Evaluation of 2015
Public Service Company of New Mexico
Energy Efficiency & Demand Response Portfolio

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1. Executive Summary

This report is to provide a summary of the evaluation effort of the 2015 Demand Side Management (DSM) portfolio by the Public Service Company of New Mexico (PNM). In 2015, the PNM portfolio consisted of 1 residential and four non-residential programs. ADM Associates, Inc. (the Evaluators) estimated gross realization, net savings, and cost-effectiveness for the eight programs evaluated in 2015.

1.1 Summary of PNM Energy Efficiency Programs

New Mexico Investor-Owned Utilities (IOUs) are required to develop cost-effective DSM programs, using ratepayer funds to reduce energy demand and consumption. IOUs submit their portfolios to the New Mexico Public Regulatory Commission (NMPRC) for approval. In 2015, the PNM DSM portfolio contained the following programs:

- Residential Lighting;
- Residential Refrigerator Recycling;
- Market Transformation;
- Low Income Easy Savings;
- Low Income CFL & Refrigerator Replacement;
- Whole House;
- Residential Stay Cool;
- Low Income Home Efficiency;
- Student Efficiency Kits;
- Home Energy Reports;
- PNM Peak Saver;
- PNM Power Saver;
- Multifamily;
- Large Customer Self-Direct
- Community CFL; and
- Commercial Comprehensive (Encompassing Retrofit Rebates, New Construction Rebates, QuickSaver Direct Install, and Building Tune-Up components).

For 2015, EM&V was conducted for a subset of the portfolio. The programs evaluated for this program year include:

- Commercial Comprehensive;

- Large Customer Self-Direct
- Whole House;
- Residential Stay Cool;
- Low Income Home Efficiency;
- Residential Lighting;
- Refrigerator Recycling;
- Home Energy Reports;
- PNM Peak Saver; and
- PNM Power Saver.

1.2 Evaluation Objectives

The objectives of this evaluation include:

- Development of program-specific evaluation plans;
- Design a sample allowing for 90% confidence and +/- 10% statistical precision for each program;
- Conduct onsite verification inspections, telephone surveying, and onsite metering as needed;
- Evaluate gross savings by program;
- Provide net savings totals through evaluation of free-ridership;
- Evaluate cost-effectiveness of each program using the Total Resource Cost (TRC) test; and
- Evaluate programs within the portfolio and make recommendations for amendments and improvements.

1.3 Summary of Findings

Gross savings were estimated by engineering analysis, simulation modeling, participant surveying, and on-site monitoring where appropriate for the program and measure type. The Evaluators then estimated free-ridership and net-to-gross ratios (NTGRs) for the reviewed programs. Table 1-1 and 1-2 present gross and net impacts by program.

Table 1-1 Gross Impact Summary

Program	Peak Demand Savings (kW)		Annual Energy Savings, (kWh)		Lifetime Energy Savings (kWh)		Gross Realization Rate
	Expected	Realized	Expected	Realized	Expected	Realized	
Residential Lighting	3,165.00	3,768.1	27,451,879	30,293,153	296,315,210	274,549,063	110.35%
Refrigerator Recycling	1,661.00	1,859.46	9,713,822	7,627,208	47,597,730	37,197,699	78.52%
Low Income Easy Savings	92.87	92.87	1,334,119	1,334,119	20,943,292	20,943,292	100.00%
LI CFL & Refrigerator	38.17	38.17	245,377	245,377	3,397,407	3,397,407	100.00%
Home Energy Check-Up	82.00	77.10	771,687	595,784	21,836,761	6,135,459	77.21%
LI Home Efficiency	119.92	117.02	1,136,987	1,286,825	21,836,761	19,343,634	113.18%
Residential Stay Cool	5,289.13	5,242.97	5,228,009	5,186,885	77,989,130	77,418,105	99.21%
Student Efficiency Kits	87.15	87.15	790,741	790,741	8,540,003	8,540,003	100.00%
Home Energy Reports	770.00	1,035.40	9,274,000	9,131,923	9,274,000	9,131,923	98.47%
Multifamily Direct Install	-	-	15,182	15,182	136,638	136,638	100.00%
Commercial Comprehensive	7,228.00	4,663.11	45,321,573	43,270,668	501,712,314	473,793,145	95.47%
Large C&I Self-Direct	34.00	34.00	187,429	187,429	2,811,435	2,811,435	100.00%
Total	18,567.24	17,015.37	101,470,805	99,965,294	1,012,390,681	933,397,803	98.52%

Table 1-2 Net Impact Summary

Program	Peak Demand Savings (kW)		Annual Energy Savings, (kWh)		Lifetime Energy Savings (kWh)		Net Realization Rate
	Expected	Realized	Expected	Realized	Expected	Realized	
Residential Lighting	2,416.20	2,615.06	20,943,292	21,023,357	226,061,613	190,713,527	100.40%
Refrigerator Recycling	1,079.60	1,268.15	6,313,985	5,201,756	30,938,524	25,368,831	82.40%
Low Income Easy Savings	92.87	92.87	1,334,119	1,334,119	20,943,292	20,943,292	100.00%
LI CFL & Refrigerator	38.17	38.17	245,377	245,377	3,397,407	3,397,407	100.00%
Home Energy Check-Up	80.40	73.50	756,723	583,204	9,691,652	5,927,875	77.10%
LI Home Efficiency	120.00	117.02	1,136,987	1,286,825	21,836,761	19,343,634	113.20%
Residential Stay Cool	1,421.40	2,336.80	1,731,843	2,336,902	25,834,871	34,668,354	134.90%
Student Efficiency Kits	87.15	87.15	790,741	790,741	8,540,003	8,540,003	100.00%
Home Energy Reports	770.00	1,035.40	9,274,000	9,131,923	9,274,000	9,131,923	98.40%
Multifamily Direct Install	0.00	0.00	15,182	15,182	136,638	136,638	100.00%
Commercial Comprehensive	6,119.10	4,413.41	38,198,926	35,751,066	423,137,136	391,354,587	93.6%
Large C&I Self-Direct	34.00	34.00	187,429	187,429	2,811,435	2,811,435	100.00%
Total	12,258.89	12,111.53	80,928,604	77,887,881	782,603,332	712,337,506	96.24%

Additionally, PNM Peak Saver and Power Saver programs were evaluated, providing independent verification of the per-unit kW Factor and total available demand reduction. The results of these evaluations are presented in

Table 1-3 and

Table 1-4.

Table 1-3 PNM Power Saver Evaluation Results

Sector	kW Factor	# Units	Available Demand Reduction	kWh Savings
Residential	0.92	36,664	33.73	580,762
Small Commercial	1.25	3,981	4.98	

Medium Commercial	7.72	455	3.51	NA
	Total	41,100	42.22	580,762

Table 1-4 PNM Peak Saver Evaluation Results

Month	*Nominated kW*	*Verified kW*	*kWh Savings*
June	15,110	17,829	394,810
July	15,015	15,178	101,393
August	15,080	17,429	315,477
September	15,965	NA	NA
Total:	15,293	17,198	811,680

Finally, the Evaluators estimated cost-effectiveness of the 2015 programs and overall portfolio using the Total Resource Cost (TRC) test and Utility Cost Test (UCT). The results are provided in Table 1-5 below.

Table 1-5 Cost Effectiveness Testing by Program

Program	*NPV of TRC Benefits*	*NPV of UCT Benefits*	*NPV of TRC Costs*	*NPV of UCT Costs*	*TRC*	*UCT*
Residential Lighting	$8,614,852	$8,614,852	$3,101,960	$2,510,018	2.78	3.43
Residential Comprehensive	$6,812,100	$6,750,072	$3,735,325	$5,266,022	1.82	1.28
Low Income Easy Savings	$1,461,382	$553,181	$440,222	$467,762	3.32	1.18
LI CFL & Refrigerator	$202,331	$202,331	$154,124	$154,124	1.31	1.31
Student Efficiency Kits	$1,087,385	$419,435	$233,676	$233,676	4.65	1.79
Home Energy Reports	$592,509	$432,566	$564,190	$564,190	1.05	0.77
Multifamily	$3,540	$3,540	$325,935	$384,039	0.01	0.01
Commercial Comprehensive	$17,032,117	$17,032,117	$14,193,189	$7,049,168	1.2	2.42
Large Customer Self-Direct	$113,625	$113,625	$62,406	$0	1.82	N/A
Power Saver	$5,508,356	$5,508,356	$3,871,645	$5,578,276	1.42	0.99
Peak Saver	$2,265,441	$2,265,441	$1,063,140	$1,666,340	2.13	1.36
Market Transformation	$0	$0	$405,220	$405,220	0	0
Aggregate Portfolio:	$43,693,638	$41,895,516	$28,151,032	$24,278,835	1.55	1.73

2. General Methodology

This chapter details general impact evaluation methodologies by program-type as well as data collection methods applied. This chapter will present full descriptions of:

- Gross Savings Estimation;
- Sampling Methodologies;
- Free-Ridership determination; and
- Data Collection Procedures.

