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2013–2014 RESIDENTIAL ROADMAP

Multifamily Focused Impact Evaluation - Final

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

Date: February 29, 2016
Calmac Study ID CPU0119.01

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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 2013–2014 program cycle. On behalf of the California Public Utilities Commission (CPUC), Apex Analytics prepared this impact evaluation of the savings claimed by these programs.

The MFEER program is a statewide core program that serves multifamily properties throughout the state. In the 2013–2014 program cycle, all four IOUs implemented and claimed savings for this prescriptive rebate program. The MFEER programs rebated more than 500,000 measures during the 2013–2014 program cycle. The SCE program redeemed the largest share of rebates, with more than 300,000 measures incented, followed by PG&E, SDG&E, and SoCalGas. For electric measures, lighting dominated the ex ante energy savings, representing 84% for PG&E, 83% for SCE, and 100% for SDG&E. For gas measures, large domestic hot water (DHW) measures, such as storage water heaters, contributed the most ex ante savings for PG&E and SoCalGas (71% and 94%, respectively). Small DHW measures, such as faucet aerators and low-flow showerheads, contributed the most to the SDG&E gas ex ante savings (59%).

As a new addition to the 2013–2014 program cycle, the four IOUs and two Regional Energy Networks (RENs)[1] implemented MF-WB, a whole building program in the multifamily sector. The MF-WB program is intended to assist property owners who wish to engage in larger retrofit projects. As part of these programs, 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 energy usage; however, the program allows for flexibility in the mix of installed measures used to achieve this savings goal. Program savings are calculated through EnergyPro building simulation modeling software. PG&E and SDG&E claimed savings for 11 MF-WB projects in 2013 and 2014, while the RENs claimed savings for 97 projects during the same period. The MFEER program savings far outweighed those from the MF-WB programs: the MF-WB programs represented only 2% of the multifamily programs electric and gas savings.

The evaluation team conducted four primary evaluation tasks:

1. **Database Review:** comprehensive review of the tracking and database systems for each MF-WB program (both IOU and REN implemented). The goal of this assessment was to ensure that the necessary data to assess program impacts were collected and fully populated.
2. **Engineering Review**: compared the ex ante savings claims, as calculated by the IOUs through simulation models, to savings claims that would have been generated using engineering algorithms for individual measures. The **consumption analysis** aimed to assess if modeled savings were reasonable when compared to the actual pre-installation energy usage at the project.

[1] RENs are third-party public agencies that implement energy efficiency programs on behalf of the IOUs. Rebates are funded by IOU rate payer dollars under the auspices of the CPUC. Bay Area REN operates this program under the name Bay Area Multifamily Building Enhancements program name, or BAMBE. SoCalREN operates this program under the Home Upgrade Program.

3. **Baseline Assessment**: estimate the percentages of early replacement (ER) and replace on burnout (ROB) participant measures through analysis of the decision maker survey.[2]

4. **Free-Ridership (FR) Estimation**: estimate the percentage of savings that would have occurred without program intervention through analysis of the decision maker survey.

These evaluation tasks are illustrated in the following table

Table 1-1: Evaluation Activities by Program and Program Administrator

Task Name	Affected Programs		Affected Program Administrators	
	MF-WB	MFEER	IOUs	RENs
Database Review	✓		✓	✓
Engineering Review	✓	✓	✓	
Baseline Assessment	✓	✓	✓	
FR Estimation	✓	✓	✓	

The baseline assessment and FR estimation relied on results from a participant decision maker survey, conducted by the evaluation team in 2015. The survey targeted property managers, owners, or other primary decision makers involved in executing the program at the property level. Surveys were completed with 252 decision makers. Topics included the following:

- Confirmation/verification of installed measures
- Anticipated actions in 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.

Key conclusions and recommendations from each study component are presented below.[3]

Database Assessment -Multifamily Whole Building Program

Conclusion 1: The evaluated IOU MF-WB projects were difficult to isolate from the single-family EUC projects within the CPUC tracking database.

> Recommendation 1: The MF-WB projects should be assigned a different program name or number from the single-family EUC projects, to facilitate clear delineation between the two project streams.

Conclusion 2: The PG&E, SDG&E, SoCalREN, and BayREN MF-WB program tracking data have varying levels of completeness.

> Recommendation 2: IOUs and RENs should adjust data collection and program tracking to ensure all fields, including participant contact information, measure details, pre-existing conditions, property

[2] See Appendix C for the decision maker survey.
[3] Note that Conclusions/Recommendations 2, 3, and 4 are duplicated in the 2013-2014 REN and CCA Programs Impact assessment as the analysis is applicable to both audiences.

systems, property details, and utility meter numbers are collected and easily accessible for all completed projects.

Conclusion 3: The evaluated MF-WB tracking databases showed that projects were assigned a standard or deemed EUL instead of one based on actual measure installations. Using a deemed EUL, rather than one based on actual measures installed, could lead to inaccurate lifetime savings estimates.

Recommendation 3: Program administrators should be sure to use the correctly savings weighted EUL and RUL instead of the set EUL currently reported in the tracking database.

Conclusion 4: Although PG&E, SDG&E, SoCalREN, and BayRENhave assumed an ER baseline on their first-year savings (MF-WB), they are not always calculating life-cycle savings to reflect a change in baseline after the end of the project's RUL. This would result in an overestimated lifecycle savings estimate.

Recommendation 4: Both IOUs and RENs should calculate life-cycle savings for ER projects using the ER baseline for the RUL period, then using a code baseline for the remainder of the EUL.

Database Assessment -Multifamily Energy Efficiency Rebate

Conclusion 5: There is not a consistent way to bundle MFEER program measures into projects or properties, making it challenging to survey a single property owner on all his or her incented measures.

Recommendation 5: The evaluation team recommends assigning and using consistent SiteIDs for measures installed on a given application or site.

Conclusion 6: Contact data for the MFEER participants was highly inaccurate, leading to a low complete rate during survey efforts.

Recommendation 6: The evaluation team recommends that implementers accurately transfer contact information on the primary decision maker—as entered on the program application—into the CPUC tracking database.

Engineering Review

Conclusion 7: The team was unable to validate the MF-WB program claimed savings via an engineering review because of insufficient tracking data and the inability to find deemed savings estimates.

Recommendation 7: Simulation models or billing analysis may provide a more effective approach to validating the claimed savings. In addition, site visits would allow for true verification of model inputs, which—as identified by the single-family assessment of EnergyPro—can significantly affect the accuracy of the claimed savings.

Consumption Analysis

Conclusion 8: Matching program data to billing data using accountIDs was largely unsuccessful, likely because of the high turnover rate for multifamily tenants.

Recommendation 8: The program administrators should collect meter numbers to allow for improved matching of program and billing data.

Conclusion 9: The consumption analysis of the MF-WB participants showed that the reported savings ratios were very close to project-level gas (therm) savings.

Recommendation 9: Even though the savings claims (were close to billing calibrated consumption ratios, it would be optimal to allow aggregate project-level billing data to be shared with the program administrators to ensure calibrated models.

Baseline Assessment

Conclusion 10a: Although this report did not make any adjustments to gross savings based on the baseline assessment findings, this research indicated that a substantial portion of projects (30% of "other" measure group and 28% of small DHW measures) may have been assigned incorrect baselines.

Conclusion 10b: A review of the baseline assignments in the tracking database showed inconsistencies within and across the IOUs.

Recommendation 10: The IOUs and their contractors should set up a survey at intake to better determine the appropriate baseline for each project and measure.

Free-Ridership Assessment

Conclusion 11: The research found an overall net-of-free-ridership (NTFR) of 51.6% for the 2013-2014 MFEER program.

Recommendation 11: As the MFEER program measure mix, incentive levels, or outreach/intervention strategies change, the NTFR may also change. These values should continue to be updated as the programs evolve.

Conclusion 12: A review of the ex ante MFEER NTFR values in the tracking database showed inconsistencies within and across the IOUs.

Recommendation 12: The IOUs should properly and thoroughly assign DEER-based NTFR values to their measures in their tracking database systems.

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 the 2013–2014 program cycle. On behalf of the California Public Utilities Commission (CPUC), Apex Analytics prepared this impact evaluation of the savings claimed by these programs.

2.1.1 Multifamily Energy Efficiency Rebate Program

The MFEER program is a statewide core program that serves multifamily properties throughout the state. In the 2013–2014 program cycle, all four IOUs implemented and claimed savings for this prescriptive rebate program. To 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 $1.50 to more than $1,400 per measure. As shown in Table 2-1, the IOUs redeemed rebates for a comprehensive, diverse group of measures during the 2013–2014 MFEER program cycle.

Table 2-1: Redeemed MFEER Rebates by IOU and Measure Group

Measure Group	Example Measures	IOU			
		PG&E	SCE	SoCalGas	SDG&E
Cooling	Central Air Conditioner	✓	✓		
Pool Equipment	Variable Speed Pool Pumps, 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	✓	✓		✓
Shell	Insulation, Windows	✓	✓	✓	
Small Domestic Hot Water (DHW)	Faucet Aerators, Low-Flow Showerheads	✓	✓	✓	✓
Large DHW	Tankless Water Heaters, Storage Water Heaters, Water Heating Boilers, Boiler Controls	✓	✓	✓	✓

Additionally, SCE, SDG&E, and SoCalGas offer certain measures[4] at no cost to the participant, including:

- ENERGY STAR® Screw-in LED A-Lamps,
- ENERGY STAR® Screw-in Reflector Screw-in CFLs,
- ENERGY STAR® Interior CFL Fixtures,
- ENERGY STAR® Exterior CFL Fixtures,
- Occupancy Sensors,
- Programmable Variable-Speed Swimming Pool Pumps,
- Window Evaporative Coolers,
- Low-Flow Faucet Aerators,
- Low-Flow Showerheads,
- Shower Start,
- HVAC Efficient Fan Control, and
- Duct Sealing.

The MFEER programs rebated more than 500,000 units during the 2013–2014 program cycle. The SCE programs redeemed the largest number of rebates, with more than 300,000 units incented (Table 2-2). For a more detailed table of the detailed measure-level ex ante gross savings, please see Section 7, Appendix B.

Table 2-2: MFEER 2013–2014 Program Ex Ante Gross Energy Savings by IOU

IOU	Measures	Savings (Ex Ante Gross)		
		kWh	kW	Therms
SCE	341,615	28,510,373	2,083	—
SDG&E	64,524	2,145,987	142	16,112
PG&E	77,343	2,055,016	1,216	662,903
SoCalGas	21,328	8,740	6	710,589
Totals	*504,810*	*32,720,116*	*3,447*	*1,389,604*

As a whole, the California IOUs did not meet their energy savings goals[5] for the MFEER programs (Table 2-3). PG&E, however, did exceed their MFEER goals for both demand (kW) and natural gas (therms).

Table 2-3: MFEER 2013–2014 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
SCE	83,584,252	28,510,373	34%	13,116	2,083	16%	-	-	-
SDGE	4,141,338	2,145,987	52%	470	142	30%	161,626	16,112	10%
PG&E	4,597,702	2,055,016	45%	841	1,216	145%	330,421	662,903	201%
SoCalGas	12,562	8,740	70%	7	6	87%	1,277,092	710,589	56%
Totals	*92,335,854*	*32,720,116*	*35%*	*14,434*	*3,447*	*24%*	*1,769,139*	*1,389,604*	*79%*

[4] Measures vary by IOU.
[5] Savings goals as reported in the individual IOU 2013-2014 Energy Efficiency Portfolio Implementation Plans.

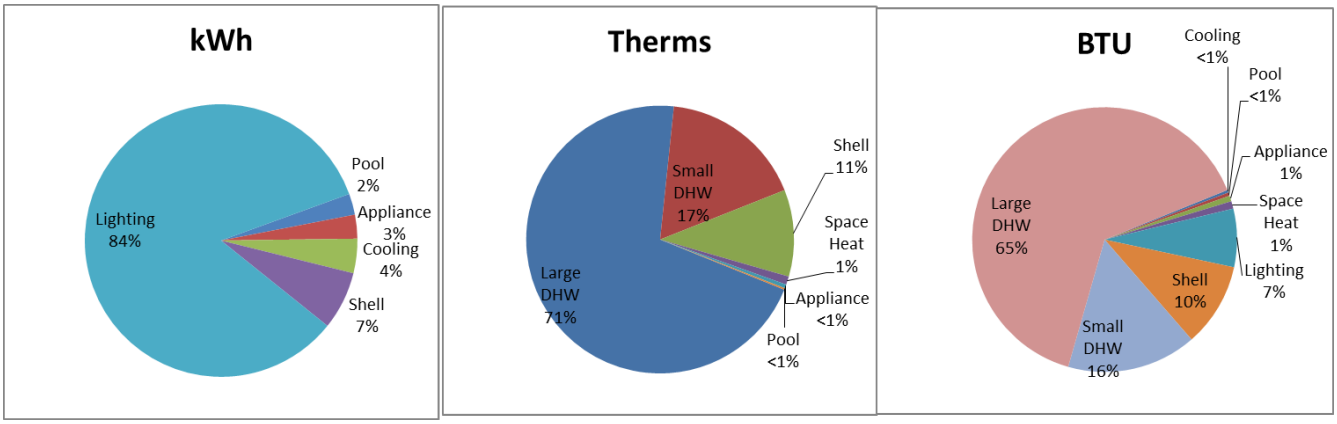
Cumulatively, the IOUs allocated over $34 million to implement and oversee the 2013-2014 MFEER programs and spent over $21 million (Table 2-4).[6]

Table 2-4: MFEER 2013–2014 Program Budgets and Percent of Goal Achieved (ex ante Gross) by IOU

IOU	Budget	Spent	% Spent	% Savings Achieved (% of goal)		
				kWh	kW	Therms
SCE	$ 23,495,962	$ 13,656,154	58%	34%	16%	0%
SDGE	$ 3,402,589	$ 2,302,767	68%	52%	30%	10%
PG&E	$ 5,189,025	$ 3,847,578	74%	45%	145%	201%
SoCalGas	$ 2,767,910	$ 1,720,688	62%	70%	87%	56%
Totals	*$ 34,855,486*	*$ 21,527,188*	*62%*	*35%*	*24%*	*79%*

The distribution of measures contributing most to ex ante savings did not vary widely between the IOU MFEER programs for electric savings, but did show some differences for gas savings. For electric measures, lighting dominated the ex ante energy savings, representing 84% for PG&E, 83% for SCE, and 100% for SDG&E (Figure 2-1, Figure 2-2, and Figure 2-3). For gas measures, large DHW measures, such as storage water heaters, contributed the most ex ante savings for PG&E and SoCalGas (71%, Figure 2-1; 94%, Figure 2-4). Small DHW measures, such as faucet aerators and low-flow showerheads, contributed the most to the SDG&E gas ex ante savings (59%, Figure 2-2).

