DNV·GL

2013–2015 RESIDENTIAL ROADMAP

2015 Multifamily Focused Impact Evaluation

California Public Utilities Commission, Energy Division
Prepared by Apex Analytics, Itron, and DNV GL

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1 EXECUTIVE SUMMARY

The California Investor Owned Utilities (IOUs) – Pacific Gas and Electric (PG&E), Southern California Edison (SCE), Southern California Gas (SoCalGas), and San Diego Gas and Electric (SDG&E) – implemented the Multifamily Energy Efficiency Rebate (MFEER) and Multifamily Whole Building (MF-WB) programs during the 2015 program year. On behalf of the California Public Utilities Commission (CPUC), Apex Analytics, DNV GL, and Itron prepared this impact evaluation of the savings claimed by these programs.

The evaluation team designed this evaluation to answer the following research questions for the 2015 MF-WB and MFEER programs. These research questions were designed to accurately estimate the energy savings impacts from these program offerings and build upon lessons learned during the 2013-2014 Multifamily Impact Evaluation[1]. To address overall research objective, the team explored the following questions:

- Are the ex ante energy savings and net-to-gross (NTG)[2] values properly applied (i.e., Database for Energy Efficiency Resources [DEER]) or calculated for MFEER lighting measures and MF-WB? What are the life cycle savings?
- Have the MF-WB program documentation and tracking systems been updated to reflect the 2013–2014 evaluation recommendations and are they adequate to support energy savings claims?
- What is the NTG ratio?[3]
- What are the proper baselines – early replacement (ER) or replace on burnout (ROB) (MF-WB only)?
- What are the gross and net savings realization rates?
- What changes are necessary to increase accuracy and transparency of energy savings estimates and realization rates on a gross and net basis? Are there challenges to using the EnergyPro modeling software for multifamily buildings? Any specific issues to low-rise versus high-rise buildings?

1.1 Multifamily Whole Building Program

All four California IOUs implemented a whole building program in the multifamily sector during 2015. The MF-WB program is intended to assist property owners who wish to engage in more comprehensive retrofit projects that go beyond single measure interventions. As part of this program, property owners are offered technical and financial assistance designed to lower barriers to multiple measure upgrades by providing a combination of both technical and financial assistance. To participate, retrofits must result in expected savings of at least 10 percent from preprogram electric or gas energy usage on a whole building level; however, the program allows for flexibility in the measures used to achieve this savings goal. Program savings are calculated through EnergyPro building simulation modeling software.[4] PG&E, SCE/SoCalGas, and SDG&E claimed savings for 36 MF-WB projects in 2015, representing over 4,500 dwelling units. The MF-WB program has grown

[1] DNVGL and Apex Analytics, 2013-2014 Multifamily Focused Impact Evaluation, CPUC, February 29, 2015.
[2] Note that the NTG calculations and findings incorporate freeridership and not spillover.
[3] Spillover effects are studied and applied at a portfolio level in a separate effort. See CPUC Resolution E-4700, December 18, 2014.
[4] The IOUs did use different EnergyPro Version 5 modules for their ex ante savings calculations. PG&E and SDG&E used the residential performance module for low-rise buildings and nonresidential performance for high-rise building projects. SCE/SoCalGas used the nonresidential performance module for all projects.

dramatically from the initial years of implementation (2013–2014) to 2015, with savings increasing by more than 400% between the two years. However, despite their high growth pattern, the California IOUs did not meet their energy savings goals (based on ex ante savings) for the 2015 MF-WB program year. Cumulatively, the IOUs reached 48% of the energy (kWh) goals, 31% of demand (kW) goals, and 46% of natural gas savings goals (therm). The evaluation team performed two primary data collection activities for the MF-WB programs, telephone surveys and site visits, which contributed to the following four evaluation activities:

(1) Baseline assessment: estimate the percentages of early replacement (ER) and replace on burnout (ROB) participant measures through analysis of the decision maker survey. Baseline assignments contribute to energy savings values by determining whether the existing conditions or current energy efficiency code should be used as a basis for energy savings.
(2) Free ridership (FR) estimation: estimate the percentage of savings that would have occurred without program intervention through analysis of the decision maker survey. The savings from measures that would have been installed without program intervention are excluded from ex post savings values, potentially reducing energy savings achieved by a program.
(3) Consumption analysis: link meter numbers collected onsite to property level consumption, assess completeness, and determine pre-program consumption levels at each visited site. This analysis allows energy savings to reflect the energy consumed at the property prior to the program. In this manner, evaluators can ground savings in actual energy use.
(4) Simulation modeling: determine gross savings values for visited participant sites, updating building and measure characteristics to those found onsite and baseline assignments to those provided during the telephone survey. Energy Simulation Models estimate total consumption of the participant property and approximate energy savings that would result by changing particular features of the home. For example, the simulation model calculates energy savings resulting from installing a new roof, based on the HVAC system, existing insulation, windows, and building orientation of the participant project site. The evaluation team adjusted IOU simulation models to conditions observed during data collection activities.

The evaluation team surveyed 13 of 36 participants in the IOU multifamily programs to feed into the baseline review and FR estimation portions of the impact assessment. The survey targeted a census (at least one respondent for each participating property) of property managers, owners, or other primary decision makers involved in executing the program at the property level. Survey topics included the following:

- Confirmation/verification of installed measures
- Anticipated actions in the absence of program intervention
- Importance of program education and incentives on the decision to install high efficiency equipment
- Working status and estimated age of replaced units
- Timing for building maintenance/upgrades
- Recruitment for site visits.

Following the telephone surveys, surveyors conducted site visits for nine completed MF-WB projects. The three objectives of these visits were to (1) to collect meter numbers to access utility consumption data for all buildings/units on the property that were part of the incentive; (2) to verify measure installation and collect data on measure quantity and efficiency; and (3) to collect high-level building and dwelling unit characteristics used to verify and update as necessary inputs in the EnergyPro models initially developed by the program contractors s to calculate ex- ante savings.

Key Conclusions and Recommendations

Conclusion 1: Although the IOUs have assumed ER savings for all multifamily measures, this research indicated that a substantial portion of projects may not qualify for ER because of planned improvements, installation of new equipment, or replacement of equipment that was in poor condition. For example, only 18% of program shell measures and 50% of water heater installations qualified as ER measures.

Recommendation 1: The IOUs should set up a survey for multifamily participants at intake to better determine the appropriate baseline for each project and measure.[5] The intake survey can follow a similar logic as that used in this report or that from the CPUC early retirement guidance document.[6] The baseline assumptions for a sample of projects should then be verified by an independent third-party evaluator.

Conclusion 2: This research found a NTG ratio of 44.6%. This value is slightly lower than the 2013–2014 REN MF-WB NTG value and significantly less than the IOU provided ex ante value of 85%.

Recommendation 2: IOUs should consider using the researched NTG ratio from this study and update this information as future evaluation results become available. Because the program is still relatively new, the composition of participants may change over time, so the NTG ratio may change as the program matures. In addition, the NTG ratio should be updated if there are changes in the implementation strategies that might reduce or alter the free-ridership (e.g., increasing incentive levels or changing the measure mix).

Conclusion 3: The consumption analysis did not result in comprehensive energy use for many of the sampled properties. This is due to challenges linking the meter numbers to IOU billing data and considerable time periods with zero energy use during the pre-program period. As such, the evaluation team could not calibrate the simulation models to the estimated consumption as planned, and thus relied upon the consumption estimates calculated in the simulation models.

Recommendation 3: Program administrators need to access and calculate whole building consumption for projects prior to approving project application and have this information readily available for evaluators to justify savings claims. Program administrators should access at least 12 months of gas and electric use prior to potential program upgrades, and 12 months of use after the upgrades occur. These data need to encompass all common area and dwelling units within the participant property and should be a prerequisite of participation. These data will allow savings assumptions and models to be calibrated and/or verified through actual customer bills and will be imperative to support future claims for projects utilizing an existing conditions baseline.

Conclusion 4: IOUs should discontinue use of the EnergyPro RES PERF model for their savings estimates because concerns about the accuracy of this software have led to it to be dropped from the CPUC list of approved simulation model software for the California single-family whole building programs.

Recommendation 4: Consider the use of the EnergyPro NR PERF model with inputs that reflect building and use characteristics of multifamily projects in future program cycles.

Conclusion 5: The IOU data collection and tracking systems were greatly improved from the 2013–2014 multifamily evaluation, with near complete information on property and measure details. For several projects,

[5] Programs in place in 2017 and beyond need also comply with CPUC rulings and guidance surrounding AB 802 and Rulemaking 13-11-005, which prescribes appropriate baselines for varying sectors and measure types.

[6] Early Retirement Using Preponderance of Evidence, Version 1.0; http://www.cpuc.ca.gov/NR/rdonlyres/8AB0DEB5-41B0-4881-BC63-F7EBBEC81318/0/ProjectBasis_EULRUL_Evidencev1July172014.pdf

however, the energy estimates and savings from energy models submitted by the IOU did not match to the tracking data.

Recommendation 5: Continue to review tracking data and energy model results before submitting IOU models to the evaluation team to ensure they match one another.

Conclusion 6: Some projects had incentivized measures that did not exceed Title 24 prescriptive requirements. For example, Title 24 2013 Standard Section 150.2(b)1B requires replacement fenestration to meet prescriptive requirements in Table 150 1-A and some projects installed windows that did not meet these prescriptive requirements according to project documentation. These projects were negatively impacted when adjusting the baseline to the proper code.

Recommendation 6: Require project submittals to include Title 24 compliance documentation for project retrofits to building envelope and mechanical systems to demonstrate that the project at least meets the required prescriptive Title 24 code requirements. Additionally, the certified performance rating certificates for windows (NFRC), HVAC (AHRI), and DHW (AHRI) equipment documenting the efficiencies at least meet code requirements should be included in project documentation. IOU staff should take photos of the NFRC ratings affixed to manufactured windows during the IOU test-out QC inspections. This may require closer coordination with the construction schedule so the labels are not removed prior to the inspection. Additionally, IOU staff should include a site measurement of solar transmission for verification of low-e glazing when NFRC labeling data is not available. Photo documentation of all installed measures should be included in the IOU final documentation.

1.2 Multifamily Energy Efficiency Rebate Program

The MFEER program is a statewide core program that serves multifamily properties throughout the state, offering downstream rebates for approved energy efficiency equipment. Each IOU maintains their own list of pre-approved measures and rebate amounts.[7] In the 2015 program, all four IOUs implemented and claimed savings for more than 600,000 units through this prescriptive rebate program. For electric measures, lighting dominated the ex ante energy savings, representing 69% of claimed kWh savings for PG&E, 88% for SCE, and 64% for SDG&E. Large DHW measures, such as storage water heaters, contributed the most ex ante gas savings, representing 98% of therm savings for PG&E, 52% for SDG&E, and 79% for SoCalGas.

As a whole, the California IOUs did not meet their energy savings goals[8] (based on ex ante savings) for the MFEER programs. Two notable exceptions are that PG&E exceeded their goals for natural gas (therms) and SDG&E exceeded their goals for demand (kW). Cumulatively, the IOUs reached 69% of the energy (kWh) goals, 76% of demand (kW) goals, and 70% of natural gas savings goals (therm) for the 2015 MFEER program.

The evaluation team focused on lighting measures for the 2015 MFEER evaluation activities as (1) lighting has been shown to contribute the majority of program electric savings for the program, and (2) the larger lighting evaluation efforts[9] have not included downstream multifamily lighting because those lighting savings

[7] The IOUs' MFEER programs are not entirely comparable. PG&E and SoCalGas have Multifamily Direct Install activities that are separate from the MFEER program; at SCE and SDG&E, these activities are part of MFEER. PG&E and SoCalGas''s multifamily direct install activities are part of other programs and were not included in this evaluation.

[8] Savings goals provided by the IOUs through EEstats data requests.

[9] For more information, see the DNV GL Impact Evaluation of 2013-2014 Upstream and Residential Downstream Lighting Efforts. CPUC. 2016.

represents such a small proportion of overall lighting end-use savings. The goal of this evaluation was to assess the accuracy of the IOU MFEER gross and net lighting savings claims.

The first step in this assessment was to determine if the IOUs were claiming the correct savings values as approved in the DEER ex ante database. To do this, the evaluation team linked the inputs and measures as reported in MFEER claim database to those present in DEER.

The second step in this process consisted of assessing the NTG assignments for MFEER lighting claims. Specifically, the team researched the requirements for the constrained area program (CAP), emerging technology (ET), and hard- to-reach (HTR) NTG assignments, and assessed which claims were eligible for each assignment. The team reassigned NTG claims as appropriate.

Key Conclusions and Recommendations

Conclusion 1: A number of measures are included in the DEER database, yet the IOUs used workpaper savings values.

Recommendation 1: IOUs should use DEER savings values for all applicable measures to make the ex ante savings more closely align with the ex post values. For measures not included in DEER, IOUs can continue to use approved workpaper values.

Conclusion 2: SCE incorrectly assigned the vast majority (78%) of measures to a constrained area NTG. Constrained area NTG is only applicable for approved zip codes and must show an increased incentive to qualify.

Recommendation 2: IOUs should apply the residential default NTG value unless the measures qualify for this increased NTG value.

2 INTRODUCTION

2.1 Multifamily Program Overviews

The California Investor Owned Utilities (IOUs) – Pacific Gas and Electric (PG&E), Southern California Edison (SCE), Southern California Gas (SoCalGas), and San Diego Gas and Electric (SDG&E) – implemented the Multifamily Energy Efficiency Rebate (MFEER) and Multifamily Whole Building (MF-WB) programs during 2015. On behalf of the California Public Utilities Commission (CPUC), Apex Analytics prepared this impact evaluation of the savings claimed by these 2015 programs.

2.1.1 Multifamily Whole Building Program

All four California IOUs implemented a whole building program in the multifamily sector during 2015.[10] The MF-WB program is intended to assist property owners who wish to engage in larger or more comprehensive retrofit projects. As part of this program, property owners are offered technical and financial assistance designed to lower barriers to multiple measure upgrades by providing a combination of both technical and financial assistance. To participate, retrofits must result in expected savings of at least 10% from preprogram electric or gas energy usage on a whole building level; however, the program allows for flexibility in the measures used to achieve this savings goal. Program savings are calculated through EnergyPro building simulation modeling software.[11] PG&E, SCE, and SDG&E claimed savings for 36 MF-WB projects in 2015, representing over 4,500 dwelling units (Table 2-1).

Table 2-1: Ex Ante Gross Energy Savings by IOU, MF-WB 2015 Programs

IOU	Projects	Tenant Units	Savings (ex ante gross)		
			kWh	kW	Therms
PG&E	19	1,324	919,887	480	47,273
SCE/SoCalGas*	6	1,080	567,155	180	54,155
SDG&E	11	2,111	1,919,050	382	49,384
Totals	*36*	*4,515*	*3,406,092*	*1,042*	*150,813*

*SoCalGas and SCE jointly implement the MF-WB program. SoCalGas did not claim savings for their joint projects in 2015.

Source: CPUC Tracking Database and IOU-provided claim IDs.

The MF-WB program has grown dramatically from the initial years of implementation (2013–2014) to 2015, with savings increasing by more than 400% between the two years (Table 2-2).

[10] Two Regional Energy Network (REN) agencies also implement a MF-WB program. The REN programs are evaluated separately.

[11] The IOUs did use different EnergyPro Version 5 modules for their ex ante savings calculations. PG&E and SDG&E used the residential performance module for low-rise buildings and nonresidential performance for high-rise building projects. SCE/SoCalGas used the nonresidential performance module for all projects.

Table 2-2: Ex Ante Gross Energy Savings by IOU, MF-WB Programs

Program Years	Savings (ex ante gross)		
	kWh	kW	Therms
2013–2014 Claimed Savings	594,942	152	23,069
2015 Claimed Savings	3,406,092	1,042	150,813
Percent Increase	*473%*	*586%*	*554%*

Sources: 2015 CPUC Tracking Database and 2013-2014 MF Impact Evaluation

Despite their high growth pattern, the California IOUs did not meet their energy savings goals (based on ex ante savings) for the 2015 MF-WB program year (Table 2-3).

Table 2-3: MF-WB 2015 Program Ex Ante Gross Energy Savings and Goals by IOU

IOU	kWh			kW			Therms		
	Goal	Ex Ante	% of Goal	Goal	Ex Ante	% of Goal	Goal	Ex Ante	% of goal
PG&E	3,200,000	919,887	29%	640	480	75%	90,000	47,273	53%
SCE/SoCalGas *	1,416,100	567,155	40%	1,360	180	13%	116,025	54,155	47%
SDG&E	2,531,783	1,919,050	76%	1,362	382	28%	125,323	49,384	39%
Totals	7,147,883	3,406,092	48%	3,362	1,042	31%	331,348	150,813	46%

*SoCalGas and SCE jointly implement the MF-WB program. SoCalGas did not claim savings for their joint projects in 2015.

Sources: CPUC Tracking Database and IOU data requests

Cumulatively, California IOUs allocated more than $13 million to implement and oversee the 2015 MF-WB programs.[12] Combined, the IOUs spent 73% of this allocated budget and achieved 48% of their electric (kWh), 31% of their demand (kW), and 46% of gas (therm) savings goals (Table 2-4).

Table 2-4: MF-WB 2015 IOU Program Budgets by IOU and Percent of Goal Achieved (ex ante gross)

IOU	Budget	Spent	% Spent	% Savings Achieved (% of goal)		
				kWh	kW	Therms
PG&E	$5,400,000	$2,217,369	41%	29%	75%	53%
SCE/SoCalGas	$2,500,000	$1,809,819	72%	40%	13%	47%
SDG&E	$5,882,655	$5,802,203	99%	76%	28%	39%
Totals	*$13,728,655*	$9,829,391	*71%*	*48%*	*31%*	*46%*

2.1.2 Multifamily Energy Efficiency Rebate Program

The MFEER program is a statewide core program that serves multifamily properties throughout the state. In the 2015 program, all four IOUs implemented and claimed savings for this prescriptive rebate program. To

[12] Budgets provided in EEstats data requests

qualify, multifamily property owners must purchase a qualified energy efficient product to install at their property located within an IOU territory and apply for the rebate. Utility offerings can differ and rebate amounts vary from $1.25 to more than $1,500 per measure. As shown in Table 2-5, the IOUs redeemed rebates for a comprehensive, diverse group of measures during the 2015 MFEER program cycle.

Table 2-5: MFEER Measure Offerings by IOU and Measure Group

Measure Group	Example Measures	IOU			
		PG&E	SCE	SoCalGas	SDG&E
Cooling	Central Air Conditioner, Variable Speed Fan, Duct Sealing, Evaporative Coolers	✓	✓		✓
Pool Equipment	Variable Speed Pool Pump, Pool Heater	✓	✓	✓	
Appliance	Clothes Washers, Refrigerators	✓	✓		✓
Space Heat	Natural Gas Furnaces, Boilers	✓		✓	✓
Lighting	Light-Emitting Diode (LED) Fixtures and Bulbs, Compact Fluorescent Lamp (CFL) Fixtures, Occupancy Sensors	✓	✓		✓
Shell	Insulation, Windows		✓	✓	
Other	Vending Machine Controls, Smartstrip		✓		✓
Small Domestic Hot Water (DHW)	Faucet Aerators, Low-Flow Showerheads, Shower Start	✓	✓		✓
Large DHW	Tankless Water Heaters, Storage Water Heaters, Water Heating Boilers, Boiler Controls	✓	✓	✓	✓

The MFEER programs rebated more than 600,000 units during the 2015 program year. The SCE programs redeemed the largest number of rebates, with more than 450,000 units (i.e., bulbs, fixtures, sensors, etc.) incented, and represented the vast majority (about 92%) of electric savings (Table 2-6).

Table 2-6: MFEER 2015 Program Ex Ante Gross Energy Savings by IOU

IOU	Measures	Savings (ex ante gross)		
		kWh	kW	Therms
PG&E	145,845	100,779	6	405,357
SCE	457,016	18,598,493	1,190	–98,850*
SoCalGas	10,268	19,035	13	147,740
SDG&E	50,819	1,560,477	670	21,642
Totals	*663,948*	*20,278,785*	*1,879*	*475,889*

*Negative therm savings represent interactive effects.

As a whole, the California IOUs did not meet their energy savings goals[13] (based on ex ante savings) for the MFEER programs (Table 2-7). Two notable exceptions are that PG&E exceeded their goals for natural gas (therms) and SDG&E exceeded their goals for demand (kW).

Table 2-7: MFEER 2015 Program Ex Ante Gross Energy Savings and Goals by IOU

IOU	kWh			kW			Therms		
	Goal	Ex Ante	% of Goal	Goal	Ex Ante	% of Goal	Goal	Ex Ante	% of goal
PG&E	200,000	100,779	50%	20	6	32%	300,000	405,357	135%
SCE	26,788,917	18,598,493	69%	2,258	1,190	53%	—	—	—
SoCalGas	—	—	—	—	—	–	481,771	147,740	31%
SDG&E	2,456,343	1,560,477	64%	187	670	359%	33,502	21,642	65%
Totals	*29,445,260*	*20,259,749*	*69%*	*2,465*	*1,866*	*76%*	*815,273*	*574,739*	*70%*

Cumulatively, the IOUs allocated more than $16 million to implement and oversee the 2015 MFEER programs and spent almost $18 million (109%) of their budget (Table 2-8).[14]

Table 2-8: MFEER 2015 Program Budgets and Percent of Goal Achieved (ex ante gross) by IOU

IOU	Budget	Spent	% Spent	% Savings Achieved (% of goal)		
				kWh	kW	therms
PG&E	$1,839,507	$1,522,581	83%	50%	32%	135%
SCE	$11,100,651	$12,912,471	116%	69%	53%	N/A
SoCalGas	$1,328,972	$851,267	64%	N/A	N/A	31%
SDG&E	$2,183,742	$2,711,606	124%	64%	359%	65%
Totals	*$16,452,872*	*$17,997,925*	*109%*	*69%*	*76%*	*70%*

[13] Savings goals provided by the IOUs through EEstats data requests

[14] Budgets as provided by the IOUs through EEstats data requests.

The distribution of measures contributing most to ex ante savings did not vary widely between the IOU MFEER programs. For electric measures, lighting dominated the ex ante energy savings, representing 69% of claimed kWh savings for PG&E, 88% for SCE, and 64% for SDG&E (Figure 2-1, Figure 2-2, and Figure 2-3)[15]. Large DHW measures, such as storage water heaters, contributed the most ex ante gas savings, representing 98% of therm savings for PG&E, 52% for SDG&E, and 79% for SoCalGas (Figure 2-1, Figure 2-2, and Figure 2-4).

Figure 2-1 : PG&E Distribution of MFEER 2015 Program Ex Ante Gross Savings by Measure Group and Fuel Type

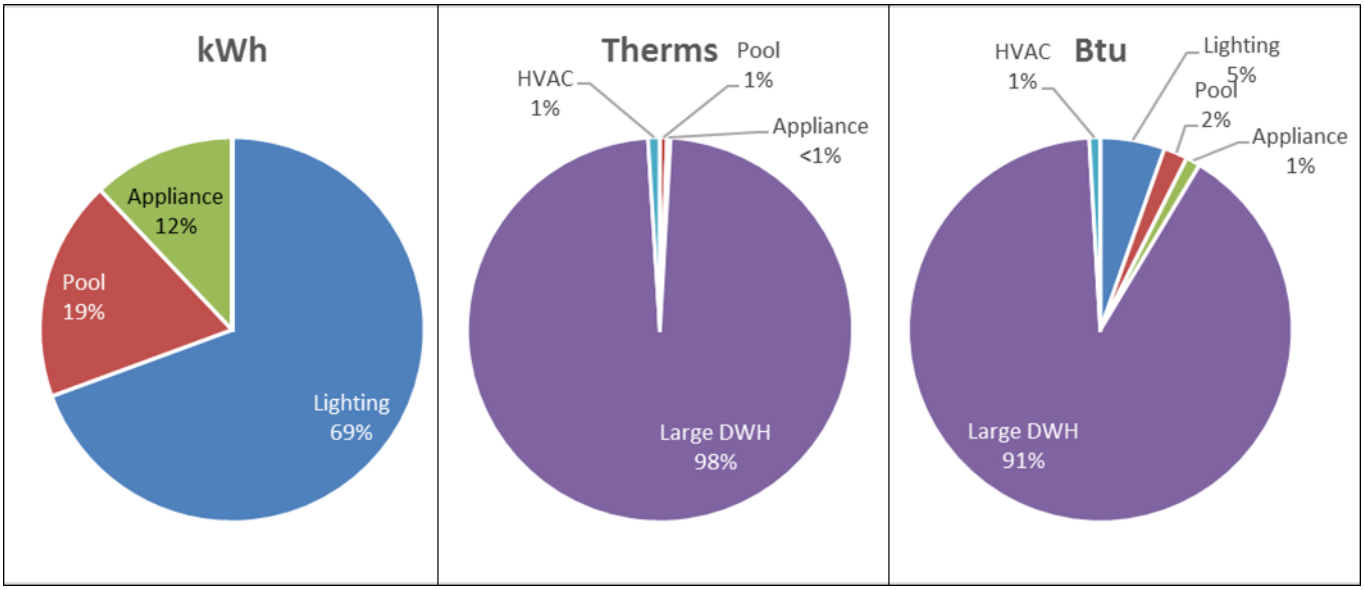
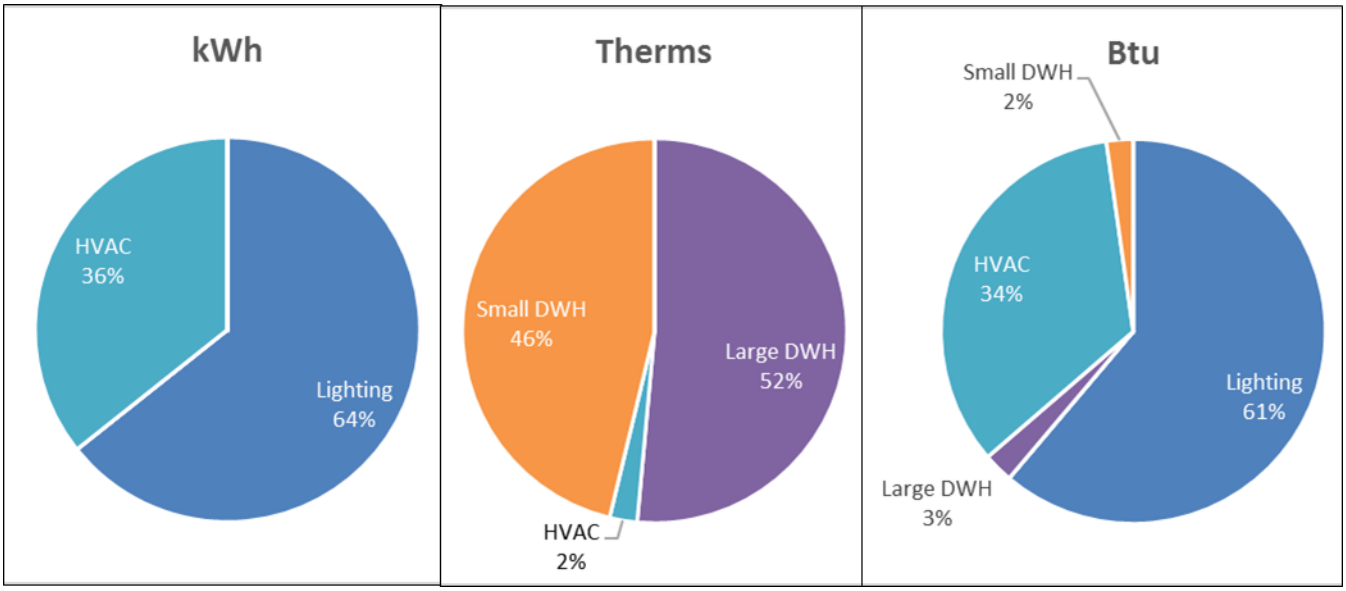


Figure 2-2: SDG&E Distribution of 2015 MFEER Program Ex Ante Gross Savings by Measure Group and Fuel Type



[15] These savings values are exclusive of interactive effects, and are site-based energy values, not source based.

Figure 2-3: SCE Distribution of MFEER 2015 Program Ex Ante Gross Savings by Measure Group

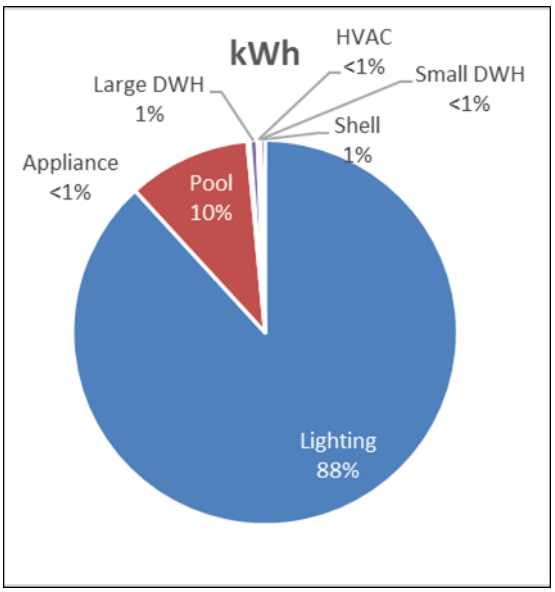
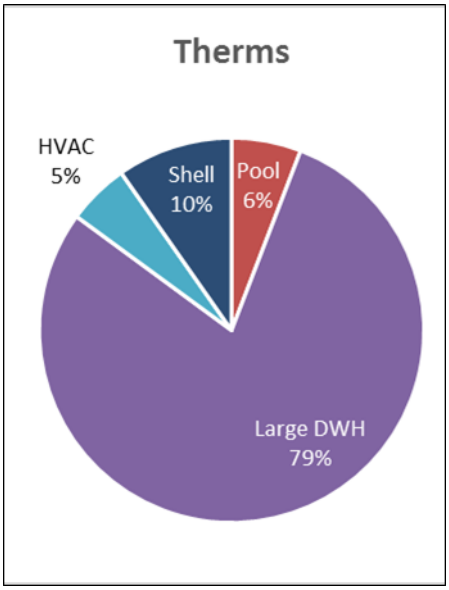


Figure 2-4: SoCalGas Distribution of MFEER 2015 Program Ex Ante Gross Savings by Measure Group

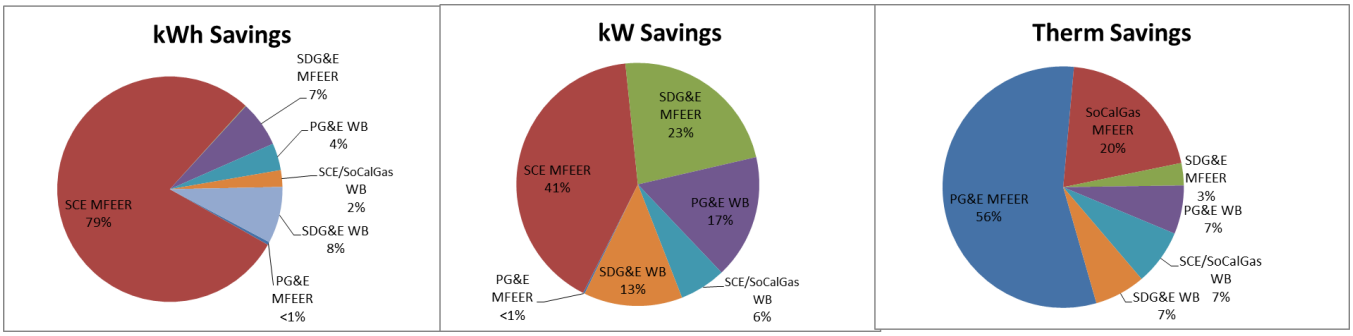


2.1.3 Claimed Savings across Investor Owned Utilities and Programs

Across the IOUs and the various programs, the SCE MFEER program claimed the largest share of multifamily energy (79%) and demand (41%) savings. The SoCalGas (56%) and PG&E (20%) MFEER programs claimed the majority of gas (therm) savings (Figure 2-5). The MFEER program savings outweighed those from the MF-WB programs; the MF-WB programs represented only 14% of the multifamily energy (kWh) and 24% of gas (therm) savings. This is, however, a substantial increase from the 2013 and 2014 program years, where the MF-WB programs contributed only 2% of the multifamily electric and gas savings.[16]

[16] As reported in 2013-2014 Multifamily Focused Impact Evaluation, CPUC, 2/29/16.

Figure 2-5: Distribution of 2015 Multifamily Program Ex Ante Savings by IOU Program and Fuel Type



The evaluation team also compared the cost of the MFEER and MF-WB programs, and the Btu savings achieved through each stream. As shown in Table 2-9, the MF-WB program was substantially more costly (per Btu saved) to implement. On average, the MF-WB programs spent $749 to save one MMBtu, while the MFEER programs spent $243 per MMBtu.

Table 2-9: MF-WB and MFEER 2015 Program Spending and Btu Savings by IOU

IOU	MF-WB		MFEER	
	Spending	$/MMBtu	Spending	$/MMBtu
PG&E	$2,217,369	$614	$1,522,581	$346
SCE/SoCalGas [17]	$1,809,819	$731	$13,763,738	$215
SDG&E	$5,802,203	$824	$2,711,606	$489
Totals	*$9,829,391*	*$749*	*$17,997,925*	*$243*

2.2 Evaluation Overview

Because of the wide variation in implementation strategies between the MFEER and MF-WB programs, the team evaluated the programs separately, using differing methods and activities. The team conducted four primary evaluation tasks for the MF-WB program: consumption analysis, baseline assessment, calibrated simulation models, and free-ridership (FR) estimation. For the MFEER evaluation the team conducted an engineering review of the lighting measures, which represented the vast majority of savings.

The evaluation team designed this evaluation to answer the following research questions for the 2015 MF-WB and MFEER programs:

- Are the ex ante energy savings and net-to-gross (NTG)[18] values properly applied (i.e., Database for Energy Efficiency Resources [DEER]) or calculated for MFEER lighting measures and MF-WB? What are the life cycle savings?

[17] Note that SCE and SoCalGas implement MFEER separately and MF-WB jointly. These IOUs are reported jointly here for comparison purposes.

[18] Throughout this evaluation, the team uses NTG and NFR interchangeably.

- These results impacts the ex post energy savings achieved by the IOUs for the 2015 MF programs.

- Have the MF-WB program documentation and tracking systems been updated to reflect the 2013–2014 evaluation recommendations and are they adequate to support energy savings claims?
  - This influences whether savings can be verified for this program year. Some projects did not have sufficient documentation to be verified during the 2013-2014 MF-WB program evaluation and were granted zero savings because of it.

- What is the net-to-gross (NTG) ratio (MF-WB only)?
  - The NTG estimate the percentage of savings that would have occurred without program intervention through analysis of the decision maker survey. The savings from measures that would have been installed without program intervention are excluded from ex post savings values, potentially reducing energy savings achieved by a program.

- What are the proper baselines – early replacement (ER) or replace on burnout (ROB) (MF-WB only)?
  - Baseline assignments contribute to energy savings values by determining whether the existing conditions or current energy efficiency code should be used as a basis for energy savings. In general, ER measures result in greater energy savings than ROB measures.

- What are the gross and net savings realization rates (RR)?
  - These metrics serve as comparisons between what the IOUs claimed to save (ex ante) and what the evaluation determined (ex post). This metric is useful to assess how accurate the ex ante claims are.

- What changes are necessary to increase accuracy and transparency of energy savings estimates and realization rates on a gross and net basis? Are there challenges to using the EnergyPro modeling software for multifamily buildings? Any specific issues to low-rise versus high-rise buildings?
  - This topic serves to guide program administrators how to calculate ex ante savings that more closely align with ex post values and to reduce variation between ex ante and ex post values.

2.2.1 MF-WB Program

The evaluation team performed two primary data collection activities, telephone surveys and site visits, which fed into the following four evaluation activities:

(1) Baseline assessment
(2) FR estimation
(3) Consumption analysis
(4) Simulation modeling.

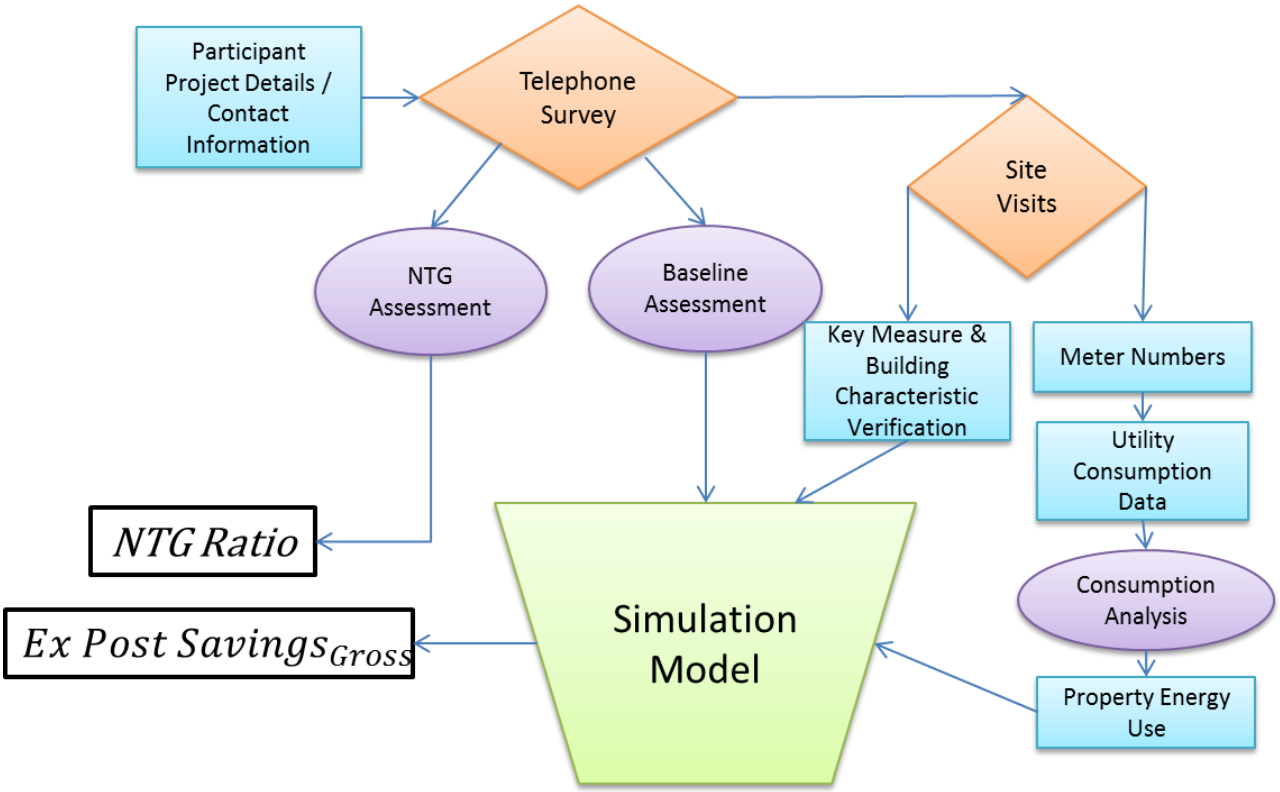
The evaluation team surveyed participants in the IOU multifamily programs to feed into the baseline review and FR estimation portions of the impact assessment. The survey targeted property managers, owners, or other primary decision makers involved in executing the program at the property level. Survey topics included the following:

- Confirmation/verification of installed measures
- Anticipated actions in the absence of program intervention

- Importance of program education and incentives on the decision to install high efficiency equipment
- Working status and estimated age of replaced units
- Timing for building maintenance/upgrades
- Recruitment for site visits.

Projects were recruited for the on-site visits during the decision maker survey. The three objectives of these visits were to (1) to collect meter numbers to access utility consumption data for all buildings on the property that were part of the incentive; (2) to verify measure installation and collect data on measure quantity and efficiency; and (3) to collect high-level building and dwelling unit characteristics used to verify inputs in the EnergyPro models used to calculate savings. Figure 2-6 illustrates how these activities combine to result in evaluated savings. Details of these activities are discussed in the following sections.

Figure 2-6: MF-WB Evaluation Activities and Outcomes



2.2.1.1 Baseline Assessment

Typically, two baseline options are used to calculate savings claims for retrofit (existing construction) projects:

- **Early replacement,** whereby the building owner/manager was not planning to replace or upgrade the equipment if the program were not available. This means that the savings would be based on a dual baseline or a step function, with the difference from existing equipment to new for the expected

remaining useful life (RUL), and then the difference of code (ROB) to new equipment for the difference between expected useful life (EUL) and RUL years (EUL-RUL).

- **Replace on burnout,** which can occur either when existing equipment fails or the building owner/manager was already planning to install new equipment if the program were not available (e.g., through a major remodel or the equipment was expected to fail in less than two years). In these cases, current codes/standards would serve as the baseline for the entire EUL of the equipment. The assumption is that the equipment would have been replaced anyway, but the program motivated the decision maker to upgrade from standard efficiency to high efficiency equipment.

The evaluation team used a decision-maker survey to estimate the percentages of ER and ROB participant measures, respectively (see Section 3.1.1 for details).

2.2.1.2 Free-Ridership Estimation

The MF-WB study also examined FR, which is the percentage of savings that would have occurred without program intervention. Note that this study focused exclusively on FR and did not account for potential spillover which, as noted above, is being investigated under a separate study.[19] This is consistent with the ex ante NTG values. Recognizing that the decision to participate and install energy efficiency measures in multifamily properties can differ by measure, the evaluation team examined potential differences in program attribution across different measures. In addition, the FR questions and the algorithm were carefully selected to capture the complex decision-making processes in the multifamily sector, which in some ways are more similar to nonresidential than residential processes. For example, the evaluation team

- Explored company policy, because it has an impact on decisions about equipment spending and selection
- Investigated and attempted to reach the true decision maker, because some companies have more than one
- Investigated the use of outside agency funding on their decision to upgrade their property.

2.2.1.3 Consumption Analysis

One of the challenges associated with performing a consumption analysis on multifamily properties is identifying a complete list of gas and electric account numbers at the tenant and common area levels for the participating buildings. Because the MF-WB programs are comprehensive, a consumption analysis is successful only if the evaluation team can access consumption information for the entire project, including all tenant and common areas in the building(s). To ensure that the billing data represented comprehensive participant-building-level energy consumption, the evaluation team conducted a thorough assessment of the property consumption information to ensure that it represented the totality of the gas and electricity consumption for a property.