2.1 Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluator provides a glossary of terms to follow:

- *Ex Ante* – A program parameter or value used by implementers/sponsoring utilities in estimating savings before implementation
- *Ex Post* – A program parameter or value as verified by the Evaluator following completion of the evaluation effort
- *Deemed Savings* – A savings estimate for homogenous measures, in which an assumed average savings across a large number of rebated units is applied (e.g., assuming 398 kWh savings for a low-flow showerhead)
- *Gross Savings* – Energy or demand savings as determined through engineering analysis and verification
- *Gross Realization Rate* – Ratio of Ex Post Savings / Ex Ante Savings (e.g. If the Evaluator verifies 300 kWh per showerhead, Gross Realization Rate = 300/398 = 75%)
- *Free-Ridership* – Percentage of participants who would have implemented the same energy efficiency measures in a similar timeframe absent the program
- *Net Savings* – Gross savings factoring off free-ridership, (e.g., if Free-Ridership for low-flow showerheads = 50%, net savings = 398 kWh x 50% = 199 kWh)
- *Net-to-Gross-Ratio (NTGR)* = (1 – Free-Ridership %), also defined as Net Savings / Gross Savings
- *Ex Ante Net Savings* = Ex Ante Gross Savings x Ex Ante Free-Ridership Rate
- *Ex Post Net Savings* = Ex Post Gross Savings x Ex Post Free-Ridership Rate
- *Net Realization Rate* = Ex Post Net Savings / Ex Ante Net Savings

- *Effective Useful Life (EUL)* – The average lifetime of a measure, denominated in years
- *Gross Lifetime kWh* = Ex Post Gross Savings x EUL
- *TRC*[1] – Total Resource Cost Test, taking the ratio of net benefits over net costs, including both participant and utility costs
- *UC – Utility Cost Test, taking the ratio of net benefits to the utility divided by net costs to the utility.*

2.2 Overview of Methodology

The Evaluator's methodology in the evaluation of the 2015 PNM DSM Portfolio is intended to provide:

- Net impact results at the 90% confidence and +/-10% precision level;
- Program feedback and recommendations via process evaluation; and
- Cost effectiveness testing at the program and portfolio level.

In doing so, the Evaluator's evaluation will provide the NMPRC with verified net savings results, provide the sponsoring utilities with recommendations for program improvement, and ensure cost-effective use of ratepayer funds. By leveraging experience and lessons learned from impact evaluation of prior program years, the Evaluator has been able to expand upon the 2015 evaluation effort, in order to use the results of this impact evaluation to better inform PNM of methods by which program and portfolio performance could be improved.

2.3 Sampling

Sampling is necessary to evaluate savings for the PNM DSM portfolio insomuch as verification of a census of program participants is typically cost-prohibitive. As per NMPRC requirements, samples are drawn in order to ensure 90% confidence at the +/-10% precision level. Programs are evaluated on one of three bases:

- Census of all participants
- Simple Random Sample
- Stratified Random Sample

2.4 Census of Participants

A census of participant data was used for select programs where such review is feasible. No PNM programs incorporated a census approach in their entirety, but some programs had a census approach to a subset of the analysis. For example, Residential

[1] TRC and UCT tests are explained in greater detail in Section 2.6

Lighting was evaluated by reviewing the deemed savings calculations for a census of line items in the provided tracking data, ensuring that energy and demand savings for each rebated CFL were calculated appropriately.

2.4.1 Simple Random Sampling

For programs with relatively homogenous measures (largely in the residential portfolio), the Evaluator conducted a simple random sample of participants. The sample size for verification surveys is calculated to meet 90% confidence and 10% precision (90/10). The sample size to meet 90/10 requirements is calculated based on the coefficient of variation of savings for program participants. Coefficient of Variation (CV) is defined as:

$$CV(x) = \frac{Standard\ Deviation(x)}{Mean(x)}$$

Where x is the average kWh savings per participant. Without data to use as a basis for a higher value, it is typical to apply a CV of .5 in residential program evaluations. The resulting sample size is estimated at:

$$n_0 = \left(\frac{1.645 * CV}{RP}\right)^2$$

Where

1.645 = Z Score for 90% confidence interval in a normal distribution

CV = Coefficient of Variation

RP = Required Precision, 10% in this evaluation

With 10% required precision (RP), this calls for a sample of 68 for programs with a sufficiently large population. However, in some instances, programs did not have sufficient participation to make a sample of this size cost-effective. In instances of low participation, the Evaluator then applied a finite population correction factor, defined as:

$$n = \frac{n_0}{1 + {n_0}/{N}}$$

Where

n_0 = Sample Required for Large Population

N = Size of Population

n = Corrected Sample

For example, if a program were to have only 100 participants, the finite population correction would result in a final required sample size of 41. The Evaluator applied finite

population correction factors in instances of low participation in determining samples required for surveying or onsite verification.

2.4.2 Stratified Random Sampling

For the PNM business portfolio, Simple Random Sampling is not an effective sampling methodology as the CV values observed in business programs are typically very high because the distributions of savings are generally positively skewed. Often, a relatively small number of projects account for a high percentage of the estimated savings for the program.

For example, the 2015 PNM Commercial Comprehensive Program had a CV of 3.31 at year's end for the Retrofit Rebates component. This would have required a census of participants, and would have been prohibitively expensive.

To address this situation, we use a sample design for selecting projects for the M&V sample that takes such skewness into account. With this approach, we select a number of sites with large savings for the sample with certainty and take a random sample of the remaining sites. To further improve the precision, non-certainty sites are selected for the sample through systematic random sampling. That is, a random sample of sites remaining after the certainty sites have been selected is selected by ordering them according to the magnitude of their savings and using systematic random sampling. Sampling systematically from a list that is ordered according to the magnitude of savings ensures that any sample selected will have some units with high savings, some with moderate savings, and some with low savings. Samples cannot result that have concentrations of sites with atypically high savings or atypically low savings. As a result of this methodology, the required sample for the CCP was reduced to 21, with one certainty stratum and 4 sample strata.

2.4.3 Free-Ridership

In determining ex post net savings for the PNM DSM portfolio, the Evaluator provides estimates of free-ridership for individual programs. Free-riders are program participants that would have implemented the same energy efficiency measures at nearly the same time absent the program. Rather than apply a binary scoring (0% vs. 100% free-ridership), the Evaluator applied a free-ridership probability to program participants, based upon four factors:

(1) Financial ability to purchase high efficiency equipment absent the rebate

(2) Importance of the rebate in the decision-making process

(3) Prior planning to purchase high efficiency equipment

(4) Demonstrated behavior in purchasing similar equipment absent a rebate

In this methodology, Part (1) is essentially a gateway value, in that if a participant does not have the financial ability to purchase energy efficient equipment absent a rebate, the other components of free-ridership become moot. As such, if they could not have afforded the high efficiency equipment absent the rebate, free-ridership is scored at 0%. If they did have the financial capability, the Evaluator then examines the other three components, each contributing an equal scoring of 33% to free-ridership. It should be noted that having financial ability does not necessarily imply free-ridership; it just opens the possibility that other factors could contribute to the decision-making process. A participant that was financially able to purchase high efficiency lighting, for example, could still be scored at 0% free-ridership if it is demonstrated that:

(1) The rebate factored into their decision-making process;

(2) They did not have prior plans to install high efficiency equipment before learning of the available rebates; and

(3) They did not demonstrate prior behavior of purchasing similar equipment absent a rebate.

There are other contributing factors to free-ridership, specifically in instances of programs that provide outreach to customers. For example, a sponsoring utility provides assistance for a large commercial retrofit project by offering energy efficiency measure recommendations or by providing a cost-benefit analysis of a measure to a business. These could factor into the decision-making in ways that mitigate free-ridership, in that there are cases where a participant did not need a rebate to participate, but was induced to participate by the sponsoring utility's efforts in recommending and/or evaluating energy efficiency measures for them. Additional issues such as this are addressed on a program-by-program basis in methodology sections to follow.

For residential programs, free-ridership is calculated as the average score determined for the sample of participants surveyed. For business programs, a weighted average is taken of verified kWh savings, as the free-ridership scores of high-savers contribute a larger share of the overall free-ridership rate. Once free-ridership is determined, he Evaluator then estimates the Net-to-Gross Ratio (NTGR), calculated as:

$$NTGR = 1 - \% \text{ Free-Ridership}$$

2.5 Data Collection

This subsection provides descriptions of the Evaluator's data collection procedures, including:

- Telephone Surveying;
- Residential On-Site Verification; and

- Business On-Site Verification & Metering.

2.5.1 Telephone Surveying

The Evaluators conducted a large volume of telephone surveys in evaluating the 2015 PNM DSM portfolio. These surveys were designed to collect a variety of data needed in the evaluation effort, including:

- Verification of installation of rebated equipment;
- Parameters used in gross savings calculations (room of installation for residential CFLs, whether a refrigerator was used indoors vs. outdoors, etc.);
- Data on decision-making to be used in determining program free-ridership; and
- Feedback from participants from their experiences with the program.

Table 2-1 below presents the total surveys conducted by program.

Table 2-1 Telephone Surveys by Program

Program	***Surveys***
Whole House	160
LI Home Efficiency	160
Residential Stay Cool	160
Refrigerator Recycling	66
Residential Lighting - Customer Intercepts	108
Residential Lighting - Store Managers	29
Commercial Comprehensive - Retrofit Rebates	25
Commercial Comprehensive - QuickSaver	47
Commercial Comprehensive - Building Operator Certification Participants	11
Commercial Comprehensive - Building Operator Certification Instructors	4
Commercial Comprehensive - Distributor Discount Vendor Interviews	4

Surveys with business program participants, PNM staff, and trade allies were conducted by ADM staff. Surveys with residential program participants were conducted by Research & Polling, an experienced survey firm, with ADM performing quality control checking on the survey programming and monitoring a sample of phone calls. This ensured that interviewers were adhering to the survey script and that all questions were read correctly.

2.5.2 Onsite Surveys

On-site data collection procedures varied by program. For residential programs, site visits constituted a verification inspection of rebated equipment. For business participants, the Evaluator conducted onsite metering at facilities where factors contributing to energy savings, including lighting schedule and motor load factors, were subject to high uncertainty. Table 2-2 below provides a summary of on-site visits by program.

Table 2-2 Summary of Site Visits by Program

Program	# Site Visits
Commercial Comprehensive – Retrofit	23
Commercial Comprehensive – New Construction	10
Commercial Comprehensive – QuickSaver	22
Whole House	40
Low Income Home Efficiency	33
Total	128

2.6 Cost-Effectiveness Testing

In evaluating the 2015 PNM DSM Portfolio, the Evaluator performed cost-effectiveness testing at the program and portfolio levels. The Evaluator performed the Total Resource Cost (TRC) and Utility Cost (UC) test.