Figure 2-1 : PG&E Distribution of MFEER 2013–2014 Program Ex Ante Gross Savings by End Use and Fuel Type



[6] Budgets reported in the individual IOU 2013-2014 Energy Efficiency Portfolio Implementation Plans and subsequent EEstats data requests.

Figure 2-2: SDG&E Distribution of 2013–2014 MFEER Program Ex Ante Gross Savings by End Use and Fuel Type

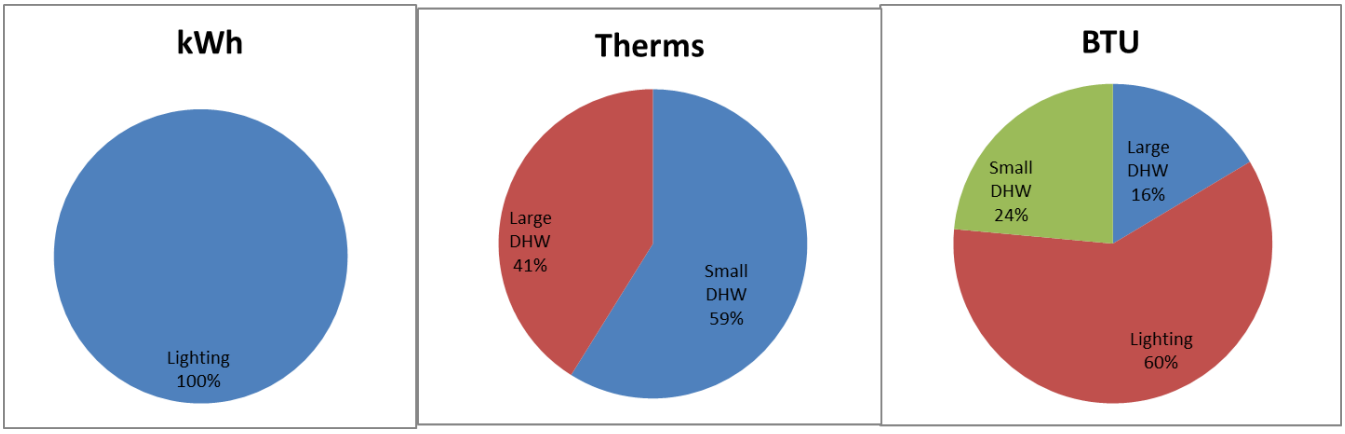


Figure 2-3: SCE Distribution of MFEER 2013–2014 Program Ex Ante Gross Savings by End Use

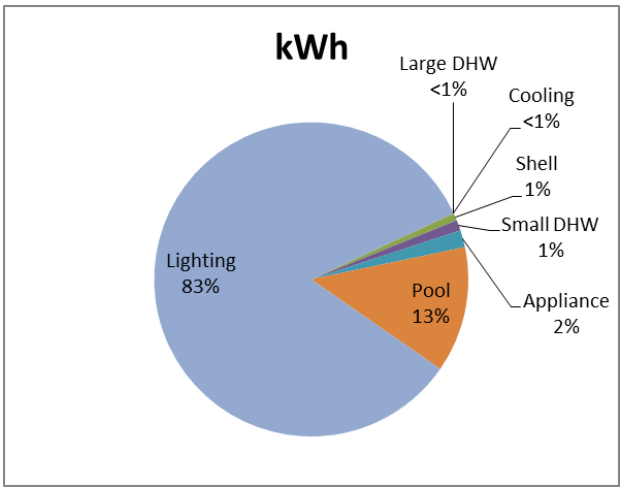
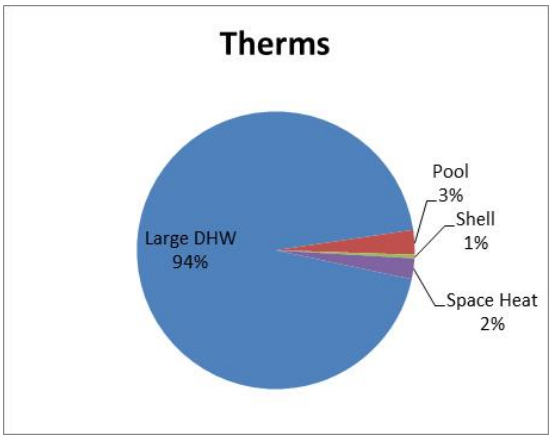


Figure 2-4: SoCalGas Distribution of MFEER 2013–2014 Program Ex Ante Gross Savings by End Use



2.1.2 Multifamily Whole Building Program

As a new addition to the 2013–2014 program cycle, the four IOUs and two Regional Energy Networks (RENs)[7] implemented a whole building program in the multifamily sector. The MF-WB program is intended to assist property owners who wish to engage in larger retrofit projects. As part of these programs, 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 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. PG&E and SDG&E claimed savings for 11 MF-WB projects in 2013 and 2014. The RENs claimed savings for 97 projects during the same period (Table 2-5).

Table 2-5: Ex Ante Gross Energy Savings by Program Administrator (PA), MF-WB 2013–2014 Programs

PA	Projects	Tenant Units	Savings (ex ante gross)		
			kWh	kW	Therms
SDGE	4	108	26,560	15.5	4,002
PG&E	7	‡	568,382	136.1	19,067
BayREN*	95	5,693	1,590,268	198.1	169,807
SoCalREN**	2	384	385,255	79.8	14,650
Totals	*108*	*6,185*	*2,570,465*	*429.6*	*207,526*

*Bay Area REN

**Southern California REN

‡PG&E did not provide this detail

As a whole, the California program administrators did not meet their energy savings goals[8] for the MF-WB programs (Table 2-6). BayRen, however, did exceed their goals for both energy (kWh) and natural gas (therms).

[7] RENs are third-party public agencies that implement energy efficiency programs on behalf of the IOUs. Rebates are funded by IOU rate payer dollars under the auspices of the CPUC. Bay Area REN operates this program under the name Bay Area Multifamily Building Enhancements program name, or BAMBE. SoCalREN operates this program under the Home Upgrade Program.

[8] Savings goals as reported in the individual 2013-2014 Energy Efficiency Portfolio Implementation Plans and/or CPUC EE stats requests.

Table 2-6: MF-WB 2013–2014 Program Ex Ante Gross Energy Savings and Goals by Program Administrator

PA	kWh			kW			Therms		
	Goal	ex ante	% of Goal	Goal	ex ante	% of Goal	Goal	ex ante	% of goal
SCE	1,416,100	-	0%	1,360	-	0%	-	-	-
SDGE	205,311	26,560	13%	164	16	9%	46,975	4,002	9%
PG&E	*	568,382	*	*	136	*	*	19,067	*
SoCalGas	-	-	-	-	-	-	116,025	-	0%
BayREN	1,365,019	1,590,268	117%	1,111	198	18%	152,850	169,807	111%
SoCalREN	6,264,000	385,255	6%	1,357	80	6%	269,280	14,650	5%
Totals	*9,250,430*	*2,570,465*	*28%*	*3,992*	*430*	*11%*	*585,130*	*207,526*	*35%*

** PG&E did not break out single and multifamily savings goals in their reporting. Therefore, the evaluation team could not compare ex ante to goal savings.*

Cumulatively, California program administrators allocated over $27 million to implement and oversee the 2013-2014 MF-WB programs (Table 2-7).[9]

Table 2-7: MF-WB 2013–2014 Program Budgets by Program Administrator and Percent of Goal Achieved (ex ante Gross)

PA	Budget	Spent	% Spent	% Savings Achieved (% of goal)		
				kWh	kW	Therms
SCE	$ 2,000,000	$ 300,676	15%	0%	0%	0%
SDGE	$ 2,501,496	$ 1,446,351	58%	13%	9%	9%
PG&E	$ 5,630,116	$ 1,598,394	28%	*	*	*
SoCalGas	$ 1,000,000	$ 43,844	4%	-	-	0%
BayREN	$ 7,293,750	$ 13,202,593	181%	117%	18%	111%
SoCalREN	$ 9,543,801	$ 2,629,978	28%	6%	6%	5%
Totals	*$ 27,969,163*	*$ 19,221,837*	69%	28%	11%	35%

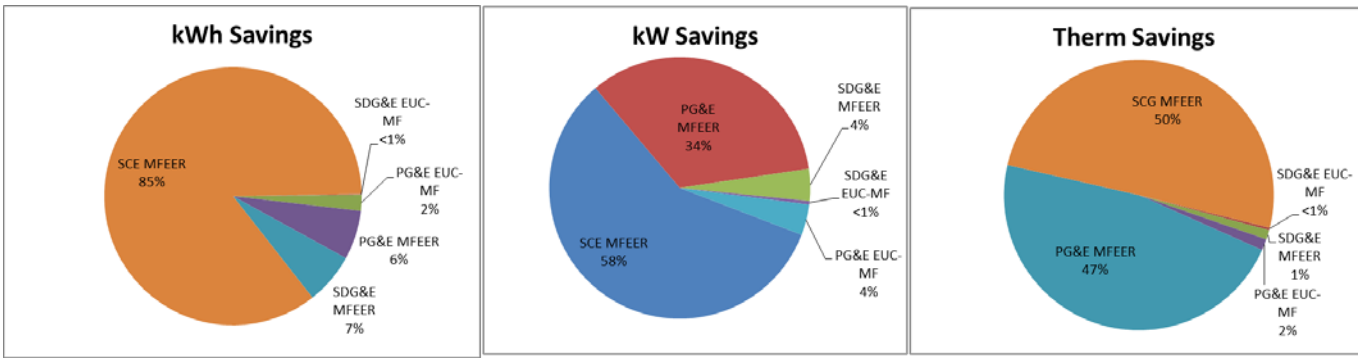
** PG&E did not break out single and multifamily savings goals in their reporting. Therefore, the evaluation team could not compare ex ante to goal savings.*

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 (kilowatt-hours) and demand (kilowatts) savings. The SoCalGas and PG&E MFEER programs claimed the majority of gas (therm) savings (Figure 2-5). The MFEER program savings far outweighed those from the MF-WB programs; the MF-WB programs represented only 2% of the multifamily electric and gas savings.

[9] Budgets reported in the individual IOU 2013-2014 Energy Efficiency Portfolio Implementation Plans and subsequent EEstats data requests.

Figure 2-5: Distribution of 2013–2014 Multifamily Program Ex Ante Savings by IOU 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 2-8, the first years of the MF-WB program were substantially more costly (per BTU saved) to implement. On average, the MF-WB programs spent $651 to save one MMBTU, while the MFEER programs spent $86 per MMBTU.

Table 2-8: MF-WB and MFEER 2013–2014 Program Spending and BTU Savings by Program Administrator

PA	MF-WB		MFEER	
	Spending	$/MMBTU	Spending	$/MMBTU
SCE	$300,676	NA	$ 13,656,154	$140
SDGE	$1,446,351	$2,947	$ 2,302,767	$258
PG&E	$ 1,598,394	$ 416	$ 3,847,578	$52
SoCalGas	$43,844	NA	$ 1,720,688	$24
BayREN	$13,202,593	$589	NA	NA
SoCalREN	$2,629,978	$946	NA	NA
Totals	*$19,221,837*	*$651*	*$ 21,527,188*	*$ 86*

2.2 Evaluation Overview

The evaluation team conducted four primary evaluation tasks: a database review, an assessment of savings claims through engineering estimates, a baseline assessment, and a free-ridership (FR) estimation. The evaluation team limited the database review to the MF-WB programs because they are new programs, and limited the REN evaluation activities to a database review because the REN programs were evaluated under a separate contract (Table 2-9).[10,11]

[10] 2013–2014 Regional Energy Networks and Community Choice Aggregator Programs Impact Assessment, to be released in January 2016

[11] The REN programs received a limited assessment as part of this report to obtain feedback before the full REN assessment is conducted.

Table 2-9: Evaluation Activities by Program and Program Administrator

Task Name	Affected Programs		Affected Program Administrators	
	MF-WB	MFEER	IOUs	RENs
Database Review	✓		✓	✓
Engineering Review	✓	✓	✓	
Baseline Assessment	✓	✓	✓	
FR Estimation	✓	✓	✓	

Each task is described in more depth in the following sections.

2.2.1 Database Assessment

For this task, the evaluation team conducted a comprehensive review of the tracking and database systems for each MF-WB program (both IOU and REN implemented). 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, but did check that the data were within acceptable ranges. This analysis was also included in the 2013-2014 REN and CCA Programs Impact Assessment Report.

2.2.2 Engineering Reviews

Because the implementation strategies of MFEER and MF-WB programs varied, the evaluation team used differing engineering review methods for each. For MFEER, the team performed an engineering analysis of the water saving kits because they were identified as an uncertain measure in the Energy Savings Performance Incentive (ESPI) list. The analysis included reviewing the best available data and updating IOU savings claims accordingly.[12]

For the MF-WB program, the evaluation team conducted an engineering review and consumption analysis of savings claims for all completed projects in the MF-WB program, incorporating survey findings wherever appropriate. The evaluation team conducted a high-level assessment of the ex ante savings assumptions, including potential over- or understatements of impacts being claimed. The goals of these two related savings assessment tasks for the MF-WB were as follows:

- The goal of the **engineering desk review** was to compare the ex ante savings claims, as calculated by the IOUs through simulation models, to savings claims that would have been generated using engineering algorithms for individual measures.
- The goal of the **consumption analysis** was to confirm that modeled savings were proportionate to the actual energy use at the project.

2.2.3 Baseline Assessment

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

[12] See 2013 ESPI Water Saver Kit Measures Review Memo, April 24, 2015, for full details on the water saving kit analysis and results.

- **Early replacement (ER),** 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 (replace on burnout [ROB]) to new equipment for the difference between expected useful life (EUL) and RUL years (EUL-RUL).
- **Replace on burnout (ROB),** 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). 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 3.2.4 for details).

2.2.4 Free-Ridership Estimation

The study also examined FR, which is the percentage of savings that would have occurred without program intervention. Note that this study focused exclusively on free-ridership and did not account for potential spillover. This is consistent with the ex ante net-to-gross values, as the team understands the current multifamily ex ante values as reported in DEER are all net-of-free-rider. All findings will be reported as net-of-free-ridership (NTFR), consistent with CPUC nomenclature.[13] 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; and
- Used invitations (sent via postal mail) to maximize the study participation and response rate.

[13] Itron, DEER Database 2011 Update Documentation; http://www.deeresources.com/files/DEER2011/download/2011_DEER_Documentation.pdf (November 2011)

3 EVALUATION APPROACH

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

- Decision-maker survey
- The Database for Energy Efficiency Resources (DEER)
- Impact evaluations from outside California
- Technical Reference Manuals (TRMs) from outside California
- Property energy consumption (billing) data.

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").[14] 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.

3.1 Data Collection

This section outlines the primary and secondary data sources the evaluation team used in the IOU multifamily impact assessment.