2.2.1.4 Calibrated Simulation Models

The evaluation team calculated ex post gross savings based on calibrated simulation models using the Non-Residential Performance (NR PERF) modules of the EnergyPro software for all projects, including the low-rise multifamily projects. For the low rise projects, the IOUs had used the Residential Performance (RES PERF) module to calculate project eligibility (which requires achievement of at least 10% or greater improvement

[19] Spillover effects are studied and applied at a portfolio level in a separate effort. See CPUC Resolution E-4700, December 18, 2014.

over existing energy use), energy savings, and incentive tiers. The evaluation team chose the NR PERF model software because of the flexibility it offered, and because of a 2010–2012 Whole House Retrofit Impact Evaluation[20] that found a significant difference in electric and gas savings between the billing analyses and the RES PERF EnergyPro model. This prompted the CPUC to allow more simulation software options for the single family program in 2015. EnergyPro RES PERF is no longer on the CPUC list of approved simulation model software for the California single family whole building programs.[21] The NR PERF module also allows for greater flexibility in adjusting operating schedules and other fixed inputs and assumptions used by the RES PERF module.

The ex post models are based on the ex ante models created by the IOUs for each project, then updated by the evaluation team, as necessary, based on three evaluation activities: a baseline assessment, building or measure attributes found on site, and pre-program consumption information. The evaluation team calculated a site-specific ex post gross savings value based on these updated EnergyPro NR PERF simulation models.

2.2.1.5 Additional Topics

Several questions arose from the 2013–2014 multifamily evaluation that the team researched during this round:

- Are the IOUs collecting sufficient data for evaluation and verification purposes?
- How are the MF-WB expected useful lives (EULs) calculated? This metric dictates how long (in years) a measure is anticipated to produce energy efficiency savings.
- To what extent are the MF-WB projects utilizing non-MFEER measures?
- Are any operation, maintenance, and behavior changes incorporated in the WB program – and how were they applied?

2.2.2 MFEER Program

Several factors make MFEER lighting an ideal candidate for the 2015 evaluation efforts: (1) lighting has been shown to contribute the majority of program electric savings for the program (see Figure 2-1, Figure 2-2, and Figure 2-3), and (2) the larger lighting evaluation efforts[22] have not included downstream multifamily lighting because those lighting savings represents such a small proportion of overall lighting end-use savings. Because multifamily lighting represents such a high proportion of MFEER program savings, though, the team believes it is critical to ensure that these measures receive a review that was not performed from the lighting evaluation. The goal of this evaluation was to assess the accuracy of the IOU MFEER gross and net lighting savings claims.

The first step in this assessment was to determine if the IOUs were claiming the correct savings values as those approved in the DEER ex ante database. To do this, the evaluation team linked the inputs and measures as reported in MFEER claim database to those present in DEER. In cases of discrepancies between the claimed savings values and DEER, the evaluation team worked to understand the key drivers behind the discrepancies, and applied the most appropriate value.

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[20] DNV-GL. Whole House Retrofit Impact Evaluation. Evaluation of Energy Upgrade California Programs. Work Order 46. CPUC, Energy Division. 2014. CALMAC ID: CPU0093.01.

[21] www.caltrack.org.

[22] For more information, see the DNV GL Impact Evaluation of 2013-2014 Upstream and Residential Downstream Lighting Efforts. CPUC. 2016.

The second step in this process consisted of assessing the NTG assignments for MFEER lighting claims. There are five different NTG assignments present in the MFEER ex ante lighting claims, each corresponding to a deemed NTG value in the DEER database. Claims made to qualified areas may be eligible for an inflated (higher) NTG value, thus resulting in higher savings. Similarly, technologies that are new to the market have the added benefit of an increased NTG value.

Specifically, the team researched the requirements for the constrained area program (CAP), emerging technology (ET), and hard- to-reach (HTR) NTG assignments, and assessed which claims were eligible for each assignment. The intention of CAP NTG was to encourage IOUs to target geographic areas where electric capacity or generation is constrained, primarily because of the San Onofre Nuclear Generating Station closure.[23] As a result of the closure, IOUs were authorized additional funds to encourage energy efficiency program participation within these constrained areas. SCE was approved to apply additional funds to 29 specific zip codes where capacity is constrained.[24] This is encouraged through a higher NTG value. The ET NTG value is applicable for measures that are directly attributable to the ET program activity and, as directed in D.12-05-015,[25] program administrators must propose and request approval from CPUC staff to use the emerging technology default. The HTR NTG designation is intended for customers that do not have easy access to energy efficiency programs because of language, location, income, or housing type.[26] To qualify, the measure must be direct installed into HTR customer facilities. The team reassigned NTG claims as appropriate.

[23] As authorized in CPUC Decision 14-10-046 Ordering Paragraph 9.
[24] Approved in Disposition Letter 3464E, December 23, 2016.
[25] CPUC Decision 12-05-015, May 10, 2012.
[26] CPUC resolution G-3497, December 18, 2014.

3 MF-WB EVALUATION

The 2013–2014 impact evaluation of the IOU MF-WB programs[27] was largely inconclusive because of poor data tracking and low participation numbers during the initial years of program implementation.

The evaluation team, however, was able to complete an evaluation of the 2013–2014 Regional Energy Networks' (REN) MF-WB programs[28], which function similarly to the IOU programs. This REN evaluation yielded useful insight into these MF-WB programs and evaluation needs for the IOU MF-WB programs, reflected in the approach and analysis reported in this report. Specifically, the REN MF-WB evaluation determined the following:

- There is evidence that both ROB (code baseline) and ER (existing equipment baseline) exist for different measures, sometimes within a single participant project. As a consequence, a pre/post-billing analysis is not an appropriate evaluation methodology for this program because that type of analysis – in the absence of a control group – uses the existing equipment energy usage as the baseline for savings. A billing analysis, therefore, would likely overestimate savings for ROB measures that should be assigned a code baseline. In addition, a billing analysis would be challenged by the small sample size, as well as the difficult in finding an adequate control group.[29]
- Complete consumption information for all the units and common areas for each participating building was not readily available, partially caused by high tenant turnover. The evaluation team has since requested that program implementers collect meter numbers for participant properties (both tenant and common areas) to overcome this issue.
- Several properties showed excessively high savings estimates as a percentage of actual pre-program consumption. For this reason, simulation model saving estimates should be calibrated to pre-program energy use to ground the savings in actual conditions.
- Engineering (desk) review yielded uncertain savings estimates likely caused by interactive and stacking effects,[30] use of nontraditional measures, and differing baseline scenarios. The evaluation team expects simulation models to overcome and account for these.

The 2015 evaluation team activities, therefore, sought to build on the previous MF-WB evaluation efforts through an expanded scope and more robust data collection activities.

27 As reported in 2013-2014 Multifamily Focused Impact Evaluation. CPUC. 2016.
28 2013-2014 Regional Area Networks and Community Choice Aggregator Programs Impact Assessment Final Report. CPUC. 2015.
29 For example, a control group (matched, or with recent participants) would be extremely difficult given the heterogeneity of the program sites and the challenge of aggregating complete billing data for a site.
30 Interactive effects occur when the decrease in energy from one measure increases the energy use from another. A common example of interactive effects is the increase in heating load associated with installing energy efficient lighting measures. Stacking effects occur when the decrease in energy from one measure decreases the energy use of another piece of equipment; the energy impacts are amplified in this situation. A common example of stacking effects is the decrease in HVAC use from shell measures.

3.1 Data Sources

The evaluation team used a variety of primary and secondary sources to assess impacts of the IOU MF-WB programs, including the following:

- Decision-maker survey
- Participant site visits
- Property energy consumption (billing) data
- IOU EnergyPro models
- IOU informational data requests.

In addition, the team used an approved analysis method, the CPUC Energy Division's *Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers* (referred to hereafter as the "framework").[31] This ensures consistency across evaluations, allows comparisons between programs, and ensures that the survey batteries and algorithms have been properly vetted. Both the FR and ER batteries have been customized to the unique characteristics of the California multifamily programs.

The following sections outline the primary and secondary data sources the evaluation team used in the IOU multifamily impact assessment.

3.1.1 Baseline and Free-Ridership Assessment (Participant Survey)

The evaluation team surveyed participants in the IOU multifamily programs to feed into the baseline review and FR estimation portions of the impact assessment. The survey targeted property managers, owners, or other primary decision makers involved in executing the program at the property level. Survey topics included the following:

- Confirmation/verification of installed measures
- Anticipated actions in the absence of program intervention
- Importance of program education and incentives on the decision to install high efficiency equipment
- Working status and estimated age of replaced units
- Timing for building maintenance/upgrades
- Recruitment for site visits.

The evaluation team reviewed the 2015 IOU tracking databases and decided to target a census of participants for the participant surveys. This decision was based primarily on the small number of projects that participated in the 2015 MF-WB program, along with a desire to conduct evaluation activities with as many projects as possible.

The evaluation team successfully completed surveys with 13 project decision makers, representing one-third of the 2015 MF-WB participant projects. The 36 completed projects were managed by 29 unique decision makers; several decision makers managed more than one project. Of the 29 individual decision makers, 13 completed surveys, six refused the survey or could not answer the questions, and 10 could not be reached. When a census is not achieved in a survey effort, there is always the potential of nonresponse bias. In this case, there could be a systematic difference between survey participants and non-participant survey responses. The team attempted surveys with each decision maker at least 7 times, throughout different times

[31] CPUC Energy Division. Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers. Prepared by the Nonresidential Net-To-Gross Ratio Working Group. 2012.

of day and days of the week in order to minimize potential nonresponse bias. Table 3-1 shows the completed surveys by IOU. Each of the IOUs was represented in the final sample.

Table 3-1: MF-WB Completed Participant Surveys by IOU

			Percent of IOU MF-WB Program Savings Represented in Surveys		
IOU	Completed Projects	Completed Surveys	Energy (kWh)	Demand (kW)	Natural Gas (therms)
PG&E	19	8	42%	39%	61%
SCE/SoCalGas	6	3	58%	34%	69%
SDG&E	11	2	9%	1%	17%
Totals	*36*	*13*	*26%*	*24%*	*49%*

3.1.2 Participant Site Visits

Surveyors conducted site visits for nine completed MF-WB projects (Table 3-2). Projects were recruited for the on-site visits during the decision maker survey (described previously) and the site visit participants were given a $100 incentive to reduce nonresponse bias and encourage participation. The three objectives of these visits, in order of importance, were to (1) to collect meter numbers to access utility consumption data for all buildings on the property that were part of the incentive; (2) to verify measure installation and collect data on measure quantity and efficiency; and (3) to collect high-level building and dwelling unit characteristics used to verify inputs in the EnergyPro models used to calculate savings. The administrators of the survey attempted to access at least one of each dwelling unit type, and 10% of total dwelling units, to sample a representative number of dwelling unit HVAC, lighting, and appliances.

Given the limited budgets for data collection, prior to the site visit the evaluation team reviewed the IOU tracking data and project documentation to gain an understanding of the project and plan the site-specific data collection focusing on meter numbers, measure verification, and building characteristics. Project aspects under consideration during this review were size of the project, total number of unique and identical buildings, type of HVAC systems, the magnitude of common area, the measures implemented and their contribution to overall energy savings. Finally, the team determined whether the IOU used the one-model or two-model approach to model energy efficiency measures and the total number of energy models per project.

Building characteristics data collection focused on verifying the following which were compared to the ex-ante energy models and project documentation during the energy modeling phase of the ex-post analysis:

- Building conditioned floor area
- Exterior wall, window, roof, and floor surface areas by orientation
- Exterior surface construction and performance values
- HVAC equipment type and efficiency
- DHW equipment type and efficiency
- Interior lighting
- Exterior equipment/lighting

Table 3-2: MF-WB Completed Site Visits by IOU

IOU	Completed Projects	Completed Site Visits	Percent of IOU MF-WB Program Savings Represented in Site Visits		
			Energy (kWh)	Demand (kW)	Natural Gas (therms)
PG&E	19	6	35%	36%	37%
SCE/SoCalGas	6	1	23%	32%	16%
SDG&E	11	2	9%	1%	17%
Totals	*36*	*9*	*18%*	*22%*	*23%*

3.1.3 Consumption Data

During the 2013–2014 REN Impact Assessment, the evaluation team found that tenant account numbers (i.e. service accounts or SAIDs) were not a reliable link to full property consumption data.[32] At the same time, the DNV GL team contracted to store and process participant consumption information, having determined that meter numbers rather than SAIDs may be a more reliable way to capture consumption information at a building or property level because the meter numbers do not change when utility accounts change hands. In July 2015, IOU multifamily program administrators were directed to capture comprehensive property meter numbers for projects starting in 2015[33]; however, this evaluation captures projects completed prior to that directive.

The 2015 evaluation team utilized meter numbers collected during participant site visits to link to property consumption data. The IOUs supplied the consumption information, which is stored through the DNV GL data management team for use in ongoing evaluation efforts. Once linked and accessed, pre-program (2013–2014) consumption data are then assessed for completeness and intended to calibrate simulation model savings estimates in actual pre-program property consumption.

3.1.4 EnergyPro Models

The IOUs calculate ex ante savings using the EnergyPro Version 5 building simulation modeling software to model the pre-retrofit energy consumption of multifamily buildings using the existing conditions verified on-site during the energy assessment (i.e., the equivalent of ER), rather than the Title 24 code baseline (i.e., the equivalent of ROB). The non-compliance RES Performance and non-compliance NR Performance modules, not the Title 24 compliance performance modules, are used for the ex-ante and ex-post analysis since the baseline is existing conditions rather than Title 24 code. The energy savings are calculated using two approaches. The first is the "one-model" approach and the second is the "two-model" approach. EnergyPro has a feature that gives the user the ability to model energy efficiency measures as parametric runs for some pre-defined measures. If all proposed alternatives can be modeled using the alternatives tab feature, the one-model

[32] This is caused by tenant turnover and associated account changes, as well as the uncertainty around fully capturing all tenant and common areas at a given property. For full details, see Itron, Inc. & Apex Analytics, LLC. *2013-2014 Regional Energy Networks and Community Choice Aggregator Programs Impact Assessment Final Report.* 2016.

[33] This directive was provided via email on 7/30/15 and again in the 2013-2014 Multifamily Focused Impact report dated February, 2016.

approach is used. In some situations, however, the proposed alternatives are not able to be modeled using this feature of EnergyPro and the two-model approach must be used. With the two-model approach, pre-retrofit model modeling the existing conditions is saved as a new file and re-named as the post-retrofit model. The proposed energy efficiency measures are then included in this model and the annual energy use is compared to the pre-retrofit annual energy use to calculate savings. One energy efficiency alternative requiring use of the two-model approach applicable to both the RES PERF and NR PERF module is interior lighting. Using the NR PERF module, the interior lighting is modeled as lighting power density (LPD) and the alternatives tab does not include the option to change LPDs in the spaces. When using the RES PERF module, lighting is input differently; the lamp type, location, and quantity is the input. The alternatives tab can replace all lighting type with another (e.g., replace all incandescent with high-efficacy); however, if the retrofit is for one of the fixtures only, the two-model approach must be used. This is the primary reason for the two-model approach in the projects reviewed as part of this evaluation. Another measure requiring the use of the two-model approach is adding demand controls to multifamily central DHW systems previously operating without controls.

The IOUs used two different EnergyPro modules for the ex ante savings: non-compliance NR PERF and non-compliance RES PERF. Either module can be used to model multifamily buildings, but the main differences between the two modules are the simulation engines used, the method to model lighting and appliances, requirement for HVAC capacities to be accurately input when using the NR PERF module, and the ability to adjust operating schedules in the NR PERF module. Both modules use the same algorithms to calculate energy use for DHW. The RES PERF modules use fixed schedules set forth in the Title 24 Residential Alternative Calculation Methodology Manual (RES ACM) and they cannot be changed by the user. The NR PERF modules use the occupancy based default schedules set forth in the Title 24 Non-Residential Alternative Calculation Methodology Manual (NR ACM) if they are left undefined. However, one benefit of using the NR PERF module is that operating schedules can be overridden with user defined schedules for improved accuracy.

PG&E and SDG&E multifamily whole building programs require the use of the RES PERF module for all low-rise (three stories and less) multifamily buildings and the NR PERF module for all high-rise buildings. SCE/SoCalGas require the use of the NR PERF module for both low-rise and high-rise multifamily buildings because their joint program requires the projects to be calibrated to billing consumption data. This can be done more easily using NR PERF module primarily because the operating schedules can be adjusted. Ideally, the utilities should coordinate with one another and agree on using the same EnergyPro module statewide for calculating project eligibility and savings estimates.

The nine projects in the evaluation comprise 103 buildings and 134 separate energy models as summarized by project in Table 3-3. Seven of the nine projects were low-rise buildings for which the RES PERF module was used to estimate ex ante savings. Another low-rise project used the NR PERF module, and the one high-rise project used the NR PERF module. As noted previously, the ex post analysis used the NR PERF module for all nine projects including those seven that were brought through the program in the RES PERF module.

Table 3-3: Description of Ex Ante Simulation Models for IOU Multifamily Whole Building Projects

Site	Building Type	Quantity of Buildings	Ex Ante Modeling Approach	Reason for Two-Model Approach	Ex Ante EnergyPro Module	Total Quantity of Energy Models
PG&E 1 (081)	Low Rise	27	One Model	N/A	RES PERF	54
PG&E 2 (102)	Low Rise	1	One Model	N/A	RES PERF	1
PG&E 3 (128)	Low Rise	2	Both	Lighting Measures	RES PERF	3
PG&E 4 (125)	Low Rise	14	Two Model	Lighting Measures	RES PERF	28
PG&E 5 (127)	Low Rise	35	Two Model	Lighting Measures	RES PERF	70
PG&E 6 (61)	Low Rise	6	Two Model	Lighting Measures	RES PERF	6
SCE/SoCalGas 1	Low Rise	13	One Model	N/A	NR PERF	13
SDG&E 1 (6541)	Low Rise	4	One Model	N/A	RES PERF	4
SDG&E 2 (7131)	High Rise	1	Two Model	Lighting Measures	NR PERF	1
Total		*103*				*134*

3.1.5 Informational Data Requests

Throughout the course of this evaluation, the team reached out to IOU representatives in both formal and informal conversations. These discussions provided insight into EUL calculations, costs, and operations of both the MFEER and MF-WB programs that were used to analyze various program aspects.

3.2 Analysis

This section outlines the various analysis methods used in the baseline assessment, FR estimation, consumption analysis, and calibrated simulation models.

3.2.1 Baseline Assessment

The ER battery in this effort was established in the 2013-2014 multifamily program evaluation,[34] and is based on research and lessons learned from a variety of evaluations, technical resource manuals, and the CPUC ER guidance document.[35][36] The ongoing challenge in ER evaluations is finding a balance between the data needed to assess a measure as ER, and those that can be reasonably collected during a telephone survey. To achieve that balance, the ER assessment was based on the following four metrics:

1. Working status of prior equipment
2. Age of prior equipment
3. Expected remaining life of prior equipment

[34] As reported in 2013-2014 Multifamily Focused Impact Evaluation. CPUC. 2016.
[35] SCE and CPUC. Early Retirement Using Preponderance of Evidence, Version 1.0. http://www.cpuc.ca.gov/NR/rdonlyres/8AB0DEB5-41B0-4881-BC63-F7EBBEC81318/0/ProjectBasis_EULRUL_Evidencev1July172014.pdf. July 16, 2014.
[36] Programs in place in 2017 and beyond need also comply with CPUC rulings and guidance surrounding AB 802 and Rulemaking 13-11-005, which prescribes appropriate baselines for varying sectors and measure types.

4. Regularly scheduled/government-mandated upgrade schedule and policy.

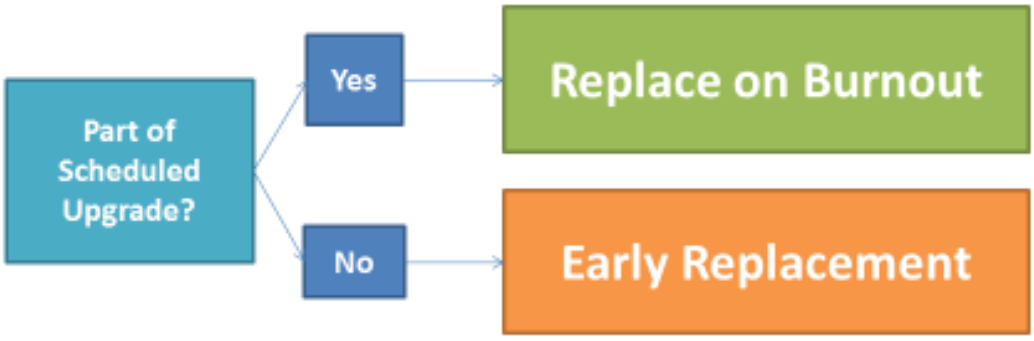
Specifically, measures qualified for ER if they were *not* part of a regularly scheduled or government-mandated replacement and if they

- Replaced existing equipment
- Replaced equipment that was functional and in need of only minor repairs (if any)
- Replaced equipment with self-reported ≥2 years left on its expected life.[37]

Figure 3-1 and Figure 3-2 illustrate the two-tiered ER logic schemes. Note that windows, roofing, lighting, small DHW (e.g., faucet aerators and low-flow showerheads), demand controls, and insulation measures were assumed to be ER unless they were part of a regularly scheduled, planned, or government-mandated upgrade process (e.g., insulation).

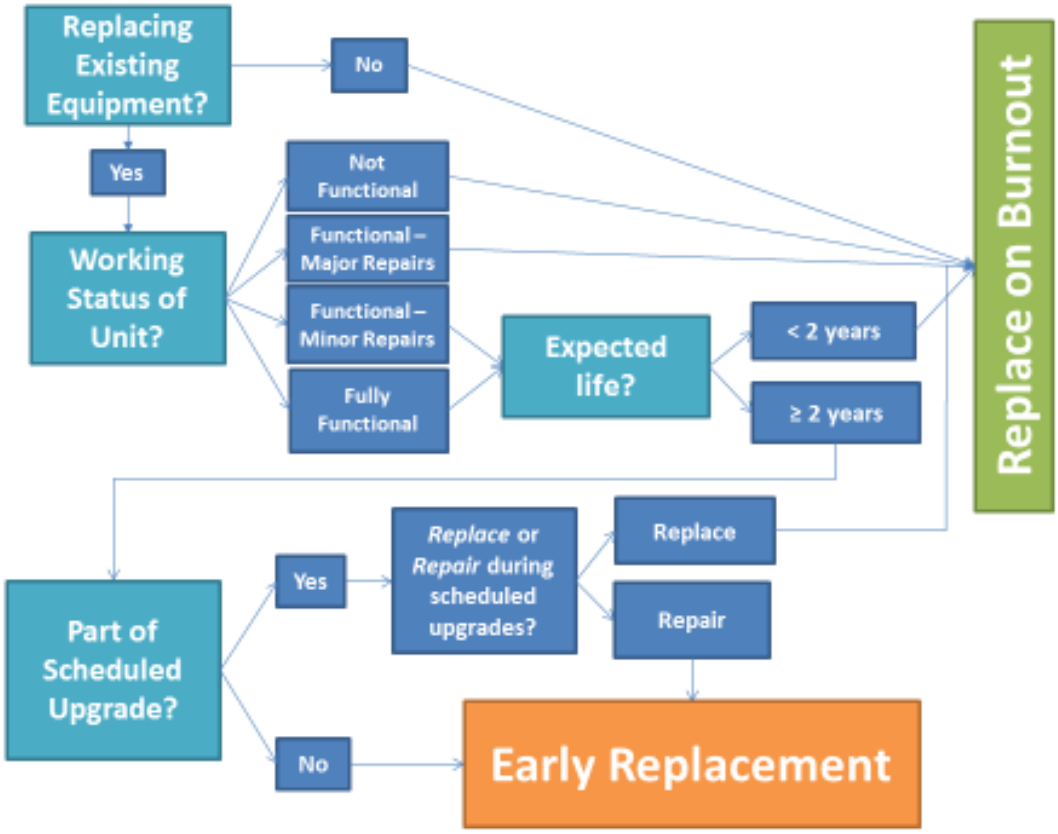
The evaluation team assessed baselines at the measure level to account for the possibility that there could be measure level differences within each site (e.g., prior plans to replace one measure but not another), as well as across the population of participants. To derive a single, program-wide ER estimate for each measure, each project-level measure quantity was used to proportionally weight up to the overall sampled quantity for that measure (i.e., the ER proportions are savings weighted across the different sites).

Figure 3- 1: ER Logic for Lighting, Small DHW, Roofing, and Shell Measures



[37] Two years was chosen as the cutoff for remaining useful life because this cutoff is analogous to that often used for FR analysis. It is deemed a reasonable time frame to indicate short-term outlook relative to a less-certain mid- or long-term time frame.

Figure 3- 2: ER Logic for All Other Surveyed Measures



3.2.2 Free-Ridership Estimation

The FR battery used in the participant survey was based on the CPUC Energy Division's framework.[38] It is important to note that this is a general framework meant to be adjusted for the individual program needs. The multifamily evaluation, therefore, modified the standards appropriately, particularly because multifamily projects represent a unique "crossroads" of residential and commercial decision making. The team believes that the modifications remain consistent with the intent of the framework.

The decision-maker survey questions were designed to measure the influence of the program on participant decisions to implement program-eligible energy efficiency measure(s). Consistent with the framework, the surveys scored three different components of program attribution. The NTG ratio was calculated as an average of these three attribution scores:

1. The program attribution index 1 score (PAI-1) reflects the influence of the most important of the various program and program-related elements in the customer's decision to select the specific program measure at the time.

[38] Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Rations for Nonresidential Customers. Prepared for the Energy Division, CPUC by the Nonresidential Net-to-Gross Ratio Working Group. 2012.

2. The program attribution index 2 score (PAI-2) captures the perceived importance of the program (whether rebate, recommendation, training, or other program intervention) relative to nonprogram factors in the decision to implement the specific measure that was eventually adopted or installed. The program influence score was adjusted (i.e., divided by 2) if respondents said that they had already made their decision to install the specific program-qualifying measure before they learned about the program.
3. The program attribution index 3 score (PAI–3) captures the likelihood of various actions the customer might have taken at the time and in the future if the program had not been available (the counterfactual).

Survey respondents were divided into one of two groups: (1) those who believed that the decision-making process responses were applicable to all measures installed and (2) those who believed that the decision-making process was unique for each individual installed measure. For those respondents who believed that the decision-making process was unique for individual measures, the battery of questions was asked for each of three randomly selected measures for that project. For the respondents who indicated that their responses applied to all measures in the project, the NTG value was applied to all measures within that project. Individual measure-level NTG estimates were weighted to the single, program-level estimate using measure-level savings.

The FR battery also included consistency checks to ensure that answers to other survey questions were consistent with the program influence scoring. The consistency checks included the following:

- If a respondent indicated that compliance with code or government mandated policy was/was not a reason they did the project but then scored this aspect low/high in the FR battery, respectively
- If a respondent indicated that compliance with property owner or property management firm policy was/was not a reason they did the project but then scored this aspect low/high in the FR battery, respectively
- If a respondent provided inconsistent responses between multiple questions (e.g., the respondent indicated that the rebate had a strong influence on why they did the project but then scored the likelihood that they would have installed the same equipment without the program (rebate) high: >7 on a likelihood scale from 0 [not at all likely] to 10 [extremely likely]).

Respondents were asked to give an open-ended response to the consistency check question, providing an opportunity to adjust the scoring from one or both of the questions that were inconsistent.

In addition, respondents were asked about the role of outside funding contributions (e.g., tax credits) in their decision to participate in the program. The evaluation team analyzed the qualitative responses and discussed the impact that responses might have on overall FR estimates.

3.2.3 Consumption Analysis

The ultimate objective of the consumption analysis was to identify electric and gas consumption for each participant project to calibrate energy simulation models to actual, and not modeled, usage. Ideally, the implementation project teams would have access to the actual billing data to calibrate ex ante building usage and savings. The evaluation team in the 2013–2014 multifamily evaluation found that, with the notable exception of the SCE/SoCalGas programs, the IOUs and their implementation contractors did not have a system in place that could capture the whole building consumption associated with all units and common

areas of a multifamily building. As a result, the team collected meter numbers as part of the on-site verification activities. Once collected, the team performed a thorough quality control process to ensure the meters were correctly transcribed and assigned.

The evaluation team was able to complete on-site data collection and collect meter details for nine sites across the four IOUs. Because accounts may change over time, especially for multifamily housing, being able to identify meters allowed the team to connect all billing accounts associated with the static meters of a building. For all but one of the nine MF sites, the team relied on the metering-to-billing data lookups as provided by DNV-GL. For one of the nine projects, the evaluation team had actual utility-assigned whole building electric consumption data to use for the simulation modelling because SCE included actual meter-based electric monthly usage data for their projects.[39]

The consumption analysis included electric and natural gas metering data from both residential and nonresidential billing systems. For any account associated with a meter that lacked residential consumption data, the team attempted to identify nonresidential consumption associated with this account through the Itron-maintained nonresidential consumption database. This was particularly important for high-rise properties, which are the most likely to be commercially metered. The team summarized meter data for each site on a monthly basis for both residential and nonresidential consumption information, allowing the team to assess the level of completeness for each month. For the residential consumption data, those buildings that had fewer monthly records than reported number of tenant units (based on non-zero consumption unit counts), the team took the average monthly consumption for those units with non-zero consumption and extrapolated this usage to the expected total building units. Any common area or master metered "house" consumption was not adjusted, but added back in to the adjusted tenant unit total. This ensured that common meter consumption was applied correctly.

As a final step, the evaluation team compared the billing data annual consumption to the estimated annual consumption as defined within each project file.[40] Results from each of these steps are reviewed in the findings section.

3.2.4 Calibrated Simulation Models

As previously discussed, the evaluators used the ex ante energy models as a starting point for the calibrated modeling approach to calculating the ex post gross savings. The IOUs did not solely assume a code baseline and used existing pre-retrofit conditions as well. The evaluation team used the NR PERF module to calculate ex post savings for all projects, even the seven low-rise multifamily projects for which ex ante savings were calculated with the RES PERF module. The evaluation team typically used the same modeling approach as the IOU, either the one- or two-model approach, to estimate savings attributed to the proposed energy efficiency measures. For the three PG&E projects served by the Sacramento Municipal Utility District (SMUD) for electricity and for which kilowatt-hour savings are not claimed by PG&E, however, the evaluation team used the one-model approach because the IOU used the two-model approach to estimate lighting savings and their contribution to program eligibility.

[39] The EnergyPro modeling files did not include monthly gas consumption from SCG, so the team still had to rely on the metering-to-billing process for the gas consumption.

[40] These files were included within the audit project, and were titled "Project_date_name_Verification.xlsx" or "Savings_Calcs.xlsx."

The modeling process followed the following steps:

1. First, the ex ante models results were compared to the tracking data ex-ante savings and consumption data.
2. Next, the ex ante models were re-run for the low-rise projects in the NR PERF module, and the results were compared to metered consumption data. The impact of this change on the savings estimates was then assessed.
3. After this, the building characteristics and measure characteristics were updated in the NR PERF module based on site conditions observed during on-site visits. The impact of these changes on realization rates was then examined.
4. Last, where identified as ROB based on the ER/ROB baseline assessment, the measure baseline efficiency was updated to Title 24 code baseline for the incented component (e.g., Title 24 climate zone based prescriptive window u-value and solar heat gain coefficient [SHGC values]) in the pre-retrofit NR PERF. The impact of this on realization rates was then reviewed. This was the final run and at this point, the ex-post realization rates were reported.

In step one, the ex-ante models were re-run to verify whether the results match the tracking savings and IOU documentation to assess the ex-ante model accuracy. In some cases, although the differences were minor, the ex ante models did not produce the same results as those found in the tracking savings and IOU documentation. The annual kilowatt-hour and therm consumption for the existing (pre-retrofit) results were also compared to the metered billing data consumption and a modeled-to-metered ratio was calculated. It is important to examine differences between the modeled consumption and the metered consumption. As discussed in the findings section, these differences may result from incomplete/inaccurate metered billing data, or from poor accuracy of the simulation software (and the techniques outlined in the IOU Multifamily Energy Modeling Guidelines) to produce reasonable estimates of absolute annual energy consumption.

In the second step, the low-rise multifamily projects were re-run in the NR PERF module with the following adjustments: (1) change the occupancy setting to high-rise residential, which is required for EnergyPro to run the NR PERF module; (2) set the internal load assumptions so that they are consistent with that occupancy type; (3) set the interior lighting schedule to the 90.1 ASHRAE multifamily lighting schedule, which is closer to the 2.4 equivalent full load hours (EFLH) for residential lighting used in the RES PERF module; and (4) set the heating and cooling schedules to the California low-rise daytime schedules used in the RES PERF module.

The third step was to update the models with any site changes for differences in building characteristics or measure discrepancies verified on site. Data collected on site were compared to the EnergyPro files for major discrepancies in inputs, such as HVAC system type (e.g., wall furnace or central furnace), construction assemblies (e.g., attic frame roof or cathedral roof), and overhangs 2 feet and bigger not modeled but verified on site. The evaluation included a tabulation of exterior walls, windows, roof, and floor areas by orientation and compared to in situ measurements taken by the evaluation surveyors. When comparing the IOU model values to those found on site, the research team accepted the IOU values if they were within 10% of what was found on site. It is possible that some small changes may have been made to the dwelling unit/building such as changes to appliances or heating systems. Furthermore, on-site surveyors only visited an average of 7% of dwellings per building, as mentioned previously. Therefore, if there were only small differences between the IOU model value and the on-site values, the team accepted the model values.

The evaluation team's sample design plan was to access approximately one in seven dwelling units of equal distribution amongst the different dwelling unit types to survey dwelling unit lighting, appliance, heating, cooling, and water heating equipment. However, in many projects, this goal was not achieved due to tenant and property manager survey fatigue from multiple touches during the IOU audit and test-out verification and the on-site surveyors were able to access only one or two dwelling units during their visits. If the equipment is not all original, or not had been replaced at one time, it is possible that the efficiency value of the unit surveyed does not match the IOU value. Therefore, actual quantity and dwelling units accessed relative to total quantity were taken into account when making a judgment call to change to the IOU model based on data collected the by evaluation team. A primary example is refrigerators. If the evaluation surveyor was only able to collect refrigerator model number for efficiency lookup in 1 dwelling unit at a property consisting of 100 dwelling units, and the refrigerator efficiency used by the IOU was based on 14 dwelling units accessed during the initial energy assessment, the evaluation team accepted the IOU values because of the low quantity of dwelling units accessed during the evaluation.

The fourth and final step was to adjust the existing condition to the Title 24 code requirement for measures identified as ROB. For example, the U-values and SHGC[41] for windows in the pre-retrofit model were adjusted from the single-pane default to the Title 24 window alteration prescriptive requirements. The results from this step are the final first-year savings used to calculate realization rates.

3.3 Findings

This section includes findings from each of the primary evaluation objectives.

3.3.1 Baseline Assessment

The energy models provided by the IOUs assumed existing conditions as the baseline for *all* whole building projects. Because the tracking database included the replacement status (the database field was titled "MeasAppType"), the evaluation team compared the tracking database-assigned baseline conditions to the baselines used in the models provided by the IOUs. Table 3-4 shows how each IOU assigned whole building project baselines. Each IOU assigned projects differently, with SDG&E assigning 100% of projects as ER. Note that RET represents retrofit of an existing measure which uses existing condition baselines instead of code. SCE/SoCalGas assigned 100% of projects ROB, while PG&E designated projects between ROB (15%) and ROBNC (85%). Note that ROBNC represents ROB of new construction projects which uses code as baseline.

[41] Single paned metal default values are 1.2 u-value and 0.80 SHGC. Prescriptive requirements are 0.32 u-value and 0.25 SHGC.

Table 3-4: Ex Ante Baseline, Whole Building Tracking Database

Baseline Assigned in Tracking Database	PG&E	SCE/SoCalGas	SDG&E	Grand Total
RET			105	105
ROB	6			6
ROBNC	32	6		38
Grand Total	*38*	*6*	*105*	*149*

RET = Retrofit (pre-program existing conditions, or ER)
ROB = Code baseline
ROBNC = ROB new construction (code baseline)

Despite what the tracking database reports, existing conditions were the baseline used in the energy models. The evaluation team confirmed that existing conditions were used as a baseline in both the IOU and REN programs.[42]

The baseline analysis was divided into two distinct groups based on the end-use type: shell and small DHW measures were included in the first group and all other measures were included in the second group. A detailed description of the factors underpinning this logic is included in the analysis discussion in Section 3.2.1.

Measures replacing equipment that was either fully functional or in need of only minor repairs could qualify for ER depending on the age and Remaining Useful Life (RUL) of the equipment and whether the installation was part of a scheduled or mandated upgrade. Table 3-5 reports measure baselines determined by the evaluation team based on feedback of 13 participants. Each participant was asked the ER battery for up to three measures. Three respondents only had two measures installed, so there was a total of 36 measures reported on in the ER analysis.

Table 3-5: Ex Post Baseline, by Measure Category

Measure Category	Measures	% ER	n =
Shell	Windows, Insulation (Attic, Roof)	18%	13
Lighting	Indoor and Outdoor CFLs and LEDs	70%	10
Large DHW	Storage/Tankless/Boiler Water Heaters, Hot Water Demand Control	50%	6
All Others	Appliances, Pool, Faucet Aerator, Low-Flow Showerhead	57%	7

The results of this analysis demonstrate that program measures were a mix of both ROB and ER. For example, 82% of shell measures (windows and insulation) were ROB instead of ER (Table 3-5). Conversely, 70% of lighting measures qualify as ER. The sample sizes were much smaller for the remaining measure categories (Large DHW and All Others), but the results do show evidence that not all measures are ER (which was the baseline used in the energy models). Table 3-6 breaks down responses by measure baseline assignments that

[42] Email correspondence between Itron and Apex Analytics. 2017.

determined ROB. The majority of measures did not qualify for ER, with the most frequent ROB baseline determined by the fact that the measure was part of a scheduled upgrade (19 of 24 ROB measures). Only 33% of the measures reported on qualify for ER when applying the logic discussed in the analysis discussion in Section 3.2.1.

Table 3-6: Response Categories That Determined ROB

Baseline	Determining ROB Aspect	Measure Count (n = 36)
ROB	Measure was part of a scheduled upgrade	19
ROB	Replaced equipment RUL <2 years	1
ER	N/A	16

3.3.2 Free-Ridership Estimation

To report on program FR, this section first provides a high-level summary of the overall program-level results and covers the three primary components that comprise the NTG battery. This will help the reader understand the driving factors behind the FR results. A more detailed review of the findings, including utility-level and measure-level results, follows immediately after.

In all, 13 whole building respondents took part in the survey, with all 13 being able to complete all three subcomponents of the FR section. The vast majority of these (10 of 13) noted that their responses were indicative of all the installed measures, so that they did not have to provide measure-specific FR estimates. In total, there were 16 measures reported on by 13 respondents. For the three respondents that did provide measure-level FR estimates, an overall FR value was based on weighted measure-level FR values. Overall NTG for the IOU Whole Building program was 44.6% based on a fuel-neutral Btu status. The three equally weighted components that comprise the NTG estimate are shown in Table 3-7. The details behind these estimates follow the table.

Table 3-7: Three Subcomponents and Overall Free-Ridership

PAI-1 (Influence)	PAI-2 (Relative Importance)	PAI-3 (Install Same Equipment)	Overall Net of FR	FR Precision (90%)
45. 9%	40.6%	47.3%	44.6%	±10.8%

Note that these results should be used with caution because they were specific to the MF Whole Building program. As the program measure mix, incentive levels, or outreach/intervention strategies change, the FR may also change. As a result, additional research would be warranted to ensure that the proper attribution is applied to the program and its associated measures. In addition, the research reported here is NTG (as noted in Section 2.2.1.2), and does not include spillover.

3.3.2.1 Influencing Factors (PAI-1)

Using a 0 to 10 rating scale, where 0 means “not at all important” and 10 means “very important,” program participants were asked to rate the importance of several program and nonprogram influences on the decision

to install a measure. Respondents reported that the payback or return on the project was more important than the availability of the IOU rebate (Table 3-8). These responses fed into the PAI-1 score.

Table 3-8: Influences on Installation Decisions

Influence on Decision	Type of Influence	Average Importance Score
Payback or Return on the Project	Program	9.2
Availability of the [IOU] Rebate	Program	7.6
Feasibility Study, Energy Audit, or Other Types of Technical Assistance Provided by the Program	Program	7.6
Age or Condition of the Old Equipment	Nonprogram	6.7
Increased Value of Property	Nonprogram	6.3
Compliance with Company's Normal Maintenance Policies	Nonprogram	5.9
Recommendation from an Equipment Vendor	Nonprogram	5.3
Previous Experience with the [IOU] Program	Program	5.1
Information from Program or Utility Training Course	Program	4.8
Previous Experience with This Type of Project	Nonprogram	4.6
Program Marketing Materials	Program	4.2
Compliance with City, State, or Federal Regulations	Nonprogram	2.3
Utility Account Representative	Program	2.0

The PAI-1 score rates program influence as it relates to nonprogram influences. Specifically, this score is calculated as the maximum program influence score divided by the sum of the maximum program and nonprogram influence score, or

$$PAI1 = \frac{Program_{Max}}{Program_{Max}+Nonprogram_{Max}}.$$

Because more respondents rated the nonprogram influences as more important than those of the program, the PAI-1 score was 0.459, or 45.9%.

The evaluation team also wanted to ensure that savings were not degraded both for ER and FR in instances where company policy (or perhaps scheduled maintenance) influenced decision making. To do this, the team performed a sensitivity analysis around the influence of a company's normal maintenance policies on the PAI-1 score and found that removing that influence rating did not change the calculated PAI-1 score at all (the PAI-1 score remained at 45.9%).

