0.47	5.00	9.00	0.00
SCG_TRK_907_0000049897	0.42	5.00	2.50	5.00
SCG_TRK_913_0000006777	0.42	5.00	3.50	4.00
SCG_TRK_922_0000006640	0.28	5.83	2.50	0.00
SCG_TRK_925_0000006834	0.28	3.33	5.00	0.00
SCG_TRK_926_0000046184	0.33	5.00	5.00	0.00
SCG_TRK_928_0000004137	0.57	5.00	5.00	7.00
SCG_TRK_928_0000059812	0.57	5.00	3.00	9.00
SCG_TRK_930_0000060205	0.72	5.56	8.00	8.00
SCG_TRK_934_0000047601	0.35	4.44	5.00	1.00

NTGR Algorithm Calculator

		Example Score	
	Score 1:	**PAI-1**	
	Highest Program Influence Score	**10.00**	
	Highest Non-program Influence Score	**8.00**	
	PAI - 1 Score = Highest Program Factor / (Highest Program Factor + Highest Nonprogram Factor)	**5.56**	
Survey Question	Please rate the importance of each of the following in your decision to implement this specific [MEASURE] at this time.		Notes:
N3b	Availability of the program rebate	9	Program Factor
N3c	Information provided through study, audit or other technical assistance provided through the program	7	Program Factor
N3g	Information from your utility or program training course	8	Program Factor
N3h	Information from your utility or program marketing materials	6	Program Factor
N3l	Suggestion by your utility account rep	10	Program Factor
N3n (if P4 > =6)	Payback on the investment P (score if rebate moved into range, 0 else)	8	Program Factor
N3n (if P4 < 6)	Payback on the investment NP (score if rebate did not affect PB, 0 else)		Non-program factor
N3a	Age or condition of the old equipment	6	Non-program factor
N3e	Previous experience with an EE project	8	Non-program factor
N3f	Previous experience with this program	3	Non-program factor
N3j	Standard practice in your industry	5	Non-program factor
N3m	Corporate policy or guidelines	6	Non-program factor
N3o	Improved lighting quality (includes visibilty, safety)	5	Non-program factor
N3p	Compliance with rules or codes set by regulatory agencies	2	Non-program factor
N3r	Reduced maintenance or equipment replacement policies	3	Non-program factor
N3s if open end is program related	Other Program factor from open end	5	Program Factor
N3s if open end is non-program related	Other Non-Program factor from open end	5	
	PAI - 2 Score -- Score reduced by half if learned after decision = N41 or N41/2 if N2 = AFTER	**8**	
N2	Did you make the decision to install MEASURE before or after you began discussions with UTILITY regarding the availability of rebates for this measure?	AFTER	
N41	How significant was PROGRAM versus other factors in your decision to implement this MEASURE? Please rate the overall importance of the PROGRAM in your decision to implement this MEASURE?	8	
	Score 3 -- No-Program Score = 10 minus N5 Score	**7.00**	
N5	If the PROGRAM had not been available, what is the likelihood that you would have installed exactly the same program qualifying efficient equipment	3	
	OVERALL NTGR SCORE	**0.69**	

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	Cold Application	6,695	6,695	1.00	100.0%	
PGE	Hot Application	0	0			
PGE	**Total**	**6,695**	**6,695**	**1.00**	**100.0%**	
SCG	Hot Application	0	0			
SCG	**Total**	**0**	**0**			
SDGE	Cold Application	175	175	1.00	100.0%	
SDGE	Hot Application	168	168	1.00	100.0%	
SDGE	**Total**	**344**	**344**	**1.00**	**100.0%**	
	Statewide	***7,039***	***7,039***	***1.00***	***100.0%***	

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	Cold Application	4,017	4,017	1.00	100.0%	0.60	0.60		
PGE	Hot Application	0	0						
PGE	**Total**	**4,017**	**4,017**	**1.00**	**100.0%**	**0.60**	**0.60**		
SCG	Hot Application	0	0						
SCG	**Total**	**0**	**0**						
SDGE	Cold Application	105	105	1.00	100.0%	0.60	0.60		
SDGE	Hot Application	101	101	1.00	100.0%	0.60	0.60		
SDGE	**Total**	**206**	**206**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***4,223***	***4,223***	***1.00***	***100.0%***	***0.60***	***0.60***		

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Cold Application	1.7	1.7	1.00	100.0%	
PGE	Hot Application	0.0	0.0			
PGE	**Total**	**1.7**	**1.7**	**1.00**	**100.0%**	
SCG	Hot Application	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**			
SDGE	Cold Application	0.0	0.0	1.00	100.0%	
SDGE	Hot Application	0.0	0.0			
SDGE	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	
	Statewide	***1.7***	***1.7***	***1.00***	***100.0%***	