3.1.1 Database Assessment

The team requested the IOU and REN tracking databases and CPUC-claimed savings information for review as part of the database assessment task. In addition, the evaluation team requested specific project- and unit-level attributes from the IOUs, including

- Participant contact information
- EnergyPro model files
- Measures installed
  - Quantity
  - Location
  - Efficiency
- Preexisting equipment/conditions
- Types of and fuels for hot water, cooling, and space heating systems
- Utility account numbers for each property, both unit and common areas
- Energy savings work-paper calculations.

3.1.2 Engineering Desk Review

As noted above, the engineering desk review for the MFEER program was completed earlier in 2015 as part of the ESPI measure review, so this evaluation limited the engineering desk review to the MF-WB programs.

[14] 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. October 16, 2012.

SDG&E had four MF-WB projects, all of which were included as part of this engineering review. Table 3-1 lists the SDG&E projects evaluated during the engineering review and presents the associated ex ante savings. PG&E MF-WB project documentation, however, did not contain sufficient measure-level details, and therefore could not be evaluated through the engineering review.

Table 3-1: SDG&E MF-WB Engineering Review Evaluated Sample by Project

Project Number	IOU	Ex Ante kWh	Ex Ante kW	Ex Ante Therms
Project 1	SDG&E	11,250	7.83	2,239
Project 2	SDG&E	8,023	6.8	1,543
Project 3	SDG&E	7,259	0.8	96
Project 4	SDG&E	29	—	124

The four SDG&E projects included a variety of energy efficiency savings measures, including attic, wall, and floor insulation; dishwashers; refrigerators; space heating systems; water heaters and recirculation pumps; windows; and a cool roof.

For this review, the evaluation team relied on the quantity and details of each installed measure provided by SDG&E in its backup documentation. The team performed an in-depth review of the SDG&E program tracking and CPUC savings data. This review allowed the team to extract pertinent information on the projects and installed measures, including the following:

- Quantity of tenant units
- Location, efficiency, size, and quantity of installed measures
- Climate zone.

SDG&E classifies the ER per unit for MF-WB projects. As a result, the measure-level savings used the ER per unit savings values in instances where the source of savings estimates provided both ER and ROB values.

The evaluation team relied on the 2013–2014 DEER, the IL TRM v4.0,[15] and utility evaluations and work papers for the evaluated savings estimates and algorithms. DEER savings estimates were the first choice for savings estimates because they represent California-specific weather and usage conditions. As window and recirculation pump measures were not present in the DEER database or workpapers, therefore the evaluation team used secondary sources to determine these savings estimates. The IL TRM was chosen for recirculation pump savings as it is updated regularly and has options for updating project and measure specific attributes on many measures. The Northwest Energy Efficiency Alliance (NEEA) Evaluation was used for window savings as very few programs are currently incentivizing windows, and this was the closest geographical evaluation found for this measure. Table 3-2 presents evaluated measures and sources for savings estimates.

[15] IL Statewide Technical Reference Manual for Energy Efficiency, Version 4.0. Effective June 1, 2015. Illinois Energy Efficiency Stakeholder Advisory Group.

Table 3-2: SDG&E MF-WB Engineering Review Project Measures and Savings Sources

Measure	Savings Source
Attic/Wall Insulation	DEER
Cool Roof	DEER
Dishwashers	DEER
Floor Insulation	N/A*
Recirculation Pump	IL TRM
Refrigerator	DEER
Space Heating	DEER
Storage Water Heater	DEER
Windows	Northwest Energy Efficiency Alliance (NEEA) Evaluation**

*The evaluation team was unable to identify a comparable source for floor insulation savings.
** Navigant Consulting, Inc. *Long-Term Monitoring and Tracking Report on 2011 Activities.* Prepared for NEEA. July 23, 2012.

3.1.3 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 two types of searches to capture consumption data for the participant properties:

1. Matches by account number(s) allow extraction of electric and gas consumption data from the IOU-provided unit- and building-level account numbers. If the account numbers are not accurate or present, though, these matches will be unsuccessful.
2. Matches by address allow extraction of all the consumption data that were available based on the street addresses provided by SDG&E. If associated units have different street addresses, though, the data will not be captured (e.g., 996 Main St. in the database will not match 998 Main St. in the consumption data, even if they are two units in the same building).

3.1.4 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 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.

The evaluation team reviewed the 2013–2014 IOU tracking databases and created the overall targeted sample size based on a goal of achieving 90% confidence and 10% precision estimates for each IOU.[16] In addition, the evaluation team stratified the sample according to the total savings of the project, with the goal of targeting a mix of small and large projects. In this manner, evaluation findings can represent a variety of project sizes, making sure that the largest, most significant projects have been represented in the final results. This survey stratification also ensured participants from each IOU were represented in the final sample.

Table 3-3 shows the target and completed surveys. MFEER program projects were stratified into three tiers based on project size. Tier One represented projects that contribute most to the IOU savings claims. In most cases, each project contributes at least 2% of program savings.[17] Tier One also included MF-WB projects. Tier Two comprises projects contributing approximately 1% to program savings, and Tier Three projects contribute <1%. The evaluation team targeted a census of Tier One and MF-WB projects, and evenly splitting the remaining target completes between the two remaining tiers.

To minimize nonresponse bias, the evaluation team worked with the IOUs to mail participant contacts a letter informing them that the survey was pending and encouraging them to participate. In addition, the evaluation team used the most experienced interviewers, particularly for Tier One and Two projects. These interviewers could schedule and adjust telephone appointments, make additional phone calls to talk with multiple decision makers (as provided or recommended by the primary contact), and had ample time to complete the interviews.

Table 3-3: Target and Completed Surveys by Tier

	Target Sample		Completed Sample	
	Count	Percent (%)	Count	Percent (%)
Total	237	100%	252	100%
Tier One	60	25%	8	3%
Tier Two	89	38%	35	14%
Tier Three	88	37%	209	83%

Table 3-4: Completed Surveys by IOU

Utility	Program	Completed Surveys
Total		252
PG&E	MFEER	43
SCE	MFEER	152
SDGE	MFEER	26
SoCalGas	MFEER	31
SDGE	MF-WB	0

[16] Targeted sample sizes were based on an assumption of a dichotomous variable with a 50% proportion, and were adjusted based on finite population correction factors.

[17] The SCE MFEER program had a few larger projects. For SCE, projects in Tier One contributed at least 0.5% of program savings.

As mentioned earlier, contacts for these surveys were originally derived from the CPUC tracking databases. During the initial survey calls, though, the evaluation team found that many of the contacts provided were tenants, not the primary decision maker at the property level. To mitigate this, the evaluation team contacted utility staff to research additional contacts at the site level, and added the new information to the existing contacts.

Ultimately the total survey goal of 237 was exceeded, although the evaluation team did not meet the survey quotas by tier and the goal of oversampling the Tier One and Tier two sites. Each site in Tier One and Tier Two was called at least 10 times; however, the evaluation team contacted only 43 of the 149 planned sites in these two tiers combined (29%, Table 3-3). As planned, when a goal target for a given tier was exhausted (because of refusals or an inability to contact), those target completes were filled by the following tier to ensure that the overall number of surveys were completed. As a result, the evaluation team completed additional surveys from Tier Three participants, resulting in completing 209 surveys from this stratum (Table 3-3). While the survey did not achieve the IOU or tier level targets, the achieved sample was similar to a random sample, with a slightly over half the respondents from the SCE program, and the majority of the surveys conducted (83%) from Tier Three participants.[18] Additionally, none of the four MF-WB participants were successfully reached, therefore, the NTFR and baseline assessment were not performed on the MF-WB programs.

3.2 Analysis

This section outlines the various analysis methods used in the database assessment, engineering reviews, baseline assessment, and FR estimation.

3.2.1 Database Assessment

The database assessment comprised two parts: (1) determining that necessary information was present and easily accessible in the data provided, and (2) confirming that life-cycle savings values were calculated correctly for ER measures. For the first step, the evaluation team ensured that the following fields were populated in the IOU- and REN-provided MF-WB databases:

- Participant contact information
- Measures installed
    - Quantity
    - Location
    - Efficiency
- Preexisting conditions, including measure efficiency[19]
- Types of and fuels for hot water, cooling, and space heating systems
- Utility account numbers for both common areas and units for each participating property.

To confirm life-cycle savings calculations, the evaluation team reviewed the CPUC tracking databases to assess whether the savings calculations correctly accounted for the ER baseline. Specifically, life-cycle savings for ER projects should be calculated using the ER baseline for the RUL period, then by using a code baseline for the remainder of the EUL, or

[18] Program tracking indicates that <1% of projects were in Tier One and Tier Two, with 99% of projects in Tier Three.
[19] Preexisting conditions are important for assessing the baseline for ER measures.

$$LifeCycle\ Savings = (RUL * Savings_{ER}) + ((EUL - RUL) * Savings_{Code}).$$

Project-level EUL values should be a weighted average of the EULs for each individual measure. Given that the RUL is one-third of the EUL,[20] life-cycle savings could be calculated as

$$LifeCycle\ Savings = \left(\frac{EUL}{3} * Savings_{ER}\right) + \left(\left(\frac{2*EUL}{3}\right) * Savings_{Code}\right).$$

EUL can be calculated through

$$EUL = 3 * \frac{LifeCycleSavings}{Savings_{ER} + 2*Savings_{Code}}.$$

3.2.2 Engineering Review

This analysis consisted of applying inputs found in SDG&E backup documentation to DEER or engineering algorithms, and documenting the resulting ex post savings numbers. The team combined the measure-level ex post savings into projects and compared these to the project-level savings from the CPUC data to determine a realization rate for kilowatt-hour, kilowatt, and therm savings estimates.

3.2.3 Consumption Analysis

Two steps were associated with the consumption analysis: (1) linking the billing data back to project savings data and validating the comprehensiveness of both data sets, and (2) comparing the reported savings to actual preprogram billing data. Linking the billing to the project savings data involved using the accountIDs and the physical address of the complex. The team evaluated the completeness of the preprogram billing data to ensure that the number of units associated with the consumption data met or exceeded the reported number of units in a project. As discussed earlier and again in Section 4, the consumption analysis must have complete project consumption data to accurately incorporate the full impact of the program. If only partial consumption data were available, this analysis may have overstate program impacts, depending on the units in the multifamily building covered by the analyzed billing data.

Once the evaluation team evaluated billing data completeness, analysts reviewed consumption data from projects for which consumption information was available. For these projects, the evaluation team compared the ex ante annual savings with the preprogram consumption for the 12 months pre-measure installation to determine the proportion of consumption represented by the ex ante savings claims. To be clear, this consumption analysis is a high-level review of the ratio of claimed savings to annual usage, and is not intended to be a more in-depth statistical billing analysis that includes weather normalization.

3.2.4 Baseline Assessment

The ER battery in this effort was based on research and lessons learned from a variety of evaluations and TRMs.[21] Furthermore, the baseline assessment as indicated in the CPUC ER guidance document[22] has similar criteria to determine ER. The CPUC criteria include two basis components: program influence and continued

[20] Per DEER

[21] IL TRM. Version 4.0; Navigant Consulting, Inc. Home Energy Efficiency Rebate Program. January 23, 2015; Gas Program Year 2 Evaluation Report. February 27, 2014; and
The Cadmus Group, Inc. 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to Gross, Market Effects, and Equipment Replacement Timing. Volume 1. Part of the Massachusetts Residential Retrofit and Low Income Program Area Evaluation. June 2013.

[22] 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.

viability of the existing equipment. The ongoing challenge in ER evaluations is finding a balance between the data needed to assess a measure as ER, and those which can be reasonably collected during a telephone survey. To achieve that balance, the ER assessment was based on the following five metrics:

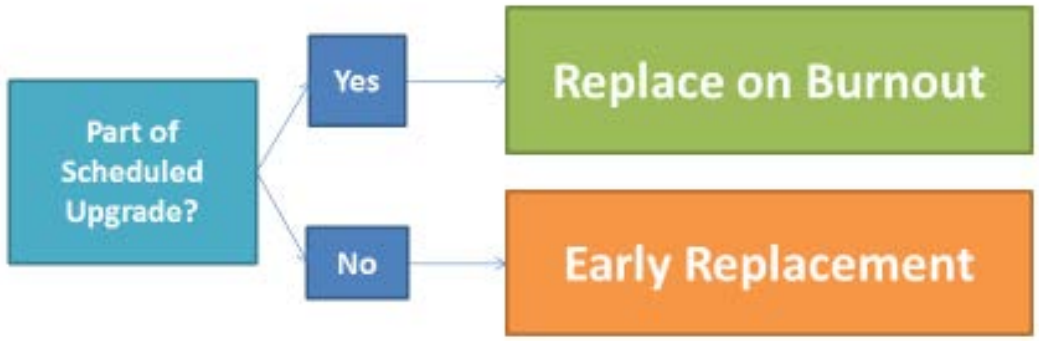
1. Working status
2. Age
3. Expected remaining life
4. Part of regularly scheduled/government-mandated upgrade
5. Standard practices during the scheduled upgrade.

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.

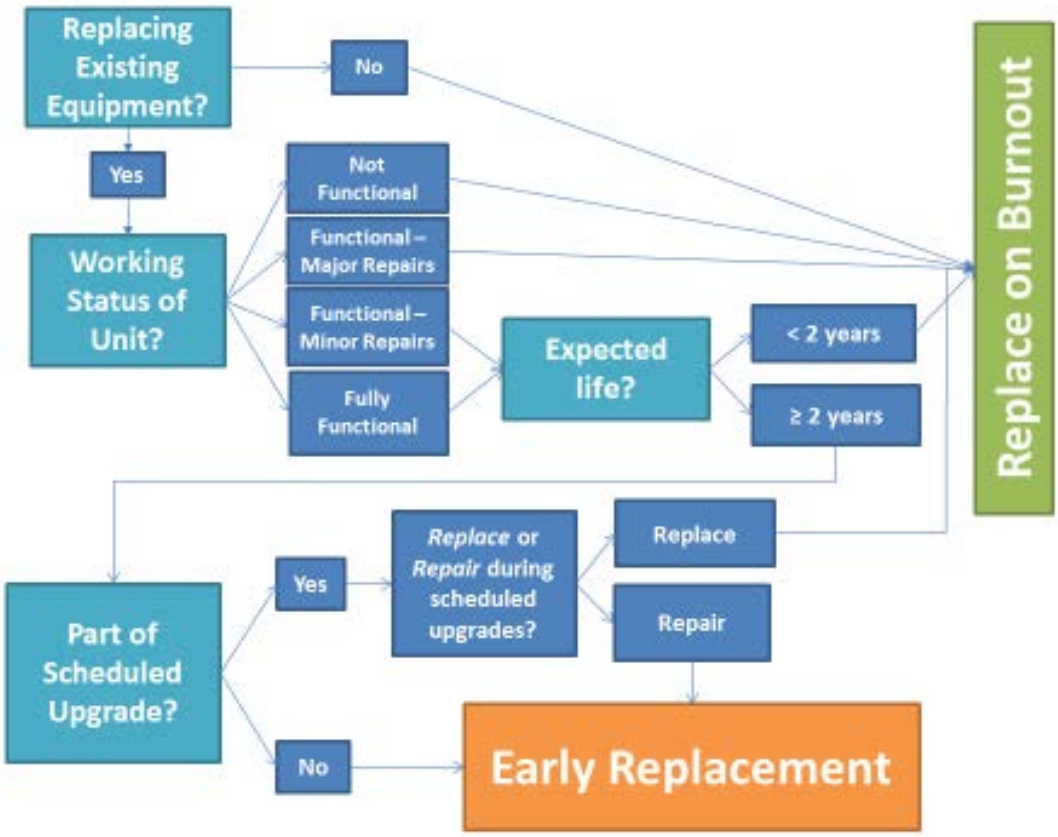
The evaluation team assessed baselines at the measure level to account for the possibility that the likelihood of ER could differ by measure. To derive a single ER estimate for each measure, each project-level measure quantity was used to proportionally weight up to the overall sampled quantity for that measure. For example, lighting and thermostat setback measures were excluded from the baseline analysis and assumed to be ER measures. Windows, roofing, small DHW (e.g., faucet aerators and low-flow showerheads), and insulation measures were assumed to be ER unless they were not part of a regularly scheduled, planned, or government-mandated upgrade process. All other surveyed measures required a more detailed ER logic, which factored in the working status of the replaced equipment and the expected remaining life,[23] as well as whether the equipment was part of a regularly scheduled upgrade. Figure 3-6 and Figure 3-7 illustrate the two-tiered ER logic schemes.