3.3.2.2 Relative Importance (PAI-2)

For the PAI-2 score, respondents were asked about the relative importance of program and nonprogram influences on their decision to install a particular measure. Although the same number of respondents (n = 8)

ranked the importance of nonprogram influences as higher than or equal to that of the program (n = 8), three respondents gave the program score 100% compared to only one respondent who gave a nonprogram score of 100%. Furthermore, because the FR analysis was savings weighted, some of the higher-savings projects gave the program-based influences higher scores. The PAI-2 score is the respondent-provided importance of the program to their decision-making process (Table 3-9).

Table 3-9: Relative Importance of Program and Nonprogram Influences on Installation Decision

Relative Importance of Factors	Count of Responses* (n = 16)
Ranked Program Influences More Important than Nonprogram Influences	8
Ranked Program and Nonprogram Influences Equally Important	2
Ranked Nonprogram Influences More Important than Program Influences	6

*Note that there were 13 respondents that provided a total of 16 responses since there was the opportunity to provide a unique response per measure installed.

Respondents were also asked if they had learned about the program before or after deciding to install the equipment. A response of "after" decreases the measure's PAI-2 score (and associated NTG) by half because they were already planning to install the measure before any program intervention. Slightly less than one-third of all of respondents (31%) indicated that they had learned about the program after deciding to install the equipment. The average PAI-2 score after the adjustment was 0.406, or 40.6%.

3.3.2.3 Likelihood of Installing Same Equipment (PAI-3)

The final component of NTG, PAI-3, is related to what equipment would have been installed if the program were not available. Using a likelihood scale from 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely," respondents were asked the likelihood of installing the same efficiency equipment if the IOU program were not available. The higher the likelihood of installing the exact equipment, the higher the FR and the lower the NTG. Respondents, on average, provided a moderate likelihood of installing the same efficiency equipment in absence of the program, with an average likelihood score of 5.87, resulting in a PAI-3 score of 4.73, or 47.3%. A review of the respondent likelihood of installing the same equipment is included in Table 3-10.

Table 3-10: Likelihood of Installation of Same Equipment

Likelihood of Installing (0 = not at all likely, 10 extremely likely)	Count of Responses (n = 16)*
Likelihood Scores	
Likelihood above 5	7
Likelihood equal to 5	2
Likelihood below 5	7
Extreme Scores	
Extremely likely (10)	2
Not at all likely (0)	5

*Note that there were 13 respondents that provided a total of 16 responses since there was the opportunity to provide a unique response per measure installed.

3.3.3 Importance of Outside Funding

The evaluation team was concerned that there were potential impacts on FR estimates as a result of outside agency financial contributions. To address this concern, survey respondents were asked if they received any funds in addition to the IOU assistance. Five of 13 respondents reported that they did received additional funds. The evaluation team asked these five respondents how the additional funds affected the motivation to pursue the project. Three (of the five) respondents reported that the additional funding allowed the project to be completed, implying that the project might not have been completed without the additional funds. The other two (of the five) said that the funding "gave us the idea to upgrade" and expanded the scope of the project. These two respondents were not of concern to the evaluation team in terms of affecting FR estimations. The evaluation team concluded that the calculated score (as described in this section) was sufficient in capturing the respondent's free ridership rate, including the impact of outside contributions. For example, one respondent, whose overall free-ridership estimate was calculated to be 58% by the evaluation team, shared that the outside funding is "really what made the rehabilitation (project) possible; without the tax credits and bonds, it would have not been possible to redevelop low income properties like this one." The evaluation team did not adjust this respondent's free-ridership estimate because the respondent also stated that it was "not at all likely" that the upgrades would have been made in the absence of the program. Similarly, one other respondent shared a similar sentiment about the outside funding, stating that "the tax credits are what made the project happen – it's a big chunk of money." This particular respondent yielded a low free-ridership estimate (37%) because of their later responses that they would have "installed the exact same equipment without the (IOU) program" and would have completed the project without IOU funding. The evaluation team concluded that the calculated score was accurate in capturing respondents' free-ridership potential.

3.3.4 Consumption Analysis

As noted in the analysis section, for eight of the nine projects for which the sites were visited, the evaluation team did not have access to utility-provided billing data, and therefore had to rely on the site-collected meter numbers and the associated DNV GL and Itron customer billing databases. A summary of the whole building

site characteristics and the number of meters collected at each site, and the number of meters linked to each site is summarized in Table 3-11.

Table 3-11: MF-WB Meter Identification Summary

Site	# Buildings	# Units	Number of Meters Collected Onsite		Number of Meters Linked to Each Site	
			# Electric Meters Collected (Unit / Common)	# Gas Meters Collected (Unit / Common)	# Electric Meters Linked (Unit / Common)	# Gas Meters Linked (Unit / Common)
PG&E 1 (081)	27	408	10 / 1	33 / 2	346 / 7	35 / 6
PG&E 2 (102)	1	14	14 / 1	14 / 1	14 / 0	8 / 1
PG&E 3 (128)	2	24	24 / 1	24 / 2	23 / 1	22 / 2
PG&E 4 (125)	6	94	NA*	95 / 4	NA	70 / 4
PG&E 5 (127)	14	175	NA*	0 / 3	NA	0 / 3
PG&E 6 (061)	1	44	NA*	44 / 1	NA	34 / 2
SCE/SoCalGas 1	13	90	89 / 0	42 / 1	90 / 0	90 / 2
SDG&E 1 (6541)	4	25	23 / 1	26 / 0	22 / 1	24 / 0
SDG&E 2 (7131)	1	152	157 / 2	0 / 0	126 / 2	2 / 0
Totals	*69*	*1,026*	*317 / 6*	*278 / 14*	*621 / 12*	*285 / 20*

**Note PG&E 4, 5, and 6 claimed gas savings only*

In some instances, the meter identification was not possible during the site visit due to inaccessible meter numbers or the meter number did not have an identifying apartment number. For the PG&E Site 1 (which had only 10 of the 408 meters collected onsite), the team had to rely solely on an address lookup performed by the DNV team, and was able to generate 85% of the expected unit counts (346/408). For properties where meter numbers were available from the site visit, the team attempted to look up all accounts and consumption data based associated with each collected meter. Unfortunately, the billing data had large gaps during the pre-installation period (2012–2014), where the billing records were blank (no data recorded for that meter-month). Because of this, the team expanded the search for consumption information, and attempted to link meters, premise numbers, and addresses within the billing database in an attempt to append the incomplete project consumption. Even with the expanded search, there were considerable gaps within most of the sampled properties. Using SDG&E 2 site as an example, the onsite team collected 157 dwelling area and two common area electric meter numbers. The data team could only find consumption for 126 units at that property, even with the extensive search of the meter numbers, premise numbers, and addresses.

To further complicate the consumption analysis, there were instances across the buildings whereby the on-site data collection team had a meter assigned differently than the billing system. The on-site data, based on labels placed next to the meter number, would be listed as common or “house” meter, and yet the utility billing system had this meter designated as tenant/unit meter (and vice versa). The team could not extrapolate missing common areas because some common area of house meters are tied to different end uses and there was too much uncertainty to be able to account for missing common area meters.

The evaluation team had planned to receive fully populated historical billing data across the billing period of interest (2012–2015) using the meter numbers as the direct link over time. However the consumption gaps within the IOU billing data proved too extensive; the evaluation team could not confidently calibrate simulation models to this incomplete consumption information. The evaluation team recommends – for IOUs that are not currently calibrating to actual usage – that the IOUs collect and maintain project level consumption information for participant projects prior to appropriating funds (See Section 3.4 for additional details on this recommendation).

3.3.4.1 Billing to Model Consumption Comparison

During the course of the evaluation, the evaluation team compared consumption calculated by the EnergyPro simulation model to the consumption calculated by linking meters, premise, and address information to IOU billing data. Due to the significant gaps discussed above, the team took several steps to adjust the billing data to attempt to fill in the missing data. These adjustments and results are discussed below.

For the residential consumption data, those buildings that had fewer monthly records than reported number of tenant units (based on non-zero consumption unit counts), the team took the average monthly consumption for those units with non-zero consumption and extrapolated this usage to the expected total building units. As an example, if a site had 24 units but only 20 meters had complete consumption data, the whole building received the average per unit consumption across the 20 units and this average was applied to the 24 total units. Common areas metered consumption data was not adjusted, but added back in to the adjusted tenant unit total.

After completing these steps and generating the estimated usage for each site, the evaluation team compared the billing-data estimated annual usage to the audit-assumed usage and generated corresponding savings ratios (annual savings as a percentage of annual usage). This helps to compare both absolute and relative usage and savings. Table 3-12 reviews the electric savings comparisons. As the summary shows, three of the nine sites had meter-based annual consumption that was consistent with the anticipated modeled usage. Three of the sites contained electric accounts through SMUD, so no electric analysis could be administered for them. The remaining three sites showed divergent meter-based savings from the modeled results, although the difference in savings was not in a consistent or biased direction.

Table 3-12: MF-WB Building Annual Electric Consumption Comparison

Site	Audit Annual kWh Consumption	Evaluated Billing-Based kWh Consumption	Ex Ante Annual kWh Savings	Savings as % of Annual kWh Usage (Audit)	Savings as % of Annual kWh Usage (Evaluated)
PG&E 1 (081)	2,262,983	3,843,908	341,940	15%	9%
PG&E 2 (102)	52,305	46,409	5,263	10%	11%
PG&E 3 (128)	105,331	69,493	12,566	12%	18%
PG&E 4 (125)*	N/A	N/A	N/A	N/A	N/A
PG&E 5 (127)*	N/A	N/A	N/A	N/A	N/A
PG&E 6 (61)*	N/A	N/A	N/A	N/A	N/A
SCE/SoCalGas 1†	425,696	425,696	141,878	33%	33%
SDG&E 1 (6541)	108,043	114,442	17,344	16%	15%
SDG&E 2 (7131)	535,340	634,828	176,573	33%	28%
Totals	*3,489,698*	*5,134,776*	*695,564*	*20%*	*14%*

*PG&E sites 4, 5, and 6 were SMUD electric customers, and did not claim any electric savings.
†SCE/SoCalGas project electric consumption was based on actual SCE-provided billing data.
Sources: Audit annual kilowatt-hour consumption from audit project files; Evaluated billing-based kilowatt-hour consumption generated based on meter data collected on site and meter matches, and extracted from PA billing data stored and managed by Itron; ex ante kilowatt-hour savings from tracking system;

The evaluation team compared the billing-data estimated annual natural gas usage to the audit-assumed usage and generated corresponding savings ratios (annual savings as a percentage of annual usage). This helps to compare both absolute and relative usage and savings. Table 3-13 reviews the annual natural gas savings comparisons. As the table shows, the billing data were not consistently higher or lower than the audit usage, and varied across the properties examined. There does not appear to be a clear-cut bias in either direction.

Table 3-13: MF-WB Building Annual Natural Gas Consumption Comparison

Site	Audit Annual Therm Consumption	Evaluated Billing-Based Therm Consumption	Annual Therm Savings	Savings as % of Annual Therm Usage (Audit)	Savings as % of Annual Therm Usage (Evaluated)
PG&E 1 (081)	38,006	20,944	5,517	15%	26%
PG&E 2 (102)	2,542	3,138	261	10%	8%
PG&E 3 (128)	7,573	6,995	708	9%	10%
PG&E 4 (125)	30,093	50,790	6,769	22%	13%
PG&E 5 (127)	26,034	41,270	4,033	15%	10%
PG&E 6 (61)	8,666	9,929	2,121	24%	21%
SCE/SoCalGas 1	26,769	36,952	9,584	36%	26%
SDG&E 1 (6541)	5,865	4,356	1,411	24%	32%
SDG&E 2 (7131)	20,384	18,574	7,797	38%	42%
Totals	*139,163*	*192,948*	*38,201*	27%	20%

Ultimately, the meter-based consumption results proved to be closely aligned with the anticipated modeled consumption for only one-third of the sites (n = 3 for electric, n = 3 for gas). Given the challenges noted previously—the uncertainty around the meter label-assigned versus the billing system assigned location, the attrition of meters during the meter-to-billing system lookup, the lower count of house or common meters collected than anticipated, and the lack of fully populated pre-installation billing data—the evaluation team cannot definitively say whether the difference between the meter-generated consumption and the audit-generated consumption is due to inaccurate billing-data matching or incorrect model-generated savings estimates. Ultimately, the evaluation team selected not to calibrate the simulation models to the estimated consumption.

3.3.5 Calibrated Simulation Models

Table 3-14, Table 3-15, and Table 3-16 report on the savings at each step in the ex post evaluation process and the gross realization rates. The first column presents the annual savings from the CPUC tracking data. The second column presents the annual savings simply from changing EnergyPro modules to NR PERF module. The third column reports annual savings based on changes made to the models based on measure verification and/or differences in observed building characteristics. The fourth column reports the annual savings for the final ex post calculation, accounting for the baseline adjustments. The last column lists the realization rates, which were developed by comparing ex ante savings to the results from the final run, accounting for site and baseline adjustments as run in the NR PERF module.

The energy savings for practically all projects were immediately affected simply by switching from the RES PERF module to the NR PERF module, although each step in the analysis led to various changes across the different sites. More detailed discussion follows. The IOU NR PERF models submitted for site SCE/SoCalGas 1 and SDG&E 2 did not match the tracking savings for both kilowatt-hours and therms. As a result, the savings values in column two are different than the tracking savings even though the projects were modeled by the IOU in NR PERF.

Table 3-14: MF-WB Building Annual Kilowatt-Hour Savings At Steps in the Modeling Process

Site	Tracking kWh Savings	Ex-Post Annual kWh Savings – NR PERF	Ex Post Annual kWh Savings – NR PERF + Site Changes	Ex Post Annual kWh Savings – NR PERF Site Changes Code Baseline	kWh Realization Rates
PG&E 1 (081)	307,746	167,667	167,667	0**	0%
PG&E 2 (102)	4,737	4,404	2,535	149	3%
PG&E 3 (128)	11,309	9,058	9,058	3,136	28%
PG&E 4 (125)	N/A*				
PG&E 5 (127)	N/A*				
PG&E 6 (61)	N/A*				
SCE/SoCalGas 1	127,690	133,243	133,243	61,690	48%
SDG&E 1 (6541)	15,610	10,295	12,510	4,940	32%
SDG&E 2 (7131)	158,916	166,099	166,099	46,563	29%
Total	*626,008*	*490,766*	*491,112*	*116,478*	*19%*

* PG&E projects 4, 5, and 6 are not claiming kilowatt-hour savings because those projects purchase electricity from SMUD.

** Project installed windows that were less efficient that title 24 code.

Table 3-15: MF-WB Building Annual kW Savings at Steps in the Modeling Process

Site	Tracking kW Savings	Ex Post Annual kW Savings – NR PERF	Ex Post Annual kW Savings – NR PERF + Site Changes	Ex Post Annual kW Savings – NR PERF Site Changes Code Baseline	kW Realization Rate
PG&E 1 (081)	162.9	100.7	100.7	0	0%
PG&E 2 (102)	4.5	4.3	1.8	0.1	2%
PG&E 3 (128)	4.8	3.4	3.4	0.5	11%
PG&E 4 (125)	N/A*				-
PG&E 5 (127)	N/A*				-
PG&E 6 (61)	N/A*				-
SCE/SoCalGas 1	57.6	65.7	65.7	25.2	44%
SDG&E 1 (6541)	12.2	2.5	2.8	1.1	9%
SDG&E 2 (7131)	-10.3	-19.1	-19.1	-6.8	66%
Total	*231.8*	*157.4*	*155.2*	*20.2*	*9%*

* PG&E projects 4, 5, and 6 are not claiming kilowatt savings because those projects purchase electricity from SMUD.

Table 3-16: MF-WB Building Annual Therm Savings at Steps in the Modeling Process

Site	Tracking Therm Savings	Ex Post Annual Therm Savings – NR PERF	Ex Post Annual Therm Savings – NR PERF + Site Changes	Ex Post Annual Therm Savings – NR PERF Site Changes Code Baseline	Therm Realization Rate
PG&E 1 (081)	4,965	1,880	1,392	1,392**	28%
PG&E 2 (102)	235	378	120	0	0%
PG&E 3 (128)	637	68	68	0	0%
PG&E 4 (125)	6,092	5,654	5,654	3,012	49%
PG&E 5 (127)	3,630	4,022	4,022	4,140	114%
PG&E 6 (61)	1,909	2,481	2,113	2,264	119%
SCE/SoCalGas 1	8,626	8,843	8,843	3,106	36%
SDG&E 1 (6541)	1,270	590	803	596	47%
SDG&E 2 (7131)	7,017	7,797	6,339	6,339	90%
Total	*34,381*	*31,713*	*29,354*	*20,849*	*61%*

** Project installed windows that were less efficient that title 24 code.

Table 3-17 summarizes the impact on total annual energy use estimates by running the IOU ex ante models that were initially run through the RES PERF modules through the NR PERF module with adjustments previously described. In almost all instances the electrical energy and natural gas energy decreases compared to the models run through the RES PERF module. In some instances, this has an impact on the project eligibility and incentive tiers. The difference in energy consumption is largely attributed to heating, cooling, and fan energy usage. Determining for each project whether the difference is attributed to the way the heating and cooling loads are calculated, or the way the heating and cooling energy are simulated, or both is beyond the scope of this evaluation. Both RES PERF and NR PERF modules calculate the DHW usage the same so these results were identical, and the lighting and plug loads also generally matched.

Table 3-17: MF-WB Building Impact on Annual Energy Use Estimates by Running Ex Ante Low-Rise MF Models in NR PERF Module

Site	NR PERF Impact on Existing Building Total Consumption	NR PERF Impact on Eligibility
PG&E 1 (081) Building 5122	36% Less kWh 54% less kW 59% less Therms	Drops Some of the Buildings to Lower Incentive Tier
PG&E 2 (102)	15% Less kWh 37% Less kW 12% Less Therms	Building Not Eligible—5.9% to 10.2% Improvement (<10%)
PG&E 3 (128)	31% Less kWh 54% Less kW 33% Less Therms	Combined Buildings Not Eligible (<10% improvement)
PG&E 4 (125)	34% more kWh 11% Less Therms	Drops from 20.21% to 18.49%
PG&E 5 (127) Building 22	21% Less kWh 46% Less kW 6% less Therms	18.5% to 10.2% Affecting Incentive Tier
PG&E 6 (61)	Almost No Impact on kWh 41% Less Therms	All Buildings Combined, 17% to 15%
SCE/SoCalGas 1	N/A – IOU Used NR PERF	NA – IOU Used NR PERF
SDG&E 1 (6541)	15% More kWh 63% Less kW 37% Less Therms	Combined % Improvement Reduced from 21% to 12% Likely Affecting Incentive Tier
SDG&E 2 (7131)	N/A – IOU Used NR PERF	NA – IOU Used NR PERF

Table 3-18 describes the changes made to the energy models for the ex post savings estimates based on the site verification but excluding the ER/ROB adjustments. Table 3-19 summarizes the site verification findings in more detail and explains causes of low realization rates and why some differences observed on site were not made to the models, such as measurement of exterior surfaces that fell within the pre-defined 10% threshold.

Table 3-18: Energy Conservation Measures (ECMs) Installed and Evaluation Findings from Simulation Modeling

Site	Measure Summary	Evaluation Findings
PG&E 1 (081)[43]	ECM-1: CRCC rated cool roof finish all roof surfaces ECM-2: High-performance windows 0.30 U-factor , 0.32 SHGC ECM-3: Refrigerators (414 kWh/yr) and dishwashers (0.80 EF) ECM-4: Exterior lighting— high efficacy and photocells	ECM-1: It does not appear that this measure was implemented from photos taken of the roofs on building 5277. The roof surface appears relatively old and much HVAC equipment and conduit lines do not appear to have been removed for the cool roof surface to be installed. This building is part of phase II; however, the phase II verification report indicated that all roofs were replaced with the cool roof material. ECM-2: Surveyor verified new vinyl double paned windows and took a picture of an NFRC label showing 0.30 u-factor and 0.22 SHGC. The label, though, appears to be attached to a translucent window not typical of clear windows installed in the dwelling units. For this reason, the evaluation modeled the windows as the same as the IOU. The windows specified in the IOU audit report and verification report (u-factor 0.30, SHGC, 0.32) do not meet the 2013 Title 24 prescriptive requirement for window alterations to use a window better than u-factor 0.35 and SHGC 0.22. The site visit report indicates an initial audit date of June 14th, 2015, significantly after the date the 2013 Title 24 standards became effective (July 1, 2014).This resulted

[43] In response to these findings, PG&E provided the evaluation team with additional project information including building department inspection records, copies of invoices, and a narrative. This new documentation raises concerns related to enrollment timeline, and whether there is sufficient evidence to support program influence. PG&E stated the program implementer engaged the project during 2013-2014 and that construction was under way when the program re-engaged the project in 2015; however, documentation was not supplied to support initial engagement in 2013-2014. The June 2015 initial assessment report recommends a new cool roof and windows; however, provided invoices indicate the roofing replacement started in August 2014, significantly prior to the 2015 program assessment. Second, while no T24 documentation or building permits were provided, the IOU stated the windows are on the same permit as the cool roof and therefore the 2008 standards apply to the windows as well. If true, this permit would have to been pulled prior to July 1, 2014 to be compliant with 2008 codes, months before the initial program assessment completed (June 2015). This indicates that the program could not influence the window or roof measure selection. The evaluation team stands by their decision of setting the baseline conditions to 2013 as the windows and cool roof were permitted and some already installed prior to program assessment.

Site	Measure Summary	Evaluation Findings
		in negative savings for this project after making the ER/ROB baseline adjustments. ECM-3: Verified as installed but removed from the Phase I model because it is claimed as part of Phase II. ECM-4: Verified high-efficacy exterior lighting as LED fixtures, but removed from the Phase I model because it is claimed as part of Phase II.
PG&E 2 (102)	ECM-1: Windows 0.30 u-value, 0.22 SHGC ECM-2: Outdoor lighting	ECM-1: Surveyor verified new windows and square footage, but was unable to collect NFRC rating information. ECM-2: Surveyor verified (14) 13-W CFL fixtures on walkways and (6) 9-W LED fixtures located on front porches.
PG&E 3 (128)	ECM-1: Windows: 1,296 sq. ft., U-value 0.30, SHGC 0.22 ECM-2: High-efficacy indoor lighting: 33 LED fixtures in kitchens and hallways ECM-3: High-efficacy outdoor lighting: 18 LED fixtures	ECM-1: Surveyor verified approximately 1,328 sq. ft. of glazing but was unable to collect NRFC or other performance ratings on site, so this measure is considered installed. ECM-2: Surveyor accessed one dwelling unit and verified one 9-W LED fixture. It is not clear which units had the hallway fixture retrofit with the LED. Total quantity not verified because only one dwelling unit was sampled, so this measure is considered installed. ECM-3: Surveyor verified 18 LED fixtures controlled by photocell in the exterior walkways.
PG&E 4 (125)	ECM-1: Large storage DHW 96%, (average of 8 units) ECM-2: Interior lighting; high-efficacy kitchen lighting (94 dwelling units) ECM-3: High-performance windows U-value 0.30, SHGC 0.22 (7,768 sq. ft.)	ECM-1: Verified eight new large central DHW; four state m/n SUF100150NE 200 rated at 98%; and four state m/n SUF100150NE 100 at 94% unclear which unit serves which buildings. The IOU modeled them all at 96%, which is acceptable. ECM-2: Verified SunPark LED 1018D fixtures in the sampled dwelling unit kitchens.

Site	Measure Summary	Evaluation Findings
		ECM-3: Verified 7,335 sq. ft. of new windows. Unable to obtain NFRC label to verify performance values.
PG&E 5 (127)	ECM-1: DHW boilers 96% ECM-2: Double-pane windows (U-value 0.28–0.30, SHGC 0.22–0.25) ECM-3: High-efficacy lighting, kitchen only	ECM-1: Boilers verified as installed ECM-2: Windows verified as installed ECM-3: High-efficiency lighting in kitchen verified as installed
PG&E 6 (61)	ECM-1: Windows U-value 0.30, SHGC 0.28 ECM-2: Indoor high-efficacy lighting	ECM-1: The IOU did not provide product specifications for the installed windows. The Itron surveyor verified slightly different window size for the 50 'A' type windows next to the front door, 6040 compared to IOU measurement of 6050. Prior to this adjustment, there was a 13% difference in total window area between the evaluation measurements and the total window area in the energy model. Making this adjustment to the IOU model reduces the verified window percentage difference from 13% to 3%. ECM-2: Surveyor verified 23-W LED bathroom vanity lighting fixtures.
SCE/SoCalGas 1	ECM-1: Windows u-value 0.34, SHGC 0.31 ECM-2: HVAC 80% annual fuel utilization efficiency (AFUE), 13 seasonal energy efficiency ratio (SEER), approximately 46 units ECM-3: DHW, 0.62 energy factor ECM-4: Exterior lighting LED ECM-5: Attic insulation, R-38	ECM-1: All dwelling units have new windows; NFRC label not obtained. ECM-2: About 70% of the units appear to be new; however, roof was not accessed for census verification. ECM-3: Verified (4) AO Smith GNR 40 200 DHW, 0.62 EF ECM-4: Verified all parking areas have new LED fixtures ECM-5: Verified 6 "Fiberglass over 3" spray in insulation.
SDG&E 1 (6541)	ECM-1: High-performance windows u-factor 0.49, SHGC 0.35	ECM-1: Surveyor verified that most windows appear to be new double-pane aluminum windows.

Site	Measure Summary	Evaluation Findings
	ECM-2: DHW, Noritz NR111-OD Instantaneous, modeled as 0.843 recovery efficiency. It appears this DHW unit was imported from the EnergyPro library. ECM-3: Pool variable-speed drive (VSD) pump	ECM-2: Verified the model number as NRC1111-DV, which includes the letter "C" indicating it is a condensing DHW unit rated at 95% recovery efficiency. ECM-3: 3.0 horsepower pump with Pentair VFD
SDG&E 2 (7131)	ECM-1: Window 17,342 sq. ft., U-factor 0.47, SHGC 0.34 ECM-2: Four high-efficacy LED fixtures per unit or 620 total in-unit of lighting and 195 fixtures of lighting common area and stairwells. IOU does not describe the corridor fixtures. 1.34 W/sq. ft. baseline 0.35 W/sq. ft. proposed for the residential floors including the dwelling units and corridors. ECM-3: Two large storage water heaters 96% recovery/thermal efficiency ECM-4: Five split DX HP serving common area on 1st floor and 16th floor lounge; SEER 20 HSPF 9.5	ECM-1: Verified new windows 17,161 sq. ft. for dwelling units. The windows specified in the IOU audit report and verification report (u-factor 0.47, SHGC 0.34) do not meet the 2013 Title 24 prescriptive requirement for window alterations to use a window better than u-factor 0.35 and SHGC 0.22 resulted in negative savings for this project after making the ER/ROB baseline adjustments. ECM-2: Verified four new high-efficacy CFL and linear fluorescent fixtures per dwelling unit, and LED ceiling mount fixtures in the corridors. ECM-3: Verified installed ECM-4: Verified the ground-level ductless heat pumps

CRCC =Cool Roof Rating Council; NFRC = National Fenestration Rating Council; EF = energy factor; AFUE = annual fuel utilization efficiency; SEER = seasonal energy efficiency ratio; VSD = variable-speed drive; hp = horse power; HSPF = heat seasonal performance factor.

Table 3-19: Summary of Model Adjustments Made Based on Site Verification Findings

Site	Adjustments to Models Based on Site Verification Findings
PG&E 1 (081)	1. Add 2-in. overhangs on 2nd floor windows 2. Remove cool roof measure (post-installation model only) 3. Remove the lighting and appliance measures (post-installation model only)
PG&E 2 (102)	1. Changed HVAC system to 65% AFUE wall furnace and 9.7 EER PTAC based on surveyor verification. 2. Added overhangs to 1st and 2nd floor windows 3. Adjusted the square footage on 2nd floor from 3,336 sq. ft. to 4,878 sq. ft.
PG&E 3 (128)	1. Added overhangs to 2nd floor windows
PG&E 4 (125)	No changes
PG&E 5 (127)	No changes
PG&E 6 (61)	1. Large storage DHW efficiency changed from 75% to 80%. 2. Dwelling unit electric DHW efficiency changed from 0.8792 EF to 0.93 based on systems verified in two dwelling units. IOU documentation does not provide information on these systems 3. Window 'A' size adjusted from 30 sq. ft. to 24 sq. ft.
SCE/SoCalGas 1	No changes
SDG&E 1 (6541)	Building characteristics: 1. Change HVAC distribution for system in Building 4 model from ducted to ductless 2. Change wall furnace efficiency from 70% to 69% Measures: 1. Increase DHW measure efficiency from 0.843 to 0.95 in all four buildings 2. Model pool pump as VSD measure
SDG&E 2 (7131)	Evaluator could not replicate the tracking savings using the pre and post models submitted by the IOU. In addition, there are square footage differences that are not explained in the IOU documentation. Evaluator performed the following steps to estimate ex post savings: 1. Started with the IOU post model and saved it as a pre model 2. Made adjustments in this new pre model to reflect the measures identified through the close-out report and other IOU documentation

EER = energy efficiency ratio

3.3.6 Ex Post Savings and Realization Rates

Realization rates (RRs) by IOU are reported in Table 3-20. The absolute annual energy consumption estimates for electricity are much lower when using the NR PERF module compared to the RES PERF module, which directly affects the kilowatt-hour and kilowatt savings estimates. The module difference had less of a pronounced effect on natural gas consumption, which is evident with the RR of 74% therms.

The low ex post RR was primarily caused by the window measures, as several projects installed windows less efficient than Title 24 prescriptive requirements for new glazing in low-rise residential buildings. This finding is important to note as 35 of the 39 IOU MF-WB projects incentivized windows. The verification for one site also found no evidence of one cool roof measure described in the IOU documentation.

Table 3-20: MF-WB Ex Ante and Ex Post Gross First Year Savings Values, Sampled Sites

Savings	Ex Ante	Ex Post	RR
kWh	626,008	116,478	19%
kW	232	20	9%
Therms	34,381	20,849	61%

The team applied these gross realization rates, by fuel type, to the program savings claims to calculate ex post savings values for each IOU MF-WB program (Table 3-21).

Table 3-21: MF-WB Ex Ante and Ex Post Gross First Year Savings Values, All Projects

IOU	kWh			kW			Therms		
	Ex Ante	Ex Post	RR	Ex Ante	Ex Post	RR	Ex Ante	Ex Post	RR
PG&E	919,887	171,158	19%	480	42	9%	47,273	28,667	61%
SCE/SoCalGas	567,155	105,527	19%	180	16	9%	54,155	32,840	61%
SDG&E	1,919,050	357,067	19%	382	33	9%	49,384	29,947	61%
Totals	*3,406,092*	*633,753*	*19%*	*1,042*	*91*	*9%*	*150,813*	*91,454*	*61%*

Additionally, the team applied the ex post NTG estimate (44.6%%; Table 3-7) to the ex post gross savings, resulting in the net RR in Table 3-22.

Table 3-22: MF-WB Ex Ante and Ex Post Net First Year Savings Values, All Projects

IOU	kWh (net)			kW (net)			Therms (net)		
	Ex Ante	Ex Post	Net RR	Ex Ante	Ex Post	Net RR	Ex Ante	Ex Post	Net RR
PG&E	869,759	76,337	9%	464	19	4%	45,122	12,786	28%
SCE/SoCalGas	342,256	47,065	14%	103	7	7%	34,857	14,647	42%
SDG&E	1,631,192	159,252	10%	325	15	5%	41,977	13,356	32%
Totals	2,843,208	282,654	10%	891	41	5%	121,956	40,789	33%

Statewide, the 2015 MF-WB IOU achieved 9% of their energy savings goals, 3% of their demand goals, and 28% of their therm goals (Table 3-23).

Table 3-23: MF-WB 2015 Program Ex Post Gross Energy Savings and Goals by IOU

IOU	kWh			kW			Therms		
	Goal	Ex Post	% of Goal	Goal	Ex Post	% of Goal	Goal	Ex Post	% of Goal
PG&E	3,200,000	171,158	5%	640	42	7%	90,000	28,667	32%
SCE/SoCalGas	1,416,100	105,527	7%	1,360	16	1%	116,025	32,840	28%
SDG&E	2,531,783	357,067	14%	1,362	33	2%	125,323	29,947	24%
Totals	7,147,883	633,753	9%	3,362	91	3%	331,348	91,454	28%

Finally, the team also compared the cost of the MFEER and MF-WB programs, and the ex post Btu savings achieved through each stream. These ex post savings incorporate the increased savings found in the MFEER program and the decreased savings evaluated in the MF-WB program. As shown in Table 3-24, the MF-WB program was substantially more costly (per Btu saved) to implement. On average, the MF-WB programs spent $3,194 to save one MMBtu, while the MFEER programs spent $235 per MMBtu.

Table 3-24: MF-WB and MFEER 2015 Program Spending and Ex Post Btu Savings by IOU

IOU	MF-WB		MFEER	
	Spending	$/MMBTU	Spending	$/MMBTU
PG&E	$2,217,369	$2,547	$1,522,581	$346
SCE/SoCalGas [44]	$1,809,819	$2,629	$13,763,738	$206
SDG&E	$5,802,203	$3,823	$2,711,606	$489
Totals	$9,829,391	$3,194	$17,997,925	$235

3.3.6.1 Lifecycle Savings

Changes to the EUL values impact lifetime savings for a measure or project; lifetime savings reflects energy savings expected for the duration of a product's service. Specifically, this metric accounts for the longevity of a product, not only the savings from the first year of installation. As shown in Table 3-25, PG&E assumed savings would be achieved for only one year after installation for five of the seven sampled projects. While code changes, behavioral changes, and measure removals could result in savings ending after a single year, it is unlikely the measures installed at these projects, such as boilers and windows, will be impacted in this manner. As such, the evaluation team has adjusted measure level EULs to reflect deemed EUL/RUL values provided by DEER, using the methodology described below.

The evaluation team calculated the lifecycle savings for each measure within the sampled MF-WB projects using EUL and RUL values from DEER, measure unit energy savings using existing conditions as the baseline (UES_1), and measure unit energy savings using code as the baseline (UES_2). For ER measures, the UES_1 is used for the 1st one third of the EUL and the UES_2 for two thirds of the EUL. The measure lifecycle savings were than summed to calculate the project lifecycle savings. This method is consistent with the recommended EUL calculation from the 2013-2014 Multifamily Focused Impact Evaluation.

$$Measure\ Lifecycle\ Savings\ ER = (EUL/3 * UES\_1) + ((EUL * 2/3) * UES\_2)$$

$$Measure\ Lifecycle\ Savings\ ROB = (EUL/3 * UES\_2) + ((EUL * 2/3) * UES\_2)$$

[44] Note that SCE and SoCalGas implement MFEER separately and MF-WB jointly. These IOUs are reported jointly here for comparison purposes.

This method resulted in some project EULs significantly differing from what was originally claimed (Table 3-25).[45] [46]

Table 3-25: MF-WB Ex Ante and Ex Post EUL Values, Sampled Projects

Site	Project EUL (years)	
	Ex Ante	Ex Post
PG&E 1 (081)	1.0	20.0
PG&E 2 (102)	1.0	20.0
PG&E 3 (128)	1.0	18.7
PG&E 4 (125)	1.0	14.9
PG&E 5 (127)	1.0	20.0
PG&E 6 (61)	10.0	20.0
SCE/SoCalGas 1	14.0	18.4
SDG&E 1 (6541)	16.5	14.8
SDG&E 2 (7131)	16.5	16.5
Average	*6.9*	*18.1*

Applying this average ex post EUL (18.1) to the population of 2015 MF-WB claims results in the following ex post lifecycle savings. As many of the EULs increased from ex ante claims, the lifecycle realization rate (RR) is greater than the first year savings RR (Table 3-26). As noted previously, realization rates serve as comparisons between what the IOUs claimed to save (ex ante) and what the evaluation determined (ex post). This metric is useful to assess how accurate the ex ante claims are.

Table 3-26: MF-WB Ex Ante and Ex Post Lifecycle Savings Values, All Projects

IOU	kWh (gross lifecycle)			kW (gross lifecycle)			Therms (gross lifecycle)		
	Ex Ante	Ex Post	Lifecycle RR	Ex Ante	Ex Post	Lifecycle RR	Ex Ante	Ex Post	Lifecycle RR
PG&E	3,927,530	3,097,969	79%	1,466	757	52%	176,363	518,875	294%
SCE/SoCalGas	7,940,167	1,910,048	24%	2,515	283	11%	758,166	594,404	78%
SDG&E	31,664,323	6,462,921	20%	6,307	603	10%	814,843	542,045	67%
Totals	*43,532,020*	*11,470,937*	*26%*	*10,288*	*1,644*	*16%*	*1,749,372*	*1,664,469*	*95%*

3.3.7 Additional Topics

The team researched the following research questions that arose from the 2013-2014 multifamily evaluation:

- Are the IOUs collecting sufficient data for evaluation and verification purposes?
- How are the ex ante MF-WB EULs calculated?

[45] See section 3.3.7.2 for details on how IOUs calculated ex ante EULs.

[46] Note that the ex post EUL includes measures, such as windows, that did not result in ex post savings. This average includes all measures at all sampled sites.

- To what extent are the MF-WB projects using non-MFEER measures?
- Are any operational, maintenance, and behavior changes incorporated in the WB program, and how were they applied?
- Are there any overlap between Building Operator Certification (BOC) or Building Performance Institute (BPI) trainings and the IOU MF-WB programs?

Findings from these research topics are covered in the following sections.

3.3.7.1 Data Collection

As mentioned earlier, the 2013–2014 multifamily impact evaluation determined that not all of the IOUs were collecting all the information necessary to perform a full impact evaluation during their initial years of implementation. That evaluation provided the IOUs with the list of necessary inputs, including participant contact information, measure details, type and fuel of HVAC and hot water systems, property characteristics, and meter numbers for both common and tenant areas.[47] This section outlines the extent to which each utility has collected and furnished these data for the 2015 evaluation.

Overall, the data collection and tracking systems were greatly improved by the time these 2015 data were requested. Any incomplete data were usually project specific. For example, on some of the properties, the quantities installed were vague, stating that "all" were replaced, rather than a specific number. Similarly, some projects captured only one or two meter numbers for a property, rather than all the tenant and common area dwellings. In Table 3-27, a ● symbol indicates that the data provided were completely populated; the ◐ symbol indicates that some of the data were populated; and the ○ symbol indicates that most or all of the requested data were missing or inaccessible. The goal of this assessment was to ensure that the necessary data to assess program impacts were collected and fully populated; this assessment was not intended to verify the accuracy of the data (through site visits or phone calls, for example). The evaluation team assessed the accuracy of inputs during participant site visits.

[47] Note that these recommendations were not finalized until February 2016. IOUs may not have been able to incorporate all recommendations before completing the 2015 projects.

Table 3-27: Completeness of Data by IOU

Attribute		IOU		
		PG&E	SDG&E	SCE/ SoCalGas
Participant Contact Information		●	●	●
Measure Details				
	Type	●	●	●
	Quantity	●	◑	●
	Location	●	●	●
	Efficiency	●	◑	●
Preexisting Conditions		●	◑	●
Property Systems (Type and Fuel)				
	Hot Water Systems	●	●	●
	Space Cooling	●	●	●
	Space Heating	●	●	●
Property Details				
	Quantity of Tenant Units	●	●	●
	Bedrooms	●	●	●
	Bathrooms	●	●	●
Utility Meter Numbers				
	Tenant Spaces	○	◑	●
	Common Areas	○	◑	●

3.3.7.2 Effective Useful Life Calculations

During the data collection process, the evaluation team requested information for each IOU on EUL calculations. As noted previously, changes to the EUL values impact lifetime savings for a measure or project; lifetime savings reflects energy savings expected for the duration of a product's service. This metric accounts for the longevity of a product, not only the savings from the first year of installation. All of the IOUs provided some information, but the level of detail varied across responses. SCE reported that it uses a default value of 14 years for all WB retrofit projects, citing SCE workpaper SCE13MI004.0. The evaluation team confirmed that all of SCE's WB claims report 14 years as the EUL. SDG&E reported that it used DEER to calculate and assign EULs; however, all of SDG&E's WB claims report a EUL of 16.5 years. PG&E also relies on DEER to calculate and assign EULs. The EUL reported for 31 projects was 1 year and the remaining 7 PG&E projects reported an EUL of 10 years. On average, across all projects and IOUs, the EUL reported was 13 years.

3.3.7.3 Whole Building and MFEER Measure Comparisons

The evaluation team explored the measures offered in the MFEER programs compared with those installed in the MF-WB projects. This activity was intended to assess to what extent MF-WB incentivizes measures outside of the current MFEER offerings. Table 3-28 shows what individual measures were installed in the 2015 MF-WB projects compared with what measures are offered in each IOU's MFEER program. Note that the MFEER measures listed are not representative of all measures offered through each IOU's MFEER program. Instead, the information reports only whether the WB measures incentivized are also offered through MFEER (e.g., a

clothes washer might be offered through MFEER but is not portrayed in this table because it was not installed as part of a WB project). The cells shaded gray are measures that were installed through a WB project, but are not offered through MFEER.

Table 3-28 shows that there are measures being installed in MF-WB projects that are not offered through MFEER; however, there is also significant overlap between the two programs. For PG&E, 7 of 12 measures installed in its MF-WB projects are not offered through the MFEER program. For SCE, 4 of the 11 measure types installed in WB projects were not offered through MFEER. Similarly, 5 of 14 measure types installed through SDG&E's WB program were not offered through MFEER.

Table 3-28: MFEER and WB Measure Comparison by IOU

	PG&E		SCE		SDG&E	
	WB	MFEER	WB	MFEER	WB	MFEER
Air Conditioner	•		•	•	•	•
Attic / Roof Insulation	•		•		•	
Aerators			•	•	•	•
Boiler	•	•				•
Cool Roof	•					
DHW Demand Control			•			
Dishwasher	•				•	
Electric Baseboard	•					
Furnace	•	•	•		•	•
Heat Pump					•	
HVAC misc.					•	•
Lighting	•	•	•	•	•	•
Low-Flow Showerhead	•	•	•	•	•	•
Low-Flow Toilet			•			
Pool Pump		•		•	•	
Recirculation Pump					•	
Refrigerator	•		•	•	•	
Water Heater	•	•	•	•	•	•
Windows	•		•	•	•	

3.3.7.4 Operational, Maintenance, and Behavior Changes

During the data collection process, the evaluation team requested information from each IOU on potential operational, maintenance, or behavior changes incorporated into the MF-WB program. PG&E and SDG&E reported that they do not incentivize O&M or behavior changes in this program. PG&E, however, is currently researching behavior changes and patterns in the multifamily sector that may offer opportunities in future program cycles. The SCE/SoCalGas MF-WB program offers recommendations on operational and maintenance procedural changes to their WB participants within the provided Energy Audit Report.