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	Cold Application	1.0	1.0	1.00	100.0%	0.60	0.60		
PGE	Hot Application	0.0	0.0						
PGE	**Total**	**1.0**	**1.0**	**1.00**	**100.0%**	**0.60**	**0.60**		
SCG	Hot Application	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**						
SDGE	Cold Application	0.0	0.0	1.00	100.0%	0.60	0.60		
SDGE	Hot Application	0.0	0.0						
SDGE	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***1.0***	***1.0***	***1.00***	***100.0%***	***0.60***	***0.60***		

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Cold Application	0	0			
PGE	Hot Application	7,575	7,575	1.00	100.0%	
PGE	**Total**	**7,575**	**7,575**	**1.00**	**100.0%**	
SCG	Hot Application	4,855	6,839	1.41	0.0%	1.41
SCG	**Total**	**4,855**	**6,839**	**1.41**	**0.0%**	**1.41**
SDGE	Cold Application	0	0			
SDGE	Hot Application	500	500	1.00	100.0%	
SDGE	**Total**	**500**	**500**	**1.00**	**100.0%**	
	Statewide	***12,930***	***14,914***	***1.15***	***62.5%***	***1.41***

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	Cold Application	0	0						
PGE	Hot Application	4,660	4,660	1.00	100.0%	0.62	0.62		
PGE	**Total**	**4,660**	**4,660**	**1.00**	**100.0%**	**0.62**	**0.62**		
SCG	Hot Application	2,954	2,997	1.01	0.0%	0.61	0.44	0.61	0.44
SCG	**Total**	**2,954**	**2,997**	**1.01**	**0.0%**	**0.61**	**0.44**	**0.61**	**0.44**
SDGE	Cold Application	0	0						
SDGE	Hot Application	300	300	1.00	100.0%	0.60	0.60		
SDGE	**Total**	**300**	**300**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***7,913***	***7,956***	***1.01***	***62.7%***	***0.61***	***0.53***	***0.61***	***0.44***

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Cold Application	609	609	1.00	100.0%	
PGE	Hot Application	0	0			
PGE	**Total**	**609**	**609**	**1.00**	**100.0%**	
SCG	Hot Application	0	0			
SCG	**Total**	**0**	**0**			
SDGE	Cold Application	13	13	1.00	100.0%	
SDGE	Hot Application	13	13	1.00	100.0%	
SDGE	**Total**	**26**	**26**	**1.00**	**100.0%**	
	Statewide	***635***	***635***	***1.00***	***100.0%***	

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	Cold Application	365	365	1.00	100.0%	0.60	0.60		
PGE	Hot Application	0	0						
PGE	**Total**	**365**	**365**	**1.00**	**100.0%**	**0.60**	**0.60**		
SCG	Hot Application	0	0						
SCG	**Total**	**0**	**0**						
SDGE	Cold Application	8	8	1.00	100.0%	0.60	0.60		
SDGE	Hot Application	8	8	1.00	100.0%	0.60	0.60		
SDGE	**Total**	**16**	**16**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***381***	***381***	***1.00***	***100.0%***	***0.60***	***0.60***		

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Cold Application	0.2	0.2	1.00	100.0%	
PGE	Hot Application	0.0	0.0			
PGE	**Total**	**0.2**	**0.2**	**1.00**	**100.0%**	
SCG	Hot Application	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**			
SDGE	Cold Application	0.0	0.0	1.00	100.0%	
SDGE	Hot Application	0.0	0.0			
SDGE	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	
	Statewide	***0.2***	***0.2***	***1.00***	***100.0%***	

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	Cold Application	0.1	0.1	1.00	100.0%	0.60	0.60		
PGE	Hot Application	0.0	0.0						
PGE	**Total**	**0.1**	**0.1**	**1.00**	**100.0%**	**0.60**	**0.60**		
SCG	Hot Application	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**						
SDGE	Cold Application	0.0	0.0	1.00	100.0%	0.60	0.60		
SDGE	Hot Application	0.0	0.0						
SDGE	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***0.1***	***0.1***	***1.00***	***100.0%***	***0.60***	***0.60***		