Figure 3-6: ER Logic for Small DHW, Roofing, and Shell Measures



[23] 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 3-7: ER Logic for All Other Surveyed Measures



3.2.5 Free-Ridership Estimation

The FR battery used in the participant survey was based on the CPUC Energy Division's framework to the extent possible. It is important to note that this is a general framework meant to be adjusted for the individual program needs (as stated on page 1 of that document; see footnote 14). 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 net-of-free-rider ratio (NTFR) 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 various program and program-related elements in the customer's decision to select the specific program measure at the time.
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 NTFR value was applied to all measures within that project. Individual measure-level NTFR 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
- 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
- If a 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 if they understood the question, were able to provide an open-ended response to the consistency check question, and if they would like to adjust the scoring from one or both of the questions that were inconsistent.

4 FINDINGS

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

4.1 Database Assessment

4.1.1 Multifamily Whole Building Database Assessment Findings

The completeness of MF-WB data varied substantially between implementers. The SDG&E MF-WB data were the most comprehensive of the MF-WB programs, and contained nearly every piece of requested information. Initially, BayREN was not tracking necessary measure-level details; however, BayREN chose to review past project data to populate a database to facilitate this evaluation. BayREN and SoCalREN backup documentation, such as work papers, procedures, and project site assessments were very useful to flesh out project specifics. SoCalREN provided some, but not all, necessary information. For example, SoCalREN provided the number, quantity, and efficiency of installed measures, but not the location. PG&E was unable to provide any measure-level information and, as a result, could not be evaluated.[24] Table 4-1 illustrates the completeness of the MF-WB databases. In the table, 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. As mentioned earlier, 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), but did check that the data were within acceptable ranges.

[24] The evaluation team and Energy Division personnel made multiple requests for the PG&E data, including emails, EEstats requests, and conference calls. PG&E representatives reported that the program was not tracking this measure-level data during the pilot phase of the program.

Table 4-1: MF-WB Database Completeness

Attribute		PA			
		SDG&E	PG&E	BayREN	SoCalREN
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 Account Numbers					
	Tenant Spaces	●	○	◑	○
	Common Areas	●	●	◑	●

The second step in the database assessment task entailed confirming life-cycle savings and calculating EUL values correctly for ER measures. For PG&E, BayREN and SDG&E life-cycle calculations, the evaluation team could not confirm if the program administrators are using a dual baseline when calculating lifetime savings for ER measures. It appears that PG&E, BayREN, and SDG&E are calculating life-cycle savings by multiplying first-year savings (which appear to be ER savings, or efficient vs. existing efficiency) by the full EUL. This calculation would overestimate life-cycle savings because it does not account for the replacement of the unit after the RUL. SoCalREN, however, appears to be using the correct calculation for life-cycle savings.

Both BayREN and SoCalREN assigned an EUL of 18 years for all MF-WB projects; SDG&E assigned three projects an 16.5-year EUL and one project an 16-year EUL; and PG&E assigned all seven projects an 10-year EUL. Project EULs should be calculated based on the EULs of individual measures installed, not a set or assigned value.[25]

One additional area of improvement for the MF-WB tracking data would be the ease of locating the IOU MF-WB projects within the tracking data. The evaluation team had difficulty differentiating the MF-WB projects from the single-family EUC projects. In some cases, the team had to go back to the implementers for clarification on projects to accurately locate the MF-WB projects. In the future, these two EUC project streams should be assigned different program names or numbers to facilitate clear delineation between the single-family and multifamily projects.

[25] See section 3.2.1 for details on this methodology.

4.1.2 Multifamily Energy Efficiency Rebate Database Assessment Findings

The evaluation team identified a number of areas for improvement within the MFEER tracking database during the MFEER evaluation. First, the MFEER tracking databases did not all have a way of grouping individual measures into projects. Many property owners install more than one measure at a given property. Currently, there is not a field to enable evaluators to bundle measures into projects. Accurate grouping is important when surveying property owners because it allows a single call or visit to encompass all the measures installed at a particular site or project.

Second, contact data for the MFEER participants were very inaccurate. As mentioned in Section 3.1.4, the participant survey could not meet the target number of completes, by tier, because of the inability to contact the primary decision maker. During the initial survey tests, the majority of contacts were the property tenants, not the decision maker, and the evaluation team had to stop calling and re-request contact information from the IOUs. These poor data caused unnecessary delays in the evaluation process, and decreased the efficacy of the recruitment letters because many were sent to incorrect addresses.

4.2 Engineering Desk Review

As noted earlier, the evaluation team conducted an engineering desk review of the four SDG&E MF-WB sites to assess the reasonableness of the savings assumptions. The evaluation team, however, was unable to fully accomplish this task for a few reasons. First, the project documentation for Project 2 did not contain the quantity (or square feet) of the window measures. Without this particular metric, the evaluation team was unable to quantify savings for that measure, rendering any project-level savings inaccurate. Second, the team could not find comparable savings for floor insulation, which were incented in both Project 1 and Project 3. After thorough review, the team could not find similar incented measures in comparable jurisdictions, and therefore could not calculate savings on this measure. Similar to windows, the team was unable to quantify savings for that measure; therefore, any project-level savings would be inaccurate for Projects 1 and 3. With only four completed MF-WB projects to evaluate, the evaluation team could not make conclusive findings through the engineering review.

4.3 Consumption Analysis

The primary goal of the consumption analysis was to ensure that the savings assumptions for the EUC projects were within reasonable bounds relative to the annual consumption (gas, electric, and overall combined Btu) of the projects. This analysis involved two primary steps: (1) connecting the projects with the billing data and ensuring that the billing data were comprehensive (i.e., included all units in the building and common areas); and (2) verifying the savings relative to the annual consumption.

The first step required billing data to be available. Billing data for each multifamily project were made available to the evaluation team via the CPUC central consumption data repository, managed by DNV-GL. For the MF-WB projects, SDG&E had billing data for all four MF-WB projects.[26] To match the project with the billing data, the evaluation team used address, gas, and electric customer accountID matching. As Table 4-2 shows, the primary issue with matching by customer accountID was that it provided incomplete billing data for the site. There was only one project, SDG&E Project 4, which included all units by matching via the account. Although the three other projects often contained the equivalent number of units in the billing data

[26] SCE and SoCalGas did not complete any MF-WB projects during 2013 and 2014, and PG&E did not provide sufficient information to evaluate. See Sections 2.1 and 4.1.1 for details.

for a string of months, none of the three had all the billing data for all the units for an entire year. It was clear from reviewing the billing data that matching usage by account does not provide a valid approach because tenants are constantly moving into and out of these sites, and accountIDs will change as a result. If the database were able to track meter numbers for an entire complex, however, program tracking and billing data could be more effectively matched. Fortunately, the billing data was also matched by using the site address, which provided a more complete picture of the project consumption.

To summarize the billing data, each project's billing was aggregated up across all accounts and months to annual billing, using the projectID. The evaluation team then checked that the number of units for each site in the billing data matched or exceeded the number of units associated with each project in the tracking data. The number of units for each site was derived from data provided by SDG&E, which included multifamily complex details, such as the number of units in each building, the number of buildings, and the total number of rooms. If the units matched or exceeded the units listed in the reference file, the team deemed the billing data to be sufficient to compare. Otherwise the site was listed as insufficient and flagged in the analysis, noting that results may not be indicative of the entire complex. Ultimately, the team used all four SDG&E projects for this consumption analysis though site SDG&E Project 1 is flagged because the unit counts did not meet the criteria set for this analysis.

Table 4-2: Billing Data Match by Fuel Type

Entity	Total Units	Address Matched Accounts	AccountID Matched Accounts	Meet or Exceed Unit Counts?
Electric				
SDG&E 1	4	3	2	N
SDG&E 2	8	9	6	Y
SDG&E 3	40	45	33	Y
SDG&E 4	56	1*	0	Y
Gas				
SDG&E 1	4	3	2	N
SDG&E 2	8	9	6	Y
SDG&E 3	40	41	33	Y
SDG&E 4	56*	1*	1*	Y

* Note that only one account exists for the SDG&E 4 project and is master-metered. Also note that the accounts may exceed the units because common areas were included.

The second step was to compare the savings with the annual usage data by fuel (kilowatt-hour electric, therm gas, and overall million Btu usage). To compare usage, the team reviewed the billing data from the 12 months of consumption before the project was installed.[27] Any project with a savings ratio (ex ante savings divided by preprogram annual usage) of under 10% or over 50% was flagged for further scrutiny.

Table 4-3 reviews the savings-to-usage ratio strata.

[27] Historical 2-year averages from 2012 and 2013 were also compiled and reviewed against the 12-month preinstallation data to ensure that there were no anomalies. Only project SDGE 4 showed a significant difference.

Table 4-3: Review of Projects by Savings-to-Usage Ratio

Entity	Total Number of Units Reviewed	Total Number of Units Matched	Savings to Usage Ratio
	Electric (kWh)		
SDG&E 1	4	3	1%*
SDG&E 2	8	9	33%
SDG&E 3	40	45	5%
SDG&E 4	56	1 (master-meter)	94%
	Gas (Therms)		
SDG&E 1	4	3	27%*
SDG&E 2	8	9	13%
SDG&E 3	40	41	16%
SDG&E 4	56	1 (master-meter)	19%
	Overall (Btu)		
SDG&E 1	4	3	19%*
SDG&E 2	8	9	23%
SDG&E 3	40	41	12%
SDG&E 4	56	1 (master-meter)	21%

*Site SDG&E 1 was listed as having four units but the team was able to extract only three units from the billing data.

The electric savings ratios, which are the claimed electric savings divided by the 12-month pre-installation usage, were scattered. Two projects were well below 10%, one project was well above 20%, and the fourth was at almost 100% of annual usage[28]. The gas savings values were consistent, with three of the four between 10% and 20%, and only one project above 20% (at 27%). Given the lack of a larger population to examine the savings ratios, this consumption analysis has shown the overall Btu and gas therm-based project-level savings claims to be only marginally higher than what historical usage patterns would suggest, though the ratios were not so high as to raise flags about the modeling procedures and assumptions used for SDG&E. However, the electric savings ratios proved to be inconsistent, with two sites being well above the 10-20% range and one site well below the 10% threshold.

4.4 Baseline Assessment

Because the tracking database included the replacement status (the database field was titled "MeasAppType"), the evaluation team leveraged the tracking-database-assigned baseline conditions to compare against the survey-determined baseline. The team confirmed with PG&E personnel that they consistently assume ROB for all installed MFEER measures, and the MeasAppType field in the tracking

[28] The SDG&E 4 project showed consistently lower usage in 2012, 2013 than expectations based on the project size and associated savings would have reflected. Note that by using the calendar year 2014 billing data for this project (which includes post-installation), the consumption ratio for this fourth project was considerably lower at 27%. This would lead the team to believe there was something wrong with the billing data being reported.

database confirmed this. As for the other IOUs, each IOU had different assignments and percentages of those assignments in each measure group. Table 4-4 reviews each measure group, along with the IOU-defined baseline. Note that the Retrofit Add-on (REA) baseline represents add-on retrofit measures (e.g., lighting controls); the RET represents retrofit of an existing measure. Both of these assignments use existing customer baselines instead of code. The proportional Btu-based savings are shown in parentheses for those measure groups that showed different baseline assignments.

Table 4-4: Baseline as Assigned in the MFEER Tracking Database

Measure Category	PG&E	SCE	SoCalGas	SDG&E
Shell	ROB	ER	REA	NA
Lighting	ROB	ER (77%); REA (7%); ROB (16%)	N/A	RET (34%); ROB (66%)
Small DHW	ROB	REA	N/A	ROB
Large DHW	ROB	ROB	REA (89%); ROB (11%)	RET
All Others	ROB	ER (86%); ROB (14%)	ROB	NA

To provide some additional context on the baseline assignments shown in Table 4-4, the following bullets review the measure group baselines:

- Shell: SCE assigned 100% ER for window tinting and PG&E assigned 100% ROB for windows; SoCalGas assigned 100% REA for insulation measures.
- Lighting: PG&E assigned all lighting as ROB; SDG&E assigned the majority of savings as ROB. SCE assigned the majority of savings as ER (all SCE ER lighting measures were also designated as direct-install delivery type).
- Small DHW: Both PG&E and SDG&E assigned ROB and SCE assigned REA (all SCE small DHW projects were also designated as direct-install delivery type).
- Large DHW: All large DHW projects were consistently assigned across the IOUs, with SDG&E and SoCalGas assigning either RET (SDG&E) or REA (SoCalGas) to water heater boiler controls.
- All Others: Appliances were consistently ROB, space heating furnaces and boilers were consistently ROB, cooling measures were all ROB except for SCE ventilation fan (REA), and pool heaters and pumps were all ROB (except for SCE pool pumps, which were all ER).

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 non-lighting measures were included in the second group. A detailed description of the factors underpinning this logic is included in the analysis discussion in Section 2. As a reminder, to derive a single ER estimate for each measure group, each project-level savings was used to weight relative to the overall sampled savings for that measure group.

Unlike the MF EUC program, the MFEER program does not assume or default to ER savings for all measures (see Section 3.2.4 for a more detailed discussion of this approach). ROB compares the efficient measure

against code; the results of this analysis, however, demonstrate that because many of the participants had replaced fully functional equipment outside of a normally scheduled upgrade, many of the participating sites do have ER measures. For example, 66% of the window and insulation projects (versus 31% across all projects in the tracking database) and 90% of the small DHW projects (versus 15% in the tracking database) qualified as ER (Table 4-5).