3.3.7.5 Building Operator Certification and Building Performance Institute Training

The evaluation team asked the 13 MF-WB surveyed participants if they, or their property management staff, had completed any BOC or BPI training. The intention of this question was to determine potential overlap between the WB and BOC/BPI training programs. These training sessions could potentially introduce property managers and staff to IOU incentive programs and opportunities. Only 1 of the 13 respondents reported participation in BOC/BPI training program, 6 declared they had not participated, and the remaining 6 did not know if they had or had not participated in these training and certification programs.

3.4 WB Conclusions and Recommendations

Conclusion 1: Although the IOUs have assumed ER savings for all multifamily measures, this research indicated that a substantial portion of projects may not qualify for ER because of planned improvements, installation of new equipment, or replacement of equipment that was in poor condition. For example, only 18% of program shell measures and 50% of water heater installations qualified as ER measures.

Recommendation 1: The IOUs should set up a survey for multifamily participants at intake to better determine the appropriate baseline for each project and measure.[48] The intake survey can follow a similar logic as that used in this report or that from the CPUC early retirement guidance document.[49] The baseline assumptions for a sample of projects should then be verified by an independent third-party evaluator.

Conclusion 2: This research found a NTG ratio of 44.6%. This value is slightly lower than the 2013–2014 REN MF-WB NTG value and significantly less than the IOU provided ex ante value of 85%. These NTG values reduce savings from measures that would have been installed without program intervention.

Recommendation 2: IOUs should consider using the researched NTG ratio from this study and update this information as future evaluation results become available. Because the program is still relatively new, the composition of participants may change over time, so the NTG ratio may change as the program matures. In addition, the NTG ratio should be updated if there are changes in the implementation strategies that might reduce or alter the free-ridership (e.g., increasing incentive levels or changing the measure mix).

Conclusion 3: The consumption analysis did not result in comprehensive energy use for many of the sampled properties. This is due to challenges linking the meter numbers to IOU billing data and considerable time periods with zero energy use during the pre-program period. As such, the evaluation team could not calibrate the simulation models to the estimated consumption as planned, and relied upon the consumption estimates calculated in the simulation models.

Recommendation 3: Program administrators need to access and calculate whole building consumption for projects prior to approving project application and have this information readily available for evaluators to justify savings claims. Program administrators should access at least 12 months of gas and electric use prior to potential program upgrades, and 12 months of use after the upgrades occur. These data need to encompass all common area and dwelling units within the participant property and should be a prerequisite of

[48] Programs in place in 2017 and beyond need also comply with CPUC rulings and guidance surrounding AB 802 and Rulemaking 13-11-005, which prescribe appropriate baselines for varying sectors and measure types.

[49] Early Retirement Using Preponderance of Evidence, Version 1.0; http://www.cpuc.ca.gov/NR/rdonlyres/8AB0DEB5-41B0-4881-BC63-F7EBBEC81318/0/ProjectBasis_EULRUL_Evidencev1July172014.pdf

participation. These data will allow savings assumptions and models to be calibrated and/or verified through actual customer bills and will be imperative to support future claims for projects utilizing an existing conditions baseline.

Conclusion 4: IOUs should discontinue use of the EnergyPro RES PERF model for their savings estimates because concerns about the accuracy of this software have led to it to be dropped from the CPUC list of approved simulation model software for the California single-family whole building programs.

Recommendation 4: Consider the use of the EnergyPro NR PERF model with inputs that reflect building and use characteristics of multifamily projects in future program cycles.

Conclusion 5: The IOU data collection and tracking systems were greatly improved from the 2013–2014 multifamily evaluation, with near complete information on property and measure details. For several projects, however, the energy estimates and savings from energy models submitted by the IOU did not match to the tracking data.

Recommendation 5: Continue to review tracking data and energy model results before submitting IOU models to the evaluation team to ensure they match one another.

Conclusion 6: Some projects had incentivized measures that did not exceed Title 24 prescriptive requirements. For example, Title 24 2013 Standard Section 150.2(b)1B requires replacement fenestration to meet prescriptive requirements in Table 150 1-A and some projects installed windows that did not meet these, according to project documentation. These projects were negatively impacted when adjusting the baseline to the proper code.

Recommendation 6: Require project submittals to include Title 24 compliance documentation for project retrofits to building envelope and mechanical systems to demonstrate that the project at least meets the required prescriptive Title 24 Code. Additionally, the certified performance rating certificates for windows (NFRC), HVAC (AHRI), and DHW (AHRI) equipment documenting the efficiencies at least meet code requirements should be included in project documentation. IOU staff should take photos of the NFRC ratings affixed to manufactured windows during the IOU test-out QC inspections. This may require closer coordination with the construction schedule so the labels are not removed prior to the inspection. Additionally, IOU staff should include a site measurement of solar transmission for verification of low-e glazing when NFRC labeling data is not available. Photo documentation of all installed measures should be included in the IOU final documentation.

4 MFEER LIGHTING EVALUATION

Based on the 2015 MFEER claim database, there were 485,742 units (bulbs, fixtures, sensors, etc.) claimed in the 2015 MFEER program. SCE ran the largest program, representing 93% of the units claimed and 94% of kilowatt-hour savings claimed. SDG&E claims made up 7% of total MFEER units claimed, leaving PG&E with less than 1% of claims. All claims across all of the IOUs were claimed under the Residential Sector (Table 4-1).

Table 4-1: MFEER Lighting Claims under Residential Sector by IOU

IOU	Number of Units	kWh Savings	kW Savings
n=	485,752	17,478,263	827
PG&E	<1%	<1%	<1%
SCE	93%	94%	94%
SDG&E	7%	6%	6%
Total	***100%***	***100%***	***100%***

MFEER measures are categorized into technology types (e.g., CFL, LED). Table 4-2 demonstrates that the vast majority of units installed were LEDs: 53% of PG&E's claims were LED fixtures, 55% of SCE's claims were LED lamps, and 79% of SDG&E's claims were LED lamps. CFL fixtures represented 43% of PG&E's unit claims, 21% of SCE units claimed, and 15% of SDG&E's units claimed. Twelve percent of SCE's units installed were infrared (IR) sensors. Each of IOUs claimed more LEDs than CFLs, and SCE was the only IOU to rebate infrared sensors.

Table 4-2: MFEER Lighting Claims by Technology Type

Technology Type	PG&E			SCE			SDG&E		
	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings
n =	1,482	69,932	1.3	451,023	16,404,858	778	33,237	1,003,472	47
Null	4%	<1%	<1%						
CFL fixture	43%	44%	37%	21%	51%	39%	15%	31%	20%
Integral CFL				<1%	<1%	1%			
Light sensor				12%	9%	14%			
LED fixture	53%	56%	63%	12%	11%	12%	6%	32%	4%
LED lamp				55%	30%	34%	79%	38%	76%
Total	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Lighting claims are further categorized into measure groups, as reported in Table 4-3, which combine use type (indoor versus outdoor) and technology type (LED versus CFL, fixture versus lamp). Indoor LED fixtures and lamps were the most commonly claimed measure group (PG&E: 44% of total units, SCE: 58% of total units, SDG&E: 80% of total units), with indoor CFL fixtures as the second most common measure group. The majority of SCE's and SDG&E's claims were indoor LED lamps (46% and 80%, respectively). Similarly, PG&E most commonly claimed indoor LED fixtures (43%), followed by outdoor CFL fixtures (35%). Outdoor measures tend to claim energy higher savings values. For example, outdoor CFL fixtures make up only 7% of SCE's units claimed, yet the associated savings make up 33% of kilowatt-hours claimed. Outdoor measures do not,

generally speaking, contribute significantly to demand (kilowatt) savings because they are usually off during peak hours. As mentioned previously, SCE was the only IOU to claim controls/sensors, and they are also the only IOU to claim indoor LED reflector lamps. All IOUs claimed at least some measures falling under the following five measure groups: indoor CFL fixtures, indoor LED fixtures, indoor LED lamps, outdoor CFL fixtures, and outdoor LED fixtures.

Table 4-3: MFEER Lighting Claims by Measure Group

Measure Group	PG&E			SCE			SDG&E		
	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings
n =	1,482	69,932	1.3	451,023	16,404,858	778	33,237	1,003,472	47
Indoor CFL > 30 Watts				<1%	<1%	<1%			
Indoor CFL Basic				<1%	<1%	<1%			
Indoor CFL Fixture	11%	7%	37%	14%	18%	39%	5%	9%	20%
Indoor Controls Wall / Ceiling Mounted Occupancy Sensor				12%	9%	14%			
Indoor LED Fixture	43%	12%	62%	12%	10%	12%	<1%	<1%	<1%
Indoor LED Lamp	1%	<1%	1%	46%	17%	31%	80%	35%	78%
Indoor LED Reflector Lamp				5%	2%	4%			
Outdoor CFL Fixture	35%	37%	<1%	7%	33%	<1%	10%	22%	<1%
Outdoor CFL Reflector				<1%	<1%	<1%			
Outdoor LED Fixture	9%	44%	<1%	<1%	<1%	<1%	4%	34%	2%
Outdoor LED Other				4%	11%	<1%			
Total	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

The lighting claims in the MFEER lighting tracking database were categorized under two delivery types: direct install and downstream prescriptive rebate. All of PG&E's units were self-installed, falling under the "Downstream Prescriptive Rebate" delivery type (Table 4-4). SCE and SDG&E offered two delivery options: direct install and self-install, with the majority of kilowatt-hour savings falling under the direct install delivery type. Two-thirds (67%) of SCE's claimed units are direct install, and these units make up 78% of SCE's claimed savings (kilowatt-hours). Similarly, SDG&E filed 19% of its units under direct install, and these units made up 59% of SDG&E's savings (kilowatt-hours). One hundred percent of PG&E's claims ran through the downstream prescriptive approach.

Table 4-4: MFEER Lighting Claims by Delivery Type

Delivery Type	PG&E*			SCE			SDG&E		
	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings
n =	1,482	69,932	1.3	451,023	16,404,858	778	33,237	1,003,472	47
Direct Install				67%	78%	74%	19%	59%	21%
Prescriptive Downstream	100%	100%	100%	33%	22%	26%	81%	41%	79%
Total	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

PG&E's direct install activities are part of other programs and were not included in this evaluation.

Savings calculations rely on an installation rate that can vary by the method of installation (direct- versus self-) and equipment type. The majority of each IOU's claims used a 100% installation rate (56% of PG&E's claimed savings, 57% of SCE's claimed savings, and 98% of SDG&E's claimed savings reported a 100% installation rate). Ex ante installation rates were primarily attributed to the Gross Savings and Installation Adjustment (GSIA)[50] values in DEER. Table 4-5 shows the range of installation rates used by IOU.

Table 4-5: MFEER Lighting Claims by Installation Rate

Installation Rate	PG&E			SCE			SDG&E		
	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings	Number of Units	kWh Savings	kW Savings
n =	1,482	69,932	1.3	451,023	16,404,858	778	33,237	1,003,472	47
80%				14%	18%	40%			
87%	2%	<1%	<1%						
88%				6%	25%	<1%	1%	2%	0%
89%	43%	44%	37%						
100%	55%	56%	63%	80%	57%	60%	99%	98%	100%
Total	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

[50] The GSIA ID links to a record or group of records in the DEER GSIA table, the Gross Savings and Installation Adjustment reference is dependent on both the measure technology and how the measure is delivered.

4.1 Data Sources

The evaluation team used secondary sources to assess impacts of the IOU MFEER Lighting programs, including the following:

- MFEER Lighting Tracking Database
- DEER
- IOU Workpapers.

The following sections outline the secondary data sources the evaluation team used in the IOU MFEER lighting assessment.

4.1.1 Database for Energy Efficient Resources

DEER provides estimates of energy savings for selected energy efficient technologies and measures. CPUC developed DEER, which is used to as the primary basis for claimed savings. The database has an interactive interface, READI, where users select inputs for a specific measure and the interface returns the associated savings value.

4.1.2 MFEER Lighting Tracking Database

This database captures all claims and savings inputs from the MFEER program. The evaluation team extracted all lighting measures to create a condensed version that is cited throughout this section.

4.1.3 IOU Workpapers

In cases where a new technology emerges and has not been added to DEER, or if an IOU sees a shortcoming in a DEER calculation, IOUs can propose alternate savings values in the form of a workpaper. The IOU workpapers tend to be just as detailed as DEER, offering multiple combinations of key inputs and associated ex ante savings for each identified measure.

4.2 Analysis

The primary objective of the MFEER lighting research was to verify that savings and expected useful life[51] (EUL), as assigned in the program tracking database (and ultimately reported as claimed savings) were based on the most appropriate savings resource. According to CPUC, IOUs should assign savings to their claims based on the following prioritization:[52]

1) Where the installed measures are included in the DEER database, the IOUs should first be consistent with the applicable version of DEER (in the case of the 2015 program year, the DEER 2014 update).

2) For those measures that are not in DEER or vary from DEER assumptions because of installation (e.g., common area installation and only in-unit installation were available in DEER for the same measure) or other notable differences, the IOUs should use Lighting Disposition values.

3) If savings and EULs are not available from either of these two sources, the IOUs may default to approved workpapers, but they need to provide documentation explaining why they diverged from DEER.

[51] Savings as defined as both first year annual and lifetime, based on the measure expected useful life.
[52] Per email conversations with Energy Division staff, February 2017.

As a first step in verifying the assignment prioritization, the evaluation team reviewed the MFEER lighting tracking database to understand the source of savings and EULs used across the IOUs. The tracking database included a field titled "version source," which indicates the source of the claimed savings. The savings source was populated for over 99% of all lighting records in the MFEER tracking system. A summary of the savings source utilized by the IOUs is shown in Table 4-6. Almost all of the PG&E MFEER tracking lighting records were assigned based on the 2013 DEER savings; most of the SCE lighting records were assigned based on workpapers. SDG&E had a mix of savings sources, including workpapers, disposition, and DEER, across its MFEER lighting records.

Table 4-6: MFEER Lighting Tracking Database Savings Source by IOU

Version Source	PG&E kWh	SCE kWh	SDG&E kWh
D13 v1.0 (DEER)	69,560	822,064	306,872
Lighting Disposition			379,002
IOU Workpaper		15,557,191	317,599
Not Provided (NULL)	372	25,604	
Total	***69,932***	***16,404,858***	***1,003,472***

For the second step, the evaluation team updated savings values to DEER-based savings values following the prioritization described previously. For <15% of savings claims, the evaluation team either could not identify the workpaper or assign an applicable DEER-based measure for these records. These lighting claims were assigned as pass-through, indicating that the evaluation team did not assess or make changes to the lighting claims. As Table 4-7 shows, a majority of kilowatt-hour savings were verified and received an updated DEER-based value. Updated savings claims were assigned either because they had been assigned a workpaper savings where a DEER-based estimate should have been used, or because they had been assigned an older DEER value that was updated based on DEER 2014 updates. A third category, of verified but no update, was included in our verification process. This category helped identify those MFEER lighting records that the team was able to review and determine that the workpaper should not be updated or that the appropriate DEER-based savings claim was used.

Table 4-7: MFEER Lighting Evaluated Savings by IOU

Verified Savings	PG&E Ex Ante kWh	SCE Ex Ante kWh	SDG&E Ex Ante kWh	Overall Ex Ante kWh
Verified-Updated	55,532	11,868,522	290,525	12,214,579
Not Verified	14,400	1,971,297	317,599	2,303,296
Verified, No Update		2,565,039	395,349	2,960,388
Total	***69,932***	***16,404,858***	***1,003,472***	***17,478,263***
Verified Total %	***79%***	***88%***	***68%***	***87%***

The evaluation team used a full extract of all lighting records in the DEER database[53] to assess the most appropriate measure assignments. To determine these assignments, the team used the following fields:

- MeasImpactType
- Use Category
- Use SubCategory
- Measure Group
- Tech Group
- Tech Type
- Climate Zone
- MeasID_[PAName]
- Building Type
- Building Vintage.

For the outdoor lighting records, the savings are not dependent on climate zone because there are no interactive effects with outdoor lighting. All outdoor lighting is assigned "Any" building type and "Any" climate zone in DEER. A summary table showing all of the original measure names, categories, use subtypes, and their reassignment to DEER (including DEER measure ID) are included in Appendix D: MFEER Lighting savings source and deer assignments.

4.2.1 Net-to-Gross Assessment

In addition to assessing the accuracy of the gross MFEER lighting claims, the evaluation team also reviewed the accuracy of the NTG assignments. The goal of this task was to ensure that the IOUs are assigning the appropriate NTG IDs and values for the 2015 lighting claims. Five NTG assignments are present in the 2015 lighting claims: Constrained Area Program (CAP), residential default, commercial default, emerging technology (ET), and hard-to-reach (HTR) customer. The most commonly applied NTG assignment was the CAP (78% of savings), followed by the residential default claim (16%;Table 4-8).

Table 4-8: MFEER Lighting NTG Ex Ante Assignments

NTG Description	DEER NTG ID	NTG Value	Percent of Savings (ex ante gross, kWh)
Commercial Default	Com-Default>2yrs	60%	2%
CAP	ConstrainedAreaProgram	85%	78%
ET	ET-Default	85%	3%
Residential Default	Res-Default>2	55%	16%
HTR	Res-Default-HTR-di	85%	2%

[53] Connection to the DEER database was done via a POSTGre SQL database connection, where the team downloaded all lighting measures from the "exante" database, "exante" schema, and the "Measure" table. The team also used the "meas" schema and the "MeasEnImp" table to assign the DEER-based ex post savings.

The CAP, ET, and HTR NTG assignments have narrow applications defined in CPUC rulings. Any claim that does not qualify for the CAP, ET, and HTR NTG assignments should be assigned to the residential or commercial default NTG, depending on the building or location characteristics. The three specialty NTG assignments are outlined in CPUC Resolution E-4807,[54] and explained in the sections that follow:

4.2.1.1 Constrained Area Program

The intention of this dedicated NTG was to encourage IOUs to target geographic areas where electric capacity or generation is constrained, primarily because of the San Onofre Nuclear Generating Station closure.[55] As a result of the closure, IOUs were authorized additional funds to encourage energy efficiency program participation within these constrained areas. SCE was approved to apply additional funds to 29 specific zip codes where capacity is constrained.[56] Resolution E-4807 further defined qualifications for constrained area NTG claims, requiring IOUs to provide incentives at least 5% greater than incentives for identical measures in non-constrained areas to qualify. The evaluation team applied the CAP NTG value if a claim (a) was within the 29 approved zip codes and (b) received an incentive of at least 5% greater than those in a non-constrained area.

4.2.1.2 Emerging Technology

This NTG value is applicable for measures that are directly attributable to the ET program activity and, as directed in D.12-05-015,[57] program administrators must propose and request approval from CPUC staff to use the emerging technology default. Technologies approved for the ET NTG value generally must be less than two years old.

4.2.1.3 Hard-to-Reach Customers

The HTR NTG designation is intended for customers that do not have easy access to energy efficiency programs because of language, location, income, or housing type.[58] According to official CPUC guidance, claims are eligible for the HTR NTG if they are (a) direct installed, (b) within a designated rural zip code,[59] and (c) at a multifamily property. However, ED granted an exception to these eligibility requirements for the 2015 program year. Specifically, claims do not have to be within a designated rural zip code to qualify for the HTR NTG. As such, the evaluation team applied the HTR NTG to those that are (a) direct installed, and (b) at a multifamily property.

4.3 Findings

This section first demonstrates the ex ante and ex post gross savings findings, followed by the associated ex ante and ex post EULs. The lighting review resulted in a low-proportion of measures receiving updated savings; however, these measures represented a high-proportion of savings claims. The overall energy (kWh)

[54] CPUC Resolution E-4807, 2015 ESPI Deemed Not Uncertain Ex Ante Savings Adjustments. 2016.
[55] As authorized in CPUC Decision 14-10-046 Ordering Paragraph 9.
[56] Approved in Disposition Letter 3464E, December 23, 2016.
[57] CPUC Decision 12-05-015, May 10, 2012.
[58] CPUC resolution G-3497, December 18, 2014.
[59] As defined in the CPUC's 2013 policy manual, these zip codes are limited to businesses or homes in areas other than the United States Office of Management and Budget Combined Statistical Areas of the San Francisco Bay Area, the Greater Los Angeles Area, and the Greater Sacramento Area, or the Office of Management and Budget metropolitan statistical areas of San Diego County.

realization was 105%, with demand (kilowatt) at 142%. The high RRs were driven mostly from SCE, with PG&E showing a moderately high RR and SDG&E a 100% RR. Table 4-9 summarizes the IOU RRs.

Table 4-9: MFEER IOU Lighting Ex Ante and Ex Post Savings Realization Rates

IOU	Gross Energy Savings (kWh)			Gross Demand Savings (kW)		
	Ex Ante	Ex Post	Realization Rate	Ex Ante	Ex Post	Realization Rate
PG&E	69,932	71,172	102%	1.31	1.46	112%
SCE	16,404,858	17,283,242	105%	778.27	1,126.49	145%
SDG&E	1,003,472	1,003,484	100%	46.93	46.93	100%
Overall	***17,478,263***	***18,357,898***	***105%***	***826.51***	***1,174.88***	***142%***

The RR table (Table 4-10) reviews the ex ante and ex post savings across the primary use subcategories. These are high-level lighting categories that indicate if the lighting measure was interior or exterior, in a common area, or in a more general use area (e.g., for interior this would be in-unit). Interior lighting accounted for the higher SCE realization rates, whereas exterior lighting accounted for PG&E's higher realization rate.

Table 4-10: MFEER IOU Lighting Ex Ante and Ex Post Savings Realization Rates by Use Subcategory

IOU	Use Subcategory	Gross Energy Savings (kWh)			Gross Demand Savings (kW)		
		Ex Ante	Ex Post	Realization Rate	Ex Ante	Ex Post	Realization Rate
PG&E	INGEN-CFL	13,087	12,758	102%	1.31	1.20	95%
	OUTCOMMON	9,988	9,988	112%	—	0.26	N/A
	OUTGEN	46,857	48,425	108%	—	—	N/A
	PG&E Total	***69,932***	***71,172***	***102%***	***1.31***	***1.46***	***112%***
SCE	INCOMMON	886,954	1,387,506	156%	31.27	155.38	497%
	INGEN	8,332,223	9,513,929	114%	747.00	866.21	116%
	OUTCOMMON	5,822,959	5,192,806	89%	—	104.89	N/A
	OUTGEN	1,234,842	1,061,121	86%	—	—	N/A
	POOL	127,880	127,880	100%	—	—	N/A
	SCE Total	***16,404,858***	***17,283,242***	***105%***	***778.27***	***1,232.68***	***145%***
SDG&E	INCOMMON	7,710	7,710	100%	1.16	1.16	100%
	INGEN	20,056	20,056	100%	1.93	1.93	100%
	INGEN-CFL	418,394	418,405	100%	42.71	42.71	100%
	OUTCOMMON	42,496	42,496	100%	1.13	1.13	100%
	OUTGEN	514,816	514,816	100%	—	—	N/A
	SDG&E Total	***1,003,472***	***1,003,484***	***100%***	***46.93***	***46.93***	***100%***
	Overall	***17,478,263***	***18,357,898***	***105%***	***826.51***	***1,174.88***	***142%***

The reassignment of several SCE lighting measures from the workpaper to DEER values, in particular, the indoor CFL and LED fixtures, was responsible for the largest increase in ex post savings (both energy and demand). The key factor in the reassignment of savings for these measures revolved around the lower hours-of-use assigned in SCE workpapers (SCE13LG103.2 and SCE13LG085.3) relative to the high hours-of-use for common area lighting assumed in DEER. As an example, the SCE measure "= 15 Watt Down Light (Res) LED Replacing 40-100 Watts Incandescent Lighting" showed 541 operating hours per the workpaper SCE13LG103.2. According to Table 2 in this workpaper, the deviation from DEER was explained by "DEER does not contain LED fixture technology as measures." The 2014 DEER did have LED fixture technology, and was assigned to the "R-In-LED-CanRet(15w)-dWP62" DEER measure ID. This DEER measure showed both higher delta watt values and higher hours-of-use (for common areas). Table 4-11 summarizes the primary measure groups and their gross ex ante, ex post, and realization rates.

Table 4-11: MFEER IOU Lighting Ex Ante and Ex Post Savings Realization Rates by Measure Group

IOU	Measure Group	Gross Energy Savings (kWh)			Gross Demand Savings (kW)		
		Ex Ante	Ex Post	RR	Ex Ante	Ex Post	RR
PG&E	Indoor CFL Fixture	4,897	4,648	95%	0.49	0.41	93%
	Indoor LED Fixture	8,122	8,039	99%	0.81	0.78	96%
	Indoor LED Lamp	68	72	106%	0.01	0.01	126%
	Outdoor CFL Fixture	25,795	27,453	106%		0.26	
	Outdoor LED Fixture	31,050	30,960	100%			
	PG&E Total	***69,932***	***71,172***	***102%***	***1.31***	***1.46***	***112%***
SCE	Indoor CFL > 30 Watts	172	1,963	1,141%	0.02	0.27	1,943%
	Indoor CFL Basic	33,102	33,102	100%	3.27	3.27	101%
	Indoor CFL Fixture	2,942,395	3,473,865	118%	303.49	382.17	158%
	Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	1,437,802	1,437,802	100%	109.97	109.97	100%
	Indoor LED Fixture	1,632,929	2,640,421	162%	92.69	193.68	209%
	Indoor LED Lamp	2,836,317	2,965,722	105%	237.75	298.55	126%
	Indoor LED Reflector Lamp	348,105	372,478	107%	30.57	33.17	109%
	Outdoor CFL Fixture	5,353,233	4,403,695	82%		94.58	
	Outdoor CFL Reflector	4,435	3,051	69%		0.05	
	Outdoor LED Fixture	41,853	43,193	103%	0.51	0.64	126%
	Outdoor LED Other	1,774,516	1,907,951	108%		10.12	
	SCE Total	***16,404,858***	***17,283,242***	***105%***	***778.27***	***1,126.49***	***145%***
SDG&E	Indoor CFL Fixture	89,598	89,598	100%	9.24	9.24	100%
	Indoor LED Fixture	1,552	1,552	100%	0.16	0.16	100%
	Indoor LED Lamp	355,010	355,021	100%	36.41	36.41	100%
	Outdoor CFL Fixture	217,274	217,274	101%			
	Outdoor LED Fixture	340,039	340,039	100%	1.13	1.13	100%
	SDG&E Total	***1,003,472***	***1,003,484***	***100%***	***46.93***	***46.93***	***100%***
	Overall	***17,478,263***	***18,357,898***	***105%***	***826.51***	***1,174.88***	***142%***

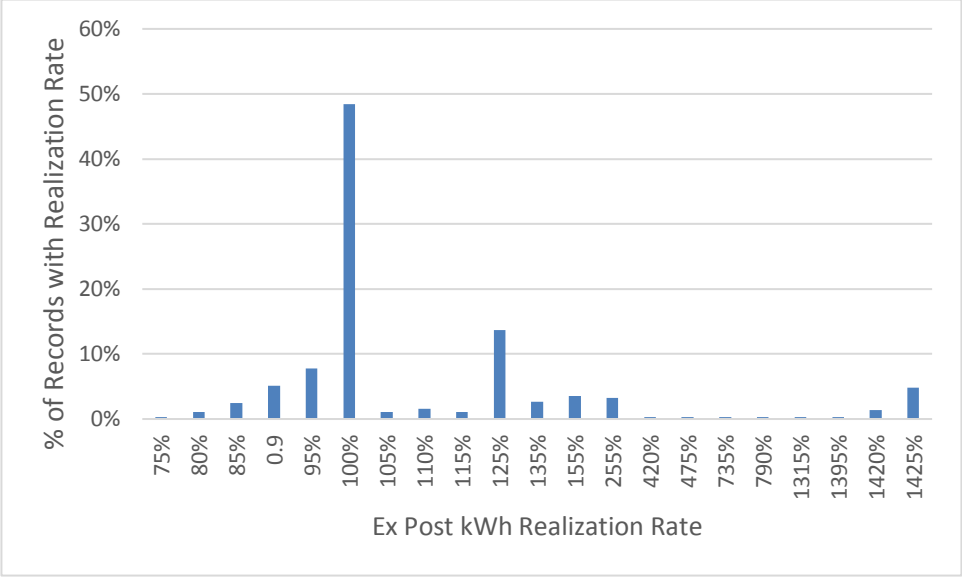
The interactive effects (negative therm savings) were also updated to reflect DEER-based values. The overall interactive effects realization was 127%. The high RRs were driven mostly from SCE, with PG&E showing a moderately high RR and SDG&E a 100% RR. Table 4-9 summarizes the IOU RRs.

Table 4-12: MFEER IOU Lighting Ex Ante and Ex Post Interactive Effects (Therm) Realization Rates

IOU	Gross Interactive Effects (Therms)		
	Ex Ante	Ex Post	Realization Rate
PG&E	-281	-287	102%
SCE	-103,711	-133,005	128%
SDG&E	-5,580	-5,578	100%
Overall	***-109,572***	***-138,870***	***127%***

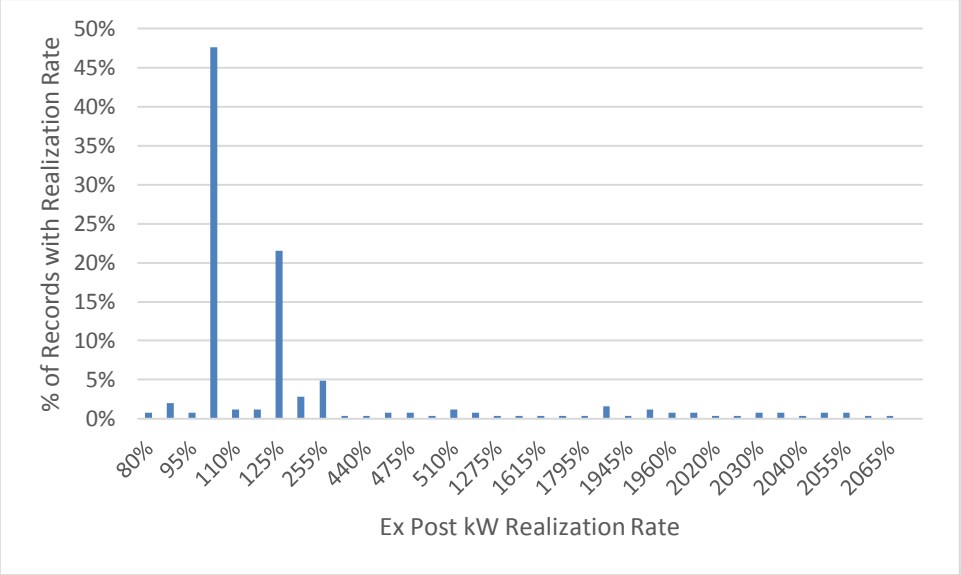
A distribution (histogram) of electric energy (kilowatt-hour) realization rates across all unique IOU-measures is shown in Figure 4-1. As noted at the beginning of this section, the majority of lighting records received a 100% realization rate.

Figure 4-1. Distribution of MFEER Lighting Ex Post Electric Energy (kWh) Realization Rates



A distribution (histogram) of electric demand (kilowatt) RRs across all unique IOU-measures is shown in Figure 4-2. The distribution of demand RRs follows the same general trend as electric energy.

Figure 4-2. Distribution of MFEER Lighting Ex Post Demand (kW) Realization Rates



The lighting review resulted in a low-proportion of measures receiving updated EULs. The overall difference between ex ante and ex post EUL was 2.4 years. The EUL differential was driven mostly from SCE, with PG&E showing a slightly lower EUL and no change to SDG&E EULs. Table 4-13 summarizes the IOU EULs.

Table 4-13: MFEER IOU Lighting Ex Ante and Ex Post EULs

IOU	Ex Ante EUL	Ex Post EUL
PG&E	14.3	12.4
SCE	13.0	10.5
SDG&E	13.9	13.9
Overall	13.1	10.7

The reassignment of several SCE lighting measures from the workpaper to DEER values, in particular, the indoor CFL and LED fixtures, was responsible for the largest decrease in ex post EULs. The key factor in the reassignment of savings for these measures revolved around the lower hours-of-use assigned in SCE workpapers (SCE13LG103.2 and SCE13LG085.3) relative to the high hours-of-use for common area lighting assumed in DEER. It was the higher hours of use that resulted in the lower overall EUL. Table 4-14 and Table 4-15 summarize the primary measure groups and their gross ex ante, ex post, and realization rates.

Table 4-14: MFEER IOU Lighting Ex Ante and Ex Post Savings Realization Rates by Use Subcategory

IOU	Use Subcategory	Ex Ante EUL	Ex Post EUL
PG&E	INGEN-CFL	16.1	16.0
	OUTCOMMON	16.0	3.0
	OUTGEN	13.4	13.4
	PG&E Total	14.3	14.3
SCE	INCOMMON	9.2	8.6
	INGEN	13.5	13.5
	OUTCOMMON	12.8	4.5
	OUTGEN	15.9	15.9
	POOL	4.9	4.9
	SCE Total	13.0	13.0
SDG&E	INCOMMON	3.0	3.0
	INGEN	16.0	16.0
	INGEN-CFL	14.6	14.6
	OUTCOMMON	14.8	14.8
	OUTGEN	13.3	13.3
	SDG&E Total	13.9	13.9
	Overall	13.1	13.1

Table 4-15: MFEER IOU Lighting Ex Ante and Ex Post Savings Realization Rates by Measure Group

IOU	Measure Group	Ex Ante EUL	Ex Post EUL
PG&E	Indoor CFL Fixture	16.0	16.0
	Indoor LED Fixture	16.2	16.0
	Indoor LED Lamp	16.0	16.0
	Outdoor CFL Fixture	16.0	11.3
	Outdoor LED Fixture	12.0	12.0
	PG&E Total	14.3	14.3
SCE	Indoor CFL > 30 Watts	16.0	15.0
	Indoor CFL Basic	9.3	9.3
	Indoor CFL Fixture	16.0	15.8
	Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	8.0	8.0
	Indoor LED Fixture	11.4	11.4
	Indoor LED Lamp	13.2	13.1
	Indoor LED Reflector Lamp	13.2	13.2
	Outdoor CFL Fixture	16.0	5.5
	Outdoor CFL Reflector	2.9	2.9
	Outdoor LED Fixture	4.8	5.8
	Outdoor LED Other	6.7	8.5
	SCE Total	13.0	10.5
SDG&E	Indoor CFL Fixture	9.7	9.7
	Indoor LED Fixture	16.0	16.0
	Indoor LED Lamp	15.7	15.7
	Outdoor CFL Fixture	9.7	9.7
	Outdoor LED Fixture	15.8	15.8
	SDG&E Total	13.9	13.9
	Overall	13.1	10.7

Even with these ex post savings adjustments on the lighting measures, the IOUs did not meet their energy savings goals for the MFEER program (Table 4-16).[60] Two notable exceptions are that PG&E exceeded their goals for natural gas (therms) and SDG&E exceeded their goals for demand (kW).

[60] Savings goals provided by the IOUs through EEstats data requests

Table 4-16: MFEER 2015 Program Ex Post Gross Energy Savings and Goals by IOU

IOU	kWh			kW			Therms		
	Goal	Ex Post	% of Goal	Goal	Ex Post	% of Goal	Goal	Ex Post	% of goal
PG&E	200,000	102,019	51%	20	7	35%	300,000	405,351	135%
SCE	26,788,917	19,476,877	73%	2,258	1,538	68%	—	-128,145	—
SoCalGas	—	19,035	—	—	13	–	481,771	147,740	31%
SDG&E	2,456,343	1,560,489	64%	187	670	359%	33,502	21,644	65%
Totals	*29,445,260*	*21,158,420*	*72%*	*2,465*	*2,227*	*90%*	*815,273*	*446,590*	*55%*

4.3.1 NTG Assessment

The evaluation team looked at the weighted NTG value across ex ante electric savings and ex post electric savings. The weighted ex ante NTG value was 80%, while the ex post NTG value was 76% (Table 4-17). Without the 2015 ED HTR zip code exception mentioned above, the ex post NTG would have been considerably lower, 55%.

Table 4-17: MFEER Lighting Ex ante and Ex Post NTG Weighted Value

	Ex ante	Ex post	NTG RR
Weighted NTG	80%	76%	95%

As discussed previously, the evaluation team assessed the appropriateness of the MFEER lighting claims assigned to the three narrowly defined NTG assignments; CAP, ET, and HTR. The evaluation team reassigned claims as appropriate. The results of this task are displayed in Table 4-18

The ex ante weighted NTG value (80%) is primarily being driven by the CAP assignment, where ex ante has assumed 78% of savings. The evaluation team found far fewer NTG assignments in the CAP, and reassigned almost all of these claims with the appropriate assignment. For the most part, these were reassigned to HTR because of the zip code exemption mentioned in Section 4.2.1. This finding resulted in a lower weighted NTG value of 76%. Details of each NTG assignment review and resulting changes are provided beginning in Section 4.3.1.1.

Table 4-18: MFEER Lighting Ex Ante and Ex Post NTG Assignments

NTG Assignment	NTG Value	Percent of Savings Assignments (kWh)	
		Ex Ante	Ex Post
Residential Default	55%	16%	28%
Commercial Default	60%	2%	2%
CAP	85%	78%	<1%
ET	85%	3%	0%
HTR	85%	2%	70%
Total		*100%*	*100%*

The NTG assignment review resulted in a high-proportion of claims receiving updated NTG assignments. The overall electric energy (kilowatt-hour) gross RR was 105% as shown in Table 4-19 The evaluation team applied NTG values to all of the lighting claims to report ex ante net savings and ex post net savings. The net RR, 104%, was driven mostly by SCE, with SDG&E showing a moderately high RR (109%) and PG&E an 98% RR. Table 4-19 summarizes the IOU RRs.

Table 4-19: MFEER Lighting Ex Ante and Ex Post Gross and Net Savings

	Gross			Net		
IOU	Ex Ante kWh	Ex Post kWh	kWh RR	Ex Ante kWh	Ex Post kWh	kWh RR
PG&E	69,932	71,172	102%	40,015	39,144	98%
SCE	16,404,858	17,283,242	105%	13,224,829	13,674,382	103%
SDG&E	1,003,472	1,003,484	100%	669,315	731,110	109%
Total	*17,478,263*	*18,357,898*	*105%*	*13,934,160*	*14,444,636*	*104%*

4.3.1.1 Constrained Area Program

SCE was the only IOU that applied the CAP NTG assignment. SCE's CAP ex ante claims span 193 different zip codes, and only 17 of these 193 zip codes actually qualify as constrained under the CAP guidelines. The evaluation team reassigned any claim with an unqualified zip code with the Residential Default NTG assignment. The evaluation team reassigned nearly 80% of the ex ante CAP NTG claims as a result of this task.

The claims with a CAP-qualified zip code were then evaluated based on the incentive offered per unit per claim. The evaluation team compared measure-specific incentives offered within the eligible CAP zip codes against the same measures in unconstrained areas. The claims with eligible CAP zip codes were made up of 27 measures, all of which the evaluation team attempted to evaluate. The evaluation team was only able to verify that two of the measure type incentives were 5% greater than those in a non-constrained area. The remaining 25 measures had incentives of equivalent value between constrained areas and unconstrained areas, which does not meet the guidelines for a CAP assignment. The evaluation team reassigned these claims with the residential default NTG ID.

The two measures for which the evaluation team was able to confirm incentives were greater than 5% of claims under non-CAP NTG assignments:

1. Up To 10 Watt Exterior A-Lamp (Common Area) LED Replacing <= 40 Watt A-Lamp
2. Up To 10 Watt Exterior MR16 (Common Area) LED Replacing 36–50 Watts MR16

4.3.1.2 Emerging Technology

There are 13 measures in the 2015 MFEER lighting claims assigned to the ET NTG value:

1. LED Screw-In A-Lamp 11 Watt
2. Up To 10 Watt Exterior A-Lamp (Common Area) LED Replacing <= 40 Watt A-Lamp
3. Up To 10 Watt Exterior A-Lamp (Dwelling Area) LED Replacing <= 40 Watt A-Lamp
4. Up To 10 Watt Exterior MR16 (Common Area) LED Replacing 36-50 Watts MR16
5. Up To 10 Watt Exterior MR16 (Dwelling Area) LED Replacing 36-50 Watts MR16
6. Up To 15 Watt Exterior Par30 (Common Area) LED Replacing <= 50 Watts Par30
7. Up To 15 Watt Exterior Par30 (Dwelling Area) LED Replacing <= 50 Watts Par30
8. Up To 21 Watt Exterior Par30 (Common Area) LED Replacing 51-75 Watt Par30
9. Up To 30 Watts Exterior A-Lamp (Common Area) LED Replacing 40-100 Watts Incandescent Lighting
10. Up To 30 Watts Exterior A-Lamp (Dwelling Area) LED Replacing 41-100 Watt A-Lamp
11. 45.8 Watt Pool Light (Dusk To Dawn) LED Replacing 300 Watt Incandescent
12. 52.4 Watt Pool Light (Dusk To Dawn) LED Replacing 400 Watt Incandescent
13. 67.4 Watt Pool Light (Dusk To Dawn) LED Replacing 500 Watt Incandescent.

Per the assigned SCE workpaper, the first 10 measures were assigned in error. Workpaper SCE13LG106.3 assigns these measures to the residential default NTG because the technology is more than two years old. The evaluation team reassigned these measures to the associated NTG value.

For the pool lights, the last three measures in the list, the referenced workpaper had also been updated in 2015 to remove the ET NTG designation. The reference study (ET10SCE1130) was conducted in 2010, rendering this technology unqualified for the ET NTG designation. The evaluation team reassigned these measures to the default residential NTG value.