2.6.1 Total Resource Cost Test

The TRC value is defined as:

$$TRC = \frac{Electric\ Cost\ Decrease + Capacity\ Credit + Non - Electric\ Cost\ Decrease}{Net\ Customer\ Investment + Utility\ Administrative\ Cost}$$

The parameters for this equation are defined in Table 2-3.

Table 2-3 Parameters for TRC Testing

Parameter	Definition
UEPCD	Utility Electric Cost Decrease: The Net Present Value (NPV) of avoided production costs. Estimated by taking NPV of net kWh savings multiplied by $/kWh production costs over the life of the measure.
UGCC	Utility Generation Capacity Credit: The NPV of avoided capacity expansion costs. Estimated by taking NPV of net demand reduction multiplied by $/kW capacity expansion costs over the life of the measure.
NEACD	Non-Electric Acquisition Cost Decrease: NPV of gas savings created incidentally by electric DSM programs (from measures such as weatherization, low-flow showerheads, etc.). Estimated by taking NPV of net Therms savings multiplied by $/Therm of gas production/distribution by gas utilities serving the PNM territory.
NCI	Net Customer Investment: Net incremental costs accrued by program participants. Estimated by taking total measure-level incremental costs and multiplying by Net-to-Gross Ratio, as costs paid by free-riders would have occurred absent the program. For give-away programs, the incremental cost of equipment paid by the utility is substituted for this value as participant costs are $0 in such programs.
UAC	Utility Administrative Costs: Costs accrued by PNM for running the program. Costs include internal administration costs, marketing, and third-party implementation costs. Rebates are not considered a cost as they represent transfer payments from PNM to program participants.

2.6.2 Utility Cost Test

The UC test is defined as:

$$UCT = \frac{Electric\ Cost\ Decrease + Capacity\ Credit}{Utility\ Equipment\ Expenditures + Utility\ Administrative\ Cost}$$

Most terms in this equation are defined and calculated in the same manner as the components of the TRC test. Where the UC test differs, however, is in costs applied. The TRC test treats rebates as a transfer payment; it is simultaneously a cost to the utility and a benefit to the participant, and as such its impact on TRC is neutral. The UC is focused on the costs the sponsoring utility incurs in running a program, and as such rebate payments are included in the cost side of the equation. Net Customer Investment (NCI) is not factored in, as this cost is external to the utility. In giveaway programs, such as the Low Income CFL & Refrigerator Program, Utility Equipment Expenditures (UEE) will be equal in value to NCI, as the “rebate” (100% of the measure incremental cost) is paid in full by the utility, and thus the NCI is paid by PNM.

3. PNM Power Saver

3.1 Program Description

The PNM Power Saver program (PPSP) is a direct load control program in which participants agree to have a Smart Switch attached to their refrigerated air unit. When PNM has a system critical peak, they can send a signal to the unit that will set a cycling rate on the compressor, turning it off for an interval of time during the hottest hours of summer weekday afternoons. It is not activated on weekends or holidays, and activation is not to last longer than four hours on a given day. Participants receive a $25 incentive for their participation.

3.2 M&V Methodology

The PNM Power Saver Program (PPSP) provides incentives to residential, small commercial (<50kW) and medium commercial (<150 kW) customers to have control switches installed on their air conditioning units, allowing PNM to curtail these units as needed during system critical peaks.

3.2.1 Evaluation of PSP Residential Component

The residential component of the PSP was evaluated through use of a control group. The Evaluator developed a sample for metering, weighted to be sufficiently representative of the Albuquerque and Santa Fe regions. The sample is metered for the length of the control season (June 1 – September 30). After each curtailment event, 20% of the curtailment group and control group are rotated, in order to ensure non-biased comparisons between the groups. In order to qualify for M&V purposes, the event must have at least one hour in which the temperature in Albuquerque, NM exceeds 97 degrees. Determining the total peak demand reduction provided by the PSP is done through the following steps:

(1) Comparison of kW/Ton values of curtailment and control groups over the range of the events;

(2) Calculating the highest kW reduction over a 15-minute rolling average of 5-minute intervals;

(3) Multiplying the resulting kW/Ton by total residential population tonnage

3.2.2 Evaluation of PSP Commercial Component

For the medium commercial component, demand reductions are evaluated using metered data for a curtailed group with a baseline determined from adjusting usage on prior days. The calculation utilizes the same 15-minute rolling average of 5-minute interval data as the Residential & Small Commercial component. However, the baseline is determined by the following equation:

$$Baseline\ kW = Mean\ kW(Baseline\ Days) * Offset\ Factor$$

Where

Baseline Days = Three of the previous 10 non-weekend, non-holiday, non-event days displaying the highest average event-time load, and

Offset Factor = kW for the hour preceding curtailment / Average kW for this hour during baseline days

This is converted to a per-unit reduction, which is then translated to the entire medium commercial population. What comes from these two methodologies is an "availability analysis", in which the in-season performance is multiplied by the number of installations at the end of the 2015 program year. This provides estimates of the value of the resource developed by the program implementation staff.

3.3 PNM Power Saver Impact Findings

The Evaluator estimated the available critical peak reduction from the PPSP by analysis of metered data from the curtailment group on the M&V Events in 2015.

3.3.1 Sample Design

Table 3-1 describes the final sample. Following a similar stratification to 2014, the 2015 plan adds the addition of strata differentiating residence type (MDU vs. non-MDU). In addition, small commercial devices have been split from residential and the medium commercial MDUs have been added to the residential population. For this proposal, the South region has been absorbed into the Central region. For the *Residential* and *Small Commercial* segment the proposed plan for 2015 is to distribute the M&V population as shown.

Table 3-1 M&V Sample Received

Strata	Participant Type	Region	MDU	Tonnage	# Sample Points	% of M&V Count
1	Residential + Small *& Medium Commercial MDUs	North	NO	≤ 3.0	3	1.0%
2				≥ 2.0	3	1.0%
3			YES	All	7	2.4%
4		Central	No	≤ 2.0	13	4.4%
5				2.0 ≤ … ≤3.5	47	15.8%
6				≥ 3.5	45	15.2%
7			Yes	≤ 1.5	54	18.2%
8				1.5 ≤ … ≤ 2.0	64	21.5%
9				> 2.0	20	6.7%
10		South NM	NO	All	4	1.0%
11			YES	All	3	1.0%
12	Small Commercial	North	No	All	14	4.7%
13		Central	No	> 4.5	13	4.4%
14				≥ 4.0	3	1.0%
15		South NM	No	All	2	.7%
				Total	297	100%

3.3.2 Residential & Small Commercial kW Factor Definition

For the residential and small-commercial Power Saver program, event performance is measured by the residential kW factor, as defined in the Comverge M&V Plan. The kW factor is defined as the largest average difference – where the averaging is done over a rolling 15-minute window, or over three 5-minute intervals – between the averaged loads of a control group and a treatment group (whose load serves as the baseline), which also occurs during a qualified M&V hour. An event hour qualifies as an M&V hour if the average temperature, as recorded at KABQ (Albuquerque International Sunport) is greater than or equal to 97 degrees Fahrenheit.

3.3.3 kW Factor Calculation

The peak reduction identified in an iterative process with the Evaluators and Comverge was .92 per unit, found on August 6th.

3.3.1 Net kWh Savings

The **reduction factor** for an event is defined as the sum of the kWh reductions across all hours of the event. The **snapback factor** is the sum of the kWh differences (which are sometimes negative, due to higher-than-normal cooling demand after the end of an event), for the three hours following the conclusion of the event. Although unusual, positive savings during the snapback period are considered valid by virtue of the control group methodology used, whereas, they are not for the commercial segment, which uses a heuristic baseline methodology).

Table 3-2 Hourly kWh Reductions - Residential

Date	*Hour 1*	*Hour 2*	*Hour 3*	*Hour 4*	*Snap 1*	*Snap 2*	*Snap 3*	*Reduction Factor (kWh)*	*Snapback Factor (kWh)*	*Net kWh Difference*
6/17/2015	0.31	0.29	0.44	0.51	-0.30	-0.31	-0.03	1.56	-0.63	0.93
6/18/2015	0.27	0.47	0.63	0.73	-0.26	-0.22	-0.20	2.10	-0.68	1.42
6/19/2015	0.33	0.50	0.69	0.64	-0.28	-0.32	-0.19	2.15	-0.79	1.36
6/22/2015	0.55	0.74	0.76	0.82	-0.35	-0.41	-0.35	2.88	-1.10	1.77
6/23/2015	0.50	0.77	0.62	0.64	-0.42	-0.65	-0.39	2.53	-1.46	1.07
6/29/2015	-	0.24	0.18	0.17	-0.03	-0.29	-0.08	0.58	-0.40	0.18
6/30/2015	0.39	0.60	0.65	0.71	-0.29	-0.49	-0.26	2.34	-1.04	1.29
7/1/2015	0.40	0.49	0.52	0.68	-0.45	-0.46	-0.36	2.08	-1.27	0.81
7/28/2015	0.40	0.59	0.75	0.60	-0.35	-0.42	-0.29	2.34	-1.06	1.28
7/31/2015	0.16	0.31	0.32	0.31	-0.15	-0.16	-0.08	1.09	-0.39	0.71
8/6/2015	0.41	0.55	0.65	0.49	-0.32	-0.27	-0.26	2.09	-0.84	1.25
8/13/2015	0.34	0.54	0.53	0.66	-0.31	-0.22	-0.25	2.06	-0.78	1.28
8/14/2015	0.50	0.59	0.58	0.57	-0.36	-0.21	-0.20	2.23	-0.76	1.46
8/18/2015	0.35	0.47	0.61	0.54	-0.53	-0.64	-0.43	1.98	-1.61	0.37
8/21/2015	0.27	0.39	0.51	0.25	-0.40	-0.21	-0.11	1.41	-0.73	0.69

Table 3-3 Net Per-Device kWh Savings

Event Date	Per-Unit kWh	Number of Units	kWh Savings
6/17/2015	0.93	37,087	34,381
6/18/2015	1.42	37,087	52,586
6/19/2015	1.36	37,087	50,470
6/22/2015	1.77	37,087	65,771
6/23/2015	1.07	37,087	39,773
6/29/2015	0.18	37,087	6,814
6/30/2015	1.29	37,087	47,997
7/1/2015	0.81	36,378	29,558
7/28/2015	1.28	36,378	46,494
7/31/2015	0.71	36,378	25,721
8/6/2015	1.25	35,801	44,872
8/13/2015	1.28	35,801	45,939
8/14/2015	1.46	35,801	52,431
8/18/2015	0.37	35,801	13,348
8/21/2015	0.69	35,801	24,607
Total	1.06 / event	36,517	580,762

3.3.2 Residential Event Load Profiles

The load profiles of the curtailment and control groups are displayed in Figure 3-1 to Figure 3-9 to follow.