Table 4-5: Comparison of ER for Shell and Small DHW Measures (MFEER)

Measure Category	Measure(s)	% Survey ER	% Tracking ER
Shell (n = 26)	Windows, Insulation (Attic, Wall, Floor, Crawlspace)	66%	31%
Small DHW (n = 30)	Faucet Aerator, Low-Flow Showerhead	90%	15%

For all other non-lighting measures, respondents were able to provide ER details on all but one-eighth of the surveyed measures (5 of the 38 measures). The sample sizes were small, however, for many of the individual measure groups, but the results do show evidence of conflicting baselines relative to the tracking database, and in both directions (for ER and ROB). For example, 21% of the large DHW savings (versus 48% across all projects in the tracking database) came from ER projects (

Table 4-6). All of the ER responses resulted from the measure being an installation that was replacing equipment that was either fully functional or in need of only minor repairs.[29]

Table 4-6: ER for Large DHW and Other Measures (MFEER)

Measure Category	Measures	% Survey ER	% Tracking ER
Large DHW (n = 27)	Storage/Tankless/Boiler Water Heaters, Hot Water Boiler Control	21%	48%
All Others (n = 29)	Appliances, Space Heating, Pool	72%	63%

The evaluation team leveraged measure specific DEER-based EULs as an additional step to ensure that the proper assignments were made for the measure baselines listed in Table 4-5 and

Table 4-6. As part of the survey, all respondents were asked the age of the equipment and their expectations for the RUL. The average self-reported RUL for each measure was then compared against the DEER-based RUL (which assumes one-third of the EUL). Nearly every respondent, except three, showed self-reported RULs that met or exceeded the DEER-based RUL. The three measures where the average respondent RUL did not match or exceed the DEER-based RUL were one pool pump, one clothes washer, and

[29] In consultation with the CPUC, the evaluation team determined applying retrospective baseline adjustments would be extremely complex due to the individual savings assumptions for each measure and project when mapped to the DEER database. As such, this was considered beyond the scope of this evaluation. But as noted in the recommendations, the IOUs and their contractors should set up a survey at intake to better determine the appropriate baseline for each project and measure, and apply that determination during savings assignments.

one storage water heater (the respondents believed there was less than 1 year left in their useful lives). For these respondents, the baseline was defaulted to ROB because of the questionable longevity of their replaced equipment.

Taking the baseline analysis one step further, the team compared the tracking-database-assigned baseline conditions for the survey respondents relative to the survey response conditions (shown in Table 4-7).[30] Table 4-7 demonstrates the percent of Btu-based savings where the survey results did not match the tracking database (gray highlighted cells) and where results matched the tracking database (non-highlighted cells). The table also includes a "savings differentiated" column that identifies the measures where there is no DEER-based savings benefit to ER (small DHW), meaning that the savings are not differentiated for ER relative to ROB.

For large DHW measures, 8% of the large DHW survey participants and 11% of shell participants had indicated ER, whereas the tracking database had these participants as ROB baselines. Even more significant is the 30% of the "All Others" measure group, which indicated ROB but was listed as ER in the tracking database. These were pool pump measures, one of which was scheduled for replacement as part of normal maintenance. The second was determined to have less than 2 years life left. Although these two examples stand out as notable disconnects between respondent- and tracking-assigned baselines, note that (1) the approach used for the assignments may account for part of this difference and (2) the other measure groups did not show disconnects. It is encouraging to see that these two distinct approaches to assignment also provided some consistency.

Table 4-7: Comparison of Tracking versus Survey ER for Survey Respondents

Measure Category	Tracking ER/ROB	Survey ER	Survey ROB	Savings Differentiated?
All Others (n = 29)	ER	15%	**30%**	Yes
	ROB	**3%**	53%	
Large DHW (n = 27)	ER	73%	**1%**	Yes
	ROB	**8%**	19%	
Small DHW (n = 30)	ER	NA	NA	No
	ROB	28%	72%	
Shell (n = 26)	ER	88%	0%	Mixed
	ROB	11%	1%	

4.5 Free-Ridership Assessment

To report on MFEER 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 NTFR battery, which 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.

[30] The RET- and REA-assigned baselines (tracking database "MeasAppType") were reassigned as ER to simplify Table 4-8 because both use existing equipment as baselines similar to ER.

In all, 252 MFEER respondents took part in the survey, with 224 being able to complete all three subcomponents of the FR section.[31] The vast majority of these (216 of 224) noted that their responses were indicative of all the installed measures, so that they did not have to provide measure-specific FR estimates. Overall net-of-FR for the IOU MFEER program was 51.6% based on a fuel-neutral Btu status. The three equally weighted components that comprise the net-of-FR estimate are shown in Table 4-8. The details behind these estimates follow the table.

Table 4-8: 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%)
47.1%	56.1%	51.7%	51.6%	±1.9%

Note that these results should be used with caution because they were specific to the MFEER program as it existed in 2013 and 2014. As the program measure mix, incentive levels, or outreach/intervention strategies change, the FR may also change, therefore 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 net-of-FR (as noted in Section 2.2.4), and does not include spillover.

4.5.1 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 age or condition of the old equipment was more important than the availability of the IOU rebate (Table 4-9). These responses fed into the PAI-1 score.

[31] As noted previously, none of the four MF-WB participants were reached during the survey effort. Therefore, these results are applicable for MFEER programs only.

Table 4-9: Influences on Installation Decisions

Influence on Decision	Type of Influence	Average Importance Score
Age or Condition of the Old Equipment	Nonprogram	7.7
Availability of the [IOU] Rebate	Program	7.4
Compliance with City, State, or Federal Regulations	Nonprogram	7.2
Feasibility Study, Energy Audit, or Other Types of Technical Assistance Provided by the Program	Program	7.2
Increased Value of Property	Nonprogram	7.2
Payback or Return on the Project	Nonprogram	7.0
Recommendation from an Equipment Vendor	Nonprogram	7.0
Compliance with Company's Normal Maintenance Policies	Nonprogram	6.9
Information from Program or Utility Training Course	Program	6.5
Previous Experience with the [MFEER] Program	Program	6.4
Previous Experience with This Type of Project	Nonprogram	6.1
Utility Account Representative	Program	5.7
Program Marketing Materials	Program	5.5

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 4.71, or 47.1%.

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 47.1%).

4.5.2 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 slightly more (n = 76) ranked the importance of nonprogram influences as higher than or equal to that of the program (n = 63), more than three times the respondents gave the program score 100% (n =18) relative to those who gave a nonprogram score of 100% (n = 5). 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 4-10).

Table 4-10: Relative Importance of Program and Nonprogram Influences on Installation Decision

Relative Importance of Factors	Count of Responses (n = 224)
Ranked Program Influences More Important than Nonprogram Influences	63
Ranked Program and Nonprogram Influences Equally Important	85
Ranked Nonprogram Influences More Important than Program Influences	76
Ranked Program 100% Influence	18
Ranked Nonprogram 100% Influence	5

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 NTFR) by half because they were already planning to install the measure before any program intervention. More than one-quarter of all of respondents (29%) indicated that they had learned about the program after deciding to install the equipment. The average PAI-2 score after the adjustment was 5.61, or 56.1%.

4.5.3 Likelihood of Installing Same Equipment (PAI-3)

The final component of NTFR, 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 NTFR. Respondents, on average, provided a moderate likelihood of installing the same efficiency equipment in absence of the program, with an average likelihood score of 4.83, resulting in a PAI-3 score of 5.17, or 51.7%. A review of the respondent likelihood of installing the same equipment is included in Table 4-11 below. Note that the total responses are greater for PAI-3 than PAI-2 since more respondents provided answers for PAI-3.

Table 4-11: Likelihood of Installation Same Equipment

Likelihood of Installing (0 = not at all likely, 10 extremely likely)	Count of Responses (n = 224)
Likelihood above 5	103
Likelihood below 5	94
Likelihood equal to 5	27
Extremely likely (10)	63
Not at all likely (0)	47

4.5.4 Free-Ridership Results by Program Attribution, Measure Group, and Fuel Type

Where sample sizes allow, the team has included the results on a utility- and measure-group-level basis.

Table 4-12 reviews the ex ante assumed NTFR by measure. During a review of the tracking database ex ante NTFR values, the evaluation team uncovered several issues and inconsistencies between the IOUs:

- PGE did not populate 99.5% of all savings in the database NTFR assignment identifier "NTG_ID." As a result, the team could not establish any linkage to DEER. Unfortunately the assigned values were not consistent with DEER by manual review. For example, 69% of the Btu savings were assigned an NTFR of 0.6, although the only residential-based DEER measures with an NTFR of 0.6 are LEDs, and none of the PG&E measures with 0.6 NTFR were LEDs.
- All SDG&E and SCG measures had database NTFR assignments "NTG_ID" that mapped to DEER, and there were no anomalies.
- SCE was the only IOU that assigned measures as hard-to-reach (HTR) direct install (as classified by the CPUC).[32] These measures received an NTFR of 0.85.
- SDG&E assigned LEDs an NTFR of 0.85. SCE assigned this measure (for non-HTR participants) an NTFR of 0.55.
- SCE had assigned 3% of all savings to an NTFR of 0.7 that either lacked an NTG_ID assignment (and manual review verified that the assignment was not correct) or had an NTG_ID that did not match the associated value in the DEER database.

As noted for SCE, multifamily direct-install measures can qualify for a higher NTFR for customers who qualify as HTR as classified by the CPUC. Specifically, multifamily customers may be considered HTR if they are not within one of the excluded geographic areas.[33] If the units are in one of the excluded geographic areas, the customer must:

a) also qualify for either the California Alternative Rates for Energy (CARE) or Family Electric Rate Assistance Program (FERA) rate, AND

b) have a primary language spoken other than English.

[32] CPUC Energy Division, Resolutions G-3497 and E-4700, Attachment 3. December 2014.

[33] The excluded areas are the U.S. Office of Management and Budget (OMB) Combined Statistical Areas of the San Francisco Bay Area, Greater Los Angeles Area, and the Greater Sacramento Area, or the OMB metropolitan statistical area of San Diego County.

Table 4-12: Tracking Database Reported Ex Ante NTFR by IOU and Measure

Measure	PGE Ex Ante NTFR Value	SCE Ex Ante NTFR Value	SoCalGas Ex Ante NTFR Value	SDG&E Ex Ante NTFR Value
Lighting	0.55; (Outdoor Sensor = 0.60)	LED = 0.55; LED Pool = 0.70 & 0.85; CFL = 0.55 & 0.76; Control/Sensor = 0.55 & 0.70 HTR = 0.85		0.55 (CFL); 0.85 (LED)
Shell (Attic/Wall Insulation, Windows)	0.55 and 0.80		0.55	
Small DHW	0.55 and 0.70	Shower = 0.70; Faucet = 0.65		0.55 and 0.59 and 0.65 (2013); 0.55 and 0.65 (2014)
Large DHW	0.55 and 0.60	0.23	Storage = 0.23; Tankless, Boiler Control = 0.55	0.55
All Others (Appliances, Space Heating, Cooling)	0.55 and 0.60 and 0.70	Clothes Washer = 0.30; Refrigerator = 0.55 and 0.70; All Others = 0.55 and 0.70		
Weighted Average IOU Ex Ante NTFR (kWh)	0.57	0.62	0.55	0.58
Weighted Average IOU Ex Ante NTFR (Therms)	0.61	0.57	0.54	0.53

Table 4-13 and Table 4-14 help illustrate the FR across each IOU and the measures that were offered. The considerably higher ex ante PG&E demand (kilowatts) NTFR is attributable to the windows measure, which represented almost 80% of the demand savings and received a 0.8 ex ante NTFR. The higher ex ante PG&E gas (therm) NTFR value is due to several water heating measures, that represent more than 70% of the gas savings, receiving an ex ante NTFR of 0.6. As a whole, the gas measures tended to have higher FR, particularly the gas measures that comprised the majority of the SoCalGas program, accounting for the higher FR value.

A savings-weighted fuel-specific aggregate NTFR value was calculated to derive an overall IOU-level NTFR estimate. The IOU-level ex ante and ex post NTFR estimates are included in Table 4-13 below. The decline in SCE NTFR can be attributed to a lower NTFR for lighting measures. The decline in the SoCalGas NTFR can be

attributed to a lower NTFR for water heating measures (these had previously received a 0.23 NTFR for storage and a 0.55 NTFR for tankless water heaters).

Table 4-14 shows the ex post NTFR values with their associated statistical precision.

Table 4-13: Ex Ante and Ex Post NTFR by IOU and Fuel Type

IOU	kWh		kW		Therms	
	Ex Ante kWh NTFR	Ex Post kWh NTFR	Ex Ante kW NTFR	Ex Post kW NTFR	Ex Ante Therms NTFR	Ex Post Therms NTFR
PG&E	57.0%	56.7%	74.8%	47.6%	61.2%	51.1%
SCE	62.3%	53.4%	55.8%	54.4%	57.9%	53.4%*
SoCalGas	55.0%	38.0%*	55.0%	38.0%*	53.6%	38.0%
SDG&E	58.0%	58.8%	59.6%	60.3%	51.2%	46.8%

* Designates interactive-based or secondary fuel benefits that receive the same value as the primary fuel NTFR for SCE and SoCalGas

Table 4-14: NTFR Precision by IOU and Fuel Type

IOU	kWh		kW		Therms	
	kWh NTFR	kWh NTFR Relative Precision (90% Confidence Interval [CI])	kW NTFR	kW NTFR Relative Precision (90% CI)	Therms NTFR	Therms NTFR Relative Precision (90% CI)
PG&E	56.7%	5.2%	47.6%	5.3%	51.1%	4.6%
SCE	53.4%	2.3%	54.4%	2.3%	53.4%*	2.3%*
SoCalGas	38.0%*	4.6%*	38.0%*	4.6%*	38.0%	4.6%
SDG&E	58.8%	5.9%	60.3%	6.0%	46.8%	5.8%

* Designates interactive-based or secondary fuel benefits that receive the same value as the primary fuel NTFR for SCE and SoCalGas

The evaluation team also calculated NTFR at the measure-group level. The measure groups follow similar groupings that were used in the ER analysis: lighting, small DHW (which includes faucet aerators and low-flow showerheads); large DHW (which includes boiler, storage, and tankless hot water, along with boiler controls); shell (insulation and windows); and all others (which includes appliances and pool pumps and pool heaters). The electricity-based measures showed higher NTFR ratios relative to the gas measures, consistent with the ex ante reported estimates. As shown in Table 4-15, lighting had the highest NTFR (55.2%) and all others (gas) had the lowest NTFR ratio (38.7%).

Table 4-15: Net of Free-Ridership by Measure Group

Measure Group	NTFR	NTFR Relative Precision (90% CI)
Lighting	55.2%	2.1%
Small DHW	52.8%	5.3%
Large DHW	43.1%	5.1%
Shell	42.5%	5.5%
All Others (Gas)	38.7%	7.0%
All Others (Electric)	53.2%	7.1%

Applying these ex post NTFR estimates to the IOU claimed savings results in a 12% decrease in energy (kWh), 17% decrease in demand (kW), and 23% decrease in the gas (therms) savings (Table 4-16).