4.3.1.3 Hard-To-Reach

The evaluation team assessed the delivery mechanism and zip code for each claim designated as HTR and determined that these claims were not appropriately assigned. Specifically, all claimed HTR records were directly installed in multifamily properties, but the claimed HTR records were not within the designated HTR zip codes. The evaluation team reassigned these records to the default residential NTG value.

There were 657 SCE claims assigned CAP under a zip code that qualifies for HTR, despite the zip code not qualifying for CAP. The evaluation team moved these claims under the HTR assignment because the delivery mechanism (direct install) and zip code qualify. These claims represent less than 1% of kilowatt-hour savings.

4.4 Conclusions and Recommendations

Conclusion 1: A number of measures are included in the DEER database, yet the IOUs used workpaper savings values.

Recommendation 1: IOUs should use DEER savings values for all applicable measures to make the ex ante savings more closely align with the ex post values. For measures not included in DEER, IOUs can continue to use approved workpaper values.

Conclusion 2: SCE incorrectly assigned the vast majority (78%) of measures to a constrained area NTG. Constrained area NTG is only applicable for approved zip codes and must show an increased incentive to qualify.

Recommendation 2: IOUs should apply the residential default NTG value unless the measures qualify for this increased NTG value.

5 APPENDIX A: MEASURE GROUP MAPPING FOR FREE-RIDERSHIP AND BASELINE ANALYSIS

Measure Group	Measure Category
Insulation (Attic/Roof)	Shell
Windows	Shell
Indoor and Outdoor CFL and LED bulbs	Lighting
LED fixtures	Lighting
Boiler	Large DHW
Tankless Water Heater	Large DHW
Storage Water Heater	Large DHW
DHW Demand control	Large DHW
Kitchen Aerator	All Others
Low-flow showerhead	All Others
Pool pump	All Others
Refrigerator	All Others
Air conditioner	All Others

6 APPENDIX B: RECOMMENDATIONS AND RESPONSES

7 APPENDIX C: DECISION MAKER SURVEY INSTRUMENT

EUC-MF Program(s) Impact Evaluation
2015 PARTICIPATING DECISION MAKER FINAL SURVEY INSTRUMENT
September, 2016

Purpose of this Survey Guide (not to be read to Participants)

The purpose of this survey guide is to collect information from participating customers in the multifamily whole building programs implemented by PG&E, SDG&E, SoCalGas, and SCE. Questions in this survey guide are to ask participating multi-family property managers or other decision-makers about their motivations for participation and possible actions in absence of the program. The table below outlines the sections, topics and questions of the interview guide.

Survey Guide: Topics and Corresponding Questions

Section	Topics	Questions
Introductory Questions	Ensuring we are talking to the primary decision maker/ actor for participation. Discussing reasons for project.	INT1 - INT4
Verification Questions	Verification of measure installation and removals.	V1 - V3
Onsite Recruitment	Recruit for onsite study	R1-R2
Early Replacement/baseline Questions	Determine working status, expected life, and scheduled upgrade of replaced unit to determine if measure qualifies for early replacement.	ER1 - ER15
Free-Ridership Questions	Determine importance of program in decision to upgrade measures	PAI1 - PAI7
Firmographics	Do residents own or rent? How many other properties do they manage?	F1 – F8

INTRODUCTION AND SCREEN

[NOTE TO INTERVIEWER: Cross-reference names from program tracking database to ensure you indicate the property utilities. Multiple decision makers will be involved in many properties – please be sensitive to respondent's need to get input from associates. Please review the participant information prior to the interview and probe for inconsistent responses.]

Hello, this is **[INTERVIEWER'S NAME]** calling from Star Data Systems on behalf of **[IOU]**. ***This is not a sales call.*** May I please speak with [contact] or the person who is most knowledgeable about your firm's involvement in the Multifamily Whole Building Program for <project> located at <address>. As part of this program, you received a rebate last year (2015) for the installation of energy efficient products at this property.

INTa. First, do you own or manage this building?

1. Yes, own /manage - Go to INT1
2. No, not familiar with listed address Thank and Terminate
3. No, live here, someone else owns the building – Ask for the contact information for the owner or property manager

INT1. Are you the person who is most knowledgeable about your company's participation in the Multifamily Whole Building Program in 2015?

1. YES [GO TO INT4]
2. NO [GO TO INT2]
3. REQUESTS MORE INFORMATION [GO TO INT3]

-98. DON'T KNOW [GO TO INT3]

-99. REFUSED [GO TO INT3]

INT2. Is there someone who may be more knowledgeable about the upgrades that I could speak with?

1. YES AND AVAILABLE [GO BACK TO INT1]
2. YES AND BUSY [SCHEDULE CALLBACK]
3. NO [TERMINATE – REFUSAL]
4. DON'T KNOW/REFUSED [TERMINATE]

INT3. Your local gas and electric utility, **[IOU],** sponsors the Multifamily Whole Building program. The California Public Utilities Commission (CPUC) authorizes the rebates for **[IOU]** and requires them to submit such a report each year. The CPUC hired our firm to prepare an independent evaluation of their energy efficiency programs. The information that we gather will help the CPUC determine the savings achieved through these programs and assist in the design of future programs.

1. SATISFIED WITH INFORMATION – CONTINUE [GO TO **Error! Reference source not found.**]
2. WANTS TO VERIFY STUDY [SCHEDULE CALLBACK]
3. REFUSED [TERMINATE]

(**IF NEEDED:** It will take about 15 minutes.)

We are interviewing firms that participated in Multifamily Whole Building program during 2015 to discuss the factors that may have influenced their decision to participate in the program.
In this survey, I will refer to the <project> property at <address> that participated in the program as "the property."

IF NEEDED: Your answers will be consolidated with answers from other program participants and used to help evaluate the effectiveness of the program and to design future programs. *We would be grateful for your participation in our research.*

INT4. There are usually a number of reasons to do a project of this type. In your own words, can you tell me why you decided to carry out this upgrade at [PROJECT]? Were there any other reasons? [DO NOT READ; ACCEPT MULTIPLE]

a. To replace old or outdated equipment
b. As part of a planned remodeling, build-out, or expansion
c. To gain more control over energy use in the building(s)
d. The maintenance of old equipment was high/equipment kept breaking
e. To improve quality/value of property to renters
f. To comply with codes and/or regulatory requirements
g. To Improve tenant comfort/satisfaction
h. To reduce gas/electric bills
i. To get a rebate from the program
j. To reduce energy use / power outages
k. To update to the latest technology
l. To adhere to company policy
m. OTHER [RECORD]
-98. [DON'T KNOW]
-99. [REFUSED]

INT5. Did you receive funds to upgrade this building previously, from [IOU] or other agency, prior to the 2015 project remodel?

1. Yes,
    a. What year did you receive this other support?
    b. What agency provided it?
    c. What were the funds used for?
2. No

-98. [DON'T KNOW]
-99. [REFUSED]

INT6. In addition to the assistance provided by [IOU], did you also receive in any other support, such government or non-profit assistance, to help fund the 2015 upgrade at [PROJECT]?

1. Yes,
2. No [SKIP TO V1]

-98. [DON'T KNOW]
-99. [REFUSED]

INT7. What organization contributed to this project?

1. [RECORD]

-98. [DON'T KNOW]
-99. [REFUSED]

INT8. How did these additional agency contributions impact the upgrade at [PROJECT]? [DO NOT READ RESPONSES, ACCEPT MULTIPLE]

1. Expanded scope of project; allowed more measures to be installed.
2. Expanded size of project; allowed more units/areas to be upgraded
3. Allowed us to complete the project; we would not have performed the upgrade without the additional agency funds.
4. Encouragement; gave us the idea to upgrade
5. Provided technical advice or expertise
6. Other [RECORD]

-98. [DON'T KNOW]
-99. [REFUSED]

INT9. Have you or any of your property management staff completed any Building Operator Certification (BOC) or Building Performance Institute (BPI) training?

1. Yes,
2. No

-98. [DON'T KNOW]
-99. [REFUSED]

VERIFICATION QUESTIONS

V1. The program records show that the following products were installed at **[PROJECT]** as part of the **[IOU]** Multifamily Whole Building Program. Please confirm that this is correct. Did you install approximately [**QTY] [UNIT] [MEASURE]? (READ MEASURES FROM INSTALLATION LIST ON CUSTOMER RECORD; ONLY READ MEASURES WITH QTY >0; DO NOT READ RESPONSES)**
[IF NEEDED: I understand if you cannot confirm the exact quantity, however, please let me know if these products or quantities seem correct.]

1. Yes, installed that measure and quantity
2. Yes, installed that measure, not sure of quantity
3. Yes, installed that measure, but that quantity is incorrect
4. No, I did not install that measure

-98. [DON'T KNOW]
-99. [REFUSED]

a. [FOR ANY MEASURES WHERE V1=3] What is the correct quantity installed?

	Measure	Qty	V1. [**Record 1-4; 98, 99**]	a. If V1 = 3: What is the correct quantity?
A	Air Conditioner			
B	Attic Insulation	*SqFt*		
D	Clothes Washer			
F	Faucet Aerator			
G	Low-Flow Showerhead			
H	Pool Pump			
I	Pool Heater			
J	Refrigerator			
K	Space Heating Boiler			
L	Storage Water Heater			
M	Tankless Water Heater			
N	Wall Insulation	*SqFt*		
O	Water Heater Boiler Controls			
P	Water Heating Boiler			
Q	Ventilation Fan			
R	Windows	*SqFt*		
S	Dishwasher			

T	Freezer			
U	Insulation	*SqFt*		
V	recirculation pump			
W	space heater			
X	space heating furnace			
Y	Vending Machine			
Z	Ceiling fans			
AA	Floor Insulation	*SqFt*		
AB	Crawlspace Insulation	*SqFt*		
AC	Water Heater Pump			
AD	Hot Water Demand Control			
AE	Ductless Heat Pump			
AF	Hot Water Pipe Insulation	*SqFt*		
AG	Pool Cover			
AH	Space Heating Boiler Controls			
AI	Thermostatic Radiator Valve			
AJ	Thermostatic Shower Valve			
AK	Thermostat Setback			

V2. We also show that the following lighting products were installed at **[PROJECT]** as part of the **[IOU]** Multifamily Whole Building Program. Please confirm that this is correct. Did you install approximately [**QTY] [MEASURE]?**
(READ ANSWERS FROM INSTALLATION LIST ON CUSTOMER RECORD; ONLY READ MEASURES WITH QTY >0)
[IF NEEDED: I understand if you cannot confirm the exact quantity, however, please let me know if these products or quantities seem correct.]

7. Yes, installed that measure and quantity
8. Yes, installed that measure, not sure of quantity
9. Yes, installed that measure, but that quantity is incorrect
10. No, I did not install that measure

-98. [DON'T KNOW]
-99. [REFUSED]

a. [FOR ANY MEASURES WHERE V2=3] What is the correct quantity of <measure> installed?

	Measure	[Original Qty from Database]	V2. [**Record 1-4; 98, 99**]	a. [If V2=3]: What is the correct quantity?
A	Indoor CFL Bulbs			
B	Indoor CFL Lighting Fixture with bulbs			
C	Indoor LED Bulbs			
D	Indoor LED Exit Sign			
E	Indoor LED Lighting Fixture with bulbs			
F	Indoor Lighting Controls or Occupancy Sensors			
G	Indoor Linear Fluorescent Fixture or Bulbs			
H	Indoor Reflector CFLs			
I	Indoor Reflector LEDs			
J	LED Pool Light			
K	Outdoor Lighting Controls or Occupancy Sensors			
L	Outdoor CFL Bulbs			
M	Outdoor CFL Lighting Fixture with bulbs			
N	Outdoor Linear Fluorescent Fixture or Bulbs			
O	Outdoor Reflector CFLs			
P	Outdoor LED Bulbs			
Q	Remove Heat Lamps			
R	Induction Lighting			

V3. Did you receive any of the following services as part of the **[IOU]** Multifamily Whole Building Program? **[READ LIST]**

	Measure	[**1=YES, 2=NO, -98 = DON'T KNOW, -99 = REFUSED**]
A	Energy Audit	
B	Technical Assistance	
C	Feasibility Study	
D	Program Training	
E	Program Incentives	
F	Assistance with Filling out Rebate Applications and/or Incentive Options	

STATUS OF PRE-EXISTING EQUIPMENT AND RETROFIT SCHEDULE

I just have some more questions. Now I want to ask about the equipment you replaced.

[ASK ER1- ER14 FOR STORAGE WATER HEATERS, TANKLESS WATER HEATERS, DISHWASHERS, RECIRCULATION PUMPS, REFRIGERATORS, SPACE HEATING FURNACE, SPACE HEATING BOILER, WATER HEATER CONTROLS, CLOTHES WASHERS, POOL PUMPS, POOL HEATERS, VENTILATION FAN, AND WATER HEATER BOILERS, AIR CONDITIONER, CENTRAL SPACE AND WATER HEATER, VENDING MACHINE, CEILING FAN, WATER HEATER PUMP, HOT WATER DEMAND CONTROL, DUCTLESS HEAT PUMP, POOL COVER, SPACE HEATING BOILER CONTROL, THERMOSTATIC RADIATOR VALVE, THERMOSTATIC SHOWER VALVE, FREEZER, SPACE HEATER][RANDOMIZE ORDER OF MEASURES ASKED]

[ASK ER1- ER8 where QTY >1; IF QTY = 1 SKIP TO ER9]

ER1.You installed [QTY1] [MEASURE1] as part of the **[IOU]** multifamily whole building program. What percent of the [QTY1] [MEASURE1] were replacing existing equipment? [**IF NEEDED:** An example of this would be where there was/were [MEASURE1] in the apartment prior to the new [MEASURE1] being installed.]

1. [**RECORD PERCENT]**

-98. [DON'T KNOW]

-99. [REFUSED]

[IF ER1 = 0%, SKIP TO NEXT MEASURE]

[IF ER1 > 0%, CALCULATE "REPLACED_QTY_MEASURE1". REPLACED_QTY_MEASURE1 = QTY1*ER1%]

ER2.Of the [REPLACED_QTY_MEASURE1] [MEASURE1] that replaced existing equipment, what percent were…

[**RESPONSES NEED TO SUM TO 100%]**

a. Fully functional and not in need of repair?

[**RECORD PERCENT]**

b. Functional, but needed minor repairs?

[**RECORD PERCENT]**

c. Functional, but needed major repairs?

[**RECORD PERCENT]**

d. Not functional?

[**RECORD PERCENT]**

-98. [DON'T KNOW]

-99. [REFUSED]

[IF ER2c + ER2d = 100%, SKIP TO [NEXT MEASURE]]

ER3.On average, how old were the [MEASURE1], prior to replacement? Your best guess is fine.

[**RECORD AGE]**

-98. [DON'T KNOW]

-99. [REFUSED]

ER4.On average, how much longer do you think your old [MEASURE1] would have lasted if you had not replaced it?

[**RECORD YEARS]**

-98. [DON'T KNOW]

-99. [REFUSED]

ER5.Were these [MEASURE1] part of a scheduled, planned, or government mandated upgrade/refurbishment of **[PROPERTY]**? [IF NEEDED: a scheduled or planned upgrade is when a company has a regularly scheduled renovation; a government mandated upgrade are those required to keep up with city, state, or federal building codes or to qualify for city, state, or federal housing subsidies.]

a. Yes, these were part of our scheduled, planned, or government mandated refurbishment/upgrade of the property

b. No, these were not part of our scheduled, planned, or government mandated refurbishment/upgrade of the property

c. [Some were part of a scheduled/mandated refurbishment upgrade, and some were not]

-98. [DON'T KNOW]
-99. [REFUSED]

[IF ER5= B, SKIP TO [NEXT MEASURE]]

ER6.[IF ER5 = c] What percent of replaced [REPLACED_QTY_MEASURE1] [MEASURE1] was part of a scheduled, planned, or government mandated upgrade, and what percent was not? **[REPONSES NEED TO SUM TO 100%]**

		Record Percent
A	Percent of replaced[MEASURE1]part of regularly scheduled or government mandated refurbishment/upgrade	
B	Percent of replaced[MEASURE1] not part of regularly scheduled or government mandated refurbishment/upgrade	
-98	(DON'T KNOW)	
-99	(REFUSED)	

ER7.[IF ER5=a, OR IF ER5=c] As part of your regularly scheduled or government mandated upgrade process at **[PROPERTY]**, do you generally *replace* the [MEASURE1], or r*epair* the existing [MEASURE1]?

1. I generally replace the existing [MEASURE1]
2. I generally repair the existing [MEASURE1]
3. Depends on the [MEASURE1]; Sometimes replace the [MEASURE1] and sometimes repair them.

-98. [DON'T KNOW]
-99. [REFUSED]

ER8.[IF ER7= 3] What percent of replaced [REPLACED_QTY_MEASURE1] [MEASURE1] would you expect to replace during your scheduled upgrade, and what percent would you expect to repair? [REPONSES NEED TO SUM TO 100%]

		Record Percent
A	Percent of replaced [MEASURE1] expect to replace	
B	Percent of replaced [MEASURE1] expect to repair	
-98	(DON'T KNOW)	
-99	(REFUSED)	

[ASK ER9 - ER14 where QTY =1]

ER9. As we just discussed, you installed ONE [MEASURE1] as part of the **[IOU]** multifamily whole building Program. Was that [MEASURE1] replacing existing equipment? [**IF NEEDED:** An example of this would be where there was/were [MEASURE1] in the apartment prior to the new [MEASURE] being installed.]

1. Yes
2. No

-98. [DON'T KNOW]
-99. [REFUSED]

[IF ER9= No, SKIP TO NEXT MEASURE]

ER10. Was the replaced [MEASURE1] ….

a. Fully functional and not in need of repair?

b. Functional, but needed minor repairs?

c. Functional, but needed major repairs?

d. Not functional?

-98. [DON'T KNOW]
-99. [REFUSED]

[IF ER10 = C or D, SKIP TO [NEXT MEASURE]]

ER11. How old was the [MEASURE1], prior to replacement? Your best guess is fine

[**RECORD AGE]**
-98. [DON'T KNOW]
-99. [REFUSED]

ER12. How much longer do you think your old [MEASURE1] would have lasted if you had not replaced it?

[**RECORD YEARS]**
-98. [DON'T KNOW]
-99. [REFUSED]

ER13. Was this replaced [MEASURE1] part of a scheduled, planned, or government mandated upgrade/refurbishment of **[PROPERTY]**?

a. Yes, this was part of our scheduled, planned, or government mandated refurbishment/upgrade of the property
b. No, this was not part of our scheduled, planned, or government mandated refurbishment/upgrade of the property

-98. [DON'T KNOW]
-99. [REFUSED]

[IF ER13= B, SKIP TO [NEXT MEASURE]. ELSE CONTINUE.]

ER14. [IF ER13 = a] As part of your regularly scheduled or government mandated upgrade process at **[PROPERTY]**, do you generally *replace* the [MEASURE1], or r*epair* the existing [MEASURE1]?

1. I generally replace the existing [MEASURE1]
2. I generally repair the existing [MEASURE1]
3. Depends on the [MEASURE1]; Sometimes replace the [MEASURE1] and sometimes repair them.

-98. [DON'T KNOW]
-99. [REFUSED]

[ASK ER15 FOR WINDOWS, COOL ROOF, ATTIC/ROOF INSULATION, WALL INSULATION, FLOOR INSULATION, FLOOR INSULATION, CROWLSPACE INSULATION, PIPE INSULATION, LIGHTING MEASURES, FAUCET AERATORS, AND LOW-FLOW SHOWERHEADS]

ER15. As we just discussed, you also installed [MEASURE1] as part of the [IOU] multifamily whole building Program. Was this replaced [MEASURE1] part of a scheduled, planned, or government mandated upgrade/refurbishment of **[PROPERTY]**?

a. Yes, this was part of our scheduled, planned, or government mandated refurbishment/upgrade of the property
b. No, this was not part of our scheduled, planned, or government mandated refurbishment/upgrade of the property

-98. [DON'T KNOW]
-99. [REFUSED]

[REPEAT ER1- ER15 FOR UP TO 3 MEASURES]

PROGRAM ATTRIBUTION INDEXES

I'm going to ask you to rate the importance of the program as well as other factors that might influence your decision to install [MEASURE1 V1 & V2], where 0 means not at all important and 10 means very important. An importance rating of 8 shows twice as much influence as a rating of 4.

PAI1. 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 install the [MEASURE1] at this time. [IF A PARTICULAR FACTOR IS NOT APPLICABLE, RECORD THE IMPORTANCE VALUE AS 0]

a. The age or condition of the old equipment

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

b. Availability of the [IOU] rebate

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

c. [ASK IF V3a=1, V3b=1, OR V3c = 1] Information provided through a the feasibility study, energy audit or other types of technical assistance provided through the **[IOU]** Multifamily Whole Building Program

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

d. Recommendation from an equipment vendor that sold you the [MEASURE] and/or installed it

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

e. Your previous experience with this type of project?

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

f. Your previous experience with the **[IOU]** Multifamily whole building program or a similar utility program?

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

g. [IF ASK IF V3D=1] Information from the whole building program or utility training course?

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

h. Information from other **[IOU]** program marketing materials

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

i. Suggestion from your utility account representative

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

j. Payback or return on the project

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

k. Increased value of the property

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

l. Compliance with city, state, or federal government regulations

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

m. Compliance with your company's normal maintenance or retrocommissioning policies

[**RECORD 0-10]**
-98. [DON'T KNOW]
-99. [REFUSED]

n. How does your company policy influence your decision to install [MEASURE]?

[**OPEN END]**
96 Not applicable not a company
-98. [DON'T KNOW]
-99. [REFUSED]

Consistency Checks

CC1. [IF INT4=INT4.f AND PAI1-l <4 ASK] 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 city, state, or federal government regulations in your decision making fairly low, why is that?

[**OPEN END]**
-98. [DON'T KNOW]
-99. [REFUSED]

CC2. [IF INT4≠INT4.f AND PAI1-l >7 ASK] You indicated earlier that compliance with codes or regulatory policies was not one of the reasons you did the project. However, just now you scored the importance of compliance with city, state, or federal government regulations in your decision making fairly HIGH, why is that?

[**OPEN END]**
-98. [DON'T KNOW]
-99. [REFUSED]

CC3. [IF INT4=INT4.l AND PAI1-m <4 ASK] You indicated earlier that adhering to company policies was one of the reasons you did the project. However, just now you scored the importance of compliance with normal maintenance or retrocommissioning practices in your decision making fairly low, why is that?

[**OPEN END]**
-98. [DON'T KNOW]
-99. [REFUSED]

CC4. [IF INT4=INT4.l AND PAI1-m >7 ASK] You indicated earlier that adhering to company policies was one of the reasons you did the project. However, just now you scored the importance of compliance with normal maintenance or retrocommissioning practices in your decision making fairly high, why is that?

[**OPEN END]**
-98. [DON'T KNOW]
-99. [REFUSED]

PAI2. Did you learn about the **[IOU]** multifamily whole building**]** Program BEFORE or AFTER you decided to install the [MEASURE1] at **[project]**?

1. I learned about the Program BEFORE I decided to install the [MEASURE]
2. I learned about the Program AFTER I decided to install the [MEASURE]

-98. [DON'T KNOW]
-99. [REFUSED]

Now I'd like to ask you a question about the importance of the program to your decision as opposed to other factors that you mentioned above. [READ THE FACTORS A-G (below) WHERE THEY GAVE AN IMPORTANCE RATING OF ≥8 IN PAI1]

a. The age or condition of the old equipment
b. Recommendation from an equipment vendor that sold you the [MEASURE] and/or installed it
c. Your previous experience with this type of project?
d. Payback or return on the project
e. Improved quality of the property
f. Compliance with city, state, or federal government regulations
g. Compliance with the company's normal maintenance or retrocommissioning practices

PAI3. 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?

a. How many of the ten points would you give to the importance of the program?

[**RECORD 0-10 SCORE]**
-98. [DON'T KNOW]
-99. [REFUSED]

b. … And how many of the ten points would you give to all these other factors?

-98. [DON'T KNOW]
-99. [REFUSED]

We want these two sets of numbers to equal 10. We have [RESPONSE FROM PAI3a] for program importance and [RESPONSE FROM PAI3b] for non-program factors. Does that sound about right? [IF NO, GO BACK TO PAI3]

PAI4. Now I would like you to think about the action you would have taken with regard to the installation of this [MEASURE] if the **[IOU]** multifamily whole building 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 the program had not been available, what is the likelihood that you would have installed exactly the same efficiency equipment that you did in this project?

[**RECORD 0-10 SCORE]**
-98. [DON'T KNOW]
-99. [REFUSED]

Consistency Checks

CC5. [IF PAI1b>7 AND PAI4>7 ASK] When you answered < PAI1b> 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 < PAI4> 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?

[**OPEN END]**
-98. [DON'T KNOW]
-99. [REFUSED]

CC6. [IF PAI1b>7 AND PAI4>7 ASK] Would you like for me to change your score on the importance of the rebate that you gave a rating of <PAI1b> and/or change your rating on the likelihood you would install the same equipment without the rebate which you gave a rating of <PAI4> and/or we can change both if you wish?

[**OPEN END]**
-98. [DON'T KNOW]

-99. [REFUSED]

PAI5. 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 [MEASURE], which of the following alternatives would you have been MOST likely to do (READ LIST)?

1. Install fewer [MEASURE]s
2. Install standard efficiency equipment or whatever required by code [SKIP TO PAI8]
3. Install equipment more efficient than code but less efficient than what you installed through the program [SKIP TO PAI7]
4. Repair the existing equipment [SKIP TO PAI8]
5. Do nothing (keep the existing equipment as is) [SKIP TO PAI8]
6. (OTHER, SPECIFY)

-98. [DON'T KNOW]
-99. [REFUSED]

PAI6. [IF PAI5 = 1] How many fewer units would you have installed?
[**RECORD]**
-98. [DON'T KNOW]
-99. [REFUSED]

PAI7. [IF PAI5 = 3] Can you tell me what model or efficiency level you were considering as an alternative?
[**RECORD OPEN END]**
-98. [DON'T KNOW]
-99. [REFUSED]

[IF MORE THAN ONE MEASURE INSTALLED AT PROPERTY]

PAI8. I understand you installed several other measures at [PROPERTY], [LIST ALL other MEASURES INSTALLED FROM V1 AND V2]. Did the program have the same influence on your decision to install the [LIST OTHER MEASURES] as we just discussed?

1 Program had the same influence on installation of all the measures at [PROPERTY]
2 Program had a different influence on installation of different measures at [PROPERTY] [REPEAT PAI1 - PAI7 FOR UP TO 3 MEASURES]
-98. [DON'T KNOW] [REPEAT PAI1 - PAI7 FOR UP TO 3 MEASURES]
-99. [REFUSED] [REPEAT PAI1 - PAI7 FOR UP TO 3 MEASURES]

ONSITE RECRUITMENT

We are looking for property owners that previously participated in the **[IOU]** multifamily whole building program that are willing to allow a trained technician to walk through and around their participant property. The technician will need access to the areas upgraded during the project. The study is very important to the future of these programs and you will be paid $100 for your time. The site visits are scheduled to take place in the late October to November timeframe. If you are interested, a technician will call you a few weeks prior to the visit to arrange a time that is convenient for you.

R1. Would you be interested in being a part of this study?

a. Yes

b. No [SKIP TO F1]

R2. [IF YES] Great. I just need to get some contact information from you for scheduling purposes.

a. First and last name? [RECORD]
b. Preferred phone number? [RECORD]
c. Alternate phone number? [RECORD]
d. Email address? [RECORD]
e. Best times to call/make contact [RECORD]
f. [OPTIONAL – OTHER REQUESTS/ DETAILS TO SHARE WITH SCHEDULERS?] [RECORD]

[IF NEEDED – BELOW ARE SOME ANSWERS TO FREQUENTLY ASKED QUESTIONS ABOUT THE ONSITE VISITS]

How long will it take?

Depending on the size of your property, two to four hours.

What does the visit consist of?

The technician will take measurements in and around your property and visually inspect some of the incentivized equipment.

What is the purpose of this study?

The purpose of the study is to evaluate the equipment incented by the program. There will be no attempt to sell you anything or encourage future participation.

Who can I call to verify the study?

Our project manager at the CPUC is Tory Francisco. He can be reached at (415) 703-2743 to validate our study.

What are the next steps?

Our scheduler will call you in the next few weeks to arrange a convenient time for the visit.

FIRMOGRAPHICS

I have just a few questions left for background purposes.

F1. Is the property that we discussed master-metered (e.g. one meter for the entire property) or individually metered (e.g. a meter for each building and the property)?

1. MASTER-METERED
2. INDIVIDUALLY METERED
3. OTHER (SPECIFY)

-98. [DON'T KNOW]
-99. [REFUSED]

F2. Do residents at your property own or rent their homes?

1. OWN
2. RENT
3. OTHER (SPECIFY)
-98. [DON'T KNOW]
-99. [REFUSED]

F3. Were there any substantial changes to tenant occupancy rates during 2013, 2014, or 2015? By substantial changes, I'm referring to large amounts of tenant turnover, unoccupied units, or other significant changes to the tenancy at the property.

1. Yes
   (a) RECORD DETAILS OF CHANGES [PROBE: what changed? When did this change occur? Why?]
2. No, no significant changes to tenancy during 2013, 2014, or 2015
-98. [DON'T KNOW]
-99. [REFUSED]

F4. How many apartments are at [PROPERTY]?

1. [RECORD #]
-98. [DON'T KNOW]
-99. [REFUSED]

F5. How many multifamily complexes, including [PROPERTY], does your company own or manage?

1. [RECORD #]
-98. [DON'T KNOW]
-99. [REFUSED]

F6. [IF F5>1] And approximately how many individual apartments or dwellings does that represent?

1. [RECORD #]
-98. [DON'T KNOW]
-99. [REFUSED]

F7. [IF F5>1] Have some of your other properties participated in [IOU] energy efficiency programs?

1. Yes
2. No
-98. [DON'T KNOW]
-99. [REFUSED]

F8. [IF F7=1] What other programs have these properties participated in? [OPEN END]

1. [RECORD RESPONSE]
-98. [DON'T KNOW]
-99. [REFUSED]

F9. [IF F7=2] Why have your other properties not participated in [IOU] energy efficiency programs?

1. [RECORD RESPONSE]
-98. [DON'T KNOW]
-99. [REFUSED]

F10. And approximately how many years have you worked at [PROPERTY]?

1. [RECORD #]
-98. [DON'T KNOW]
-99. [REFUSED]

OUTRO. Those are all the questions I have. On behalf of the [IOU] multifamily whole building Program, thank you very much for your time.

8 APPENDIX D: MFEER LIGHTING SAVINGS SOURCE AND DEER ASSIGNMENTS

PA	Measure Group	Measure Name	Track Version	Track Version Source	DEER Measure ID	Ex Ante kWh
PGE	Lighting Indoor CFL Fixture	MF - Interior Pin-Based Hardwire Fixtures	DEER2014	D13 v1.0	R-In-CFLfixt-29w(29w)-dWP73	4,897
		MF - Interior Pin-Based Hardwire Fixtures - Com	NULL	NULL	(blank)	-
	Lighting Indoor LED Fixture	LED Surf Pendt Track ACcnt And Recssd Dwnlight Install = 10w To <11w LED	DEER2014	D13 v1.0	R-In-LEDFixt-7(10w)-dWP19	137
		LED Surf Pendt Track ACcnt And Recssd Dwnlight Install = 11w To< 12w LED	DEER2014	D13 v1.0	R-In-LEDFixt-1(11w)-dWP21	1,024
			NULL	NULL	R-In-LEDFixt-1(11w)-dWP21	173
		LED Surf Pendt Track ACcnt And Recssd Dwnlight Install = 12w To <13w LED	DEER2014	D13 v1.0	R-In-LEDFixt-6(12w)-dWP23	4,133
		LED Surf Pendt Track ACcnt And Recssd Dwnlight Install = 17w To <18w LED	DEER2014	D13 v1.0	R-In-LEDFixt(17w)-dWP33	53
		LED Surf Pendt Track ACcnt And Recssd Dwnlight Install = 18w To <19w LED	DEER2014	D13 v1.0	R-In-LEDFixt-3(18w)-dWP35	95
		LED Surf Pendt Track ACcnt And Recssd Dwnlight Install = 21w To <22w LED	DEER2014	D13 v1.0	R-In-LEDFixt-3(21w)-dWP41	550
		LED Surf Pendt Track ACcnt And Recssd Dwnlight Install = 9w To <10w LED	DEER2014	D13 v1.0	R-In-LEDFixt-3(9w)-dWP17	1,104
			NULL	NULL	R-In-LEDFixt-3(9w)-dWP17	198
		LED Surf Pendt Track ACcnt And Recssd Dwnlight Install >= 25w LED	DEER2014	D13 v1.0	R-In-LEDFixt-2(25w)-dWP49	655
	Lighting Indoor LED Lamp	LED Surf Pendt Track ACcnt And Recssd Dwnlight Install < 7w LED	DEER2014	D13 v1.0	R-In-LEDFixt-2(5w)-dWP9	68
	Lighting Outdoor CFL Fixture	MF - Outdoor Pin-Based Hardwire Fixtures	DEER2014	D13 v1.0	R-Out-CFLfixt-15w-ext(15w)-dWP37	15,807
		MF - Outdoor Pin-Based Hardwire Fixtures - Com	DEER2014	D13 v1.0	R-OutCmn-CFLfixt-15w-	9,988

					ext(15w)-dWP37	
	Lighting Outdoor LED Fixture	LED Outdoor Area Lighting - Install 0-50 W Fixture	**DEER2014**	D13 v1.0	C-Out-LEDFixt-Ext(50w)-dwP45	16,650
		LED Outdoor Area Lighting - Install 71-110 W Fixture	**DEER2014**	D13 v1.0	(blank)	14,400
SCE	**Lighting Indoor CFL > 30 Watts**	72 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 249.84	**ExAnte2014**	IOU workpaper	R-InCmn-CFLfixt-72w(72w)-dWP182	172
	Lighting Indoor CFL Basic	15 Watt Integral Spiral With Reflector (Common Area) CFL Replacing Incandescent Average Watts = 61.35	**ExAnte2014**	IOU workpaper	(blank)	2,615
		15 Watt Integral Spiral With Reflector (Dwelling Area) CFL Replacing Incandescent Average Watts = 61.35	**ExAnte2014**	D13 v1.0	(blank)	29,155
		22 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 76.34	**ExAnte2014**	D13 v1.0	R-In-CFLfixt-Circ-22w(22w)-dWP55	1,332
	Lighting Indoor CFL Fixture	22 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 76.34	**ExAnte2014**	IOU workpaper	R-InCmn-CFLfixt-Circ-22w(22w)-dWP55	10,444
		23 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 79.81	**ExAnte2014**	IOU workpaper	R-InCmn-CFLfixt-23w(23w)-dWP58	8,226
		23 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 79.81	**ExAnte2014**	D13 v1.0	R-In-CFLfixt-23w(23w)-dWP58	61,490
		26 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 90.22	**ExAnte2014**	IOU workpaper	R-In-CFLfixt-26w(26w)-dWP65	39,823
		26 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 90.22	**ExAnte2014**	D13 v1.0	R-In-CFLfixt-26w(26w)-dWP65	275,303
		36 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 124.92	**ExAnte2014**	IOU workpaper	R-InCmn-CFLfixt-36w(36w)-dWP91	5,741
		36 Watt Interior Fixture (Dwelling Area) CFL Replacing	**ExAnte2014**	IOU workpaper	R-In-CFLfixt-36w(36w)-dWP91	275,867

		Incandescent Average Watts = 124.92				
		39 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 135.33	**ExAnte2014**	IOU workpaper	R-InCmn-CFLfixt-39w(39w)-dWP98	2,530
		39 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 135.33	**ExAnte2014**	IOU workpaper	R-In-CFLfixt-39w(39w)-dWP98	443,734
		46 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 159.62	**ExAnte2014**	IOU workpaper	R-InCmn-CFLfixt-46w(46w)-dWP116	38,350
		46 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 159.62	**ExAnte2014**	IOU workpaper	R-In-CFLfixt-46w(46w)-dWP116	1,308,480
		52 Watt Interior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 180.44	**ExAnte2014**	IOU workpaper	R-InCmn-CFLfixt-52w(52w)-dWP131	2,201
		52 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 180.44	**ExAnte2014**	IOU workpaper	R-In-CFLfixt-52w(52w)-dWP131	369,860
		54 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 187.38	**ExAnte2014**	IOU workpaper	R-In-CFLfixt-54w(54w)-dWP136	35,029
		72 Watt Interior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 249.84	**ExAnte2014**	IOU workpaper	R-In-CFLfixt-72w(72w)-dWP182	65,317
	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	Occupancy Sensor (Res Common Area) Control	**ExAnte2014**	IOU workpaper	(blank)	488,894
		Occupancy Sensor (Res Dwelling Area) Control	**ExAnte2014**	IOU workpaper	(blank)	948,908
	Lighting Indoor LED Fixture	= 15 Watt Down Light (Common Area) LED Replacing 40-100 Watts Incandescent Lighting	**ExAnte2014**	IOU workpaper	(blank)	971,043
		= 15 Watt Down Light (Dwelling Area) LED Replacing 40-100 Watts Incandescent Lighting	**ExAnte2014**	IOU workpaper	R-In-LED-CanRet(15w)-dWP62	13,025

		= 15 Watt Down Light (Non Res) LED Replacing 40-100 Watts Incandescent Lighting	**ExAnte2014**	IOU workpaper	C-In-LED-CanRet(10w)-dWP24	16,708
		= 15 Watt Down Light (Res) LED Replacing 40-100 Watts Incandescent Lighting	**ExAnte2014**	IOU workpaper	R-In-LED-CanRet(15w)-dWP62	631,515
		= 5 Watt Landscape Lighting LED Replacing Halogen Fixture	**ExAnte2013**	IOU workpaper	(blank)	638
	Lighting Indoor LED Lamp	< 8 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	60,222
		< 8 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	R-In-LED-(8w)-dWP15	448,894
		> 5 Watt To = 15 Watt Landscape Lighting LED Replacing Halogen Fixture	**NULL**	NULL	(blank)	6,835
		10 Watt To < 11 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	139,003
		10 Watt To < 11 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	R-In-LED-A19(10w)-dWP19	197,593
		11 Watt To < 12 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	R-InCmn-LED-A19(11w)-dWP21	223,845
		11 Watt To < 12 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	R-In-LED-A19(11w)-dWP21	723,379
		11 Watt To < 12 Watt MR16 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	3,086
		12 Watt To < 13 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	R-InCmn-LED-A19(12w)-dWP23	204,001
		12 Watt To < 13 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	R-In-LED-A19(12w)-dWP23	634,723
		13 Watt To < 14 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	12,582
		14 Watt To < 15 Watt Par30 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	6,053
		14 Watt To < 15 Watt Par30 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	17,967
		16 Watt To < 17 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	5,705
		17 Watt To < 18 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	33,321
		17 Watt To < 18 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	12,598
		17 Watt To < 18 Watt Par30 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	2,630

		18 Watt To < 19 Watt Par38 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	1,784
		7 Watt To < 8 Watt MR16 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	33,966
		8 Watt To < 9 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	2,678
		8 Watt To < 9 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	8,772
		9 Watt To < 10 Watt A-Lamp (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	33,893
		Up To 10 Watt Exterior A-Lamp (Dwelling Area) LED Replacing <= 40 Watt A-Lamp	**ExAnte2013**	IOU workpaper	R-Out-LED-A19-Ext(10w)-dWP19	22,514
		Up To 10 Watt Exterior MR16 (Dwelling Area) LED Replacing 36-50 Watts MR16	**ExAnte2013**	IOU workpaper	R-Out-LED-MR16-Ext(7w)-dWP22	271
	Lighting Indoor LED Reflector Lamp	< 10 Watt Par30 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	18,737
		< 10 Watt Par30 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	R-In-LED-PAR30(9w)-dWP21	199,448
		10 Watt To < 11 Watt Par30 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	18,712
		11 Watt To < 12 Watt Par30 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	16,824
		11 Watt To < 12 Watt Par30 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	38,904
		13 Watt To < 14 Watt Par30 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	4,467
		13 Watt To < 14 Watt Par30 (Dwelling Area) LED	**ExAnte2014**	IOU workpaper	(blank)	783
		20 Watt To < 21 Watt Par38 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	1,995
		23 Watt Integral Spiral With Reflector (Dwelling Area) CFL Replacing Incandescent Average Watts = 94.07	**ExAnte2014**	D13 v1.0	(blank)	15,509
		7 Watt To < 8 Watt MR16 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	32,725
	Lighting Outdoor CFL Fixture	13 Watt Exterior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 52.91	**ExAnte2013**	IOU workpaper	R-OutCmn-CFLfixt-13w-ext(13w)-dWP32	541
		18 Watt Exterior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 73.26	**ExAnte2013**	IOU workpaper	R-OutCmn-CFLfixt-18w-ext(18w)-dWP45	578,337
		18 Watt Exterior Fixture (Dwelling Area) CFL Replacing	**ExAnte2013**	D13 v1.0	R-Out-CFLfixt-18w-	335,841