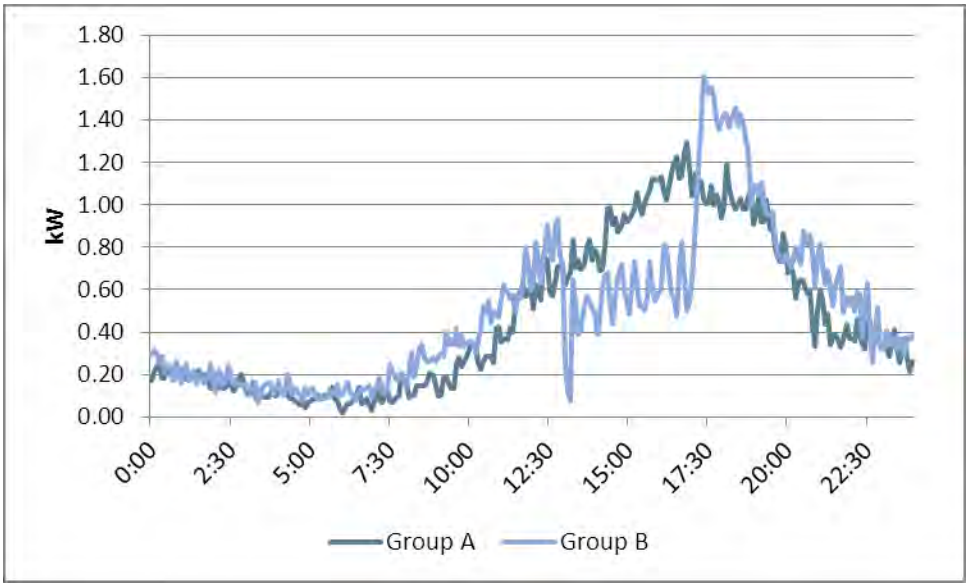


Figure 3-1 June 17th – Residential Load Profile

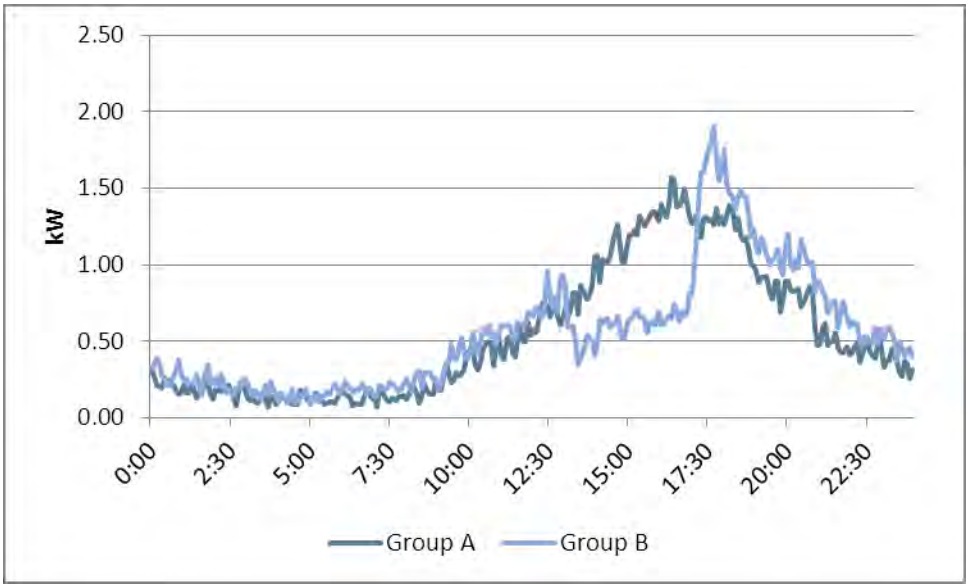


Figure 3-2 June 18th - Residential Load Profile

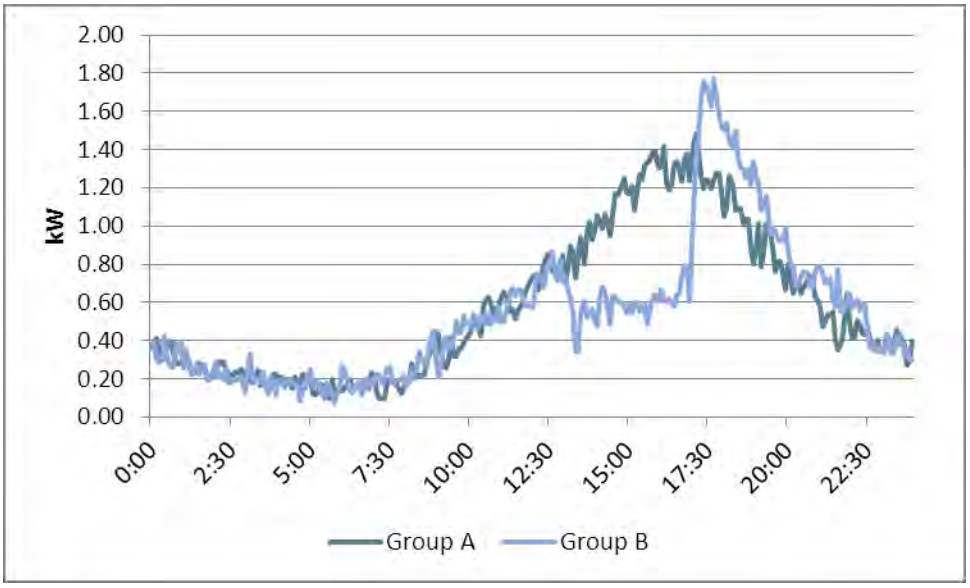


Figure 3-3 June 19th – Residential Load Profile

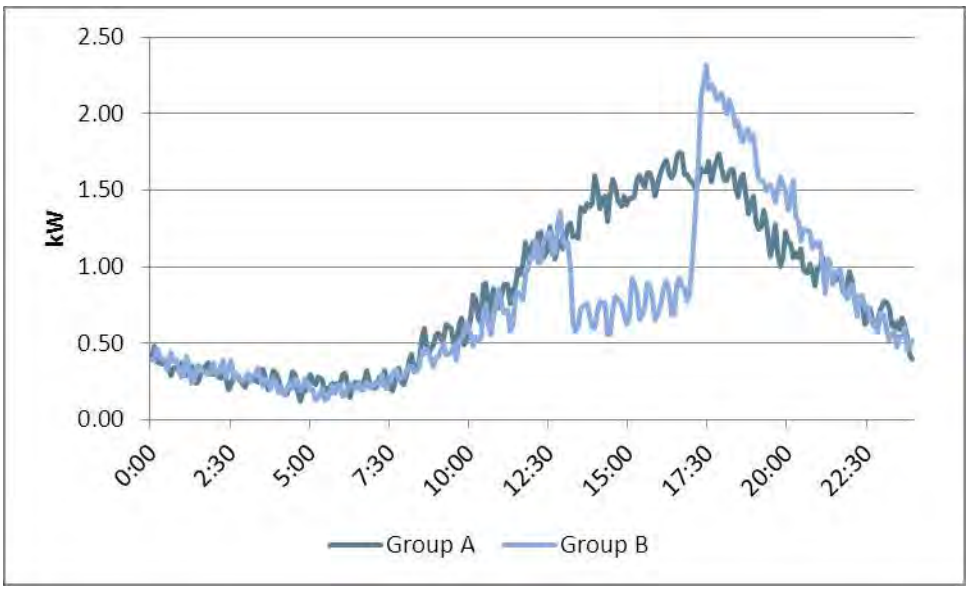


Figure 3-4 June 22nd - Residential Load Profile

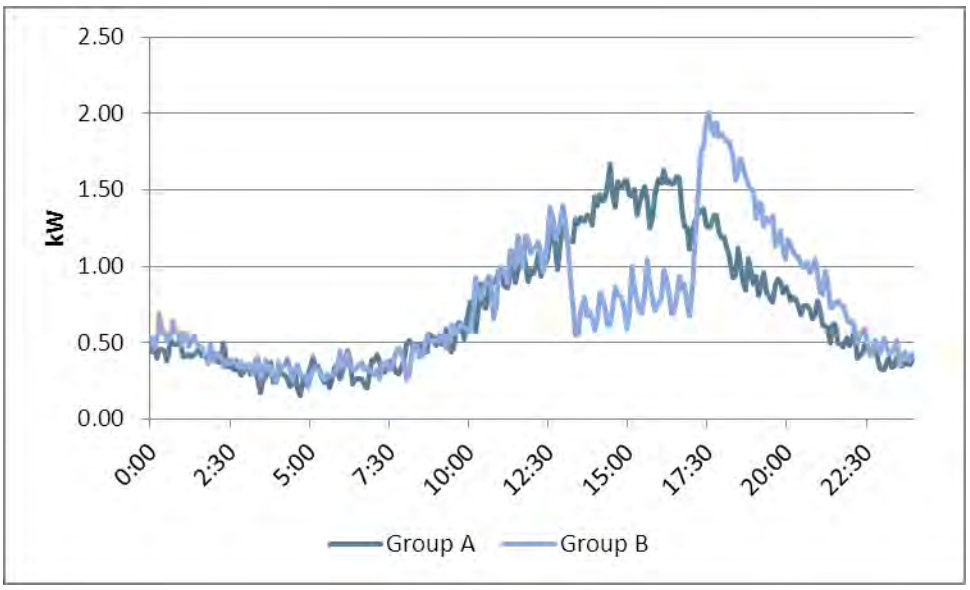


Figure 3-5 June 23rd - Residential Load Profile

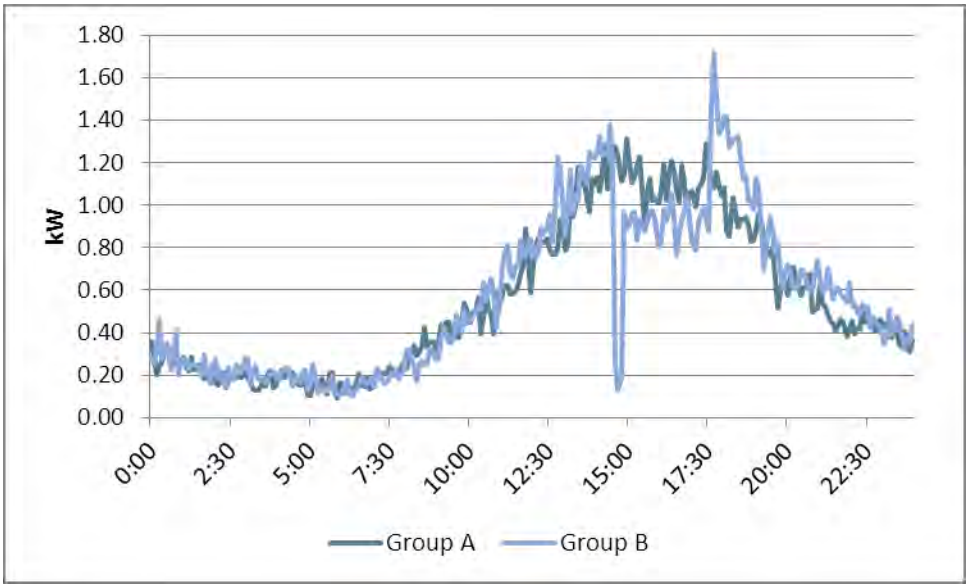


Figure 3-6 June 29th - Residential Load Profile

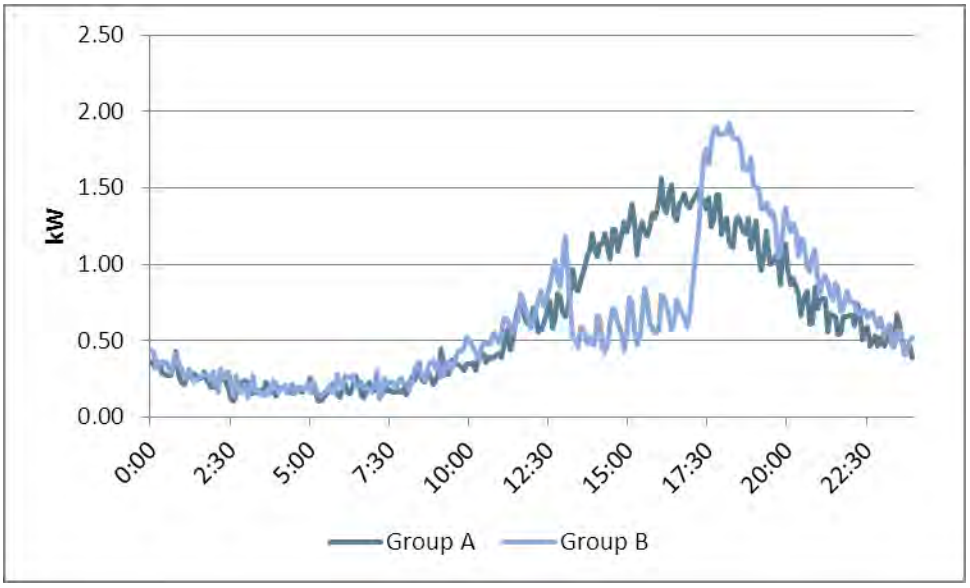