Table 4-16: Ex Ante to Ex Post Net Savings Values by IOU

IOU	kWh (net)			kW (net)			Therms (net)		
	ex ante	ex post	% change	ex ante	ex post	% change	ex ante	ex post	% change
SCE	17,752,793	15,224,539	-14%	1,163	1,133	-3%	-45,995	-42,449	-8%
SDGE	1,245,224	1,261,840	1%	85	86	1%	8,255	7,541	-9%
PG&E	1,171,596	1,165,194	-1%	909	579	-36%	405,815	338,743	-17%
SoCalGas	4,807	3,321	-31%	3	2	-33%	380,694	270,024	-29%
Totals	*20,174,420*	*17,654,894*	-12%	*2,160*	*1,800*	-17%	*794,764*	*616,308*	-23%

5 CONCLUSIONS AND RECOMMENDATIONS

The impact evaluation of the MFEER and MF-WB programs comprised four tasks: (1) a database assessment, (2) an engineering review and consumption analysis, (3) a baseline assessment, and (4) a FR estimation. The key conclusions and recommendations from each of these study components are presented in this section. Note that since one of the key objectives of this study was to serve as an evaluability assessment, many of the conclusions and recommendations concern tracking and process improvements to improve future evaluation efforts.

5.1 Database Assessment

5.1.1 Multifamily Whole Building Program[34]

Conclusion 1: The evaluated IOU MF-WB projects were difficult to isolate from the single-family EUC projects within the CPUC tracking database.

> **Recommendation 1:** The MF-WB projects should be assigned a different program name or number from the single-family EUC projects, to facilitate clear delineation between the two project streams.

Conclusion 2: The PG&E, SDG&E, SoCalREN, and BayRENMF-WB program tracking data have varying levels of completeness. As examples, PG&E is tracking inadequate levels of data, and SDG&E had nearly all required fields.

> **Recommendation 2:** IOUs and RENs should adjust data collection and program tracking to ensure all fields in Table 4-1, including participant contact information, measure details, pre-existing conditions, property systems, property details, and utility meter numbers are collected and easily accessible for all completed projects.

Conclusion 3: The evaluated tracking databases showed that projects were assigned a standard or deemed EUL instead of one based on actual measure installations using the logic described in this report.

> **Recommendation 3:** Program administrators should be sure to use the correctly savings weighted EUL and RUL instead of the set EUL currently reported in the tracking database.

Conclusion 4: Although PG&E, SDG&E, SoCalREN, and BayREN have assumed an ER baseline on their first-year savings, they are not always calculating life-cycle savings to reflect a change in baseline after the end of the project's RUL. For example, BayREN, PG&E, and SDG&E appear to be calculating life-cycle savings using ER conditions for the entirety of the project's EUL.

> **Recommendation 4:** Both IOUs and RENs should calculate life-cycle savings for ER projects using the ER baseline for the RUL period, then using a code baseline for the remainder of the EUL, or

$$LifeCycle\ Savings = (RUL * Savings_{ER}) + ((EUL - RUL) * Savings_{Code})$$

5.1.2 Multifamily Energy Efficiency Rebate

Conclusion 5: There is not a consistent way to bundle MFEER program measures into projects or properties, making it challenging to survey a single property owner on all his or her incented measures.

[34] Note that Conclusions/Recommendations 2, 3, and 4 are duplicated in the 2013-2014 REN and CCA Programs Impact assessment as the analysis is applicable to both audiences.

Recommendation 5: The evaluation team recommends assigning and using consistent SiteIDs for measures installed on a given application or site.

Conclusion 6: Contact data for the MFEER participants was highly inaccurate, leading to a low complete rate during survey efforts.

Recommendation 6: The evaluation team recommends that implementers accurately transfer contact information on the primary decision maker—as entered on the program application—into the CPUC tracking database.

5.2 Engineering Review

Conclusion 7: The team was unable to validate the program claimed savings via an engineering review because of insufficient tracking data and the inability to find deemed savings estimates.

Recommendation 7: Simulation models or billing analysis may provide a more effective approach to validating the claimed savings. In addition, site visits would allow for true verification of model inputs, which—as identified by the single-family assessment of EnergyPro—can significantly affect the accuracy of the claimed savings.

5.3 Consumption Analysis

Conclusion 8: Matching program data to billing data using accountIDs was largely unsuccessful, likely because of the high turnover rate for multifamily tenants. Because tenants are constantly moving into and out of these sites, accountIDs will change, making it difficult to match program tracking to billing data.

Recommendation 8: The program administrators should collect meter numbers to allow for improved matching of program and billing data. If the database were able to track meter numbers for an entire complex, program tracking and billing data could be more effectively matched at an even higher rate than by using an address match and ensure that all units and common areas are captured.

Conclusion 9: The consumption analysis of the MF-WB participants showed that the reported savings ratios were very close to project-level gas (therm) reported savings. Three of the four SDG&E EUC projects were within several percentage points of claimed savings, while the fourth was approximately 10% higher than reported.

Recommendation 9: Even though the savings claims were close to billing calibrated consumption ratios, it would still be optimal to allow aggregate project-level billing data to be shared with the program administrators to ensure calibrated models. The key to sharing aggregate site-level consumption data to the contractors would be ensuring privacy and security.

5.4 Baseline Assessment

Conclusion 10a: Although this report did not make any adjustments to gross savings based on the baseline assessment findings, **this research indicated that a substantial portion of projects may have been assigned incorrect baselines**. For example, 30% of ”all other” measure category were assigned ER in the

tracking database but were found to be ROB based on survey results, while 28% of small DHW measures were assigned ROB in the tracking database while the survey found ER baseline.

Conclusion 10b: A review of the baseline assignments in the tracking database showed inconsistencies within and across the IOUs for the same measure. For example, SDG&E assigned 100% of its large DHW projects as RET (ER); PGE and SCE assigned 100% to ROB; and SCG assigned 89% to REA (ER) and 11% to ROB. Although some of this disconnect can be attributed to the different large DHW measures installed, even the same measures received different baselines across the IOUs.

> **Recommendation 10: The IOUs and their contractors should set up a survey at intake to better determine the appropriate baseline for each project and measure**. The intake survey can follow a similar logic as the logic used in this report, or it should meet the CPUC-approved preponderance of evidence approach (see footnote 22). The baseline assumptions for a sample of projects should then be verified by an independent third-party evaluator. This should be consistently performed across all IOUs rather than piecemeal by only a select few.

5.5 Free-Ridership Assessment

Conclusion 11: The research found an overall NTFR of 51.6% for the 2013-2014 MFEER program. All three components to FR were consistent in showing high FR.

> **Recommendation 11**: As the MFEER program measure mix, incentive levels, or outreach/intervention strategies change, the FR may also change. These values should continue to be updated as the programs evolve.

Conclusion 12: A review of the ex ante NTFR values in the tracking database showed inconsistencies within and across the IOUs. In addition, some of the IOUs did not provide linkages between the NTFR assignments and the DEER-based tables that are used to provide NTFR documentation, nor could the NTFR assignments be manually linked between the tracking database and DEER. Finally, SCE had assigned 20% of its fuel-neutral (Btu) savings as HTR, with the higher NTFR of 0.85. None of the other IOUs used this assignment for their programs

> **Recommendation 12: The IOUs should properly and thoroughly assign DEER-based NTFR values to their measures in their tracking database systems**. The IOUs should also be sure to consistently assign the correct DEER values to the same measures, and also research the potential of assigning HTR status to their projects where applicable. Qualified customers should continue to receive the appropriate HTR NTFR value as long as there is sufficient documentation to justify their HTR classification. Future evaluation efforts should consider reviewing HTR participant classification documentation should HTR customers become a larger part of the MF programs.

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

Measure Group	Measure Category
Insulation (Wall, Attic/Roof)	Shell
Windows	Shell
Window film	Shell
Faucet Aerator	Small DHW
Low-flow showerhead	Small DHW
Water Heating Boiler	Large DHW
Tankless Water Heater	Large DHW
Storage Water Heater	Large DHW
Hot Water Boiler Controls	Large DHW
CFL and LED bulbs	Lighting
CFL and LED fixtures	Lighting
Occupancy Sensor and controls	Lighting
Pool (pump and heater)	All Others
Appliances (Refrigerator, Clothes Washer)	All Others
HVAC (ventilation fan, air conditioner, cool roof, space heater, space heating boiler, space heating furnace)	All Others

7 APPENDIX B: EX ANTE GROSS MEASURE SAVINGS BY IOU

End Use	Measure	PGE	SCE	SCG	SDGE	Total
		Annual kWh				
Appliance	Clothes Washer	44,256	134,061			178,317
	Freezer		52,632			52,632
	Refrigerator	13,897	315,424			329,322
Cooling	Air Conditioner		11,482			11,482
	Cool Roof	83,948				83,948
	Ventilation Fan		561			561
Large DHW	Storage Water Heater		6,268			6,268
	Tankless Water Heater					
	Water Heater Boiler Controls					
	Water Heating Boiler					
Lighting	Indoor CFL Bulbs		7,774			7,774
	Indoor CFL Fixture with Bulb(s)	423,132	8,751,394		1,173,467	10,347,993
	Indoor CFL Reflectors	664,696	308,363		5,320	978,378
	Indoor LED Bulbs		55,073		137,280	192,353
	Indoor LED Exit Sign					
	Indoor LED Fixture with Bulb(s)	1,137	588,678			589,815
	Indoor LED Reflectors	1,060	1,200,974		79,155	1,281,189
	Indoor Lighting Controls or Occupancy Sensors	89,355	1,745,212			1,834,567
	Indoor Linear Fluorescent Fixture or Bulbs		195,212			195,212
	LED Pool Light		1,237,243			1,237,243
	Outdoor CFL Bulbs		379,822			379,822
	Outdoor CFL Fixture with Bulb(s)	539,642	9,238,082		750,764	10,528,488
	Outdoor Lighting Controls or Occupancy Sensors	638				638
	Outdoor Linear Fluorescent Delamping					
	Outdoor Linear Fluorescent Fixture or Bulbs		31,974			31,974
	Outdoor Reflector CFLs		37,423			37,423
Pool	Pool Heater					
	Pool Pump	51,436	3,691,660			3,743,096
Shell	Attic / Roof Insulation			8,528		8,528
	Wall Insulation			212		212
	Windows	141,819	213,022			354,841

End Use	Measure	PGE	SCE	SCG	SDGE	Total
		Annual kWh				
Small DHW	Faucet Aerator		33,995			33,995
	Low-Flow Showerhead		274,044			274,044
Space Heat	Central System Space and Water Heater					
	Space Heater					
	Space Heating Boiler					
	Space Heating Furnace					
	Grand Total	**2,055,016**	**28,510,373**	**8,740**	**2,145,987**	**32,720,116**

Measure Group	Measure	PGE	SCE	SCG	SDGE
		Annual kW			
Appliance	Clothes Washer	7	50		
	Freezer		10		
	Refrigerator	3	57		
Cooling	Air Conditioner		5		
	Cool Roof	15			
	Ventilation Fan				
Large DHW	Storage Water Heater		1		
	Tankless Water Heater				
	Water Heater Boiler Controls				
	Water Heating Boiler				
Lighting	Indoor CFL Bulbs				
	Indoor CFL Fixture with Bulb(s)	44	720		120
	Indoor CFL Reflectors	76	30		1
	Indoor LED Bulbs				14
	Indoor LED Exit Sign				
	Indoor LED Fixture with Bulb(s)		47		
	Indoor LED Reflectors		27		8
	Indoor Lighting Controls or Occupancy Sensors	16	147		
	Indoor Linear Fluorescent Fixture or Bulbs		13		
	LED Pool Light				
	Outdoor CFL Bulbs				
	Outdoor CFL Fixture with Bulb(s)				
	Outdoor Lighting Controls or Occupancy Sensors				
	Outdoor Linear Fluorescent Delamping				
	Outdoor Linear Fluorescent Fixture or Bulbs				
	Outdoor Reflector CFLs				
Pool	Pool Heater				
	Pool Pump	7	575		
Shell	Attic / Roof Insulation			6	
	Wall Insulation				
	Windows	1,048	370		
Small DHW	Faucet Aerator		3		
	Low-Flow Showerhead		28		
Space Heat	Central System Space and Water Heater				
	Space Heater				
	Space Heating Boiler				
	Space Heating Furnace				
	Grand Total	**1,216**	**2,083**	**6**	**142**

Measure Group	Measure	PGE	SCE	SCG	SDGE	Total
		Annual Therms				
Appliance	Clothes Washer	3,536	10,017			13,553
	Freezer		(957)			(957)
	Refrigerator	(463)	(5,985)			(6,448)
Cooling	Air Conditioner					
	Cool Roof	(478)				(478)
	Ventilation Fan		(6)			(6)
Large DHW	Storage Water Heater	134,337		31,658		165,994
	Tankless Water Heater	116,266		11,940		128,207
	Water Heater Boiler Controls			596,604	14,688	611,292
	Water Heating Boiler	221,844		30,000		251,844
Lighting	Indoor CFL Bulbs		(68)			(68)
	Indoor CFL Fixture with Bulb(s)	(5,498)	(95,944)		(16,432)	(117,874)
	Indoor CFL Reflectors		(4,742)		(75)	(4,817)
	Indoor LED Bulbs				(2,153)	(2,153)
	Indoor LED Exit Sign					
	Indoor LED Fixture with Bulb(s)	(24)	(2,501)			(2,525)
	Indoor LED Reflectors	(23)	(12,033)		(953)	(13,009)
	Indoor Lighting Controls or Occupancy Sensors	(860)	(8,692)			(9,551)
	Indoor Linear Fluorescent Fixture or Bulbs					
	LED Pool Light					
	Outdoor CFL Bulbs					
	Outdoor CFL Fixture with Bulb(s)					
	Outdoor Lighting Controls or Occupancy Sensors					
	Outdoor Linear Fluorescent Delamping					
	Outdoor Linear Fluorescent Fixture or Bulbs					
	Outdoor Reflector CFLs					
Pool	Pool Heater	1,274		20,276		21,550
	Pool Pump					
Shell	Attic / Roof Insulation			1,562		1,562
	Wall Insulation			101		101
	Windows	70,215	27,551	1,348		99,113
Small DHW	Faucet Aerator		1,476		3,321	4,797
	Low-Flow Showerhead	116,064	12,391		17,716	146,172
Space Heat	Central System Space and Water Heater			17,100		17,100

Measure Group	Measure	PGE	SCE	SCG	SDGE	Total
		Annual Therms				
	Space Heater	244				244
	Space Heating Boiler	6,332				6,332
	Space Heating Furnace	137				137
	Grand Total	**662,903**	**(79,493)**	**710,589**	**16,112**	**1,310,111**