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Cold Application	0	0			
PGE	Hot Application	689	689	1.00	100.0%	
PGE	**Total**	**689**	**689**	**1.00**	**100.0%**	
SCG	Hot Application	441	622	1.41	0.0%	1.41
SCG	**Total**	**441**	**622**	**1.41**	**0.0%**	**1.41**
SDGE	Cold Application	0	0			
SDGE	Hot Application	45	45	1.00	100.0%	
SDGE	**Total**	**45**	**45**	**1.00**	**100.0%**	
	Statewide	***1,175***	***1,356***	***1.15***	***62.5%***	***1.41***

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	Cold Application	0	0						
PGE	Hot Application	424	424	1.00	100.0%	0.62	0.62		
PGE	**Total**	**424**	**424**	**1.00**	**100.0%**	**0.62**	**0.62**		
SCG	Hot Application	269	272	1.01	0.0%	0.61	0.44	0.61	0.44
SCG	**Total**	**269**	**272**	**1.01**	**0.0%**	**0.61**	**0.44**	**0.61**	**0.44**
SDGE	Cold Application	0	0						
SDGE	Hot Application	27	27	1.00	100.0%	0.60	0.60		
SDGE	**Total**	**27**	**27**	**1.00**	**100.0%**	**0.60**	**0.60**		
	Statewide	***719***	***723***	***1.01***	***62.7%***	***0.61***	***0.53***	***0.61***	***0.44***

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	Cold Application	1	0.0%		11.0	314.2	28.6	28.6
PGE	Hot Application	1	0.0%		11.0	0.0	0.0	0.0
SCG	Hot Application	0	0.0%	0.0%	11.0	0.0	0.0	0.0
SDGE	Cold Application	1	0.0%		13.0	45.1	3.5	3.5
SDGE	Hot Application	1	0.0%		11.1	36.5	2.8	2.8

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	Cold Application	1	0.0%		11.0	0.0	0.0	0.0
PGE	Hot Application	1	0.0%		11.0	194.8	17.7	17.7
SCG	Hot Application	0	0.0%	0.0%	11.0	186.5	17.0	17.0
SDGE	Cold Application	1	0.0%		13.0	0.0	0.0	0.0
SDGE	Hot Application	1	0.0%		11.1	108.3	9.8	9.8

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	Cold Application	1	0.0%		11.0	188.5	17.1	17.1
PGE	Hot Application	1	0.0%		11.0	0.0	0.0	0.0
SCG	Hot Application	0	0.0%	0.0%	11.0	0.0	0.0	0.0
SDGE	Cold Application	1	0.0%		13.0	27.1	2.1	2.1
SDGE	Hot Application	1	0.0%		11.1	21.9	1.7	1.7

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	Cold Application	1	0.0%		11.0	0.0	0.0	0.0
PGE	Hot Application	1	0.0%		11.0	119.8	10.9	10.9
SCG	Hot Application	0	0.0%	0.0%	11.0	81.7	7.4	7.4
SDGE	Cold Application	1	0.0%		13.0	0.0	0.0	0.0
SDGE	Hot Application	1	0.0%		11.1	65.0	5.9	5.9

APPENDIX AC RESPONSE TO RECOMMENDATIONS

EM&V Impact Study Recommendations
Study Title: 2015 Nonresidential Downstream ESPI Deemed Pipe Insulation Impact Evaluation
Study Manager: CPUC

ID		Section	Conclusion	Recommendation	Disposition (Accepted, Rejected, or Other)	Disposition Notes (e.g. Description of specific program change or Reason for rejection or Under further review)
1	SCG	Section 6	The average diameter of insulated pipe was considerably higher for all customers and fluid types in the high-diameter tier. The PAs separated pipe insulation measures by diameter: less than 1" (0.7" average assumed in IOU calculations) and greater than or equal to 1" (1.7" average assumed in IOU calculations). Evaluators determined a greater average diameter for the latter tier, for all fluid-customer permutations: large commercial hot water (4.3" diameter on average), large commercial medium-pressure steam (2.5"), industrial hot water (2.4"), and industrial medium-pressure steam (3.2"). Greater-than-assumed diameter leads to higher savings per insulated linear foot.	An additional tier for large-diameter piping should be added to the tracking protocol for pipe insulation measures. Currently, the program includes two savings tiers based on pipe diameter: less than 1" diameter piping, and greater than or equal to 1" diameter piping. However, both in the PY2013-14 evaluation and this study, evaluators found that a significant portion of rebated piping (approximately 62% by pipe length in PY2015) had a diameter of 3" or greater. Higher-diameter piping leads to higher thermal mass and heat losses, and therefore higher savings after insulation. The evaluation team therefore recommends that the program incorporate a large-diameter tier, for piping greater than or equal to 3" in diameter, for future program tracking to ensure more accurate savings estimation.		