Figure 3-7 June 30th - Residential Load Profile

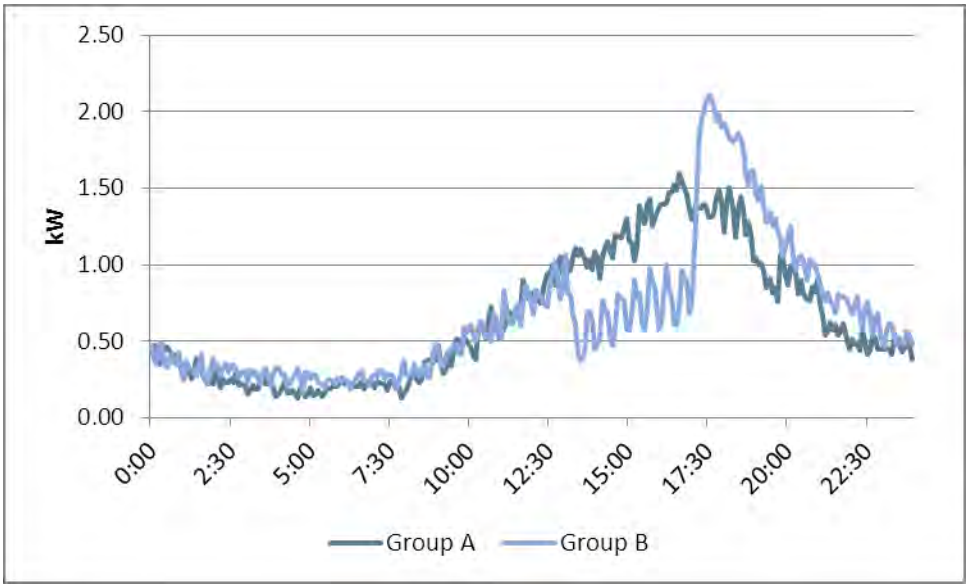


Figure 3-8 July 1st - Residential Load Profile

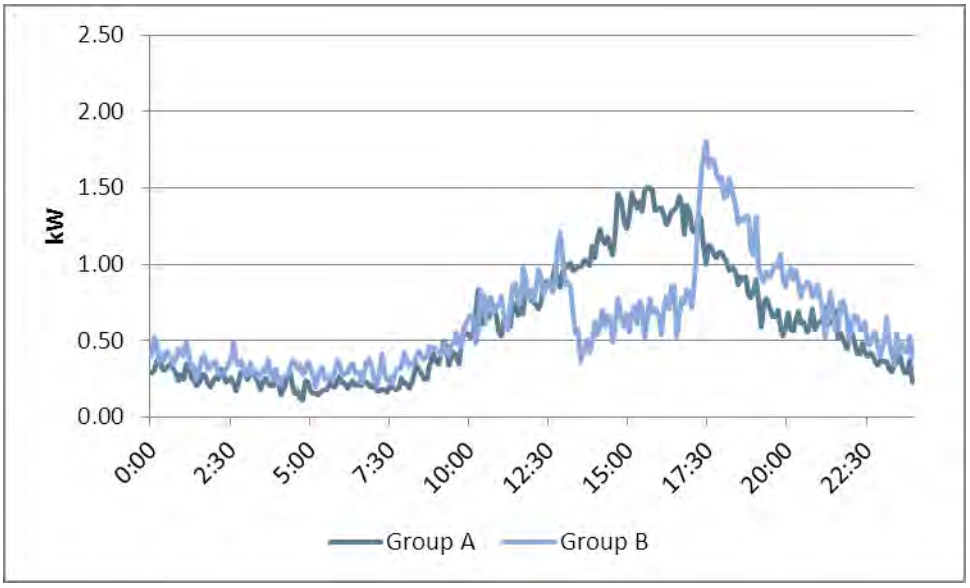


Figure 3-9 July 28th - Residential Load Profile

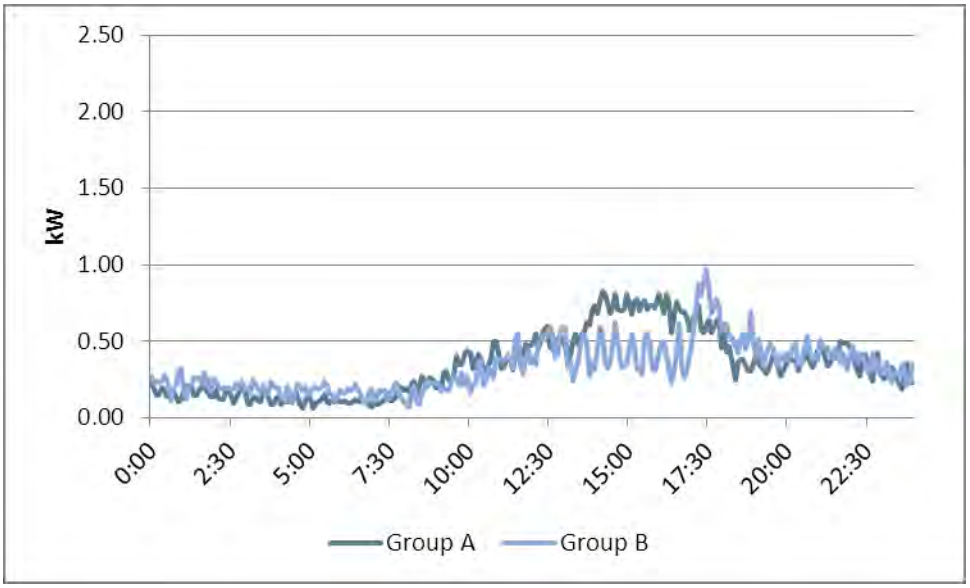


Figure 3-10 July 31st – Residential Load Profile

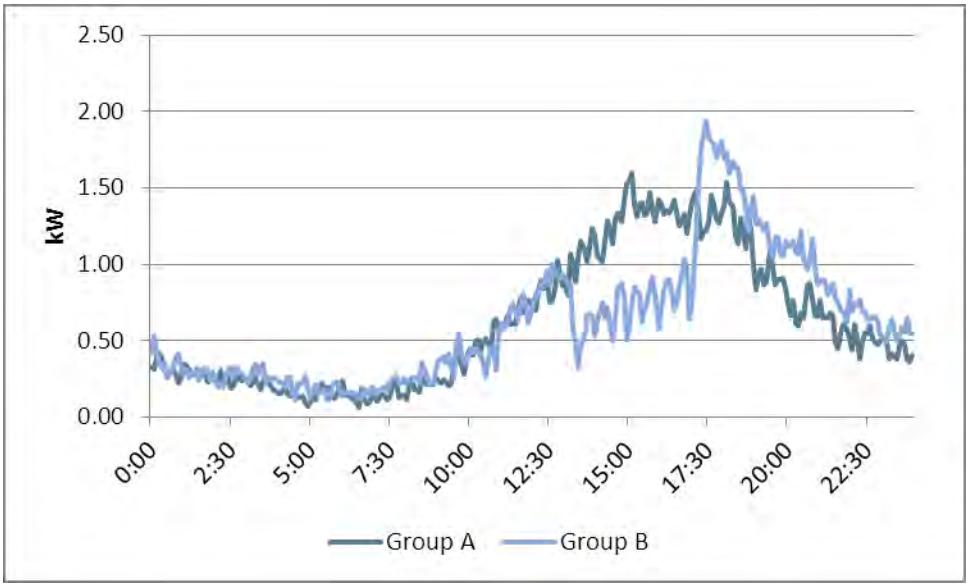


Figure 3-11 August 6th – Residential Load Profile

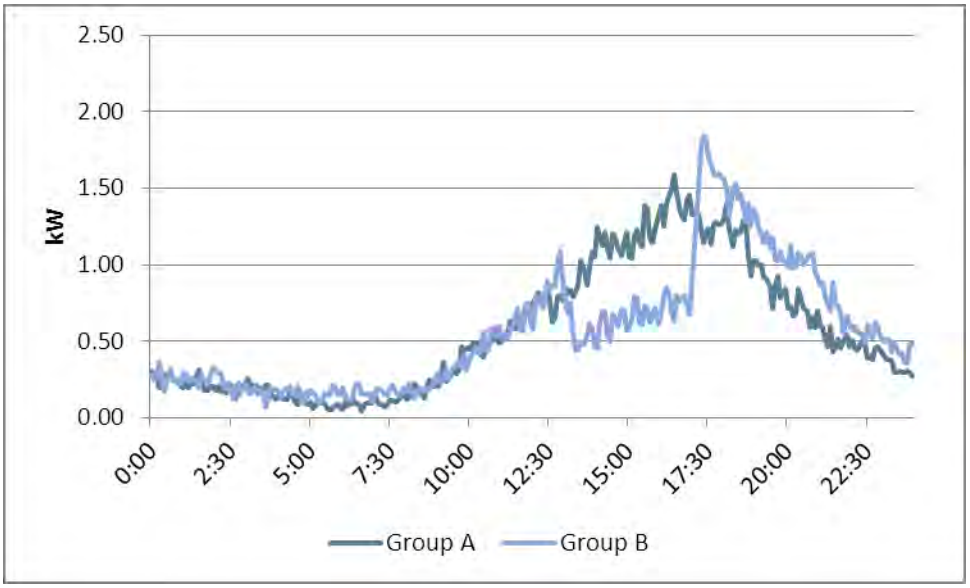


Figure 3-12 August 13th – Residential Load Profile

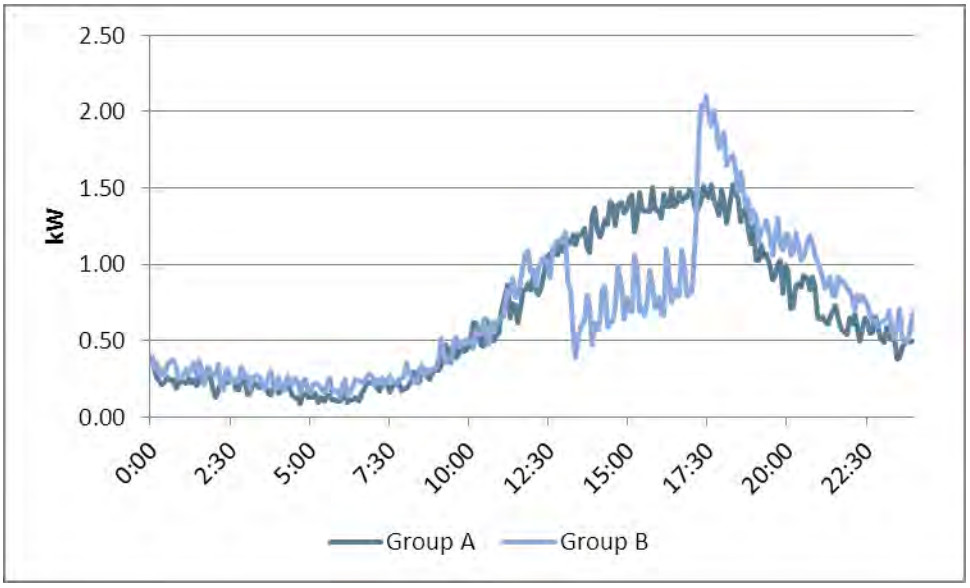


Figure 3-13 August 14h – Residential Load Profile