	Incandescent Average Watts = 73.26			ext(18w)-dWP45	
	23 Watt Exterior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 93.61	**ExAnte2013**	IOU workpaper	R-OutCmn-CFLfixt-23w-ext(23w)-dWP58	2,406,000
	23 Watt Exterior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 93.61	**ExAnte2013**	IOU workpaper	R-Out-CFLfixt-23w-ext(23w)-dWP58	592,412
	26 Watt Exterior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 105.82	**ExAnte2013**	IOU workpaper	R-OutCmn-CFLfixt-26w-ext(26w)-dWP65	138,216
	26 Watt Exterior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 105.82	**ExAnte2013**	D13 v1.0	R-Out-CFLfixt-26w-ext(26w)-dWP65	44,312
	36 Watt Exterior Fixture (Common Area) CFL Replacing Incandescent Average Watts = 146.52	**ExAnte2013**	IOU workpaper	R-OutCmn-CFLfixt-36w-ext(36w)-dWP91	1,198,452
	36 Watt Exterior Fixture (Dwelling Area) CFL Replacing Incandescent Average Watts = 146.52	**ExAnte2013**	D13 v1.0	R-Out-CFLfixt-36w-ext(36w)-dWP91	59,122
Lighting Outdoor CFL Reflector	15 Watt Exterior With R30 Reflector (Common Area) CFL Replacing Incandescent Average Watts = 61.05	**ExAnte2013**	IOU workpaper	R-OutCmn-CFLscw-Refl-Ext(15)-dWP28	997
	23 Watt Exterior With R40 Reflector (Common Area) CFL Replacing Incandescent Average Watts = 93.61	**ExAnte2013**	IOU workpaper	R-OutCmn-CFLscw-Refl-Ext(23)-dWP42	3,439
Lighting Outdoor LED Fixture	11 Watt To < 12 Watt MR16 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	2,547
	15 Watt To < 16 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	3,151
	17 Watt To < 18 Watt Par30 (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	10,394
	9 Watt To < 10 Watt A-Lamp (Common Area) LED	**ExAnte2014**	IOU workpaper	(blank)	2,521
	Up To 10 Watt Exterior MR16 (Common Area) LED Replacing 36-50 Watts MR16	**ExAnte2013**	IOU workpaper	R-OutCmn-LED-MR16-Ext(7w)-dWP22	3,735
	Up To 21 Watt Exterior Par30 (Common Area) LED Replacing 51-75 Watt Par30	**ExAnte2013**	IOU workpaper	R-OutCmn-LED-PAR30-Ext(15w)-dWP36	19,504

	Lighting Outdoor LED Other	Up To 10 Watt Exterior A-Lamp (Common Area) LED Replacing <= 40 Watt A-Lamp	**ExAnte2013**	IOU workpaper	R-OutCmn-LED-A19-Ext(10w)-dWP19	248,299
		Up To 15 Watt Exterior Par30 (Common Area) LED Replacing <= 50 Watts Par30	**ExAnte2013**	IOU workpaper	R-OutCmn-LED-PAR30-Ext(6w)-dWP14	29,620
		Up To 15 Watt Exterior Par30 (Dwelling Area) LED Replacing <= 50 Watts Par30	**ExAnte2013**	IOU workpaper	R-Out-LED-PAR30-Ext(6w)-dWP14	278
		Up To 30 Watts Exterior A-Lamp (Common Area) LED Replacing 40-100 Watts Incandescent Lighting	**ExAnte2013**	IOU workpaper	R-OutCmn-LED-A19-Ext(10w)-dWP19	1,195,820
		Up To 30 Watts Exterior A-Lamp (Dwelling Area) LED Replacing 41-100 Watt A-Lamp	**ExAnte2013**	IOU workpaper	R-Out-LED-A19-Ext(10w)-dWP19	172,619
		45.8 Watt Pool Light (Dusk To Dawn) LED Replacing 300 Watt Incandescent	**ExAnte2013**	IOU workpaper		20,844
			Blank	Blank		4,169
		52.4 Watt Pool Light (Dusk To Dawn) LED Replacing 400 Watt Incandescent	**ExAnte2013**	IOU workpaper		66,983
			Blank	Blank		12,826
		67.4 Watt Pool Light (Dusk To Dawn) LED Replacing 500 Watt Incandescent	**ExAnte2013**	IOU workpaper		21,284
			Blank	Blank		1,774
SDG&E	**Lighting Indoor CFL Fixture**	Lighting-Energy Star Interior Hardwired Fluorescent Fixtures >=30 Watt	**DEER2014**	D13 v1.0	Res-Lighting-InGen_CFLratio0353_CFLfixt-32w	12,416
		Lighting-Interior CFL Fixtures (Energy Star Qualified) 22-29 Watt	**DEER2014**	D13 v1.0	Res-Lighting-InGen_CFLratio0353_CFLfixt-26w	3,729
		M06: 36w Cf Fixture	**DEER2014**	D13 v1.0	Res-Lighting-InGen_CFLratio0353_CFLfixt-36w	73,454
	Lighting Indoor LED Fixture	LED Recessed Downlight 13 Watt - Common Areas	**ExAnte2014**	IOU workpaper	(blank)	1,552
		LED Recessed Downlight 13 Watt - Dwelling Units	**ExAnte2014**	IOU workpaper	(blank)	18,504

	Lighting Indoor LED Lamp	LED Screw-In A-Lamp 11 Watt	**DEER1314**	Lighting Disposition	R-In-LED-A19(11w)-dWP21	135,294
		LED Screw-In A-Lamp 11 Watt - Interior Common Area	**DEER1314**	Lighting Disposition	R-InCmn-LED-A19(11w)-dWP21	3,666
		LED Screw-In A-Lamp 12 Watt	**DEER1314**	Lighting Disposition	R-In-LED-A19(12w)-dWP23	162,029
		LED Screw-In A-Lamp 12 Watt - Interior Common Area	**DEER1314**	Lighting Disposition	R-InCmn-LED-A19(12w)-dWP23	2,772
		LED Screw-In A-Lamp 13 Watt	**DEER1314**	Lighting Disposition	R-In-LED-A19(13w)-dWP25	31,473
		LED Screw-In A-Lamp 13 Watt - Interior Common Area	**DEER1314**	Lighting Disposition	R-InCmn-LED-A19(13w)-dWP25	1,272
	Lighting Outdoor CFL Fixture	Lighting -Ext. Hardwired Fluorescent Porch Light (19-27 Watts)	**DEER1314**	D13 v1.0	Res-Lighting-OutGen_CFLratio0407_CFLfixt-24w	8,186
		Lighting-Energy Star Exterior Hardwired Fluorescent Fixtures 15 Watt	**DEER1314**	D13 v1.0	Res-Lighting-OutGen_CFLratio0407_CFLfixt-15w	11,195
		M07: Porch Light 18 Watt	**DEER1314**	D13 v1.0	Res-Lighting-OutGen_CFLratio0407_CFLfixt-18w	197,892
	Lighting Outdoor LED Fixture	Exterior LED Landscape Fixtures 4w 26 W Basecase (Dawn-To Dusk)	**ExAnte2013**	IOU workpaper	(blank)	297,543
		LED Screw-In A-Lamp 11 Watt - Exterior Common Area	**DEER1314**	Lighting Disposition	R-OutCmn-LED-A19-Ext(10w)-dWP19	20,783
		LED Screw-In A-Lamp 12 Watt - Exterior Common Area	**DEER1314**	Lighting Disposition	R-OutCmn-LED-A19-Ext(10w)-dWP19	20,584
		LED Screw-In A-Lamp 13 Watt - Exterior Common Area	**DEER1314**	Lighting Disposition	R-OutCmn-LED-A19-Ext(10w)-dWP19	1,129

9 APPENDIX E: SSMVP WRITE-UPS

Site ID: PG&E 1			
Element	**Details**	**IOU**	**Itron Review Summary**
Model Inputs and Building Characteristics	Building and Appliances		
	Exterior Surface Areas		Surface areas verified within 10%
	Exterior Surface Construction and Performance Values	No overhangs modeled	Itron will update to include 2' overhangs on 2nd floor windows
	HVAC Equipment Type and Efficiency	Three different packaged HVAC units used in IOU analysis: 1-bed: 78% AFUE /13 SEER 2-bed: 78% AFUE/8.9 SEER 3-bed: 78% AFUE/8.9 SEER + PTAC system	Surveyor collected nameplate for one unit and it appears to be for the 1-bedroom. The Goodman GPG1324045M has an 80% AFUE and 13 SEER ratings per the documentation available on-line. However, Itron QC noticed that the surveyor collected nameplate data on only one unit and looking at the pictures of the roof, it looks like this one is newer than the others and not representative of the all units installed.
	DHW Equipment Type and Efficiency	Individual electric resistance units for each dwelling unit. 0.92 energy factor.	Surveyor collected data on the central DHW units serving the laundry rooms. Surveyor did not collect data on the individual DHW units serving the dwelling units.
	Lighting	All incandescent	Surveyor verified screw-in CFL's in sampled dwelling units.
	Exterior Equipment	None	There is a pool on the property and it does not appear this load was to the building energy models.
Measure Verification	ECM-1: CRCC Rated Cool Roof Finish all roof surfaces ECM-2: High-Performance windows U-0.30, SHGC-0.32 ECM-3: Refrigerators (414 kWh/yr.) and Dishwashers (0.80 EF) ECM-4: Exterior Lighting - high efficacy and photocells	Only Phase I is part of this evaluation. Phase I entailed implementation of ECM-1 and ECM-2 in 12 of the 27 buildings according to IOU documentation. The buildings included in phase I are 5209, 5221, 5223, 5225, 5241, 5243, 5253, 5255, 5257, 5275, 5289, and 5291. Phase II entailed implementation of ECM-1 and ECM-2 in the other buildings in addition to implementation of ECM-3 and ECM-4 in all buildings. The IOU provided spreadsheet savings documentation for Phase II and the kWh, kW, and therm savings which do not match the tracking savings. Evaluator attempted to recreate the PHI savings by summing results for only those buildings listed in the Phase I verification report, and removed the appliance and lighting measures, and was unable to recreate the tracking savings although the site savings % listed in in Phase I Verification report match the modeled results.	ECM-1: It does not appear this measure was implemented from photos taken of the roofs on building 5277. The condition of the roof surface appears relatively old and there is a lot of HVAC equipment and conduit lines that don't appear to have been removed for the cool roof surface to be installed. This building is part of phase II, however, the phase II verification report indicated all roofs were replaced with the cool roof material. ECM-2: Surveyor verified new vinyl paned windows and took a picture of an NFRC label showing 0.30 u-factor and 0.22 SHGC, however it appears to be attached to a translucent window in the office building and not typical of clear windows installed in the dwelling units which the IOU indicated in their verification report to be U-30 and SHGC-0.32. For this reason, the evaluation modeled the windows as the same as the IOU which is U-0.30 and SHGC-0.32. ECM-3: Verified as installed but removed from the Phase I model since it is claimed as part of Phase II. ECM-4: verified high-efficacy exterior lighting as LED fixtures, but removed from the Phase I model since it is claimed as part of Phase II.
Dwelling Unit Sampling and Verification Summary			The Itron surveyor accessed seven (7) dwelling units for lighting and appliance survey: 209, 207,202,203, 107 and 205 Surveyor accessed rooftop and collected nameplate data on two packaged units.
Modeling Approach	EnergyPro Module	Res Performance	
	Errors		
	Eligibility Considerations		There is a pool on the property and it does not appear this load was to the building energy models.
Change Log	Initial Comparison - modeled to metered ratio		118% kWh, 316% therms
	NR PERF Comparison - modeled to metered ratio		Only modeled phase I and can not make an accurate comparison to the full set of metered data.
	Adjustments - building characteristics and measures		1.. Add 2' overhangs on 2nd floor windows 2. Remove cool roof measure (post-installation model only) not installed 3. Remove the lighting and appliance measures (post-installation model only) installed as part of Phase II.
	Adjustments - ER/ROB		1. Window u-value: 0.32 SHGC: 0.25 (ROB)
Tracking Ex-Ante 1st Year Savings	kWh	307,746	
	kW	163	
	Therms	4,965	
Ex-Post 1st Year Savings	kWh		(24,223.00)
	kW		(8.44)
	Therms		1,392.00
Realization Rates	kWh		-8%
	kW		-5%
	Therms		28%

Site ID: PG&E 2			
Element	**Details**	**IOU**	**Summary of Itron Review**
Model Inputs and Building Characteristics	Building and Appliances	default refrigerator and dishwasher Electric cooktop No clothes washer/dryer	Surveyor verified gas cooktop Surveyor verified washer and dryer
	Exterior Surface Areas	Did not model overhangs.	2' overhangs on 1st floor windows, 4' overhangs on 2nd floor windows
	Exterior Surface Construction and Performance Values	Default prior to 1978 for all surfaces	Probably accurate assessment; Itron surveyor was not able to verify insulation.
	HVAC Equipment Type and Efficiency	Modeled as Split DX with condensing forced air furnace, even when they have a picture of the PTAC unit and indicate in the report the building is served by "P-tack" units.	Surveyor verified ductless wall furnaces and 9.7 EER PTAC units. This has been changed in the model.
	DHW Equipment Type and Efficiency	Modeled one small DHW boiler for the whole property.	Make, model number, and specs match the IOU model.
	Lighting	(2) incandescent fixtures per dwelling unit	LED lighting fixtures instead of incandescent for one of the two?
	Exterior Equipment	none	none
Measure Verification	ECM-1: Windows ECM-2: Outdoor lighting	ECM-1: 0.30 u-value, 0.22 SHGC NRFC ECM-2:	ECM-1: Surveyor verified new windows and square footage, but was unable to collect NFRC rating information. ECM-2: Surveyor verified (14) 13W CFL fixtures on walkways and (6) 9W LED fixtures located on front porches.
Dwelling Unit Sampling and Verification Summary	(12) 1-bed units (2) 2-bed units		The Itron surveyor accessed three dwelling units (two 1-bed and one 2-bed) for HVAC, lighting, and appliance verification.
Modeling Approach	General Observations	Residential Performance module used.	NR PERF
	Errors	NA	Modeling errors not observed.
	Eligibility Considerations	outdoor lighting savings not being calculated with the model submitted by the IOU.	
Change Log	Initial Comparison - modeled to metered ratio		113% kWh, 81% therms
	Adjustments - building characteristics and measures		1. Changed HVAC system to 65% AFUE wall furnace and 9.7 EER PTAC based on surveyor verification. 2. Added overhangs to 1st and 2nd floor windows 3. Adjusted the square footage on 2nd floor from 3,336 s.f to 4,878 s.f. 116% kWh 101% therms modeled to metered ratio 84% kWh 145% therms realization rates
	Adjustments and Impact - Site changes + NR PEF		76% kWh 88% therms modeled to metered ratio 48% kWh 46% therms realization rates
	Adjustments - ER/ROB		1. ECM:1 Window 0.32 U-value, 0.25 SHGC (ROB) 2. ECM-2: no change (ER)
Tracking Ex-Ante 1st Year Savings	kWh	4,737	
	kW	5	
	Therms	235	
Ex-Post 1st Year Savings	kWh		149
	kW		0.09
	Therms		-5
Realization Rates	kWh		3%
	kW		2%
	Therms		-2%

Site ID: PG&E 3			
Element	**Details**	**IOU**	**Summary of Itron Review**
Model Inputs and Building Characteristics	Building and Appliances	Default appliance efficiencies (775 kWh fridge, 0.46 EF dishwasher)	
	Exterior Surface Areas		Itron verified all exterior surface totals to within 5% of IOU values. The primary discrepancies are window area by orientation for both buildings, but overall window area is within 10% so no changes are made to the models.
	Exterior Surface Construction and Performance Values	Default construction assembly insulation values. IOU did not model the 2nd floor overhangs.	Appears accurate to use the default values and Itron did not verify the insulation values so no changes made to exterior surface. Itron verified 2' overhangs on the 2nd floor windows.
	HVAC Equipment Type and Efficiency	PTAC 10.7 EER and Wall Furnace 65%	Verified types as modeled; wall furnace nameplate data not visible and model number not collected so no changes to the IOU model. PTAC EER verified from nameplate.
	DHW Equipment Type and Efficiency	Large storage boiler central MF system	Verified as modeled by the IOU
	Lighting		
	Exterior Equipment	none	none
Measure Verification	1. Windows: 1,296 square feet. U-0.30 SHGC-0.22 2. High efficacy indoor lighting: 33 LED fixtures in kitchens and hallways. ` 3. High efficacy outdoor lighting: 18 LED fixtures		1. Surveyor verified approximately 1,328 square feet of glazing but was unable to collect NRFC or other performance ratings on-site so this measure is considered installed. 2. Surveyor accessed one dwelling unit and verified one 9W LED fixture. It is not clear which units had the hallway fixture retrofit wit the LED. Total quantity not verified due to sampling just one dwelling unit so this measure is considered installed. 3. Surveyor verified 18 LED fixtures in the exterior walkways controlled by photocell.
Dwelling Unit Sampling and Verification Summary	(24) 1-bed dwelling units in two buildings.		Itron surveyor accessed three of the dwelling units for heater, appliance, and lighting verification.
Modeling Approach	General Observations	RES Performance module used.	Building 1-2 modeled with 2-model approach to model retrofit 2 of 3 interior lighting fixtures because the alternatives tab replaces all fixtures. Since this evaluation is using the NR PERF module, lights cannot be modeled on the HERS tab and the baseline wattage is not available in the IOU documentation so the LPD method using the NR PERF module is not feasible. 1,978 kWh of lighting savings is passed thru.
	Errors		none observed
	Eligibility Considerations		none observed
Change Log	Modeled to metered ration - initial comparison		152% kWh 108% therms
	Modeled to metered ration - running as NR PERF		90% kWh 71% therms
	Adjustments - building characteristics and measures		Overhangs added to 2nd floor windows
	Adjustments - ER/ROB		1. Windows 0.32 u-value 0.25 SHGC
Tracking Ex-Ante 1st Year Savings	kWh	11309	
	kW	5	
	Therms	637	
Ex-Post 1st Year Savings	kWh		3,136.00
	kW		0.53
	Therms		(48.00)
Realization Rates	kWh		28%
	kW		11%
	Therms		-8%

Site ID: PG&E 4			
Element	**Details**	**IOU**	**Itron QC Comments**
Dwelling Unit Sampling and Verification Summary		IOU surveyed fourteen (14) units.	The Itron surveyor accessed three (3) dwelling units for lighting and appliance survey: 18,30,32 Surveyor did not have access to the rooftop and was unable to collected nameplate data on split DX air conditioner serving the dwelling units.
Model Inputs and Building Characteristics	Building and Appliances	67,008 floor area 94 dwelling units 413 kWh/yr. refrigerator using an average of values based on 14 sampled dwelling units which included three they could not look up the efficiency and used program default of 775 kWh/yr. for these three.	71,018 floor area 94 dwelling units Modeling default plug load (0.5 w/sf) in NR PERF using default schedules. Collected three refrigerator nameplates, which are old units, and the efficiency look-up did not find a kWh/yr. value.
	Exterior Surface Areas	windows: 7,768 s.f	windows: 7,335 s.f
	Exterior Surface Construction and Performance Values	Single pane aluminum windows (replaced as measure), 3' overhangs on top floor. Slab on grade R-11 attic (default prior to 1978 insulation) R-0 walls (default prior to 1978 insulation)	Verified all new double paned vinyl windows (measure), 3' overhangs on top floor. Slab on grade 2x4 roof unable to access cavity for insulation verification. Wood frame walls unable to access cavity for insulation verification.
	HVAC Equipment Type and Efficiency	75% AFUE natural gas forced air furnace 8.14 SEER split DX air-conditioners (based on 13 units using default of 8.0 SEER and 1 newer unit rated at 10.0 SEER) Ducted distribution in conditioned space	natural gas forced air furnace Trimline HG80XN-2 (matches the pictures in the IOU documentation) Split DX air conditioners on roof, unable to access. Age based default appears appropriate. Ducted distribution in conditioned space
	DHW Equipment Type and Efficiency	80% large storage, .021 SBL, Recirc pump no control	verified incented DHW measures
	Lighting	Modeled in HERS tab - incandescent, CFL, and high-efficacy	Modeling in NR PERF and using default 0.5 w/sf with ASHRAE 90.1 MF Lighting Schedule
	Exterior Equipment	Incandescent exterior lighting modeled here	
Measure Verification	ECM-1: Large storage DHW 96%, (average of 8 units) ECM-2: Interior Lighting - high efficacy kitchen lighting (94 dwelling units) ECM-3: High-Performance windows U-0.30, SHGC-0.22 (7,768 s.f)		ECM-1: Verified (8) new large central DHW. (4) State m/n SUF100150NE 200 rated at 98% and (4) State m/n SUF100150NE 100 100 at 94% but not sure which unit serves which buildings. The IOU modeled them all at 96% which is acceptable. ECM-2: Verified SunPark LED 1018D fixtures in the kitchens. ECM-3: Verified 7,335 s.f. of new windows. Unable to obtain NFRC label to verify performance values.
Modeling Approach	Errors	Two-model to account for only the kitchen lighting measure	Evaluation not modeling the lighting so we can use the one-model approach in NR PERF. Additionally, kWh savings not being claimed.
	Eligibility Considerations		
Change Log	Initial Comparison - modeled to metered ratio		51% therms, no kWh metered data
	NR PERF Comparison - modeled to metered ratio		67% therms, no kWh metered data
	Adjustments and Impact - building characteristics and measures		No changes
	Adjustments and Impact - ER/ROB		1. Large storage DHW, 80% RE 2. Windows, u-value 0.32 SHGC 0.25
Tracking Ex-Ante 1st Year Savings	Total Energy Savings (% Improvement)	22.00%	
	kWh	0.0	
	kW	0.00	
	Therms	6092.1	
Ex-Post 1st Year Savings	kWh		0
	kW		0
	Therms		3,012.00
Realization Rates	kWh		-
	kW		-
	Therms		49%

Site ID: PG&E 5			
Element	**Details**	**IOU**	**Itron Review Summary**
Model Inputs and Building Characteristics	Building and Appliances	167,568 square feet 175 dwelling units	161,580 square feet 177 dwelling units
	Exterior Surface Areas		
	Exterior Surface Construction and Performance Values	R-0 wood wall Slab on grade R-0 cathedral roof Single metal windows and double pane vinyl overhangs modeled	wood framed wall 2x4 wood roof (insulation not verifiable, however, 2x4 framing so the IOU R-0 roof is probably accurate assessment. how come not default wall and roof assemblies not used? They assume some insulation.
	HVAC Equipment Type and Efficiency	Split heat pump 10.4 SEER, 6.94 HSPF	Rheem split heat pumps (different types throughout, Rheem/Gibson/Lennox)
	DHW Equipment Type and Efficiency	81% DHW boilers 850 kBtuh input (existing, is a measure) no pump control	Lochnivar AWN701PM and Lochnivar AWN601Pm 98% efficiency
	Lighting	mix of CFL and incandescent	mix of CFL and incandescent
	Exterior Equipment		
Measure Verification		ECM-1: DHW boilers 96% ECM-2: Double pane windows (25,330 s.f. U-factor 0.28-0.30, SHGC 0.22-0.25) ECM-3: High Efficacy lighting - Kitchen only 1 screw in CFL fixture replaced with 1 high-efficacy fixture	ECM-1: Lochnivar AWN701PM and Lochnivar AWN601Pm 96% efficiency ECM-2: Verified 24,064 of vinyl window's in dwelling units, however, it is unclear which were new and which were existing. According the IOU documentation some of the existing windows were already dual paned vinyl. The IOU modeled some proposed windows as 0.30 u-value/0.22 SHGC and some as 0.30 u-value/0.30 SHGC and the did not provide documentation as to why this was done. Seems two different windows were used on the same orientation in some buildings. Because this measure does not affect natural gas use, and the electric savings are not claimed because the project is located in SMUD territory, the ex-post analysis is assuming this measure was installed as modeled. ECM-3: Verified 15W LED fixtures in kitchen
			:
Dwelling Unit Sampling and Verification		(85) 1-bedroom (77) 2-bed (15) 2-bed loft	Sampled one of each type
Modeling Approach	General Approach	Two model approach to account for kitchen lighting being one of multiple fixtures being retrofit.	Ex-post
	Errors		None observed
	Eligibility Considerations		Does not appear the pool was included in the model. Do the PG&E program require these loads to be considered when calculating the % improvement?
Change Log	Initial Comparison - modeled to metered ratio		63% therms, no kWh metered data
	NR PERF Comparison - modeled to metered ratio		
	Adjustments and Impact - building characteristics and measures		none
	Adjustments and Impact - ER/ROB		1. (3) large storage DHW efficiency changed to 80% (ROB)
Tracking Ex-Ante 1st Year Savings	Percent Improvement	16%	
	kWh	-	
	kW	-	
	Therms	3,630	
Ex-Post 1st Year Savings	kWh		0
	kW		0
	Therms		4141
Realization Rates	kWh		-
	kW		-
	Therms		114%

Site ID: PG&E 6			
Element	**Details**	**IOU**	**Itron Review Summary**
Model Inputs and Building Characteristics	Building and Appliances	722 kWh/yr. refrigerator. Electric cooking.	Electric cooking.
	Exterior Surface Areas		
	Exterior Surface Construction and Performance Values	Wood framed R-11 walls and R-0 cathedral roof. Insulation values not accessible. Slab on grade. IOU modeled 4' , 2', and overhangs.	Wood framed walls and cathedral roof. Insulation values not accessible. Slab on grade. 3' overhangs on some of the windows.
	HVAC Equipment Type and Efficiency	Building 2: Split DX 10.3 SEER, natural gas central furnace 80% AFUE, no setback t-stat,	Split DX 10 SEER, natural gas central furnace GE 21LG looks very old, ducts in conditioned, no setback t-stat.
	DHW Equipment Type and Efficiency	1. Gas-fired large storage modeled in building 1 and building 4. Bldg. 1 modeled with a 100 gallon 76% recovery efficiency, 0.025 SBL. Manufacturer and model number not provided in documentation. 2. Electric resistance small storage, 0.8792 energy factor (bldg2) Laundry Room:	1. Gas-fired large storage, 100 gallon 80% efficiency. Bradford White MI100T6BN10. This unit is in the EnergyPro DWH library and lists 80% as well as the product documentation, although not in AHRI directory. 2. Electric resistance small storage, 0.93 energy factor, Rheem XE30T065T45UO serving dwelling units.
	Lighting	A mix of incandescent, CFL, and high efficacy.	
	Exterior Equipment/Lighting	Building 2: no exterior lighting or laundry DHW	
Measure Verification	1. Windows 0.30 SHGC 0.28 2. Indoor Lighting, high efficacy	1. Baseline windows: default single pane metal u-factor - 1.28 SHGC 0.8. Proposed u-factor 0.30 SHGC 0.28 2. Bldg. 2 one incandescent and one screw-in CFL replaced with two high-efficacy fixtures.	1. The IOU did not provide product specifications for the installed windows. Itron surveyor verified slightly different window size for the fifty 'A' type windows next to the front door, 6040 compared to IOU measurement of 6050. Making this adjustment to the IOU model reduces the verified window percentage difference from 13% to 3%. 2. Surveyor Verified 23W LED bathroom vanity lighting fixtures.
Modeling Approach	General Observations	Two model approach used because not all interior lighting fixtures were included in scope of work.	Compared the test-in input files to verify measures in model and if there were other differences between the two models, which there are not.
	Errors		
	Eligibility Considerations	While electricity is provided by SMUD and the kWh and kW savings are subsequently not claimed by the IOU, the electric loads impacts the projects eligibility and incentive tier.	
Dwelling Unit Sampling and Verification Summary	(40) 800 sq. 1-bed units (5) 1,200 s.f. 2-bed units		Itron surveyor accessed two dwelling units, one of each types.
Change Log	Initial Comparison - modeled to metered ratio		87% for therms, kWh not obtained from SMUD.
	NR PERF Comparison - modeled to metered ratio		58% for therms
	Adjustments and Impact - building characteristics and measures		1. Large storage DHW efficiency changed from 75% to 80%. 2. Dwelling unit electric DHW efficiency changed from 0.8792 energy factor to 0.93 based on systems verified in two dwelling units. IOU documentation does not provide information on these systems. 3. Window 'A' size adjusted from 30 s.f to 24 s.f.
	Adjustments and Impact - ER/ROB		1. Windows 0.32 u-value 0.25 SHGC
Tracking Ex-Ante 1st Year Savings	Total Energy Savings (% Improvement)	17% for all six buildings combined	
	kWh	NA	
	kW	NA	
	Therms	1,909	
Ex-Post 1st Year Savings	kWh		NA
	kW		NA
	Therms		2,264.00
Realization Rates	kWh		NA
	kW		NA
	Therms		119%

Site ID: SCE/SCG 1			
Element	**Details**	**IOU**	**Itron Review Summary**
Data Collection Forms	Missing Forms		
	Missing Data		
Model Inputs and Building Characteristics	Building and Appliances	75,344 conditioned floor area 0.89W/sf for zones with kitchens No interior common area	75,344 conditioned floor area Refrigerator model numbers not found, default 775 kWh is appropriate. No interior common area
	Exterior Surface Areas		
	Exterior Surface Construction and Performance Values	Default wall 1978 - 1991 R-19 cathedral on 1st floor, R-19 attic on 2nd floor Slab on grade for 1st floor, raised floor on 2nd floor	Wood frame wall Slab on Grade, 1st floor
	HVAC Equipment Type and Efficiency	Packaged Central Furnace 80%, DX air conditioner 10 SEER Ducts in attic, R-5.1	No roof access to verify, however it appears 75% of units were replaced.
	DHW Equipment Type and Efficiency	Small storage gas 40 gallon, 0.525 energy factor	Small storage gas, 40 gallon,
	Lighting	0.38 W/sf dwelling units	Surveyor verified T8 linear fluorescents and 13 W CFL's, but did not calculate the LPD to verify.
	Exterior Equipment	some lighting	
Measure Verification		ECM-1: Windows 0.34 u-factor, 0.31 SHGC ECM-2: HVAC 80% AFUE, 13 SEER, approximately 46 units ECM-3: DHW, 0.62 energy factor ECM-4: Exterior Lighting LED ECM-5: Attic Insulation, R-38	ECM-1: All dwelling units have new windows, NFRC label not obtained. ECM-2: About 70% of the units appear to be new, however did not access roof for census verification. ECM-3: Verified (4) AO Smith GNR 40 200 DHW, 0.62 energy factor ECM-4: Verified all parking areas have new LED fixtures
Dwelling Unit Sampling and Verification Summary		(88) total dwelling units	Accessed Units 1G, 12A, 11A, 10F, 9A, 9E, 6A, 6D, 7F, 5D
Modeling Approach	General Approach	Two model approach in NR PERF to calibrate to utility bills. According the IOU assessment report documentation there were some unique calibration tweaks to adjust the kWh (continuous fans with low fan power to account for glitch with running fans intermittently) and therm consumption (number of dwelling units to reduce demand).	
	Errors		
	Eligibility Considerations		
Change Log	Initial Comparison - modeled to metered ratio		The IOU calibrated this model to 97% electric 84% therms.
	NR PERF Comparison - modeled to metered ratio		NA
	Adjustments and Impact - building characteristics and		none
	Adjustments and Impact - ER/ROB		1. DHW 0.62 energy factor (ROB) 2. HVAC 80% AFUE 13.0 SEER 3. Roof R-38 0.025 u-factor
Tracking Ex-Ante 1st Year Savings	Percent Improvement	34.40%	
	kWh	127690	
	kW	58	
	Therms	8626	
Ex-Post 1st Year Savings	kWh		61,690
	kW		25.23
	Therms		3,106
Realization Rates	kWh		48%
	kW		44%
	Therms		36%

Site ID: SDG&E 1			
Element	**Details**	**IOU**	**Itron Review Summary**
Model Inputs and Building Characteristics	Building and Appliances	453 kWh/yr. refrigerator	Verified in the one accessible dwelling unit.
	Exterior Surface Areas		Evaluator checked the exterior surface area for all buildings, and in aggregate, all are within 10% threshold except for a couple small windows. Evaluator not changing the model since the differences are less than 10% and/or the difference in absolute area is minor.
	Exterior Surface Construction and Performance Values	R-0 wood framed wall (Default wall prior to 1978) R-0 cathedral roof (default roof prior to 1978) Slab on grade	Wood framed walls, unable to verify insulation Rafter roof, unable to verify insulation Slab on grade
	HVAC Equipment Type and Efficiency	Wall furnaces (70% AFUE) and PTAC units (9.7 EER) Ductless distribution for systems, except for one system in Building 4 was incorrectly modeled as a ducted system.	In the one apartment accessed, Itron verified a Williams natural gas wall furnace with manufacturer claims of 69%.
	DHW Equipment Type and Efficiency	Small storage 0.58 Energy Factor (replaced with instantaneous DHW)	Four units were found in the stairways and one in the pool room. Each unit serves four dwelling units. Noritz m/n NRC1111-DV, 199 kBtuh inputs,. AHRI indicates 0.92 energy factor. The certificate also indicates 95% recovery efficiency, which matches manufacturer spec sheet, though the RE is not AHRI certified.
	Lighting	CFL and incandescent	There are screw in LED (considered screw-in CFL per the definition of high-efficacy lighting in the Title 24 manual) and incandescent fixtures in the one dwelling unit accessed.
	Exterior Equipment		
Measure Verification	1. High Performance Windows 2. Domestic Hot Water 3. Pool Pump VSD	1. u-value=0.49, SHGC = 0.35 2. Noritz NR111-OD Instantaneous, modeled as 0.843 recovery efficiency. It appears this DHW unit was imported from the EnergyPro library. 3. For building one EnergyPro model, the pool is modeled	1. Surveyor verified most windows appear to be new double pane aluminum windows. However, these do not meet 2013 prescriptive requirements of u-value = 0.35 and SHGC = 0.25 and therefore are less efficient than the windows modeled in the ER/ROB run. 2. Verified the model number as NRC1111-DV, which
Dwelling Unit Sampling and Verification Summary			Accessed one dwelling unit for lighting, appliances, and HVAC verification.
Modeling Approach	Errors		none observed
	Eligibility Considerations		Installed windows do not meet 2013 Title 24 prescriptive requirements.
Change Log	Initial Comparison - modeled to metered ratio		84% kWh, Therms 131%
	Impact on Building Total Consumption when Running NR PERF		97% kWh, Therms 87%
	Adjustments and Impact - building characteristics and measures		Building Characteristics: 1. Change HVAC distribution for system in Building 4 model from ducted to ductless. 2. Change wall furnace efficiency from 70% to 69%. Measures: 1. Increase DHW measure efficiency from 0.843 to 0.95 in all four buildings. 2. Model pool pump as VSD measure.
	Adjustments and Impact - ER/ROB		1. Existing Windows: U-factor = 0.32, SHGC = 0.25
Tracking Ex-Ante 1st Year Savings	kWh	15,610	
	kW	12	
	Therms	1,270	
Ex-Post 1st Year Savings	kWh		4,940.00
	kW		1.14
	Therms		596.00
Realization Rates	kWh		32%
	kW		9%
	Therms		47%

Site ID: SDG&E 2			
Element	**Details**	**IOU**	**Itron Review Summary**
Model Inputs and Building Characteristics	Building and Appliances	152 dwelling units no supporting documentation to show how they calculated 0.62 W/sf for the refrigerators.	Verified 152 dwelling units Appliances are not measures so this is OK.
	Exterior Surface Areas	Single paned aluminum framed windows. Concrete walls and roof.	Concrete walls and roof
	Exterior Surface Construction and Performance Values	Default values.	appropriate
	HVAC Equipment Type and Efficiency	Dwelling Unit: electric wall Common area: new mini split heat pumps serving 1st floor and 16th floor common areas. Modeled at 21.7 SEER and 9.5 HSPF, however no product documentation or model numbers are included in the IOU energy models and documentation.	Dwelling units: electric wall furnaces Cadet C5T503 3.0 kW (two in the one bedroom units and one in the studio units). Common Area: New split heat pumps CU-2/3 Toshiba RAVSP240AT2-UL. Rated up to 21 SEER and 11.9 HSPF per manufacturer literature. CU-1 Rheum 13PJL24A01
	DHW Equipment Type and Efficiency	(2) large storage 65.75% recovery/thermal efficiency	(2) large storage DHW Lochnivar AWN50IPM 96% thermal efficiency, approximate 200 gallon storage
	Lighting	From internal IOU QC document: In unit retrofit lighting consists of 1-26w hallway fixture,1- kitchen fixture2-32 watt bulbs,1-13watt wall fixture and 1bathroom fixture with 3-13watt bulbs total wattage per unit 142 watts LPD should be closer to .33 rather than .29 This should be consistent for all units. Pre-retrofit is (2) kitchen fixtures w/3 100 Watt incandescent, (1) wall fixture w/1 60 Watt incandescent, (1) hall fixture w/2 60 Watt incandescent, and (1) bathroom fixture with 23 W CFL	
	Exterior Equipment	IOU modeled significant amount of loads on the exterior use tab including seven exhaust fans, water booster pumps, and elevator motors and assigned a 24/7 hour schedule.	Evaluator thinks the 24/7 operating schedule is excessive and is contributing the 158% modeled to metered data ratio for kWh. Adjusting the schedule down, along with reduction in Watts due to cycling, would reduce the modeled kWh usage to be in more in line with the metered data and not affect the absolute energy savings for the implemented measures since all that load is outside the building and does not affect heating and cooling loads.. It could affect the % improvement and incentive tier though since a fair amount of baseline energy would be reduced.
	Operating schedules	All default high-rise residential except for the lighting schedule, which uses the 2.54 EFLH specified in the energy modeling guidelines.	Acceptable approach.
Measure Verification	ECM-1: High Performance Windows ECM-2: Dwelling Unit and Corridor Interior Lighting ECM-3: DHW Boilers ECM-4: Heat Pumps	ECM-1: Windows .17,342 square feet, U-factor 0.47/ SHGC 0.34 ECM-2: 4 high efficacy LED fixtures per unit or 620 total in-unit of lighting and 195 fixtures of lighting common area and stairwells. IOU does not describe the corridor fixtures. 1.34 W/sf baseline 0.35 W/sf proposed for the residential floors including the dwelling units and corridors. E CM-3: (2) large storage 96% recovery/thermal efficiency ECM-4: (5) split DX HP serving common area on 1st floor and 16th floor lounge. 20 SEER 9.5 HSPF.	ECM-1: Verified new windows 17,161 s.f. for dwelling units. ECM-2: Verified four new high efficacy CFL and linear fluorescent fixtures per dwelling unit, and LED ceiling mount fixtures in the corridors. ECM-3: Verified installed ECM-4: Verified the ground level ductless heat pumps
Dwelling Unit Sampling and Verification Summary			Surveyor accessed four (4) dwelling units.
Modeling Approach	General Observations	Evaluator could not replicate the tracking savings using the Pre and Post models submitted by the IOU, and additionally there are square footage differences which are not explained in the IOU documentation.	Evaluator performed the following steps to estimate ex-post savings: 1. started with the IOU post model and saved it as a the Pre model. 2. made adjustments in this new Pre model to reflect the measures identified through the close-out report and other IOU documentation.
	Errors	Computer room and office modeled with LPD of 0 Zone 16 Residential lighting schedule not set to 90.1 ASHRAE MF like the other residential zones	Updated based to 0.9 (default) based on site verification Changed schedule from undefined to 90.1 Multifamily Lighting
	Eligibility Considerations		
Change Log	Initial Comparison - modeled to metered ratio		158% kWh, 120% therms
	Impact on Building Total Consumption when Running NR PERF		
	Adjustments and Impact - building characteristics and measures		none
	Adjustments and Impact - ER/ROB		1. Windows u-value 0.47 SHGC 0.40 2. Lighting LPD 0.65
	Final Comparison		
Tracking Ex-Ante 1st Year Savings	Total Energy Savings (% Improvement)	24.40%	15.70%
	kWh	158916.0	
	kW	-10.26	
	Therms	7017.3	
Ex-Post 1st Year Savings	kWh		46,563.00
	kW		(6.80)
	Therms		6339
Realization Rates	kWh		29%
	kW		66%
	Therms		90%

10 APPENDIX F: PROJECT CHARACTERISTICS

Project Characteristic	Metric	All Projects	Surveyed Projects
Building Vintage	Range	1925-2008	1955-1994
	Average	1975	1973
Number of Floors	Range	1-40	2-16
	Average	3.9	3.2
Number of Buildings	Range	1-48	1-30
	Average	9.2	10.1
Number of Units	Range	14-679	14-356
	Average	125	129
Number of Bedrooms	Range	1-576	1-356
	Average	127	208
Number of Bathrooms	Range	1-576	1-576
	Average	94	169
Facility Square Footage	Range	6,374-653,679	6,374-296,872
	Average	103,031	109,021
Property Rate	Market Rate	42%	62%
	Affordable	58%	38%

11 APPENDIX AA: STANDARDIZED REPORTING 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	Appliance Clothes Washer	134	134	1.00	100.0%	
PGE	Appliance Refrigerator	0	0			
PGE	HVAC Boiler	0	0			
PGE	HVAC Furnace	0	0			
PGE	HVAC Heating Other	0	0			
PGE	Lighting Indoor CFL Fixture	78	74	0.95	0.0%	0.95
PGE	Lighting Indoor LED Fixture	131	129	0.98	0.0%	0.98
PGE	Lighting Indoor LED Lamp	1	1	1.06	0.0%	1.06
PGE	Lighting Outdoor CFL Fixture	413	309	0.75	0.0%	0.75
PGE	Lighting Outdoor LED Fixture	373	372	1.00	46.4%	0.99
PGE	MF Whole Building	3,928	3,098	0.79	0.0%	0.79
PGE	Pool Heater	0	0			
PGE	Pool Pump	187	187	1.00	100.0%	
PGE	Water Heating Boiler	0	0			
PGE	Water Heating Showerhead	0	0			
PGE	Water Heating Storage Water Heater	0	0			
PGE	Water Heating Tankless Water Heater	0	0			
PGE	**Total**	**5,244**	**4,303**	**0.82**	**9.4%**	**0.80**
SCE	Appliance Clothes Washer	256	256	1.00	100.0%	
SCE	Appliance Refrigerator	182	182	1.00	100.0%	
SCE	Building Envelope New Windows	486	1,453	2.99	100.0%	
SCE	HVAC EVAP Cooler	371	371	1.00	100.0%	
SCE	HVAC PTAC-PTHP	6	6	1.00	100.0%	
SCE	Lighting Indoor CFL Basic	307	306	1.00	0.0%	1.00
SCE	Lighting Indoor CFL Fixture	46,923	55,012	1.17	0.0%	1.17
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	11,502	11,502	1.00	100.0%	
SCE	Lighting Indoor LED Fixture	13,937	30,057	2.16	0.1%	2.16
SCE	Lighting Indoor LED Lamp	36,625	38,955	1.06	7.6%	1.07
SCE	Lighting Indoor LED Reflector Lamp	4,523	4,913	1.09	26.1%	1.12