8 APPENDIX C: RECOMMENDATIONS AND RESPONSES

EM&V Impact, Process, Market Assessment Study Recommendations							
Study Title:	**Multifamily Focused Impact Evaluation**						
Program:	**EUC-MF**						
Author:	**Apex Analytics and DNVGL**						
	Item #	**Page**	**Findings**	**Best Practice / Recommendations**	**Recommendation Recipient**	**Utility/ Agency Perspective**	**Program Actions**
	1	39	IOU EUC-MF projects were difficult to isolate from the single-family EUC projects within the CPUC tracking database.	The EUC-MF projects should be assigned a different program name or number from the single-family EUC projects, to facilitate clear delineation between the two project streams.	All IOUs		
	2	39	The IOU and REN EUC-MF program tracking data have varying levels of completeness.	IOUs and RENs should adjust data collection and program tracking to ensure all fields in Table 4-1, including participant contact information, measure details, pre-existing conditions, property systems, property details, and utility meter numbers are collected and easily accessible for all completed projects.	All IOUs, BayREN, SoCalREN		
	3	39	The tracking databases showed that projects were assigned a standard or deemed EUL instead of one based on actual measure installations using the logic described in this report.	Program administrators should be sure to use the correctly weighted and calibrated EUL and RUL instead of the set EUL currently reported in the tracking database.	All IOUs, BayREN, SoCalREN		
	4	39	Although both IOUs and RENs have assumed an ER baseline on their first-year savings, they are not always calculating life-cycle savings to reflect a change in baseline after the end of the project's RUL	Both IOUs and RENs should calculate life-cycle savings for ER projects using the ER baseline for the RUL period, then using a code baseline for the remainder of the EUL	All IOUs, BayREN		
	7	40	The team was unable to validate the program claimed savings via an engineering review because of insufficient tracking data and the inability to find deemed savings estimates.	Simulation models or billing analysis may provide a more effective approach to validating the claimed savings. In addition, site visits would allow for true verification of model inputs, which—as identified by the single-family assessment of EnergyPro—can significantly affect the accuracy of the claimed savings.	Energy Division		
	8	40	Matching program data to billing data using accountIDs was largely unsuccessful, likely because of the high turnover rate for multifamily tenants	Program administrators should collect meter numbers to allow for improved matching of program and billing data.	All IOUs, BayREN, SoCalREN		
	9	40	The consumption analysis of the MF-WB participants showed that the reported savings ratios were very close to project-level gas (therm) reported savings. Three of the four SDG&E EUC projects were within several percentage points of claimed savings, while the fourth was approximately 10% higher than reported.	Even though the savings claims were close to billing calibrated consumption ratios, it would still be optimal to allow aggregate project-level billing data to be shared with the program administrators to ensure calibrated models.	All IOUs, BayREN, SoCalREN		
	10	41	This research indicated that a substantial portion of projects mayave been assigned incorrect baselines.	The IOUs and their contractors should set up a survey at intake to better determine the appropriate baseline for each project and measure.	All IOUs, BayREN, SoCalREN		

EM&V Impact, Process, Market Assessment Study Recommendations							
Study Title:	**Multifamily Focused Impact Evaluation**						
Program:	**MFEER**						
Author:	**Apex Analytics and DNVGL**						
	Item #	**Page/ Section #**	**Findings**	**Best Practice / Recommendations**	**Recommendation Recipient**	**Utility/ Agency Perspective**	**Program Actions**
	5	39	There is not a consistent way to bundle MFEER program measures into projects or properties, making it challenging to survey a single property owner on all his or her incented measures	The evaluation team recommends assigning and using consistent SiteIDs for measures installed on a given application or site.	All IOUs		
	6	39	Contact data for the MFEER participants was highly inaccurate, leading to a low complete rate during survey efforts.	The evaluation team recommends that implementers accurately transfer contact information on the primary decision maker—as entered on the program application—into the CPUC tracking database.	All IOUs		
	10a	40	This research indicated that a substantial portion of projects mayave been assigned incorrect baselines.	The IOUs and their contractors should set up a survey at intake to better determine the appropriate baseline for each project and measure.	All IOUs		
	10b	41	A review of the baseline assignments in the tracking database showed inconsistencies within and across the IOUs for the same measure				
	11	41	The research found an overall NTFR of 51.6% for the 2013-2014 MFEER program.	As the MFEER program measure mix, incentive levels, or outreach/intervention strategies change, the FR may also change. These values should continue to be updated as the programs evolve.	All IOUs, Energy Division		
	12	41	A review of the ex ante NTFR values in the tracking database showed inconsistencies within and across the IOUs.	The IOUs should properly and thoroughly assign DEER-based NTFR values to their measures in their tracking database systems. The IOUs should also be sure to consistently assign the correct DEER values to the same measures, and also research the potential of assigning HTR status to their projects where applicable. Qualified customers should continue to receive the appropriate HTR NTFR value as long as there is sufficient documentation to justify their HTR classification.	All IOUs		

9 APPENDIX D: DECISION MAKER SURVEY INSTRUMENT

MFEER and EUC-MF Program(s) Impact Evaluation
2013-2014 PARTICIPATING DECISION MAKER FINAL SURVEY INSTRUMENT
April, 2015

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 IOU MFEER and EUC-MF programs. 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 - INT5
Verification Questions	Verification of measure installation and removals.	V1 - V3
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. For EUC-MF participants, please review the participant information prior to the interview and probe for inconsistent responses.]

Hello, this is **[INTERVIEWER'S NAME]** calling from Pacific Market Research on behalf of [**IOU]**. ***This is not a sales call.*** May I please speak with the [contact],person who is most knowledgeable about your firm's involvement in the **[Energy Upgrade California / Multi-Family Energy Efficiency Rebate]** Program for <project> located at <insert address>. As part of this program, you received a rebate 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 **[Energy Upgrade California / Multi-Family Energy Efficiency Rebate]** Program in 2013/2014?

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 utilities sponsor the [Multi-Family Home Energy Savings Program/Energy Upgrade California program]. The California Public Utilities Commission (CPUC) requires certain utilities 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 INT4]
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 **[Energy Upgrade California / Multi-Family Energy Efficiency Rebate]** during 2013 and 2014 to discuss the factors that may have influenced their decision to participate in the program In this survey, I will refer to the [PNAME] property at [LOCAT] 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. How did the idea for this project originate? [DO NOT READ, ACCEPT MULTIPLE] (Probe: Did your company develop the idea, was it suggested by a vendor or consultant, was it the result of an audit, was it part of a larger expansion or remodeling effort?)
a. Utility Bill Insert
b. Program Literature
c. Utility Account Representative
d. Program Vendor
e. Utility or Program Website
f. Trade Publication
g. Conference
h. Newspaper Article
i. Word of Mouth
j. Previous experience with [IOU] Program
k. City/Government Recommendation
l. Contractor
m. Result of an Audit
n. Part of a larger expansion or remodeling effort
o. Company policy
p. Other [RECORD]
-98. [DON'T KNOW]
-99. [REFUSED]

INT5. 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 [PNAME]? 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]

VERIFICATION QUESTIONS

V1. The program records show that the following products were installed at **[PNAME]** as part of the [**IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate]** Program. Please confirm that this is correct. Did you install approximately [**QTY] [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*		
C	Central Space and Water Heater			
D	Clothes Washer			
E	Cool Roof	*SqFt*		
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			

V2. We also show that the following lighting products were installed at **[PNAME]** as part of the [**IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate]** 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.]

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 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			

V3. Did you receive any of the following services as part of the [**IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate]** 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

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, 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] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] 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 long 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 **[PNAME]**? [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 **[PNAME]**, 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] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] 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 long 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 **[PNAME]**?

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]]

ER14. [IF ER13 = a] As part of your regularly scheduled or government mandated upgrade process at **[PNAME]** , 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, FAUCET AERATORS, AND LOW-FLOW SHOWERHEADS]

ER15. As we just discussed, you also installed [MEASURE1] as part of the [IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] Program. Was this replaced [MEASURE1] part of a scheduled, planned, or government mandated upgrade/refurbishment of **[PNAME]**?

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] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] 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] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] or a similar utility program?

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

g. [IF ASK IF V3D=1] Information from Program or utility training course?

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

h. Information from other [IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] Program marketing materials

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

i. Suggestion from your IOU 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 INT5=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 INT5≠f AND PAI1-l >7 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 HIGH, why is that?

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

CC3. [IF INT5=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 INT5=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] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] Program BEFORE or AFTER you decided to install the [MEASURE1] at **[PNAME]**?

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-M WHERE THEY GAVE AN IMPORTANCE RATING OF ≥8 IN PAI1]

a. The age or condition of the old equipment
b. Availability of the [IOU] rebate
c. Information provided through a the feasibility study, energy audit or other types of technical assistance provided through the [IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] Program
d. Recommendation from an equipment vendor that sold you the [MEASURE] and/or installed it
e. Your previous experience with this type of PROJECT?
f. Your previous experience with the [IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] or a similar utility program?
g. Information from Program or utility training course?
h. Information from other [IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] Program marketing materials
i. Suggestion from your account representative
j. Payback or return on the Project
k. Improved Quality of the Property
l. Compliance with city, state, or federal government regulations
m. 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] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] 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 PNAME]

PAI8. I understand you installed several other measures at [PNAME], [LIST ALLother 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 [PNAME]
2 Program had a different influence on installation of different measures at [PNAME] [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]

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. Are units at this property offered at market rental rates or government subsidized housing?
1. Market Rate
2. Government Subsidized
3. Both market rate and government subsidized
-98. [DON'T KNOW]
-99. [REFUSED]

F4. How many apartments are at [PNAME]?
1. [RECORD #]
-98. [DON'T KNOW]
-99. [REFUSED]

F5. How many multifamily complexes, including [PNAME], 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 [PNAME]?
1. [RECORD #]
-98. [DON'T KNOW]
-99. [REFUSED]

OUTRO. Those are all the questions I have. On behalf of the [IOU] [Energy Upgrade California / Multi-Family Energy Efficiency Rebate] Program, thank you very much for your time.

10 APPENDIX E: EX POST SAVINGS ADJUSTMENTS

In an effort to standardize reporting of findings for impact evaluations, the Impact Evaluation Standard Reporting (IESR) team has provided templates to summarize the results of the Focused Multifamily Impact Evaluation. These standard reporting tables summarize first year and lifecycle savings, as well as lifecycle and EUL values. The following sections explain updates to the ex ante savings values for the Investor Owned Utility (IOU) Multifamily Whole Building Program (MF-WB) and Multifamily Energy Efficiency Rebate (MFEER) Program which are presented in the subsequent IESR tables.

Multifamily Whole Building Program Adjustments

There are two primary adjustments made to the ex ante savings values for the MF-WB programs: gross adjustments and net adjustments. As stated in Section 4.1.1, PG&E did not provide any measure level information on this program, and as a result, these projects could not be verified or evaluated. In consultation with Energy Division (ED), these PG&E projects received zero savings (Table 10-1). Gross adjustments were not applied to the San Diego Gas and Electric (SDG&E) MF-WB program. While the evaluation determined that some of the ex ante values can be improved, particularly through alternative approaches to estimating the proper baseline, the evaluation did not adjust gross savings values due to the limited scope of the research. Future evaluation efforts, however, may determine that a gross realization rate other than 1.0 is appropriate.

Table 10-1: Ex Ante and Ex Post Gross Energy Savings by IOU, MF-WB 2013–2014 Programs

IOU	Savings (ex ante gross)			Savings (ex post gross)		
	kWh	kW	Therms	kWh	kW	Therms
SDG&E	26,560	15.5	4,002	26,560	15.5	4,002
PG&E	568,382	136.1	19,067	-	-	-
Totals	*594,942*	*151.6*	*23,069*	*26,560*	*15.5*	*4,002*

Net adjustments were applied to the ex ante savings as a result of the freeridership (FR) estimates found during the 2013-2014 Regional Energy Network (REN) MF-WB evaluation.[35] As stated in Section 3.1.4, none of the four SDG&E MF-WB participants responded to repeated survey attempts, therefore, the FR assessment could not be performed on the IOU participants. However, the same FR instrument and methodology were successfully used in the REN evaluation of their 2013-2014 MF-WB evaluation, resulting in a net of FR (NTFR) estimate of 0.58.[36] The IOU and REN programs are similar in implementation, incentives, and constituents. Therefore, at this time, the REN MF-WB NTFR value offers the best available estimate for the 2013-2014 IOU MF-WB program. This value should be updated with IOU participants during future evaluation efforts. Table 10-2 compares the ex post gross and ex post net energy and gas savings for the SDG&E and PG&E MF-WB programs.

[35] 2013 -14 Regional Energy Networks and Community Choice Aggregator Programs Impact Assessment Draft Report. November 16, 2015.
[36] See Section 5.2 and 5.3 of the REN report.

Table 10-2: Ex Post Gross and Ex Post Net Energy Savings by IOU, MF-WB 2013–2014 Programs

IOU	Savings (ex post gross)			NTFR %	Savings (ex post net)		
	kWh	kW	Therms		kWh	kW	Therms
SDG&E	26,560	15.5	4,002	58%	15,405	9.0	2,321
PG&E	-	-	-	58%	-	-	-
Totals	*26,560*	*15.5*	*4,002*	58%	*15,405*	*9.0*	*2,321*

The IOUs had assumed a 0.85 NTFR on their ex ante net savings values. Updating ex ante savings claims in for both gross and net adjustments results in a 68% net realization rate (ex post net savings/ex ante net savings) for SDG&E and 0% net realization rate for PG&E MF-WB programs.

Table 10-3: Ex Ante and Ex Post Net Energy Savings by Program Administrator (PA), MF-WB 2013–2014 Programs

IOU	Savings (ex ante net)			Savings (ex post net)			Net RR
	kWh	kW	Therms	kWh	kW	Therms	
SDGE	22,576	13.2	3,402	15,405	9.0	2,321	68%
PG&E	483,124	115.7	16,207	-	-	-	0%
Totals	*505,701*	*128.9*	*19,608*	*15,405*	*9.0*	*2,321*	*3%*

Multifamily Energy Efficiency Rebate Program Adjustments

Only net savings adjustments were applied to the MFEER ex ante savings claims, and were based off of the MFEER decision maker survey. As seen in Table 10-4, net realization rates varied from 64% (PG&E kW) to 101% (SDG&E kWh). Similar to the SDG&E MF-WB program, the evaluation team did not adjust the gross savings values for the MFEER program. Therefore, the net realization rates below only reflect updates to the ex ante NTFR values, not gross savings adjustments.