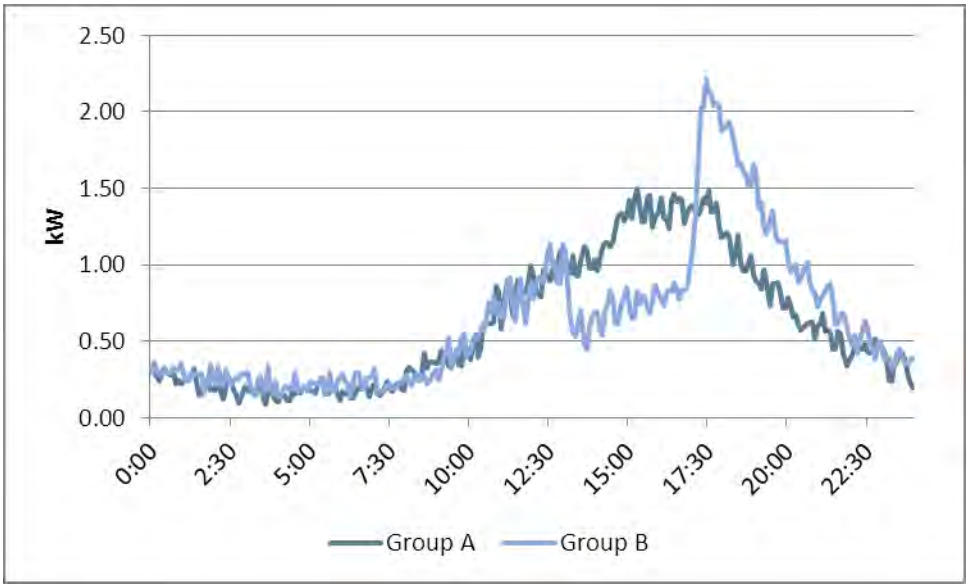


Figure 3-14 August 14h – Residential Load Profile

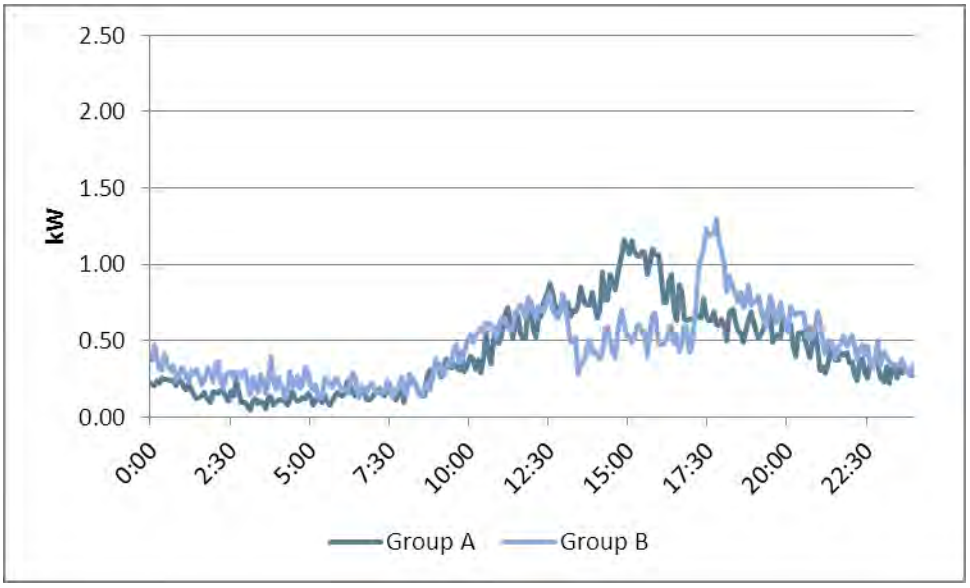


Figure 3-15 August 18h – Residential Load Profile

3.3.3 Power Saver Small Commercial

The Evaluators found that in many events there were issues of biased sample design that did not allow for full event performance calculations. Settlement calculation was completed, however, with a kW factor of 1.25

3.3.4 Power Saver Medium Commercial

Insufficient data was provided to calculate performance of every event. Settlement calculation was completed at 7.72 kW per facility.