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SCE	Lighting Outdoor CFL Fixture	85,652	24,027	0.28	0.0%	0.28
SCE	Lighting Outdoor CFL Reflector	13	9	0.70	0.0%	0.70
SCE	Lighting Outdoor LED Fixture	199	251	1.27	30.9%	1.39
SCE	Lighting Outdoor LED Other	12,088	16,254	1.34	0.0%	1.34
SCE	MF Whole Building	7,940	1,910	0.24	0.0%	0.24
SCE	Pool Pump	7,991	19,180	2.40	100.0%	
SCE	Vending Machine	20	20	1.00	100.0%	
SCE	Water Heating Faucet Aerator	22	22	1.00	100.0%	
SCE	Water Heating Showerhead	178	178	1.00	100.0%	
SCE	Water Heating Storage Water Heater	1,528	1,528	1.00	100.0%	
SCE	**Total**	**230,748**	**206,392**	**0.89**	**11.5%**	**0.82**
SCG	Building Envelope Ceiling-Roof Insulation	102	102	1.00	100.0%	
SCG	Building Envelope Wall Insulation	265	265	1.00	100.0%	
SCG	Building Envelope Window Film	0	0			
SCG	HVAC Boiler	0	0			
SCG	HVAC Furnace	0	0			
SCG	Other	13	13	1.00	100.0%	
SCG	Pool Heater	0	0			
SCG	Water Heating Boiler	0	0			
SCG	Water Heating Controls	0	0			
SCG	Water Heating Storage Water Heater	0	0			
SCG	Water Heating Tankless Water Heater	-2	-2	1.00	100.0%	
SCG	**Total**	**378**	**378**	**1.00**	**100.0%**	
SDGE	HVAC Controls Fan	1,722	1,722	1.00	100.0%	
SDGE	HVAC Duct Sealing	171	171	1.00	100.0%	
SDGE	HVAC RCA	4,327	4,327	1.00	100.0%	
SDGE	Lighting Indoor CFL Fixture	866	866	1.00	0.0%	1.00
SDGE	Lighting Indoor LED Fixture	25	25	1.00	100.0%	
SDGE	Lighting Indoor LED Lamp	5,580	5,580	1.00	5.3%	1.00

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Lighting Outdoor CFL Fixture	2,101	2,101	1.00	0.0%	1.00
SDGE	Lighting Outdoor LED Fixture	5,388	5,388	1.00	88.4%	1.00
SDGE	MF Whole Building	31,664	6,463	0.20	0.0%	0.20
SDGE	Water Heating Controls	0	0			
SDGE	Water Heating Faucet Aerator	0	0			
SDGE	Water Heating Showerhead	0	0			
SDGE	**Total**	**51,844**	**26,643**	**0.51**	**21.8%**	**0.38**
	Statewide	***288,214***	***237,716***	***0.82***	***13.4%***	***0.75***

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	Appliance Clothes Washer	78	78	1.00	100.0%	0.58	0.58		
PGE	Appliance Refrigerator	0	0						
PGE	HVAC Boiler	0	0						
PGE	HVAC Furnace	0	0						
PGE	HVAC Heating Other	0	0						
PGE	Lighting Indoor CFL Fixture	43	41	0.95	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Fixture	72	71	0.98	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Lamp	1	1	1.06	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor CFL Fixture	227	170	0.75	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor LED Fixture	224	204	0.91	0.0%	0.60	0.55	0.60	0.55
PGE	MF Whole Building	3,426	1,382	0.40	0.0%	0.87	0.45	0.87	0.45
PGE	Pool Heater	0	0						
PGE	Pool Pump	103	103	1.00	100.0%	0.55	0.55		
PGE	Water Heating Boiler	0	0						
PGE	Water Heating Showerhead	0	0						
PGE	Water Heating Storage Water Heater	0	0						
PGE	Water Heating Tankless Water Heater	0	0						
PGE	**Total**	**4,173**	**2,049**	**0.49**	**4.3%**	**0.80**	**0.48**	**0.81**	**0.47**
SCE	Appliance Clothes Washer	92	92	1.00	100.0%	0.36	0.36		
SCE	Appliance Refrigerator	102	102	1.00	100.0%	0.56	0.56		
SCE	Building Envelope New Windows	267	799	2.99	100.0%	0.55	0.55		
SCE	HVAC EVAP Cooler	259	259	1.00	100.0%	0.70	0.70		
SCE	HVAC PTAC-PTHP	3	3	1.00	100.0%	0.55	0.55		
SCE	Lighting Indoor CFL Basic	261	261	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor CFL Fixture	39,885	46,761	1.17	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	9,777	9,777	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor LED Fixture	9,305	20,367	2.19	0.0%	0.67	0.68	0.67	0.68
SCE	Lighting Indoor LED Lamp	27,890	29,624	1.06	0.0%	0.76	0.76	0.76	0.76
SCE	Lighting Indoor LED Reflector Lamp	2,913	3,172	1.09	0.0%	0.64	0.65	0.64	0.65
SCE	Lighting Outdoor CFL Fixture	71,909	20,287	0.28	0.0%	0.84	0.84	0.84	0.84
SCE	Lighting Outdoor CFL Reflector	11	8	0.70	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Outdoor LED Fixture	156	159	1.02	0.0%	0.79	0.63	0.79	0.63
SCE	Lighting Outdoor LED Other	10,273	13,044	1.27	0.0%	0.85	0.80	0.85	0.80

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
SCE	MF Whole Building	4,792	852	0.18	0.0%	0.60	0.45	0.60	0.45
SCE	Pool Pump	6,139	14,736	2.40	100.0%	0.77	0.77		
SCE	Vending Machine	11	11	1.00	100.0%	0.55	0.55		
SCE	Water Heating Faucet Aerator	19	19	1.00	100.0%	0.85	0.85		
SCE	Water Heating Showerhead	152	152	1.00	100.0%	0.85	0.85		
SCE	Water Heating Storage Water Heater	351	351	1.00	100.0%	0.23	0.23		
SCE	**Total**	**184,568**	**160,836**	**0.87**	**4.0%**	**0.80**	**0.78**	**0.81**	**0.79**
SCG	Building Envelope Ceiling-Roof Insulation	29	29	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Wall Insulation	74	74	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Window Film	0	0						
SCG	HVAC Boiler	0	0						
SCG	HVAC Furnace	0	0						
SCG	Other	11	11	1.00	100.0%	0.85	0.85		
SCG	Pool Heater	0	0						
SCG	Water Heating Boiler	0	0						
SCG	Water Heating Controls	0	0						
SCG	Water Heating Storage Water Heater	0	0						
SCG	Water Heating Tankless Water Heater	-1	-1	1.00	100.0%	0.55	0.55		
SCG	**Total**	**113**	**113**	**1.00**	**100.0%**	**0.30**	**0.30**		
SDGE	HVAC Controls Fan	1,464	1,464	1.00	100.0%	0.85	0.85		
SDGE	HVAC Duct Sealing	145	145	1.00	100.0%	0.85	0.85		
SDGE	HVAC RCA	3,375	3,375	1.00	100.0%	0.78	0.78		
SDGE	Lighting Indoor CFL Fixture	690	690	1.00	0.0%	0.80	0.80	0.80	0.80
SDGE	Lighting Indoor LED Fixture	14	21	1.55	0.0%	0.55	0.85	0.55	0.85
SDGE	Lighting Indoor LED Lamp	3,368	3,159	0.94	0.0%	0.60	0.57	0.60	0.57
SDGE	Lighting Outdoor CFL Fixture	1,730	1,730	1.00	0.0%	0.82	0.82	0.82	0.82
SDGE	Lighting Outdoor LED Fixture	3,233	4,423	1.37	0.0%	0.60	0.82	0.60	0.82
SDGE	MF Whole Building	26,915	2,882	0.11	0.0%	0.85	0.45	0.85	0.45
SDGE	Water Heating Controls	0	0						
SDGE	Water Heating Faucet Aerator	0	0						
SDGE	Water Heating Showerhead	0	0						
SDGE	**Total**	**40,932**	**17,889**	**0.44**	**12.2%**	**0.79**	**0.67**	**0.79**	**0.63**
	Statewide	***229,786***	***180,886***	***0.79***	***5.5%***	***0.80***	***0.76***	***0.80***	***0.77***

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Appliance Clothes Washer	0.0	0.0	1.00	100.0%	
PGE	Appliance Refrigerator	0.0	0.0			
PGE	HVAC Boiler	0.0	0.0			
PGE	HVAC Furnace	0.0	0.0			
PGE	HVAC Heating Other	0.0	0.0			
PGE	Lighting Indoor CFL Fixture	0.0	0.0	0.83	0.0%	0.83
PGE	Lighting Indoor LED Fixture	0.0	0.0	0.95	0.0%	0.95
PGE	Lighting Indoor LED Lamp	0.0	0.0	1.26	0.0%	1.26
PGE	Lighting Outdoor CFL Fixture	0.0	0.0			
PGE	Lighting Outdoor LED Fixture	0.0	0.0			
PGE	MF Whole Building	1.5	0.8	0.52	0.0%	0.52
PGE	Pool Heater	0.0	0.0			
PGE	Pool Pump	0.0	0.0	1.00	100.0%	
PGE	Water Heating Boiler	0.0	0.0			
PGE	Water Heating Showerhead	0.0	0.0			
PGE	Water Heating Storage Water Heater	0.0	0.0			
PGE	Water Heating Tankless Water Heater	0.0	0.0			
PGE	**Total**	**1.5**	**0.8**	**0.54**	**3.5%**	**0.52**
SCE	Appliance Clothes Washer	0.1	0.1	1.00	100.0%	
SCE	Appliance Refrigerator	0.0	0.0	1.00	100.0%	
SCE	Building Envelope New Windows	0.3	0.8	2.99	100.0%	
SCE	HVAC EVAP Cooler	0.7	0.7	1.00	100.0%	
SCE	HVAC PTAC-PTHP	0.0	0.0	1.00	100.0%	
SCE	Lighting Indoor CFL Basic	0.0	0.0	1.00	0.0%	1.00
SCE	Lighting Indoor CFL Fixture	4.9	6.0	1.24	0.0%	1.24
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	0.9	0.9	1.00	100.0%	
SCE	Lighting Indoor LED Fixture	1.2	2.8	2.40	0.0%	2.40
SCE	Lighting Indoor LED Lamp	3.6	3.9	1.11	6.1%	1.11
SCE	Lighting Indoor LED Reflector Lamp	0.5	0.5	1.09	22.8%	1.12

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SCE	Lighting Outdoor CFL Fixture	0.0	0.3			
SCE	Lighting Outdoor CFL Reflector	0.0	0.0			
SCE	Lighting Outdoor LED Fixture	0.0	0.0	2.18	100.0%	
SCE	Lighting Outdoor LED Other	0.0	0.1			
SCE	MF Whole Building	2.5	0.3	0.11	0.0%	0.11
SCE	Pool Pump	2.6	3.0	1.17	100.0%	
SCE	Vending Machine	0.0	0.0			
SCE	Water Heating Faucet Aerator	0.0	0.0	1.00	100.0%	
SCE	Water Heating Showerhead	0.0	0.0	1.00	100.0%	
SCE	Water Heating Storage Water Heater	0.2	0.2	1.00	100.0%	
SCE	**Total**	**17.3**	**19.7**	**1.14**	**29.2%**	**1.12**
SCG	Building Envelope Ceiling-Roof Insulation	0.1	0.1	1.00	100.0%	
SCG	Building Envelope Wall Insulation	0.2	0.2	1.00	100.0%	
SCG	Building Envelope Window Film	0.0	0.0			
SCG	HVAC Boiler	0.0	0.0			
SCG	HVAC Furnace	0.0	0.0			
SCG	Other	0.0	0.0			
SCG	Pool Heater	0.0	0.0			
SCG	Water Heating Boiler	0.0	0.0			
SCG	Water Heating Controls	0.0	0.0			
SCG	Water Heating Storage Water Heater	0.0	0.0			
SCG	Water Heating Tankless Water Heater	0.0	0.0	1.00	100.0%	
SCG	**Total**	**0.3**	**0.3**	**1.00**	**100.0%**	
SDGE	HVAC Controls Fan	2.3	2.3	1.00	100.0%	
SDGE	HVAC Duct Sealing	0.3	0.3	1.00	100.0%	
SDGE	HVAC RCA	4.6	4.6	1.00	100.0%	
SDGE	Lighting Indoor CFL Fixture	0.1	0.1	1.00	0.0%	1.00
SDGE	Lighting Indoor LED Fixture	0.0	0.0	1.00	100.0%	
SDGE	Lighting Indoor LED Lamp	0.6	0.6	1.00	5.0%	1.00

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Lighting Outdoor CFL Fixture	0.0	0.0			
SDGE	Lighting Outdoor LED Fixture	0.0	0.0	1.00	0.0%	1.00
SDGE	MF Whole Building	6.3	0.6	0.10	0.0%	0.10
SDGE	Water Heating Controls	0.0	0.0			
SDGE	Water Heating Faucet Aerator	0.0	0.0			
SDGE	Water Heating Showerhead	0.0	0.0			
SDGE	**Total**	**14.1**	**8.4**	**0.60**	**50.7%**	**0.18**
	Statewide	***33.2***	***29.1***	***0.88***	***37.6%***	***0.76***

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	Appliance Clothes Washer	0.0	0.0	1.00	100.0%	0.58	0.58		
PGE	Appliance Refrigerator	0.0	0.0						
PGE	HVAC Boiler	0.0	0.0						
PGE	HVAC Furnace	0.0	0.0						
PGE	HVAC Heating Other	0.0	0.0						
PGE	Lighting Indoor CFL Fixture	0.0	0.0	0.83	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Fixture	0.0	0.0	0.95	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Lamp	0.0	0.0	1.26	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor CFL Fixture	0.0	0.0				0.55		0.55
PGE	Lighting Outdoor LED Fixture	0.0	0.0						
PGE	MF Whole Building	1.3	0.3	0.26	0.0%	0.89	0.45	0.89	0.45
PGE	Pool Heater	0.0	0.0						
PGE	Pool Pump	0.0	0.0	1.00	100.0%	0.55	0.55		
PGE	Water Heating Boiler	0.0	0.0						
PGE	Water Heating Showerhead	0.0	0.0						
PGE	Water Heating Storage Water Heater	0.0	0.0						
PGE	Water Heating Tankless Water Heater	0.0	0.0						
PGE	**Total**	**1.3**	**0.4**	**0.28**	**2.2%**	**0.87**	**0.46**	**0.88**	**0.45**
SCE	Appliance Clothes Washer	0.1	0.1	1.00	100.0%	0.36	0.36		
SCE	Appliance Refrigerator	0.0	0.0	1.00	100.0%	0.56	0.56		
SCE	Building Envelope New Windows	0.1	0.4	2.99	100.0%	0.55	0.55		
SCE	HVAC EVAP Cooler	0.5	0.5	1.00	100.0%	0.70	0.70		
SCE	HVAC PTAC-PTHP	0.0	0.0	1.00	100.0%	0.55	0.55		
SCE	Lighting Indoor CFL Basic	0.0	0.0	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor CFL Fixture	4.1	5.1	1.24	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	0.7	0.7	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor LED Fixture	0.8	1.9	2.42	0.0%	0.68	0.68	0.68	0.68
SCE	Lighting Indoor LED Lamp	2.7	3.0	1.11	0.0%	0.76	0.76	0.76	0.76
SCE	Lighting Indoor LED Reflector Lamp	0.3	0.3	1.09	0.0%	0.64	0.64	0.64	0.64
SCE	Lighting Outdoor CFL Fixture	0.0	0.2				0.84		0.84
SCE	Lighting Outdoor CFL Reflector	0.0	0.0				0.85		0.85
SCE	Lighting Outdoor LED Fixture	0.0	0.0	2.36	0.0%	0.65	0.70	0.65	0.70
SCE	Lighting Outdoor LED Other	0.0	0.1				0.84		0.84

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
SCE	MF Whole Building	1.4	0.1	0.09	0.0%	0.57	0.45	0.57	0.45
SCE	Pool Pump	2.0	2.3	1.17	100.0%	0.77	0.77		
SCE	Vending Machine	0.0	0.0						
SCE	Water Heating Faucet Aerator	0.0	0.0	1.00	100.0%	0.85	0.85		
SCE	Water Heating Showerhead	0.0	0.0	1.00	100.0%	0.85	0.85		
SCE	Water Heating Storage Water Heater	0.0	0.0	1.00	100.0%	0.23	0.23		
SCE	**Total**	**12.8**	**14.9**	**1.16**	**21.0%**	**0.74**	**0.76**	**0.75**	**0.78**
SCG	Building Envelope Ceiling-Roof Insulation	0.0	0.0	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Wall Insulation	0.0	0.0	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Window Film	0.0	0.0						
SCG	HVAC Boiler	0.0	0.0						
SCG	HVAC Furnace	0.0	0.0						
SCG	Other	0.0	0.0						
SCG	Pool Heater	0.0	0.0						
SCG	Water Heating Boiler	0.0	0.0						
SCG	Water Heating Controls	0.0	0.0						
SCG	Water Heating Storage Water Heater	0.0	0.0						
SCG	Water Heating Tankless Water Heater	0.0	0.0	1.00	100.0%	0.55	0.55		
SCG	**Total**	**0.1**	**0.1**	**1.00**	**100.0%**	**0.28**	**0.28**		
SDGE	HVAC Controls Fan	1.9	1.9	1.00	100.0%	0.85	0.85		
SDGE	HVAC Duct Sealing	0.2	0.2	1.00	100.0%	0.85	0.85		
SDGE	HVAC RCA	3.6	3.6	1.00	100.0%	0.78	0.78		
SDGE	Lighting Indoor CFL Fixture	0.1	0.1	1.00	0.0%	0.80	0.80	0.80	0.80
SDGE	Lighting Indoor LED Fixture	0.0	0.0	1.55	0.0%	0.55	0.85	0.55	0.85
SDGE	Lighting Indoor LED Lamp	0.3	0.3	0.94	0.0%	0.60	0.57	0.60	0.57
SDGE	Lighting Outdoor CFL Fixture	0.0	0.0						
SDGE	Lighting Outdoor LED Fixture	0.0	0.0	1.00	0.0%	0.60	0.60	0.60	0.60
SDGE	MF Whole Building	5.4	0.3	0.05	0.0%	0.85	0.45	0.85	0.45
SDGE	Water Heating Controls	0.0	0.0						
SDGE	Water Heating Faucet Aerator	0.0	0.0						
SDGE	Water Heating Showerhead	0.0	0.0						
SDGE	**Total**	**11.5**	**6.4**	**0.56**	**49.7%**	**0.82**	**0.76**	**0.83**	**0.53**
	Statewide	***25.7***	***21.7***	***0.85***	***33.1%***	***0.78***	***0.75***	***0.79***	***0.75***

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Appliance Clothes Washer	13	13	1.00	100.0%	
PGE	Appliance Refrigerator	0	0			
PGE	HVAC Boiler	59	59	1.00	100.0%	
PGE	HVAC Furnace	1	1	1.00	100.0%	
PGE	HVAC Heating Other	1	1	1.00	100.0%	
PGE	Lighting Indoor CFL Fixture	-2	-2	1.13	0.0%	1.13
PGE	Lighting Indoor LED Fixture	-3	-3	0.95	0.0%	0.95
PGE	Lighting Indoor LED Lamp	0	0	0.89	0.0%	0.89
PGE	Lighting Outdoor CFL Fixture	0	0			
PGE	Lighting Outdoor LED Fixture	0	0			
PGE	MF Whole Building	176	519	2.94	0.0%	2.94
PGE	Pool Heater	12	12	1.00	100.0%	
PGE	Pool Pump	0	0			
PGE	Water Heating Boiler	3,464	3,464	1.00	100.0%	
PGE	Water Heating Showerhead	0	0			
PGE	Water Heating Storage Water Heater	1,440	1,440	1.00	100.0%	
PGE	Water Heating Tankless Water Heater	1,421	1,421	1.00	100.0%	
PGE	**Total**	**6,583**	**6,926**	**1.05**	**97.4%**	**2.99**
SCE	Appliance Clothes Washer	14	14	1.00	100.0%	
SCE	Appliance Refrigerator	-3	-3	1.00	100.0%	
SCE	Building Envelope New Windows	24	71	2.99	100.0%	
SCE	HVAC EVAP Cooler	-9	-9	1.00	100.0%	
SCE	HVAC PTAC-PTHP	0	0			
SCE	Lighting Indoor CFL Basic	-4	-4	1.00	0.0%	1.00
SCE	Lighting Indoor CFL Fixture	-668	-785	1.18	0.0%	1.18
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	-118	-118	1.00	100.0%	
SCE	Lighting Indoor LED Fixture	-155	-384	2.49	0.0%	2.49
SCE	Lighting Indoor LED Lamp	-485	-532	1.10	5.9%	1.10
SCE	Lighting Indoor LED Reflector Lamp	-62	-68	1.09	22.5%	1.12

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SCE	Lighting Outdoor CFL Fixture	0	0			
SCE	Lighting Outdoor CFL Reflector	0	0			
SCE	Lighting Outdoor LED Fixture	0	0	1.00	100.0%	
SCE	Lighting Outdoor LED Other	0	0			
SCE	MF Whole Building	758	594	0.78	0.0%	0.78
SCE	Pool Pump	0	0			
SCE	Vending Machine	0	0			
SCE	Water Heating Faucet Aerator	1	1	1.00	100.0%	
SCE	Water Heating Showerhead	8	8	1.00	100.0%	
SCE	Water Heating Storage Water Heater	0	0			
SCE	**Total**	**-699**	**-1,216**	**1.74**	**18.1%**	**1.98**
SCG	Building Envelope Ceiling-Roof Insulation	24	24	1.00	100.0%	
SCG	Building Envelope Wall Insulation	124	124	1.00	100.0%	
SCG	Building Envelope Window Film	139	139	1.00	100.0%	
SCG	HVAC Boiler	152	152	1.00	100.0%	
SCG	HVAC Furnace	1	1	1.00	100.0%	
SCG	Other	3	3	1.00	100.0%	
SCG	Pool Heater	43	43	1.00	100.0%	
SCG	Water Heating Boiler	210	210	1.00	100.0%	
SCG	Water Heating Controls	714	714	1.00	100.0%	
SCG	Water Heating Storage Water Heater	351	351	1.00	100.0%	
SCG	Water Heating Tankless Water Heater	49	49	1.00	100.0%	
SCG	**Total**	**1,811**	**1,811**	**1.00**	**100.0%**	
SDGE	HVAC Controls Fan	0	0			
SDGE	HVAC Duct Sealing	19	19	1.00	100.0%	
SDGE	HVAC RCA	-4	-4	1.00	100.0%	
SDGE	Lighting Indoor CFL Fixture	-11	-11	1.00	0.0%	1.00
SDGE	Lighting Indoor LED Fixture	0	0	1.00	100.0%	
SDGE	Lighting Indoor LED Lamp	-69	-69	1.00	4.7%	1.00

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Lighting Outdoor CFL Fixture	0	0			
SDGE	Lighting Outdoor LED Fixture	0	0			
SDGE	MF Whole Building	815	542	0.67	0.0%	0.67
SDGE	Water Heating Controls	210	210	1.00	100.0%	
SDGE	Water Heating Faucet Aerator	4	4	1.00	100.0%	
SDGE	Water Heating Showerhead	121	121	1.00	100.0%	
SDGE	**Total**	**1,085**	**812**	**0.75**	**32.0%**	**0.63**
	Statewide	***8,780***	***8,333***	***0.95***	***96.2%***	***-0.47***

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	Appliance Clothes Washer	8	8	1.00	100.0%	0.58	0.58		
PGE	Appliance Refrigerator	0	0						
PGE	HVAC Boiler	33	33	1.00	100.0%	0.55	0.55		
PGE	HVAC Furnace	1	1	1.00	100.0%	0.55	0.55		
PGE	HVAC Heating Other	1	1	1.00	100.0%	0.55	0.55		
PGE	Lighting Indoor CFL Fixture	-1	-1	1.13	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Fixture	-2	-1	0.95	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Lamp	0	0	0.89	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor CFL Fixture	0	0						
PGE	Lighting Outdoor LED Fixture	0	0						
PGE	MF Whole Building	155	231	1.49	0.0%	0.88	0.45	0.88	0.45
PGE	Pool Heater	7	7	1.00	100.0%	0.60	0.60		
PGE	Pool Pump	0	0						
PGE	Water Heating Boiler	2,078	2,078	1.00	100.0%	0.60	0.60		
PGE	Water Heating Showerhead	0	0						
PGE	Water Heating Storage Water Heater	859	859	1.00	100.0%	0.60	0.60		
PGE	Water Heating Tankless Water Heater	853	853	1.00	100.0%	0.60	0.60		
PGE	**Total**	**3,991**	**4,067**	**1.02**	**96.2%**	**0.61**	**0.59**	**0.89**	**0.45**
SCE	Appliance Clothes Washer	5	5	1.00	100.0%	0.36	0.36		
SCE	Appliance Refrigerator	-2	-2	1.00	100.0%	0.56	0.56		
SCE	Building Envelope New Windows	13	39	2.99	100.0%	0.55	0.55		
SCE	HVAC EVAP Cooler	-6	-6	1.00	100.0%	0.70	0.70		
SCE	HVAC PTAC-PTHP	0	0						
SCE	Lighting Indoor CFL Basic	-4	-4	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor CFL Fixture	-568	-668	1.18	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	-100	-100	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor LED Fixture	-106	-265	2.49	0.0%	0.69	0.69	0.69	0.69
SCE	Lighting Indoor LED Lamp	-368	-404	1.10	0.0%	0.76	0.76	0.76	0.76
SCE	Lighting Indoor LED Reflector Lamp	-40	-44	1.09	0.0%	0.64	0.65	0.64	0.65
SCE	Lighting Outdoor CFL Fixture	0	0						
SCE	Lighting Outdoor CFL Reflector	0	0						
SCE	Lighting Outdoor LED Fixture	0	0	1.00	0.0%	0.64	0.64	0.64	0.64
SCE	Lighting Outdoor LED Other	0	0						

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
SCE	MF Whole Building	488	265	0.54	0.0%	0.64	0.45	0.64	0.45
SCE	Pool Pump	0	0						
SCE	Vending Machine	0	0						
SCE	Water Heating Faucet Aerator	1	1	1.00	100.0%	0.85	0.85		
SCE	Water Heating Showerhead	7	7	1.00	100.0%	0.85	0.85		
SCE	Water Heating Storage Water Heater	0	0						
SCE	**Total**	**-681**	**-1,175**	**1.73**	**-2.6%**	**0.97**	**0.97**	**0.95**	**0.94**
SCG	Building Envelope Ceiling-Roof Insulation	7	7	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Wall Insulation	35	35	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Window Film	77	77	1.00	100.0%	0.55	0.55		
SCG	HVAC Boiler	84	84	1.00	100.0%	0.55	0.55		
SCG	HVAC Furnace	1	1	1.00	100.0%	0.55	0.55		
SCG	Other	3	3	1.00	100.0%	0.85	0.85		
SCG	Pool Heater	24	24	1.00	100.0%	0.55	0.55		
SCG	Water Heating Boiler	116	116	1.00	100.0%	0.55	0.55		
SCG	Water Heating Controls	393	393	1.00	100.0%	0.55	0.55		
SCG	Water Heating Storage Water Heater	86	86	1.00	100.0%	0.24	0.24		
SCG	Water Heating Tankless Water Heater	27	27	1.00	100.0%	0.55	0.55		
SCG	**Total**	**850**	**850**	**1.00**	**100.0%**	**0.47**	**0.47**		
SDGE	HVAC Controls Fan	0	0						
SDGE	HVAC Duct Sealing	16	16	1.00	100.0%	0.85	0.85		
SDGE	HVAC RCA	-3	-3	1.00	100.0%	0.78	0.78		
SDGE	Lighting Indoor CFL Fixture	-9	-9	1.00	0.0%	0.80	0.80	0.80	0.80
SDGE	Lighting Indoor LED Fixture	0	0	1.55	0.0%	0.55	0.85	0.55	0.85
SDGE	Lighting Indoor LED Lamp	-41	-39	0.94	0.0%	0.60	0.56	0.60	0.56
SDGE	Lighting Outdoor CFL Fixture	0	0						
SDGE	Lighting Outdoor LED Fixture	0	0						
SDGE	MF Whole Building	693	242	0.35	0.0%	0.85	0.45	0.85	0.45
SDGE	Water Heating Controls	116	116	1.00	100.0%	0.55	0.55		
SDGE	Water Heating Faucet Aerator	3	3	1.00	100.0%	0.65	0.65		
SDGE	Water Heating Showerhead	103	103	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**877**	**428**	**0.49**	**26.8%**	**0.81**	**0.53**	**0.87**	**0.42**
	Statewide	***5,037***	***4,170***	***0.83***	***98.1%***	***0.57***	***0.50***	***0.56***	***2.48***

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Appliance Clothes Washer	12	12	1.00	100.0%	
PGE	Appliance Refrigerator	0	0			
PGE	HVAC Boiler	0	0			
PGE	HVAC Furnace	0	0			
PGE	HVAC Heating Other	0	0			
PGE	Lighting Indoor CFL Fixture	5	5	0.95	0.0%	0.95
PGE	Lighting Indoor LED Fixture	8	8	0.99	0.0%	0.99
PGE	Lighting Indoor LED Lamp	0	0	1.06	0.0%	1.06
PGE	Lighting Outdoor CFL Fixture	26	27	1.06	0.0%	1.06
PGE	Lighting Outdoor LED Fixture	31	31	1.00	46.4%	0.99
PGE	MF Whole Building	920	171	0.19	0.0%	0.19
PGE	Pool Heater	0	0			
PGE	Pool Pump	19	19	1.00	100.0%	
PGE	Water Heating Boiler	0	0			
PGE	Water Heating Showerhead	0	0			
PGE	Water Heating Storage Water Heater	0	0			
PGE	Water Heating Tankless Water Heater	0	0			
PGE	**Total**	**1,021**	**273**	**0.27**	**4.4%**	**0.23**
SCE	Appliance Clothes Washer	23	23	1.00	100.0%	
SCE	Appliance Refrigerator	13	13	1.00	100.0%	
SCE	Building Envelope New Windows	73	73	1.00	100.0%	
SCE	HVAC EVAP Cooler	25	25	1.00	100.0%	
SCE	HVAC PTAC-PTHP	0	0	1.00	100.0%	
SCE	Lighting Indoor CFL Basic	33	33	1.00	0.0%	1.00
SCE	Lighting Indoor CFL Fixture	2,943	3,476	1.18	0.0%	1.18
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	1,438	1,438	1.00	100.0%	
SCE	Lighting Indoor LED Fixture	1,633	2,640	1.62	0.0%	1.62
SCE	Lighting Indoor LED Lamp	2,836	2,966	1.05	13.4%	1.05
SCE	Lighting Indoor LED Reflector Lamp	348	372	1.07	38.2%	1.11

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SCE	Lighting Outdoor CFL Fixture	5,353	4,404	0.82	0.0%	0.82
SCE	Lighting Outdoor CFL Reflector	4	3	0.69	0.0%	0.69
SCE	Lighting Outdoor LED Fixture	42	43	1.03	44.5%	1.06
SCE	Lighting Outdoor LED Other	1,775	1,908	1.08	0.0%	1.08
SCE	MF Whole Building	567	106	0.19	0.0%	0.19
SCE	Pool Pump	1,918	1,918	1.00	100.0%	
SCE	Vending Machine	4	4	1.00	100.0%	
SCE	Water Heating Faucet Aerator	2	2	1.00	100.0%	
SCE	Water Heating Showerhead	18	18	1.00	100.0%	
SCE	Water Heating Storage Water Heater	118	118	1.00	100.0%	
SCE	**Total**	**19,166**	**19,582**	**1.02**	**21.7%**	**1.03**
SCG	Building Envelope Ceiling-Roof Insulation	5	5	1.00	100.0%	
SCG	Building Envelope Wall Insulation	13	13	1.00	100.0%	
SCG	Building Envelope Window Film	0	0			
SCG	HVAC Boiler	0	0			
SCG	HVAC Furnace	0	0			
SCG	Other	1	1	1.00	100.0%	
SCG	Pool Heater	0	0			
SCG	Water Heating Boiler	0	0			
SCG	Water Heating Controls	0	0			
SCG	Water Heating Storage Water Heater	0	0			
SCG	Water Heating Tankless Water Heater	0	0	1.00	100.0%	
SCG	**Total**	**19**	**19**	**1.00**	**100.0%**	
SDGE	HVAC Controls Fan	115	115	1.00	100.0%	
SDGE	HVAC Duct Sealing	10	10	1.00	100.0%	
SDGE	HVAC RCA	433	433	1.00	100.0%	
SDGE	Lighting Indoor CFL Fixture	90	90	1.00	0.0%	1.00
SDGE	Lighting Indoor LED Fixture	2	2	1.00	100.0%	
SDGE	Lighting Indoor LED Lamp	355	355	1.00	5.2%	1.00

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Lighting Outdoor CFL Fixture	217	217	1.00	0.0%	1.00
SDGE	Lighting Outdoor LED Fixture	340	340	1.00	87.5%	1.00
SDGE	MF Whole Building	1,919	357	0.19	0.0%	0.19
SDGE	Water Heating Controls	0	0			
SDGE	Water Heating Faucet Aerator	0	0			
SDGE	Water Heating Showerhead	0	0			
SDGE	**Total**	**3,480**	**1,918**	**0.55**	**25.1%**	**0.40**
	Statewide	***23,685***	***21,792***	***0.92***	***21.5%***	***0.90***

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	Appliance Clothes Washer	7	7	1.00	100.0%	0.58	0.58		
PGE	Appliance Refrigerator	0	0						
PGE	HVAC Boiler	0	0						
PGE	HVAC Furnace	0	0						
PGE	HVAC Heating Other	0	0						
PGE	Lighting Indoor CFL Fixture	3	3	0.95	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Fixture	4	4	0.99	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Lamp	0	0	1.06	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor CFL Fixture	14	15	1.06	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor LED Fixture	19	17	0.91	0.0%	0.60	0.55	0.60	0.55
PGE	MF Whole Building	870	76	0.09	0.0%	0.95	0.45	0.95	0.45
PGE	Pool Heater	0	0						
PGE	Pool Pump	10	10	1.00	100.0%	0.55	0.55		
PGE	Water Heating Boiler	0	0						
PGE	Water Heating Showerhead	0	0						
PGE	Water Heating Storage Water Heater	0	0						
PGE	Water Heating Tankless Water Heater	0	0						
PGE	**Total**	**927**	**133**	**0.14**	**1.9%**	**0.91**	**0.49**	**0.92**	**0.48**
SCE	Appliance Clothes Washer	8	8	1.00	100.0%	0.36	0.36		
SCE	Appliance Refrigerator	7	7	1.00	100.0%	0.56	0.56		
SCE	Building Envelope New Windows	40	40	1.00	100.0%	0.55	0.55		
SCE	HVAC EVAP Cooler	17	17	1.00	100.0%	0.70	0.70		
SCE	HVAC PTAC-PTHP	0	0	1.00	100.0%	0.55	0.55		
SCE	Lighting Indoor CFL Basic	28	28	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor CFL Fixture	2,501	2,954	1.18	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	1,222	1,222	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor LED Fixture	1,054	1,745	1.66	0.0%	0.65	0.66	0.65	0.66
SCE	Lighting Indoor LED Lamp	2,157	2,253	1.04	0.0%	0.76	0.76	0.76	0.76
SCE	Lighting Indoor LED Reflector Lamp	225	241	1.07	0.0%	0.65	0.65	0.65	0.65
SCE	Lighting Outdoor CFL Fixture	4,494	3,697	0.82	0.0%	0.84	0.84	0.84	0.84
SCE	Lighting Outdoor CFL Reflector	4	3	0.69	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Outdoor LED Fixture	32	27	0.84	0.0%	0.76	0.62	0.76	0.62
SCE	Lighting Outdoor LED Other	1,508	1,503	1.00	0.0%	0.85	0.79	0.85	0.79

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
SCE	MF Whole Building	342	47	0.14	0.0%	0.60	0.45	0.60	0.45
SCE	Pool Pump	1,474	1,474	1.00	100.0%	0.77	0.77		
SCE	Vending Machine	2	2	1.00	100.0%	0.55	0.55		
SCE	Water Heating Faucet Aerator	2	2	1.00	100.0%	0.85	0.85		
SCE	Water Heating Showerhead	15	15	1.00	100.0%	0.85	0.85		
SCE	Water Heating Storage Water Heater	27	27	1.00	100.0%	0.23	0.23		
SCE	**Total**	**15,160**	**15,314**	**1.01**	**10.5%**	**0.79**	**0.78**	**0.80**	**0.79**
SCG	Building Envelope Ceiling-Roof Insulation	1	1	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Wall Insulation	4	4	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Window Film	0	0						
SCG	HVAC Boiler	0	0						
SCG	HVAC Furnace	0	0						
SCG	Other	1	1	1.00	100.0%	0.85	0.85		
SCG	Pool Heater	0	0						
SCG	Water Heating Boiler	0	0						
SCG	Water Heating Controls	0	0						
SCG	Water Heating Storage Water Heater	0	0						
SCG	Water Heating Tankless Water Heater	0	0	1.00	100.0%	0.55	0.55		
SCG	**Total**	**6**	**6**	**1.00**	**100.0%**	**0.30**	**0.30**		
SDGE	HVAC Controls Fan	98	98	1.00	100.0%	0.85	0.85		
SDGE	HVAC Duct Sealing	8	8	1.00	100.0%	0.85	0.85		
SDGE	HVAC RCA	338	338	1.00	100.0%	0.78	0.78		
SDGE	Lighting Indoor CFL Fixture	71	71	1.00	0.0%	0.80	0.80	0.80	0.80
SDGE	Lighting Indoor LED Fixture	1	1	1.55	0.0%	0.55	0.85	0.55	0.85
SDGE	Lighting Indoor LED Lamp	214	201	0.94	0.0%	0.60	0.57	0.60	0.57
SDGE	Lighting Outdoor CFL Fixture	179	179	1.00	0.0%	0.82	0.82	0.82	0.82
SDGE	Lighting Outdoor LED Fixture	204	278	1.36	0.0%	0.60	0.82	0.60	0.82
SDGE	MF Whole Building	1,631	159	0.10	0.0%	0.85	0.45	0.85	0.45
SDGE	Water Heating Controls	0	0						
SDGE	Water Heating Faucet Aerator	0	0						
SDGE	Water Heating Showerhead	0	0						
SDGE	**Total**	**2,744**	**1,334**	**0.49**	**16.2%**	**0.79**	**0.70**	**0.79**	**0.65**
	Statewide	***18,837***	***16,787***	***0.89***	***10.9%***	***0.80***	***0.77***	***0.80***	***0.78***

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Appliance Clothes Washer	0.0	0.0	1.00	100.0%	
PGE	Appliance Refrigerator	0.0	0.0			
PGE	HVAC Boiler	0.0	0.0			
PGE	HVAC Furnace	0.0	0.0			
PGE	HVAC Heating Other	0.0	0.0			
PGE	Lighting Indoor CFL Fixture	0.0	0.0	0.83	0.0%	0.83
PGE	Lighting Indoor LED Fixture	0.0	0.0	0.96	0.0%	0.96
PGE	Lighting Indoor LED Lamp	0.0	0.0	1.26	0.0%	1.26
PGE	Lighting Outdoor CFL Fixture	0.0	0.0			
PGE	Lighting Outdoor LED Fixture	0.0	0.0			
PGE	MF Whole Building	0.5	0.0	0.09	0.0%	0.09
PGE	Pool Heater	0.0	0.0			
PGE	Pool Pump	0.0	0.0	1.00	100.0%	
PGE	Water Heating Boiler	0.0	0.0			
PGE	Water Heating Showerhead	0.0	0.0			
PGE	Water Heating Storage Water Heater	0.0	0.0			
PGE	Water Heating Tankless Water Heater	0.0	0.0			
PGE	**Total**	**0.5**	**0.0**	**0.10**	**1.0%**	**0.09**
SCE	Appliance Clothes Washer	0.0	0.0	1.00	100.0%	
SCE	Appliance Refrigerator	0.0	0.0	1.00	100.0%	
SCE	Building Envelope New Windows	0.0	0.0	1.00	100.0%	
SCE	HVAC EVAP Cooler	0.0	0.0	1.00	100.0%	
SCE	HVAC PTAC-PTHP	0.0	0.0	1.00	100.0%	
SCE	Lighting Indoor CFL Basic	0.0	0.0	1.00	0.0%	1.00
SCE	Lighting Indoor CFL Fixture	0.3	0.4	1.26	0.0%	1.26
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	0.1	0.1	1.00	100.0%	
SCE	Lighting Indoor LED Fixture	0.1	0.2	2.09	0.0%	2.09
SCE	Lighting Indoor LED Lamp	0.2	0.3	1.26	8.1%	1.28
SCE	Lighting Indoor LED Reflector Lamp	0.0	0.0	1.09	26.5%	1.12

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SCE	Lighting Outdoor CFL Fixture	0.0	0.1			
SCE	Lighting Outdoor CFL Reflector	0.0	0.0			
SCE	Lighting Outdoor LED Fixture	0.0	0.0	1.26	100.0%	
SCE	Lighting Outdoor LED Other	0.0	0.0			
SCE	MF Whole Building	0.2	0.0	0.09	0.0%	0.09
SCE	Pool Pump	0.3	0.3	1.00	100.0%	
SCE	Vending Machine	0.0	0.0			
SCE	Water Heating Faucet Aerator	0.0	0.0	1.00	100.0%	
SCE	Water Heating Showerhead	0.0	0.0	1.00	100.0%	
SCE	Water Heating Storage Water Heater	0.0	0.0	1.00	100.0%	
SCE	**Total**	**1.4**	**1.6**	**1.13**	**40.1%**	**1.22**
SCG	Building Envelope Ceiling-Roof Insulation	0.0	0.0	1.00	100.0%	
SCG	Building Envelope Wall Insulation	0.0	0.0	1.00	100.0%	
SCG	Building Envelope Window Film	0.0	0.0			
SCG	HVAC Boiler	0.0	0.0			
SCG	HVAC Furnace	0.0	0.0			
SCG	Other	0.0	0.0			
SCG	Pool Heater	0.0	0.0			
SCG	Water Heating Boiler	0.0	0.0			
SCG	Water Heating Controls	0.0	0.0			
SCG	Water Heating Storage Water Heater	0.0	0.0			
SCG	Water Heating Tankless Water Heater	0.0	0.0	1.00	100.0%	
SCG	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	
SDGE	HVAC Controls Fan	0.2	0.2	1.00	100.0%	
SDGE	HVAC Duct Sealing	0.0	0.0	1.00	100.0%	
SDGE	HVAC RCA	0.5	0.5	1.00	100.0%	
SDGE	Lighting Indoor CFL Fixture	0.0	0.0	1.00	0.0%	1.00
SDGE	Lighting Indoor LED Fixture	0.0	0.0	1.00	100.0%	
SDGE	Lighting Indoor LED Lamp	0.0	0.0	1.00	4.9%	1.00