Table 10-4: Ex Ante Net Savings to Ex Post Net Savings Values by IOU, MFEER 2013-2014

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
SCE	17,752,793	15,224,539	86%	1,163	1,133	97%	-45,995	-42,449	92%
SDGE	1,245,224	1,261,840	101%	85	86	101%	8,255	7,541	91%
PG&E	1,171,596	1,165,194	99%	909	579	64%	405,815	338,743	83%
SoCalGas	4,807	3,321	69%	3	2	67%	380,694	270,024	71%
Totals	*20,174,420*	*17,654,894*	88%	*2,160*	*1,800*	83%	*794,764*	*616,308*	78%

11 APPENDIX F: STANDARDIZED EVALUATED DATABASE TABLES

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	MF Whole Building	5,684	0	0.00	100.0%	
PGE	PGE_MFEER	22,319	22,319	1.00	100.0%	
PGE	**Total**	28,003	22,319	0.80	100.0%	
SCE	SCE_MFEER	355,693	355,693	1.00	100.0%	
SCE	**Total**	355,693	355,693	1.00	100.0%	
SCG	SCG_MFEER	175	175	1.00	100.0%	
SCG	**Total**	175	175	1.00	100.0%	
SDGE	MF Whole Building	434	434	1.00	100.0%	
SDGE	SDGE_MFEER	22,122	22,122	1.00	100.0%	
SDGE	**Total**	22,556	22,556	1.00	100.0%	
	Statewide	*406,427*	*400,743*	*0.99*	*100.0%*	

Net Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	MF Whole Building	4,831	0	0.00	0.0%	0.85		0.85	
PGE	PGE_MFEER	13,039	12,655	0.97	0.0%	0.58	0.57	0.58	0.57
PGE	**Total**	17,870	12,655	0.71	0.0%	0.64	0.57	0.64	0.57
SCE	SCE_MFEER	222,264	189,940	0.85	0.0%	0.62	0.53	0.62	0.53
SCE	**Total**	222,264	189,940	0.85	0.0%	0.62	0.53	0.62	0.53
SCG	SCG_MFEER	96	66	0.69	0.0%	0.55	0.38	0.55	0.38
SCG	**Total**	96	66	0.69	0.0%	0.55	0.38	0.55	0.38
SDGE	MF Whole Building	369	252	0.68	0.0%	0.85	0.58	0.85	0.58
SDGE	SDGE_MFEER	13,206	13,008	0.98	0.0%	0.60	0.59	0.60	0.59
SDGE	**Total**	13,575	13,259	0.98	0.0%	0.60	0.59	0.60	0.59
	Statewide	*253,805*	*215,921*	*0.85*	*0.0%*	*0.62*	*0.54*	*0.62*	*0.54*

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	MF Whole Building	1	0	0.00	100.0%	
PGE	PGE_MFEER	22	22	1.00	100.0%	
PGE	**Total**	24	22	0.94	100.0%	
SCE	SCE_MFEER	24	24	1.00	100.0%	
SCE	**Total**	24	24	1.00	100.0%	
SCG	SCG_MFEER	0	0	1.00	100.0%	
SCG	**Total**	0	0	1.00	100.0%	
SDGE	MF Whole Building	0	0	1.00	100.0%	
SDGE	SDGE_MFEER	2	2	1.00	100.0%	
SDGE	**Total**	2	2	1.00	100.0%	
	Statewide	*50*	*48*	*0.97*	*100.0%*	

Net Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	MF Whole Building	1	0	0.00	0.0%	0.85		0.85	
PGE	PGE_MFEER	17	11	0.62	0.0%	0.76	0.48	0.76	0.48
PGE	**Total**	18	11	0.58	0.0%	0.77	0.48	0.77	0.48
SCE	SCE_MFEER	13	13	0.98	0.0%	0.56	0.54	0.56	0.54
SCE	**Total**	13	13	0.98	0.0%	0.56	0.54	0.56	0.54
SCG	SCG_MFEER	0	0	0.69	0.0%	0.55	0.38	0.55	0.38
SCG	**Total**	0	0	0.69	0.0%	0.55	0.38	0.55	0.38
SDGE	MF Whole Building	0	0	0.68	0.0%	0.85	0.58	0.85	0.58
SDGE	SDGE_MFEER	1	1	0.97	0.0%	0.62	0.60	0.62	0.60
SDGE	**Total**	1	1	0.92	0.0%	0.65	0.60	0.65	0.60
	Statewide	*33*	*25*	*0.76*	*0.0%*	*0.66*	*0.51*	*0.66*	*0.51*

Gross Lifecycle Savings (MMTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	MF Whole Building	191	0	0.00	100.0%	
PGE	PGE_MFEER	10,270	10,270	1.00	100.0%	
PGE	**Total**	10,461	10,270	0.98	100.0%	
SCE	SCE_MFEER	-1,403	-1,403	1.00	100.0%	
SCE	**Total**	-1,403	-1,403	1.00	100.0%	
SCG	SCG_MFEER	9,691	9,691	1.00	100.0%	
SCG	**Total**	9,691	9,691	1.00	100.0%	
SDGE	MF Whole Building	65	65	1.00	100.0%	
SDGE	SDGE_MFEER	221	221	1.00	100.0%	
SDGE	**Total**	287	287	1.00	100.0%	
	Statewide	*19,035*	*18,845*	*0.99*	*100.0%*	

Net Lifecycle Savings (MMTherms)

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	MF Whole Building	162	0	0.00	0.0%	0.85		0.85	
PGE	PGE_MFEER	6,381	5,248	0.82	0.0%	0.62	0.51	0.62	0.51
PGE	**Total**	6,543	5,248	0.80	0.0%	0.63	0.51	0.63	0.51
SCE	SCE_MFEER	-795	-749	0.94	0.0%	0.57	0.53	0.57	0.53
SCE	**Total**	-795	-749	0.94	0.0%	0.57	0.53	0.57	0.53
SCG	SCG_MFEER	5,219	3,683	0.71	0.0%	0.54	0.38	0.54	0.38
SCG	**Total**	5,219	3,683	0.71	0.0%	0.54	0.38	0.54	0.38
SDGE	MF Whole Building	55	38	0.68	0.0%	0.85	0.58	0.85	0.58
SDGE	SDGE_MFEER	110	104	0.94	0.0%	0.50	0.47	0.50	0.47
SDGE	**Total**	166	141	0.85	0.0%	0.58	0.49	0.58	0.49
	Statewide	*11,131*	*8,323*	*0.75*	*0.0%*	*0.58*	*0.44*	*0.58*	*0.44*

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	MF Whole Building	568	0	0.00	100.0%	
PGE	PGE_MFEER	2,055	2,055	1.00	100.0%	
PGE	**Total**	2,623	2,055	0.78	100.0%	
SCE	SCE_MFEER	28,510	28,510	1.00	100.0%	
SCE	**Total**	28,510	28,510	1.00	100.0%	
SCG	SCG_MFEER	9	9	1.00	100.0%	
SCG	**Total**	9	9	1.00	100.0%	
SDGE	MF Whole Building	27	27	1.00	100.0%	
SDGE	SDGE_MFEER	2,146	2,146	1.00	100.0%	
SDGE	**Total**	2,173	2,173	1.00	100.0%	
	Statewide	*33,315*	*32,747*	*0.98*	*100.0%*	

Net First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	MF Whole Building	483	0	0.00	0.0%	0.85		0.85	
PGE	PGE_MFEER	1,172	1,165	0.99	0.0%	0.57	0.57	0.57	0.57
PGE	**Total**	1,655	1,165	0.70	0.0%	0.63	0.57	0.63	0.57
SCE	SCE_MFEER	17,753	15,225	0.86	0.0%	0.62	0.53	0.62	0.53
SCE	**Total**	17,753	15,225	0.86	0.0%	0.62	0.53	0.62	0.53
SCG	SCG_MFEER	5	3	0.69	0.0%	0.55	0.38	0.55	0.38
SCG	**Total**	5	3	0.69	0.0%	0.55	0.38	0.55	0.38
SDGE	MF Whole Building	23	15	0.68	0.0%	0.85	0.58	0.85	0.58
SDGE	SDGE_MFEER	1,245	1,262	1.01	0.0%	0.58	0.59	0.58	0.59
SDGE	**Total**	1,268	1,277	1.01	0.0%	0.58	0.59	0.58	0.59
	Statewide	*20,680*	*17,670*	*0.85*	*0.0%*	*0.62*	*0.54*	*0.62*	*0.54*

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	MF Whole Building	0	0	0.00	100.0%	
PGE	PGE_MFEER	1	1	1.00	100.0%	
PGE	**Total**	1	1	0.90	100.0%	
SCE	SCE_MFEER	2	2	1.00	100.0%	
SCE	**Total**	2	2	1.00	100.0%	
SCG	SCG_MFEER	0	0	1.00	100.0%	
SCG	**Total**	0	0	1.00	100.0%	
SDGE	MF Whole Building	0	0	1.00	100.0%	
SDGE	SDGE_MFEER	0	0	1.00	100.0%	
SDGE	**Total**	0	0	1.00	100.0%	
	Statewide	*4*	*3*	*0.96*	*100.0%*	

Net First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	MF Whole Building	0	0	0.00	0.0%	0.85		0.85	
PGE	PGE_MFEER	1	1	0.64	0.0%	0.75	0.48	0.75	0.48
PGE	**Total**	1	1	0.56	0.0%	0.76	0.48	0.76	0.48
SCE	SCE_MFEER	1	1	0.97	0.0%	0.56	0.54	0.56	0.54
SCE	**Total**	1	1	0.97	0.0%	0.56	0.54	0.56	0.54
SCG	SCG_MFEER	0	0	0.69	0.0%	0.55	0.38	0.55	0.38
SCG	**Total**	0	0	0.69	0.0%	0.55	0.38	0.55	0.38
SDGE	MF Whole Building	0	0	0.68	0.0%	0.85	0.58	0.85	0.58
SDGE	SDGE_MFEER	0	0	1.01	0.0%	0.60	0.60	0.60	0.60
SDGE	**Total**	0	0	0.97	0.0%	0.62	0.60	0.62	0.60
	Statewide	*2*	*2*	*0.79*	*0.0%*	*0.64*	*0.52*	*0.64*	*0.52*

Gross First Year Savings (MMTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	MF Whole Building	19	0	0.00	100.0%	
PGE	PGE_MFEER	663	663	1.00	100.0%	
PGE	**Total**	682	663	0.97	100.0%	
SCE	SCE_MFEER	-79	-79	1.00	100.0%	
SCE	**Total**	-79	-79	1.00	100.0%	
SCG	SCG_MFEER	711	711	1.00	100.0%	
SCG	**Total**	711	711	1.00	100.0%	
SDGE	MF Whole Building	4	4	1.00	100.0%	
SDGE	SDGE_MFEER	16	16	1.00	100.0%	
SDGE	**Total**	20	20	1.00	100.0%	
	Statewide	*1,333*	*1,314*	*0.99*	*100.0%*	

Net First Year Savings (MMTherms)

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	MF Whole Building	16	0	0.00	0.0%	0.85		0.85	
PGE	PGE_MFEER	406	339	0.83	0.0%	0.61	0.51	0.61	0.51
PGE	**Total**	422	339	0.80	0.0%	0.62	0.51	0.62	0.51
SCE	SCE_MFEER	-46	-42	0.92	0.0%	0.58	0.53	0.58	0.53
SCE	**Total**	-46	-42	0.92	0.0%	0.58	0.53	0.58	0.53
SCG	SCG_MFEER	381	270	0.71	0.0%	0.54	0.38	0.54	0.38
SCG	**Total**	381	270	0.71	0.0%	0.54	0.38	0.54	0.38
SDGE	MF Whole Building	3	2	0.68	0.0%	0.85	0.58	0.85	0.58
SDGE	SDGE_MFEER	8	8	0.91	0.0%	0.51	0.47	0.51	0.47
SDGE	**Total**	12	10	0.85	0.0%	0.58	0.49	0.58	0.49
	Statewide	*769*	*576*	*0.75*	*0.0%*	*0.58*	*0.44*	*0.58*	*0.44*

Per Unit (Quantity) Gross Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Lifecycle	First Year	Annualized
PGE	MF Whole Building	1	0.0%		10.0	0	0	0
PGE	PGE_MFEER	1	0.0%		17.2	29	3	3
SCE	SCE_MFEER	1	100.0%		13.3	734	59	54
SCG	SCG_MFEER	1	0.0%		18.6	1	0	0
SDGE	MF Whole Building	1	0.0%		16.5	19,738	1,207	1,183
SDGE	SDGE_MFEER	1	0.0%		11.3	343	33	32

Per Unit (Quantity) Gross Energy Savings (kW)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Lifecycle	First Year	Annualized
PGE	MF Whole Building	1	0.0%		10.0	0	0	0
PGE	PGE_MFEER	1	0.0%		17.2	0	0	0
SCE	SCE_MFEER	1	100.0%		13.3	0	0	0
SCG	SCG_MFEER	1	0.0%		18.6	0	0	0
SDGE	MF Whole Building	1	0.0%		16.5	11	1	1
SDGE	SDGE_MFEER	1	0.0%		11.3	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)	Lifecycle	First Year	Annualized
PGE	MF Whole Building	1	0.0%		10.0	0	0	0
PGE	PGE_MFEER	1	0.0%		17.2	13	1	1
SCE	SCE_MFEER	1	100.0%		13.3	-3	0	0
SCG	SCG_MFEER	1	0.0%		18.6	44	3	3
SDGE	MF Whole Building	1	0.0%		16.5	2,966	182	179
SDGE	SDGE_MFEER	1	0.0%		11.3	3	0	0

Per Unit (Quantity) Net Energy Savings (Kwh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Lifecycle	First Year	Annualized
PGE	MF Whole Building	0	0.0%	100.0%	10.0	0	0	0
PGE	PGE_MFEER	0	0.0%	100.0%	17.2	16	2	2
SCE	SCE_MFEER	0	100.0%	100.0%	13.3	392	31	29
SCG	SCG_MFEER	0	0.0%	100.0%	18.6	0	0	0
SDGE	MF Whole Building	0	0.0%	100.0%	16.5	11,448	700	686
SDGE	SDGE_MFEER	0	0.0%	100.0%	11.3	202	20	19

Per Unit (Quantity) Net Energy Savings (Kw)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Lifecycle	First Year	Annualized
PGE	MF Whole Building	0	0.0%	100.0%	10.0	0	0	0
PGE	PGE_MFEER	0	0.0%	100.0%	17.2	0	0	0
SCE	SCE_MFEER	0	100.0%	100.0%	13.3	0	0	0
SCG	SCG_MFEER	0	0.0%	100.0%	18.6	0	0	0
SDGE	MF Whole Building	0	0.0%	100.0%	16.5	7	0	0
SDGE	SDGE_MFEER	0	0.0%	100.0%	11.3	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)	Lifecycle	First Year	Annualized
PGE	MF Whole Building	0	0.0%	100.0%	10.0	0	0	0
PGE	PGE_MFEER	0	0.0%	100.0%	17.2	7	0	0
SCE	SCE_MFEER	0	100.0%	100.0%	13.3	-2	0	0
SCG	SCG_MFEER	0	0.0%	100.0%	18.6	17	1	1
SDGE	MF Whole Building	0	0.0%	100.0%	16.5	1,721	106	104
SDGE	SDGE_MFEER	0	0.0%	100.0%	11.3	2	0	0