3.4 Total Demand Reductions

For the 2015 curtailment season the reduction calculations yielded a result of 0.92 kW per device for the Residential segment and 1.25 kW per device for the Small Commercial segment. For the Commercial segment, there was a reduction of 7.72 kW per facility. This leads to an average total estimated load reduction of 42.22 MW based on the total installed capacity.

As of Sept 30, 2015, the total verified load reductions are summarized in Table 3-4.

Table 3-4 Settlement Calculations for PNM Power Saver Program

Sector	***kW Factor***	***# Units***	***Available Demand Reduction (MW)***	***kWh Savings***
Residential	0.92	36,664	35.18	580,762
Small Commercial	1.25	3,981	2.55	
Medium Commercial	7.72 (per premise)	455	5.1	NA
		Total	42.83	580,762

4. PNM Peak Saver

4.1 Program Description

The PNM Peak Saver Program is a load management program for larger commercial and industrial customers with peak loads of 150 kW or greater per month. This program targets non-essential electric loads that can be reduced during periods of peak system demand. PNM has hired a third-party contractor, EnerNOC, Inc., to manage and market this program

4.2 M&V Methodology

The PNM Peak Saver Program (PKSP) provides incentives to large commercial and industrial customers (load > 150 kW) to curtail loads at their facility when called upon by PNM. Facilities nominate a load reduction and are then paid by performance following a load management event.

4.2.1 Verifying Per-Event Load Reduction

To verify load reduction in a specific event, the Evaluator reviews results from a census of program participants. Load reductions are then calculated according to the contractual method agreed upon between PNM and the program implementer, EnerNOC. This involves calculating:

- Customer Baseline;
- Weather Adjustment;
- 10-Minute Capacity Performance;
- Average Capacity Performance; and
- Verified Capacity Performance.

4.2.1.1 Customer Baseline

The baseline methodology for Peak Saver curtailment is such that for a given customer, the initial baseline for the season is calculated as the average kWh load on each 5-minute interval for the (5) days preceding the first eligible day of the control season. For a day to be eligible as a Baseline Day, it must be a non-event, non-holiday weekday in which there was not a blackout or interruption to electric service.

When there are multiple consecutive events without eligible baseline days in between, the same baseline is used. When a qualifying baseline day next occurs, the Customer Baseline is then adjusted, equaling for each 5-minute interval:

*New Baseline on Event Day = .9 * Baseline kWh on Day Prior to Event+ .1 * kWh on Day Prior to Event*

This is repeated until a new event day occurs.

4.2.1.2 Weather Adjustment

On an event day, a determination is made to see whether the baseline should be adjusted to weather. This is performed by tracking the average hourly load for the two hours preceding the beginning of the event on the event day, and dividing by the load observed over that same interval on the baseline. If this ratio is > 1 (implying that the load on the Event Day is higher due to weather), the baseline is multiplied by the Weather Adjustment Factor to create the Adjusted Baseline. The Weather Adjustment for consecutive days will be the higher of the previous Program Event Day's Weather Adjustment or the present Day's Weather Adjustment.

4.2.1.3 Capacity Performance

There are three forms of capacity performance calculated in the M&V effort of Peak Saver:

- 10-Minute Capacity Performance;
- Average Capacity Performance; and
- Verified Capacity Performance.

They are calculated as follows:

10-Minute Capacity Performance = Adjusted Baseline kWh –The lowest actual electrical demand measured in one-minute interval readings in the eighth (8), ninth (9) or tenth (10) minutes after receipt of the PNM dispatch signal

Average Capacity Performance = Mean Value of Adjusted Baseline kWh – Event Day kWh for all 5-minute intervals occurring after the 5-minute interval comprising the 10-Minute Capacity Performance measurement.

Verified Capacity Performance = .6 * 10-Minute Capacity Performance + .4 * Average Capacity Performance.

4.3 Impact Findings

The Evaluator estimated the available critical peak reduction from the Peak Saver Program (PKSP) by analysis of metered data from a census of participants. This was used to calculate kW reductions according to PNM's contractually agreed methodology with EnerNOC, as well as providing hourly reductions for each event in 2015.

4.3.1 Nominated kW

The PKSP recruits participants with connected loads exceeding 150 kW, who then nominate an amount of available kW reduction each month of the summer cooling season (June 1st – September 30th). If there are no events that month, the participant is

paid based upon their nomination. If there are events, they are paid on the basis of verified kW reduction

Table 4-1 summarizes the participation and nomination values and the average event performance in the affected period.

Table 4-1 2015 Peak Saver Nomination Summary

Month	Total Nominated kW	Number of Events	Average Event Performance	Maximum Event Performance
June	15,110	6	16,451	20,066
July	15,015	2	12,674	15,156
August	15,080	5	15,574	17,567
September	15,965	0	-	-

Though any facility exceeding 150 kW in connected load is eligible for the PKSP, most of the participation comes from a few facility types: Industrial, Entertainment, and Education/K-12 facilities accounted for 46% of total participating facilities and 14% of nominated kW. Snapshots of participation by Nominated kW and by facility counts are presented in Figure 4-1 and Figure 4-2 below.

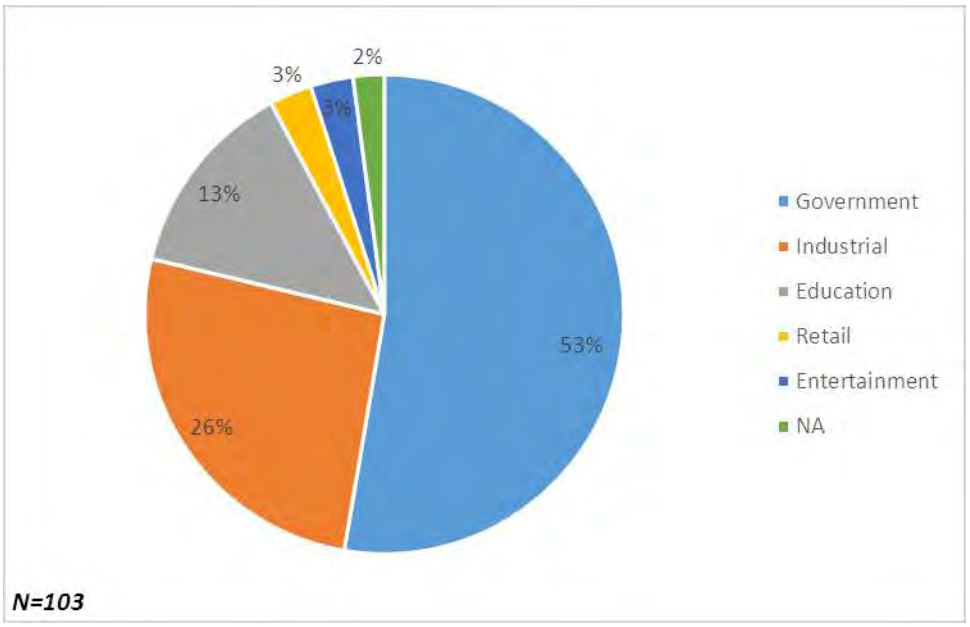


Figure 4-1 Peak Saver Nominations by Facility Type

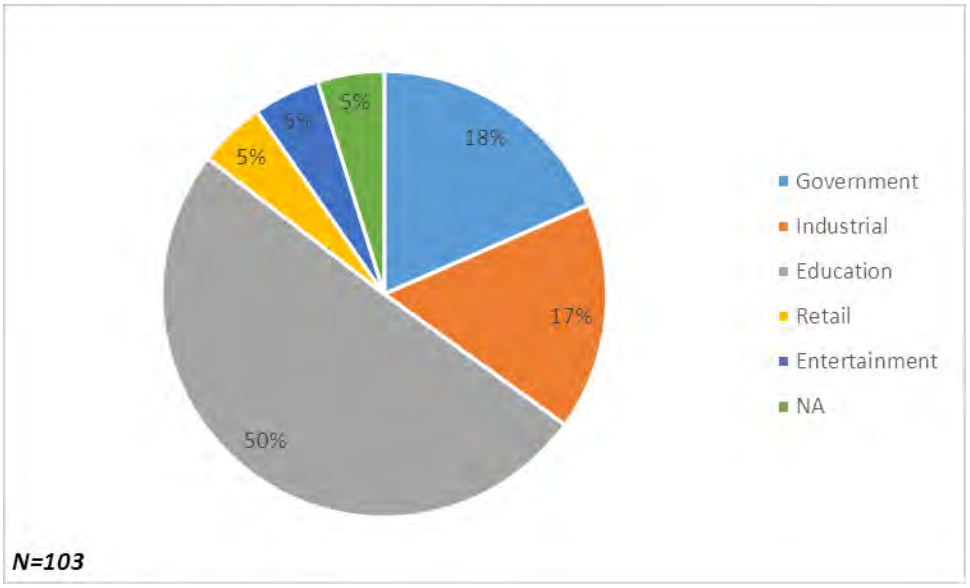


Figure 4-2 Peak Saver Participation by Facility Type

4.3.1 Event Performance

The Evaluator then calculated event performance by each of the criteria detailed in Section 4.2.1. These are summarized in Table 4-2.