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Lighting Outdoor CFL Fixture	0.0	0.0			
SDGE	Lighting Outdoor LED Fixture	0.0	0.0	1.00	0.0%	1.00
SDGE	MF Whole Building	0.4	0.0	0.09	0.0%	0.09
SDGE	Water Heating Controls	0.0	0.0			
SDGE	Water Heating Faucet Aerator	0.0	0.0			
SDGE	Water Heating Showerhead	0.0	0.0			
SDGE	**Total**	**1.1**	**0.7**	**0.67**	**59.4%**	**0.18**
	Statewide	***2.9***	***2.3***	***0.79***	***40.8%***	***0.65***

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	Appliance Clothes Washer	0.0	0.0	1.00	100.0%	0.58	0.58		
PGE	Appliance Refrigerator	0.0	0.0						
PGE	HVAC Boiler	0.0	0.0						
PGE	HVAC Furnace	0.0	0.0						
PGE	HVAC Heating Other	0.0	0.0						
PGE	Lighting Indoor CFL Fixture	0.0	0.0	0.83	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Fixture	0.0	0.0	0.96	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Lamp	0.0	0.0	1.26	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor CFL Fixture	0.0	0.0				0.55		0.55
PGE	Lighting Outdoor LED Fixture	0.0	0.0						
PGE	MF Whole Building	0.5	0.0	0.04	0.0%	0.97	0.45	0.97	0.45
PGE	Pool Heater	0.0	0.0						
PGE	Pool Pump	0.0	0.0	1.00	100.0%	0.55	0.55		
PGE	Water Heating Boiler	0.0	0.0						
PGE	Water Heating Showerhead	0.0	0.0						
PGE	Water Heating Storage Water Heater	0.0	0.0						
PGE	Water Heating Tankless Water Heater	0.0	0.0						
PGE	**Total**	**0.5**	**0.0**	**0.05**	**0.6%**	**0.96**	**0.46**	**0.96**	**0.45**
SCE	Appliance Clothes Washer	0.0	0.0	1.00	100.0%	0.36	0.36		
SCE	Appliance Refrigerator	0.0	0.0	1.00	100.0%	0.56	0.56		
SCE	Building Envelope New Windows	0.0	0.0	1.00	100.0%	0.55	0.55		
SCE	HVAC EVAP Cooler	0.0	0.0	1.00	100.0%	0.70	0.70		
SCE	HVAC PTAC-PTHP	0.0	0.0	1.00	100.0%	0.55	0.55		
SCE	Lighting Indoor CFL Basic	0.0	0.0	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor CFL Fixture	0.3	0.3	1.26	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	0.1	0.1	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor LED Fixture	0.1	0.1	2.12	0.0%	0.66	0.67	0.66	0.67
SCE	Lighting Indoor LED Lamp	0.2	0.2	1.25	0.0%	0.76	0.76	0.76	0.76
SCE	Lighting Indoor LED Reflector Lamp	0.0	0.0	1.09	0.0%	0.65	0.65	0.65	0.65
SCE	Lighting Outdoor CFL Fixture	0.0	0.1				0.84		0.84
SCE	Lighting Outdoor CFL Reflector	0.0	0.0				0.85		0.85
SCE	Lighting Outdoor LED Fixture	0.0	0.0	1.30	0.0%	0.65	0.67	0.65	0.67
SCE	Lighting Outdoor LED Other	0.0	0.0				0.84		0.84

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
SCE	MF Whole Building	0.1	0.0	0.07	0.0%	0.57	0.45	0.57	0.45
SCE	Pool Pump	0.2	0.2	1.00	100.0%	0.77	0.77		
SCE	Vending Machine	0.0	0.0						
SCE	Water Heating Faucet Aerator	0.0	0.0	1.00	100.0%	0.85	0.85		
SCE	Water Heating Showerhead	0.0	0.0	1.00	100.0%	0.85	0.85		
SCE	Water Heating Storage Water Heater	0.0	0.0	1.00	100.0%	0.23	0.23		
SCE	**Total**	**1.0**	**1.2**	**1.17**	**28.9%**	**0.74**	**0.76**	**0.75**	**0.78**
SCG	Building Envelope Ceiling-Roof Insulation	0.0	0.0	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Wall Insulation	0.0	0.0	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Window Film	0.0	0.0						
SCG	HVAC Boiler	0.0	0.0						
SCG	HVAC Furnace	0.0	0.0						
SCG	Other	0.0	0.0						
SCG	Pool Heater	0.0	0.0						
SCG	Water Heating Boiler	0.0	0.0						
SCG	Water Heating Controls	0.0	0.0						
SCG	Water Heating Storage Water Heater	0.0	0.0						
SCG	Water Heating Tankless Water Heater	0.0	0.0	1.00	100.0%	0.55	0.55		
SCG	**Total**	**0.0**	**0.0**	**1.00**	**100.0%**	**0.28**	**0.28**		
SDGE	HVAC Controls Fan	0.1	0.1	1.00	100.0%	0.85	0.85		
SDGE	HVAC Duct Sealing	0.0	0.0	1.00	100.0%	0.85	0.85		
SDGE	HVAC RCA	0.4	0.4	1.00	100.0%	0.78	0.78		
SDGE	Lighting Indoor CFL Fixture	0.0	0.0	1.00	0.0%	0.80	0.80	0.80	0.80
SDGE	Lighting Indoor LED Fixture	0.0	0.0	1.55	0.0%	0.55	0.85	0.55	0.85
SDGE	Lighting Indoor LED Lamp	0.0	0.0	0.94	0.0%	0.60	0.57	0.60	0.57
SDGE	Lighting Outdoor CFL Fixture	0.0	0.0						
SDGE	Lighting Outdoor LED Fixture	0.0	0.0	1.00	0.0%	0.60	0.60	0.60	0.60
SDGE	MF Whole Building	0.3	0.0	0.05	0.0%	0.85	0.45	0.85	0.45
SDGE	Water Heating Controls	0.0	0.0						
SDGE	Water Heating Faucet Aerator	0.0	0.0						
SDGE	Water Heating Showerhead	0.0	0.0						
SDGE	**Total**	**0.9**	**0.5**	**0.63**	**58.4%**	**0.81**	**0.77**	**0.83**	**0.54**
	Statewide	***2.3***	***1.8***	***0.75***	***34.1%***	***0.80***	***0.76***	***0.82***	***0.76***

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	Appliance Clothes Washer	1	1	1.00	100.0%	
PGE	Appliance Refrigerator	0	0			
PGE	HVAC Boiler	4	4	1.00	100.0%	
PGE	HVAC Furnace	0	0	1.00	100.0%	
PGE	HVAC Heating Other	0	0	1.00	100.0%	
PGE	Lighting Indoor CFL Fixture	0	0	1.13	0.0%	1.13
PGE	Lighting Indoor LED Fixture	0	0	0.96	0.0%	0.96
PGE	Lighting Indoor LED Lamp	0	0	0.89	0.0%	0.89
PGE	Lighting Outdoor CFL Fixture	0	0			
PGE	Lighting Outdoor LED Fixture	0	0			
PGE	MF Whole Building	47	29	0.61	0.0%	0.61
PGE	Pool Heater	2	2	1.00	100.0%	
PGE	Pool Pump	0	0			
PGE	Water Heating Boiler	231	231	1.00	100.0%	
PGE	Water Heating Showerhead	0	0			
PGE	Water Heating Storage Water Heater	96	96	1.00	100.0%	
PGE	Water Heating Tankless Water Heater	71	71	1.00	100.0%	
PGE	**Total**	**453**	**434**	**0.96**	**89.6%**	**0.60**
SCE	Appliance Clothes Washer	1	1	1.00	100.0%	
SCE	Appliance Refrigerator	0	0	1.00	100.0%	
SCE	Building Envelope New Windows	4	4	1.00	100.0%	
SCE	HVAC EVAP Cooler	-1	-1	1.00	100.0%	
SCE	HVAC PTAC-PTHP	0	0			
SCE	Lighting Indoor CFL Basic	0	0	1.00	0.0%	1.00
SCE	Lighting Indoor CFL Fixture	-42	-50	1.19	0.0%	1.19
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	-15	-15	1.00	100.0%	
SCE	Lighting Indoor LED Fixture	-11	-26	2.28	0.0%	2.28
SCE	Lighting Indoor LED Lamp	-31	-38	1.21	7.1%	1.23
SCE	Lighting Indoor LED Reflector Lamp	-4	-4	1.09	24.5%	1.12

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SCE	Lighting Outdoor CFL Fixture	0	0			
SCE	Lighting Outdoor CFL Reflector	0	0			
SCE	Lighting Outdoor LED Fixture	0	0	1.00	100.0%	
SCE	Lighting Outdoor LED Other	0	0			
SCE	MF Whole Building	54	33	0.61	0.0%	0.61
SCE	Pool Pump	0	0			
SCE	Vending Machine	0	0			
SCE	Water Heating Faucet Aerator	0	0	1.00	100.0%	
SCE	Water Heating Showerhead	1	1	1.00	100.0%	
SCE	Water Heating Storage Water Heater	0	0			
SCE	**Total**	**-45**	**-95**	**2.13**	**29.4%**	**2.60**
SCG	Building Envelope Ceiling-Roof Insulation	1	1	1.00	100.0%	
SCG	Building Envelope Wall Insulation	6	6	1.00	100.0%	
SCG	Building Envelope Window Film	7	7	1.00	100.0%	
SCG	HVAC Boiler	8	8	1.00	100.0%	
SCG	HVAC Furnace	0	0	1.00	100.0%	
SCG	Other	0	0	1.00	100.0%	
SCG	Pool Heater	9	9	1.00	100.0%	
SCG	Water Heating Boiler	11	11	1.00	100.0%	
SCG	Water Heating Controls	71	71	1.00	100.0%	
SCG	Water Heating Storage Water Heater	32	32	1.00	100.0%	
SCG	Water Heating Tankless Water Heater	3	3	1.00	100.0%	
SCG	**Total**	**148**	**148**	**1.00**	**100.0%**	
SDGE	HVAC Controls Fan	0	0			
SDGE	HVAC Duct Sealing	1	1	1.00	100.0%	
SDGE	HVAC RCA	0	0	1.00	100.0%	
SDGE	Lighting Indoor CFL Fixture	-1	-1	1.00	0.0%	1.00
SDGE	Lighting Indoor LED Fixture	0	0	1.00	100.0%	
SDGE	Lighting Indoor LED Lamp	-4	-4	1.00	4.6%	1.00

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Lighting Outdoor CFL Fixture	0	0			
SDGE	Lighting Outdoor LED Fixture	0	0			
SDGE	MF Whole Building	49	30	0.61	0.0%	0.61
SDGE	Water Heating Controls	14	14	1.00	100.0%	
SDGE	Water Heating Faucet Aerator	0	0	1.00	100.0%	
SDGE	Water Heating Showerhead	12	12	1.00	100.0%	
SDGE	**Total**	**71**	**52**	**0.73**	**38.0%**	**0.56**
	Statewide	***627***	***538***	***0.86***	***90.5%***	***-0.49***

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	Appliance Clothes Washer	1	1	1.00	100.0%	0.58	0.58		
PGE	Appliance Refrigerator	0	0						
PGE	HVAC Boiler	2	2	1.00	100.0%	0.55	0.55		
PGE	HVAC Furnace	0	0	1.00	100.0%	0.55	0.55		
PGE	HVAC Heating Other	0	0	1.00	100.0%	0.55	0.55		
PGE	Lighting Indoor CFL Fixture	0	0	1.13	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Fixture	0	0	0.96	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Indoor LED Lamp	0	0	0.89	0.0%	0.55	0.55	0.55	0.55
PGE	Lighting Outdoor CFL Fixture	0	0						
PGE	Lighting Outdoor LED Fixture	0	0						
PGE	MF Whole Building	45	13	0.28	0.0%	0.95	0.45	0.95	0.45
PGE	Pool Heater	1	1	1.00	100.0%	0.60	0.60		
PGE	Pool Pump	0	0						
PGE	Water Heating Boiler	139	139	1.00	100.0%	0.60	0.60		
PGE	Water Heating Showerhead	0	0						
PGE	Water Heating Storage Water Heater	57	57	1.00	100.0%	0.60	0.60		
PGE	Water Heating Tankless Water Heater	43	43	1.00	100.0%	0.60	0.60		
PGE	**Total**	**288**	**255**	**0.89**	**84.4%**	**0.64**	**0.59**	**0.96**	**0.44**
SCE	Appliance Clothes Washer	0	0	1.00	100.0%	0.36	0.36		
SCE	Appliance Refrigerator	0	0	1.00	100.0%	0.56	0.56		
SCE	Building Envelope New Windows	2	2	1.00	100.0%	0.55	0.55		
SCE	HVAC EVAP Cooler	0	0	1.00	100.0%	0.70	0.70		
SCE	HVAC PTAC-PTHP	0	0						
SCE	Lighting Indoor CFL Basic	0	0	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor CFL Fixture	-35	-42	1.19	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	-13	-13	1.00	0.0%	0.85	0.85	0.85	0.85
SCE	Lighting Indoor LED Fixture	-8	-17	2.31	0.0%	0.68	0.68	0.68	0.68
SCE	Lighting Indoor LED Lamp	-24	-29	1.21	0.0%	0.76	0.76	0.76	0.76
SCE	Lighting Indoor LED Reflector Lamp	-3	-3	1.09	0.0%	0.65	0.65	0.65	0.65
SCE	Lighting Outdoor CFL Fixture	0	0						
SCE	Lighting Outdoor CFL Reflector	0	0						
SCE	Lighting Outdoor LED Fixture	0	0	1.00	0.0%	0.64	0.64	0.64	0.64
SCE	Lighting Outdoor LED Other	0	0						

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
SCE	MF Whole Building	35	15	0.42	0.0%	0.64	0.45	0.64	0.45
SCE	Pool Pump	0	0						
SCE	Vending Machine	0	0						
SCE	Water Heating Faucet Aerator	0	0	1.00	100.0%	0.85	0.85		
SCE	Water Heating Showerhead	1	1	1.00	100.0%	0.85	0.85		
SCE	Water Heating Storage Water Heater	0	0						
SCE	**Total**	**-45**	**-87**	**1.93**	**-5.8%**	**1.01**	**0.91**	**0.96**	**0.90**
SCG	Building Envelope Ceiling-Roof Insulation	0	0	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Wall Insulation	2	2	1.00	100.0%	0.28	0.28		
SCG	Building Envelope Window Film	4	4	1.00	100.0%	0.55	0.55		
SCG	HVAC Boiler	4	4	1.00	100.0%	0.55	0.55		
SCG	HVAC Furnace	0	0	1.00	100.0%	0.55	0.55		
SCG	Other	0	0	1.00	100.0%	0.85	0.85		
SCG	Pool Heater	5	5	1.00	100.0%	0.55	0.55		
SCG	Water Heating Boiler	6	6	1.00	100.0%	0.55	0.55		
SCG	Water Heating Controls	39	39	1.00	100.0%	0.55	0.55		
SCG	Water Heating Storage Water Heater	8	8	1.00	100.0%	0.24	0.24		
SCG	Water Heating Tankless Water Heater	2	2	1.00	100.0%	0.55	0.55		
SCG	**Total**	**70**	**70**	**1.00**	**100.0%**	**0.47**	**0.47**		
SDGE	HVAC Controls Fan	0	0						
SDGE	HVAC Duct Sealing	1	1	1.00	100.0%	0.85	0.85		
SDGE	HVAC RCA	0	0	1.00	100.0%	0.78	0.78		
SDGE	Lighting Indoor CFL Fixture	-1	-1	1.00	0.0%	0.80	0.80	0.80	0.80
SDGE	Lighting Indoor LED Fixture	0	0	1.55	0.0%	0.55	0.85	0.55	0.85
SDGE	Lighting Indoor LED Lamp	-3	-2	0.95	0.0%	0.60	0.56	0.60	0.56
SDGE	Lighting Outdoor CFL Fixture	0	0						
SDGE	Lighting Outdoor LED Fixture	0	0						
SDGE	MF Whole Building	42	13	0.32	0.0%	0.85	0.45	0.85	0.45
SDGE	Water Heating Controls	8	8	1.00	100.0%	0.55	0.55		
SDGE	Water Heating Faucet Aerator	0	0	1.00	100.0%	0.65	0.65		
SDGE	Water Heating Showerhead	10	10	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**57**	**29**	**0.50**	**33.0%**	**0.81**	**0.56**	**0.88**	**0.41**
	Statewide	***370***	***267***	***0.72***	***90.3%***	***0.59***	***0.50***	***0.86***	***1.42***

12 APPENDIX AB: STANDARDIZED REPORTING 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	Lighting Indoor CFL Fixture	0	0.0%	0.0%	16.0	531.2	33.2	33.2
PGE	Lighting Indoor LED Fixture	0	0.0%	0.0%	16.0	200.6	12.5	12.5
PGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	88.8	5.6	5.6
PGE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	13.7	616.6	54.8	54.8
PGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	12.0	2,208.0	184.0	184.0
PGE	MF Whole Building	0	0.0%	0.0%	18.1	163,051.0	9,008.3	9,008.3
PGE	Appliance Clothes Washer	1	0.0%		11.0	4,606.0	418.7	418.7
PGE	Appliance Refrigerator	1	0.0%		1.0	0.0	0.0	0.0
PGE	HVAC Boiler	1	0.0%		15.0	0.0	0.0	0.0
PGE	HVAC Furnace	1	0.0%		20.0	0.0	0.0	0.0
PGE	HVAC Heating Other	1	0.0%		15.0	0.0	0.0	0.0
PGE	Lighting Indoor CFL Fixture	1	0.0%		16.0	0.0	0.0	0.0
PGE	Lighting Outdoor CFL Fixture	1	0.0%		1.0	0.0	0.0	0.0
PGE	Lighting Outdoor LED Fixture	1	0.0%		12.0	3,840.0	320.0	320.0
PGE	MF Whole Building	1	0.0%		18.1	0.0	0.0	0.0
PGE	Pool Heater	1	0.0%		5.0	0.0	0.0	0.0
PGE	Pool Pump	1	0.0%		10.0	6,680.0	668.0	668.0
PGE	Water Heating Boiler	1	0.0%		15.0	0.0	0.0	0.0
PGE	Water Heating Showerhead	1	0.0%		10.0	0.0	0.0	0.0
PGE	Water Heating Storage Water Heater	1	0.0%		15.0	0.0	0.0	0.0
PGE	Water Heating Tankless Water Heater	1	0.0%		20.0	0.0	0.0	0.0
SCE	Lighting Indoor CFL Basic	0	3.8%	3.8%	9.9	217.7	23.5	23.5
SCE	Lighting Indoor CFL Fixture	0	100.0%	100.0%	16.0	876.0	55.4	55.4
SCE	Lighting Indoor LED Fixture	0	0.0%	0.0%	14.6	564.6	49.6	49.6
SCE	Lighting Indoor LED Lamp	0	0.0%	0.0%	15.8	185.4	13.2	13.2
SCE	Lighting Indoor LED Reflector Lamp	0	0.0%	0.0%	15.8	200.9	12.9	12.9
SCE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	8.5	745.5	136.6	136.6
SCE	Lighting Outdoor CFL Reflector	0	0.0%	0.0%	2.9	344.2	117.3	117.3
SCE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	7.8	624.8	80.9	80.9
SCE	Lighting Outdoor LED Other	0	0.0%	0.0%	10.6	900.2	105.7	105.7
SCE	MF Whole Building	0	0.0%	0.0%	18.1	318,341.3	17,587.9	17,587.9
SCE	Appliance Clothes Washer	1	0.0%		11.0	3,761.4	341.9	341.9
SCE	Appliance Refrigerator	1	0.0%		14.0	1,467.1	104.8	104.8
SCE	Building Envelope New Windows	1	100.0%		20.0	46.5	2.3	2.3

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
SCE	HVAC EVAP Cooler	1	0.0%		15.0	6,279.9	418.7	418.7
SCE	HVAC PTAC-PTHP	1	0.0%		15.0	5,557.5	370.5	370.5
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	1	0.0%		8.0	214.8	26.9	26.9
SCE	Lighting Indoor LED Fixture	1	0.0%		12.0	478.2	39.9	39.9
SCE	Lighting Indoor LED Lamp	1	0.0%		13.7	249.2	34.2	34.2
SCE	Lighting Indoor LED Reflector Lamp	1	0.0%		14.7	265.6	29.9	29.9
SCE	Lighting Outdoor LED Fixture	1	0.0%		3.3	758.3	229.8	229.8
SCE	Pool Pump	1	100.0%		10.0	68,746.0	6,874.6	6,874.6
SCE	Vending Machine	1	0.0%		5.0	5,085.2	1,017.0	1,017.0
SCE	Water Heating Faucet Aerator	1	0.0%		10.0	8.2	0.8	0.8
SCE	Water Heating Showerhead	1	0.0%		10.0	88.5	8.9	8.9
SCE	Water Heating Storage Water Heater	1	0.0%		13.0	3,536.0	272.0	272.0
SCG	Building Envelope Ceiling-Roof Insulation	1	0.0%		20.0	0.9	0.0	0.0
SCG	Building Envelope Wall Insulation	1	0.0%		20.0	2.3	0.1	0.1
SCG	Building Envelope Window Film	1	0.0%		20.0	0.0	0.0	0.0
SCG	HVAC Boiler	1	0.0%		20.0	0.0	0.0	0.0
SCG	HVAC Furnace	1	0.0%		20.0	0.0	0.0	0.0
SCG	Other	1	0.0%		16.5	13,145.2	796.7	796.7
SCG	Pool Heater	1	0.0%		5.0	0.0	0.0	0.0
SCG	Water Heating Boiler	1	0.0%		20.0	0.0	0.0	0.0
SCG	Water Heating Controls	1	0.0%		10.0	0.0	0.0	0.0
SCG	Water Heating Storage Water Heater	1	0.0%		11.0	0.0	0.0	0.0
SCG	Water Heating Tankless Water Heater	1	0.0%		16.6	-35.7	-1.8	-1.8
SDGE	Lighting Indoor CFL Fixture	0	0.0%	0.0%	9.7	481.6	49.8	49.8
SDGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	205.7	13.1	13.1
SDGE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	9.7	658.6	68.1	68.1
SDGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	14.8	979.4	66.4	66.4
SDGE	MF Whole Building	0	0.0%	0.0%	18.1	61,551.6	3,400.6	3,400.6
SDGE	HVAC Controls Fan	1	0.0%		15.0	884.9	59.0	59.0
SDGE	HVAC Duct Sealing	1	0.0%		18.0	87.0	4.8	4.8
SDGE	HVAC RCA	1	0.0%		10.0	518.2	51.8	51.8
SDGE	Lighting Indoor LED Fixture	1	0.0%		16.0	279.0	17.4	17.4
SDGE	Lighting Indoor LED Lamp	1	0.0%		16.0	278.0	17.4	17.4
SDGE	Lighting Outdoor LED Fixture	1	0.0%		16.0	6,182.7	386.4	386.4

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
SDGE	MF Whole Building	1			18.1	0.0	0.0	0.0
SDGE	Water Heating Controls	1	0.0%		15.0	0.0	0.0	0.0
SDGE	Water Heating Faucet Aerator	1	0.0%		10.0	0.0	0.0	0.0
SDGE	Water Heating Showerhead	1	0.0%		10.0	0.0	0.0	0.0

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	Lighting Indoor CFL Fixture	0	0.0%	0.0%	16.0	-13.6	-0.8	-0.8
PGE	Lighting Indoor LED Fixture	0	0.0%	0.0%	16.0	-4.2	-0.3	-0.3
PGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	-1.6	-0.1	-0.1
PGE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	13.7	0.0	0.0	0.0
PGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	12.0	0.0	0.0	0.0
PGE	MF Whole Building	0	0.0%	0.0%	18.1	27,309.2	1,508.8	1,508.8
PGE	Appliance Clothes Washer	1	0.0%		11.0	450.3	40.9	40.9
PGE	Appliance Refrigerator	1	0.0%		1.0	0.0	0.0	0.0
PGE	HVAC Boiler	1	0.0%		15.0	2,111.8	140.8	140.8
PGE	HVAC Furnace	1	0.0%		20.0	406.5	20.3	20.3
PGE	HVAC Heating Other	1	0.0%		15.0	915.0	61.0	61.0
PGE	Lighting Indoor CFL Fixture	1	0.0%		16.0	0.0	0.0	0.0
PGE	Lighting Outdoor CFL Fixture	1	0.0%		1.0	0.0	0.0	0.0
PGE	Lighting Outdoor LED Fixture	1	0.0%		12.0	0.0	0.0	0.0
PGE	MF Whole Building	1	0.0%		18.1	0.0	0.0	0.0
PGE	Pool Heater	1	0.0%		5.0	11.5	2.3	2.3
PGE	Pool Pump	1	0.0%		10.0	0.0	0.0	0.0
PGE	Water Heating Boiler	1	0.0%		15.0	42.7	2.8	2.8
PGE	Water Heating Showerhead	1	0.0%		10.0	0.0	0.0	0.0
PGE	Water Heating Storage Water Heater	1	0.0%		15.0	40.3	2.7	2.7
PGE	Water Heating Tankless Water Heater	1	0.0%		20.0	57.1	2.9	2.9
SCE	Lighting Indoor CFL Basic	0	3.8%	3.8%	9.9	-3.1	-0.3	-0.3
SCE	Lighting Indoor CFL Fixture	0	100.0%	100.0%	16.0	-12.5	-0.8	-0.8
SCE	Lighting Indoor LED Fixture	0	0.0%	0.0%	14.6	-7.2	-0.5	-0.5
SCE	Lighting Indoor LED Lamp	0	0.0%	0.0%	15.8	-2.6	-0.2	-0.2
SCE	Lighting Indoor LED Reflector Lamp	0	0.0%	0.0%	15.8	-2.9	-0.2	-0.2
SCE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	8.5	0.0	0.0	0.0
SCE	Lighting Outdoor CFL Reflector	0	0.0%	0.0%	2.9	0.0	0.0	0.0
SCE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	7.8	0.0	0.0	0.0
SCE	Lighting Outdoor LED Other	0	0.0%	0.0%	10.6	0.0	0.0	0.0
SCE	MF Whole Building	0	0.0%	0.0%	18.1	99,067.3	5,473.3	5,473.3
SCE	Appliance Clothes Washer	1	0.0%		11.0	203.7	18.5	18.5
SCE	Appliance Refrigerator	1	0.0%		14.0	-26.9	-1.9	-1.9
SCE	Building Envelope New Windows	1	100.0%		20.0	2.3	0.1	0.1

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
SCE	HVAC EVAP Cooler	1	0.0%		15.0	-153.3	-10.2	-10.2
SCE	HVAC PTAC-PTHP	1	0.0%		15.0	0.0	0.0	0.0
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	1	0.0%		8.0	-2.2	-0.3	-0.3
SCE	Lighting Indoor LED Fixture	1	0.0%		12.0	0.0	0.0	0.0
SCE	Lighting Indoor LED Lamp	1	0.0%		13.7	-2.6	-0.2	-0.2
SCE	Lighting Indoor LED Reflector Lamp	1	0.0%		14.7	-3.1	-0.2	-0.2
SCE	Lighting Outdoor LED Fixture	1	0.0%		3.3	-1.5	-0.5	-0.5
SCE	Pool Pump	1	100.0%		10.0	0.0	0.0	0.0
SCE	Vending Machine	1	0.0%		5.0	0.0	0.0	0.0
SCE	Water Heating Faucet Aerator	1	0.0%		10.0	0.4	0.0	0.0
SCE	Water Heating Showerhead	1	0.0%		10.0	4.0	0.4	0.4
SCE	Water Heating Storage Water Heater	1	0.0%		13.0	0.0	0.0	0.0
SCG	Building Envelope Ceiling-Roof Insulation	1	0.0%		20.0	0.2	0.0	0.0
SCG	Building Envelope Wall Insulation	1	0.0%		20.0	1.1	0.1	0.1
SCG	Building Envelope Window Film	1	0.0%		20.0	1.5	0.1	0.1
SCG	HVAC Boiler	1	0.0%		20.0	38,000.0	1,900.0	1,900.0
SCG	HVAC Furnace	1	0.0%		20.0	216.0	10.8	10.8
SCG	Other	1	0.0%		16.5	3,433.3	208.1	208.1
SCG	Pool Heater	1	0.0%		5.0	10.8	2.2	2.2
SCG	Water Heating Boiler	1	0.0%		20.0	15,000.0	750.0	750.0
SCG	Water Heating Controls	1	0.0%		10.0	184.6	18.5	18.5
SCG	Water Heating Storage Water Heater	1	0.0%		11.0	355.7	32.3	32.3
SCG	Water Heating Tankless Water Heater	1	0.0%		16.6	795.9	49.9	49.9
SDGE	Lighting Indoor CFL Fixture	0	0.0%	0.0%	9.7	-6.2	-0.6	-0.6
SDGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	-2.6	-0.2	-0.2
SDGE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	9.7	0.0	0.0	0.0
SDGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	14.8	0.0	0.0	0.0
SDGE	MF Whole Building	0	0.0%	0.0%	18.1	5,162.3	285.2	285.2
SDGE	HVAC Controls Fan	1	0.0%		15.0	0.0	0.0	0.0
SDGE	HVAC Duct Sealing	1	0.0%		18.0	9.8	0.5	0.5
SDGE	HVAC RCA	1	0.0%		10.0	-0.5	-0.1	-0.1
SDGE	Lighting Indoor LED Fixture	1	0.0%		16.0	-3.9	-0.2	-0.2
SDGE	Lighting Indoor LED Lamp	1	0.0%		16.0	-3.0	-0.2	-0.2
SDGE	Lighting Outdoor LED Fixture	1	0.0%		16.0	0.0	0.0	0.0

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
SDGE	MF Whole Building	1			18.1	0.0	0.0	0.0
SDGE	Water Heating Controls	1	0.0%		15.0	510.0	34.0	34.0
SDGE	Water Heating Faucet Aerator	1	0.0%		10.0	5.0	0.5	0.5
SDGE	Water Heating Showerhead	1	0.0%		10.0	30.3	3.0	3.0

Per Unit (Quantity) Net Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
PGE	Lighting Indoor CFL Fixture	0	0.0%	0.0%	16.0	204.5	12.8	12.8
PGE	Lighting Indoor LED Fixture	0	0.0%	0.0%	16.0	110.4	6.9	6.9
PGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	48.8	3.1	3.1
PGE	Lighting Outdoor CFL Fixture	0	0.0%	4.2%	13.2	324.9	28.9	28.9
PGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	12.0	1,513.6	126.1	126.1
PGE	MF Whole Building	0	0.0%	50.0%	18.1	36,360.4	2,008.9	2,008.9
PGE	Appliance Clothes Washer	1	0.0%		11.0	2,677.9	243.4	243.4
PGE	Appliance Refrigerator	1	0.0%		1.0	0.0	0.0	0.0
PGE	HVAC Boiler	1	0.0%		15.0	0.0	0.0	0.0
PGE	HVAC Furnace	1	0.0%		20.0	0.0	0.0	0.0
PGE	HVAC Heating Other	1	0.0%		15.0	0.0	0.0	0.0
PGE	Pool Heater	1	0.0%		5.0	0.0	0.0	0.0
PGE	Pool Pump	1	0.0%		10.0	3,674.0	367.4	367.4
PGE	Water Heating Boiler	1	0.0%		15.0	0.0	0.0	0.0
PGE	Water Heating Showerhead	1	0.0%		10.0	0.0	0.0	0.0
PGE	Water Heating Storage Water Heater	1	0.0%		15.0	0.0	0.0	0.0
PGE	Water Heating Tankless Water Heater	1	0.0%		20.0	0.0	0.0	0.0
SCE	Lighting Indoor CFL Basic	0	3.8%	3.8%	9.9	185.0	20.0	20.0
SCE	Lighting Indoor CFL Fixture	0	100.0%	100.0%	16.0	744.6	47.0	47.0
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	0	0.0%	0.0%	8.0	182.6	22.8	22.8
SCE	Lighting Indoor LED Fixture	0	0.0%	0.0%	14.6	382.6	32.8	32.8
SCE	Lighting Indoor LED Lamp	0	0.0%	0.0%	15.7	143.6	10.9	10.9
SCE	Lighting Indoor LED Reflector Lamp	0	0.0%	0.0%	15.6	137.8	10.5	10.5
SCE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	8.5	629.5	114.7	114.7
SCE	Lighting Outdoor CFL Reflector	0	0.0%	0.0%	2.9	292.6	99.7	99.7
SCE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	6.9	413.8	69.2	69.2
SCE	Lighting Outdoor LED Other	0	0.0%	0.0%	10.6	722.5	83.3	83.3
SCE	MF Whole Building	0	0.0%	0.0%	18.1	141,980.2	7,844.2	7,844.2
SCE	Appliance Clothes Washer	1	0.0%		11.0	1,354.6	123.1	123.1
SCE	Appliance Refrigerator	1	0.0%		14.0	823.3	58.8	58.8
SCE	Building Envelope New Windows	1	100.0%		20.0	25.6	1.3	1.3
SCE	HVAC EVAP Cooler	1	0.0%		15.0	4,396.0	293.1	293.1
SCE	HVAC PTAC-PTHP	1	0.0%		15.0	3,056.6	203.8	203.8
SCE	Pool Pump	1	100.0%		10.0	52,816.1	5,281.6	5,281.6

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
SCE	Vending Machine	1	0.0%		5.0	2,796.8	559.4	559.4
SCE	Water Heating Faucet Aerator	1	0.0%		10.0	7.0	0.7	0.7
SCE	Water Heating Showerhead	1	0.0%		10.0	75.3	7.5	7.5
SCE	Water Heating Storage Water Heater	1	0.0%		13.0	813.3	62.6	62.6
SCG	Building Envelope Ceiling-Roof Insulation	1	0.0%		20.0	0.2	0.0	0.0
SCG	Building Envelope Wall Insulation	1	0.0%		20.0	0.6	0.0	0.0
SCG	Building Envelope Window Film	1	0.0%		20.0	0.0	0.0	0.0
SCG	HVAC Boiler	1	0.0%		20.0	0.0	0.0	0.0
SCG	HVAC Furnace	1	0.0%		20.0	0.0	0.0	0.0
SCG	Other	1	0.0%		16.5	11,173.4	677.2	677.2
SCG	Pool Heater	1	0.0%		5.0	0.0	0.0	0.0
SCG	Water Heating Boiler	1	0.0%		20.0	0.0	0.0	0.0
SCG	Water Heating Controls	1	0.0%		10.0	0.0	0.0	0.0
SCG	Water Heating Storage Water Heater	1	0.0%		11.0	0.0	0.0	0.0
SCG	Water Heating Tankless Water Heater	1	0.0%		16.6	-19.6	-1.0	-1.0
SDGE	Lighting Indoor CFL Fixture	0	0.0%	0.0%	9.7	383.3	39.6	39.6
SDGE	Lighting Indoor LED Fixture	0	0.0%	0.0%	16.0	237.1	14.8	14.8
SDGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	118.1	7.5	7.5
SDGE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	9.7	542.2	56.1	56.1
SDGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	15.4	3,136.6	197.5	197.5
SDGE	MF Whole Building	0	0.0%	0.9%	18.1	27,193.0	1,502.4	1,502.4
SDGE	HVAC Controls Fan	1	0.0%		15.0	752.2	50.1	50.1
SDGE	HVAC Duct Sealing	1	0.0%		18.0	74.0	4.1	4.1
SDGE	HVAC RCA	1	0.0%		10.0	404.2	40.4	40.4
SDGE	Water Heating Controls	1	0.0%		15.0	0.0	0.0	0.0
SDGE	Water Heating Faucet Aerator	1	0.0%		10.0	0.0	0.0	0.0
SDGE	Water Heating Showerhead	1	0.0%		10.0	0.0	0.0	0.0

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	Lighting Indoor CFL Fixture	0	0.0%	0.0%	16.0	-5.2	-0.3	-0.3
PGE	Lighting Indoor LED Fixture	0	0.0%	0.0%	16.0	-2.3	-0.1	-0.1
PGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	-0.9	-0.1	-0.1
PGE	Lighting Outdoor CFL Fixture	0	0.0%	4.2%	13.2	0.0	0.0	0.0
PGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	12.0	0.0	0.0	0.0
PGE	MF Whole Building	0	0.0%	50.0%	18.1	6,090.0	336.5	336.5
PGE	Appliance Clothes Washer	1	0.0%		11.0	262.5	23.9	23.9
PGE	Appliance Refrigerator	1	0.0%		1.0	0.0	0.0	0.0
PGE	HVAC Boiler	1	0.0%		15.0	1,161.5	77.4	77.4
PGE	HVAC Furnace	1	0.0%		20.0	223.6	11.2	11.2
PGE	HVAC Heating Other	1	0.0%		15.0	503.3	33.6	33.6
PGE	Pool Heater	1	0.0%		5.0	6.9	1.4	1.4
PGE	Pool Pump	1	0.0%		10.0	0.0	0.0	0.0
PGE	Water Heating Boiler	1	0.0%		15.0	25.6	1.7	1.7
PGE	Water Heating Showerhead	1	0.0%		10.0	0.0	0.0	0.0
PGE	Water Heating Storage Water Heater	1	0.0%		15.0	24.1	1.6	1.6
PGE	Water Heating Tankless Water Heater	1	0.0%		20.0	34.2	1.7	1.7
SCE	Lighting Indoor CFL Basic	0	3.8%	3.8%	9.9	-2.6	-0.3	-0.3
SCE	Lighting Indoor CFL Fixture	0	100.0%	100.0%	16.0	-10.6	-0.7	-0.7
SCE	Lighting Indoor Controls Wall Or Ceiling Mounted Occupancy Sensor	0	0.0%	0.0%	8.0	-1.9	-0.2	-0.2
SCE	Lighting Indoor LED Fixture	0	0.0%	0.0%	14.6	-5.0	-0.3	-0.3
SCE	Lighting Indoor LED Lamp	0	0.0%	0.0%	15.7	-2.0	-0.1	-0.1
SCE	Lighting Indoor LED Reflector Lamp	0	0.0%	0.0%	15.6	-1.9	-0.1	-0.1
SCE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	8.5	0.0	0.0	0.0
SCE	Lighting Outdoor CFL Reflector	0	0.0%	0.0%	2.9	0.0	0.0	0.0
SCE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	6.9	-0.2	-0.1	-0.1
SCE	Lighting Outdoor LED Other	0	0.0%	0.0%	10.6	0.0	0.0	0.0
SCE	MF Whole Building	0	0.0%	0.0%	18.1	44,184.0	2,441.1	2,441.1
SCE	Appliance Clothes Washer	1	0.0%		11.0	74.1	6.7	6.7
SCE	Appliance Refrigerator	1	0.0%		14.0	-15.1	-1.1	-1.1
SCE	Building Envelope New Windows	1	100.0%		20.0	1.2	0.1	0.1
SCE	HVAC EVAP Cooler	1	0.0%		15.0	-107.3	-7.2	-7.2
SCE	HVAC PTAC-PTHP	1	0.0%		15.0	0.0	0.0	0.0
SCE	Pool Pump	1	100.0%		10.0	0.0	0.0	0.0

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
SCE	Vending Machine	1	0.0%		5.0	0.0	0.0	0.0
SCE	Water Heating Faucet Aerator	1	0.0%		10.0	0.3	0.0	0.0
SCE	Water Heating Showerhead	1	0.0%		10.0	3.4	0.3	0.3
SCE	Water Heating Storage Water Heater	1	0.0%		13.0	0.0	0.0	0.0
SCG	Building Envelope Ceiling-Roof Insulation	1	0.0%		20.0	0.1	0.0	0.0
SCG	Building Envelope Wall Insulation	1	0.0%		20.0	0.3	0.0	0.0
SCG	Building Envelope Window Film	1	0.0%		20.0	0.8	0.0	0.0
SCG	HVAC Boiler	1	0.0%		20.0	20,900.0	1,045.0	1,045.0
SCG	HVAC Furnace	1	0.0%		20.0	118.8	5.9	5.9
SCG	Other	1	0.0%		16.5	2,918.3	176.9	176.9
SCG	Pool Heater	1	0.0%		5.0	5.9	1.2	1.2
SCG	Water Heating Boiler	1	0.0%		20.0	8,250.0	412.5	412.5
SCG	Water Heating Controls	1	0.0%		10.0	101.5	10.2	10.2
SCG	Water Heating Storage Water Heater	1	0.0%		11.0	87.1	7.9	7.9
SCG	Water Heating Tankless Water Heater	1	0.0%		16.6	437.8	27.5	27.5
SDGE	Lighting Indoor CFL Fixture	0	0.0%	0.0%	9.7	-5.0	-0.5	-0.5
SDGE	Lighting Indoor LED Fixture	0	0.0%	0.0%	16.0	-3.3	-0.2	-0.2
SDGE	Lighting Indoor LED Lamp	0	0.0%	0.0%	16.0	-1.5	-0.1	-0.1
SDGE	Lighting Outdoor CFL Fixture	0	0.0%	0.0%	9.7	0.0	0.0	0.0
SDGE	Lighting Outdoor LED Fixture	0	0.0%	0.0%	15.4	0.0	0.0	0.0
SDGE	MF Whole Building	0	0.0%	0.9%	18.1	2,280.7	126.0	126.0
SDGE	HVAC Controls Fan	1	0.0%		15.0	0.0	0.0	0.0
SDGE	HVAC Duct Sealing	1	0.0%		18.0	8.3	0.5	0.5
SDGE	HVAC RCA	1	0.0%		10.0	-0.4	0.0	0.0
SDGE	Water Heating Controls	1	0.0%		15.0	280.5	18.7	18.7
SDGE	Water Heating Faucet Aerator	1	0.0%		10.0	3.2	0.3	0.3
SDGE	Water Heating Showerhead	1	0.0%		10.0	25.8	2.6	2.6