Table 4-2 Peak Saver Event Performance Summary

Date	Event Start (MDT)	Event End (MDT)	10-Minute Capacity (kW)	Average Capacity (kW)	Verified Capacity (kW)	kWh Savings
6/17/2015	2:00 PM	6:00 PM	18,213	13,405	16,290	66,445
6/18/2015	2:00 PM	6:00 PM	25,375	15,655	21,487	80,262
6/19/2015	2:00 PM	6:00 PM	21,135	17,074	19,510	62,144
6/22/2015	2:00 PM	6:00 PM	20,447	14,730	18,160	64,914
6/23/2015	2:00 PM	6:00 PM	20,170	15,445	18,280	70,684
6/30/2015	2:00 PM	6:00 PM	14,579	11,243	13,245	50,361
7/1/2015	2:00 PM	6:00 PM	21,191	14,653	18,575	60,625
7/28/2015	2:00 PM	6:00 PM	13,336	9,447	11,781	40,768
8/6/2015	2:00 PM	6:00 PM	16,967	14,390	15,936	62,930
8/13/2015	2:00 PM	6:00 PM	17,669	15,635	16,855	66,823
8/14/2015	2:00 PM	6:00 PM	20,215	16,820	18,857	66,578
8/18/2015	2:00 PM	6:00 PM	22,475	15,698	19,764	70,268
8/21/2015	2:00 PM	6:00 PM	16,608	12,165	14,831	48,878

4.3.2 Event Load Profiles

Figure 4-3 through Figure 4-15 present the load profiles for each Peak Saver event.

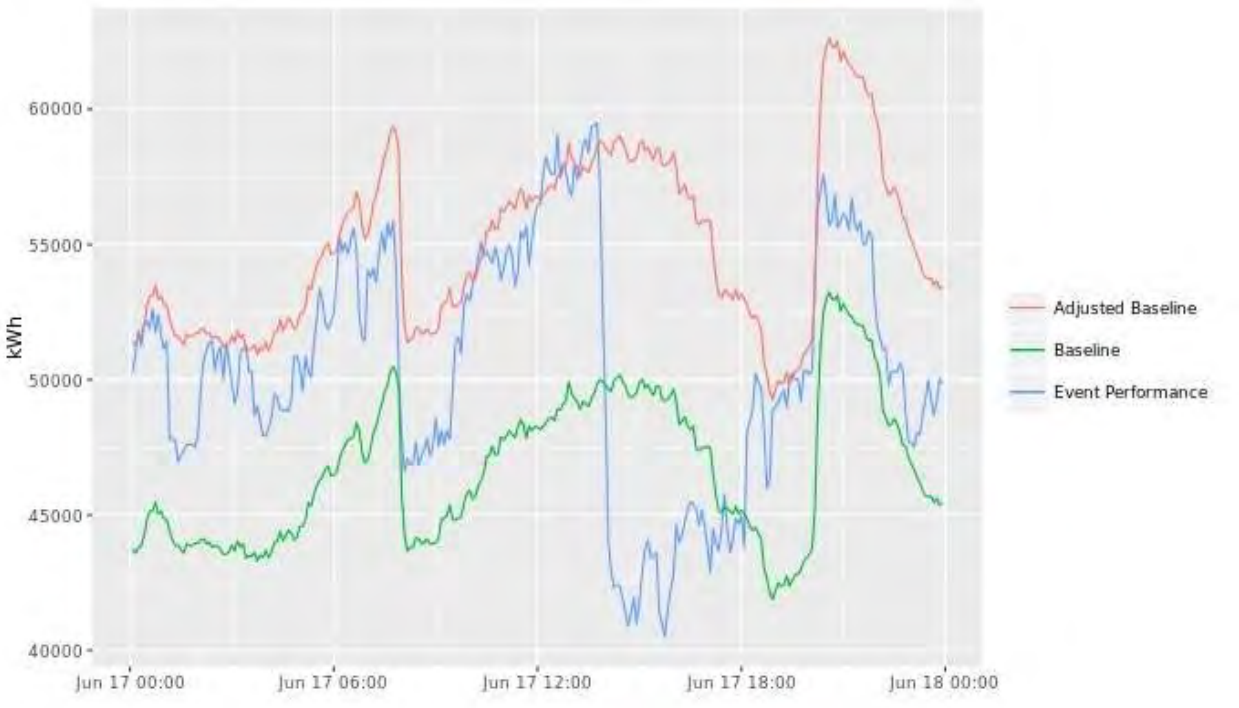


Figure 4-3 June 17th Peak Saver Event Load Profile

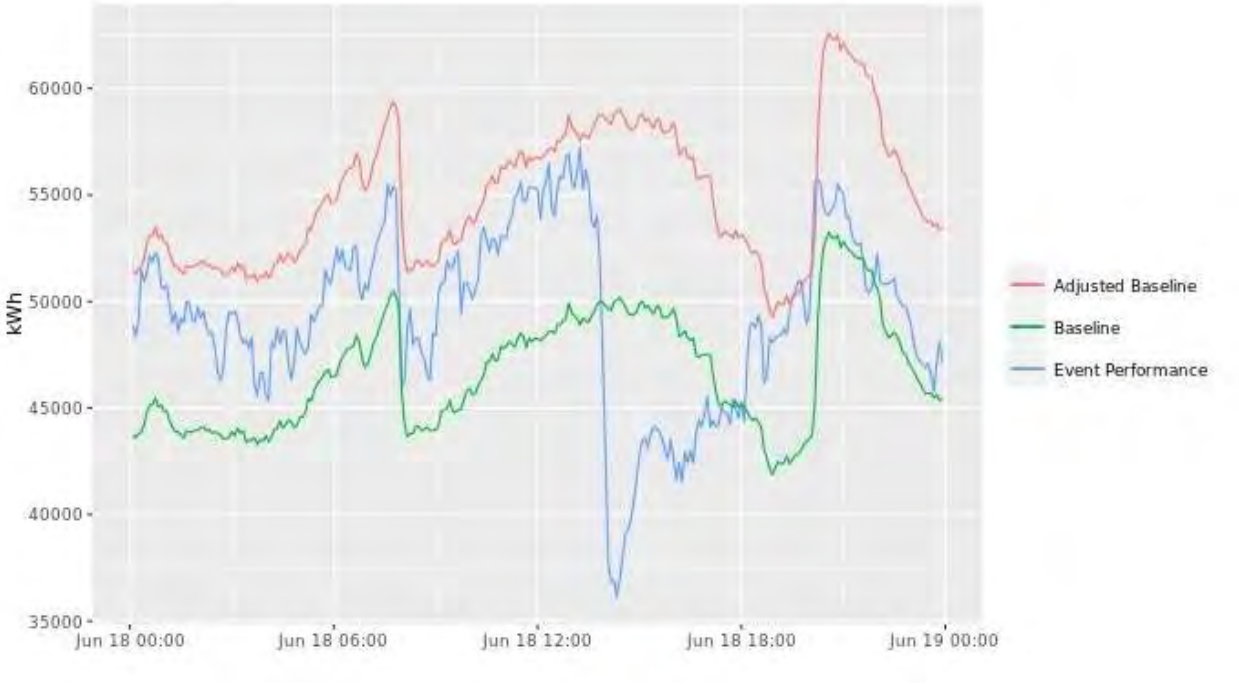


Figure 4-4 June 18th Peak Saver Event Load Profile

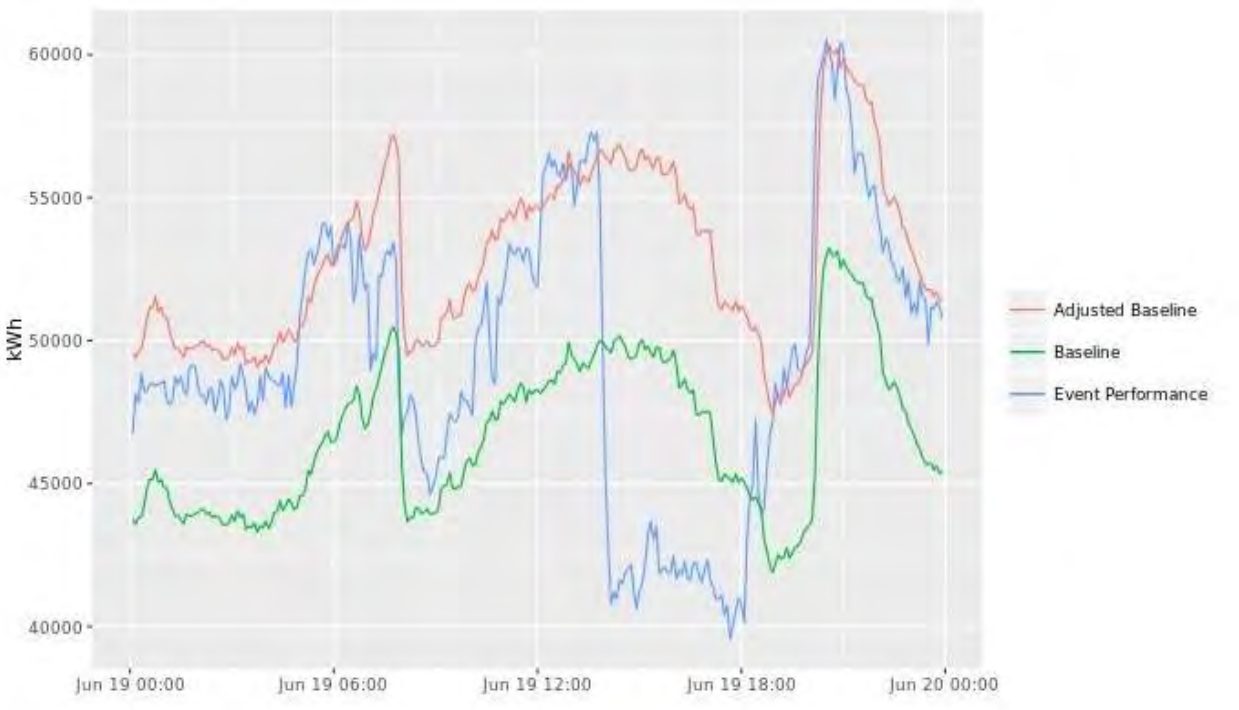


Figure 4-5 June 19th Peak Saver Event Load Profile

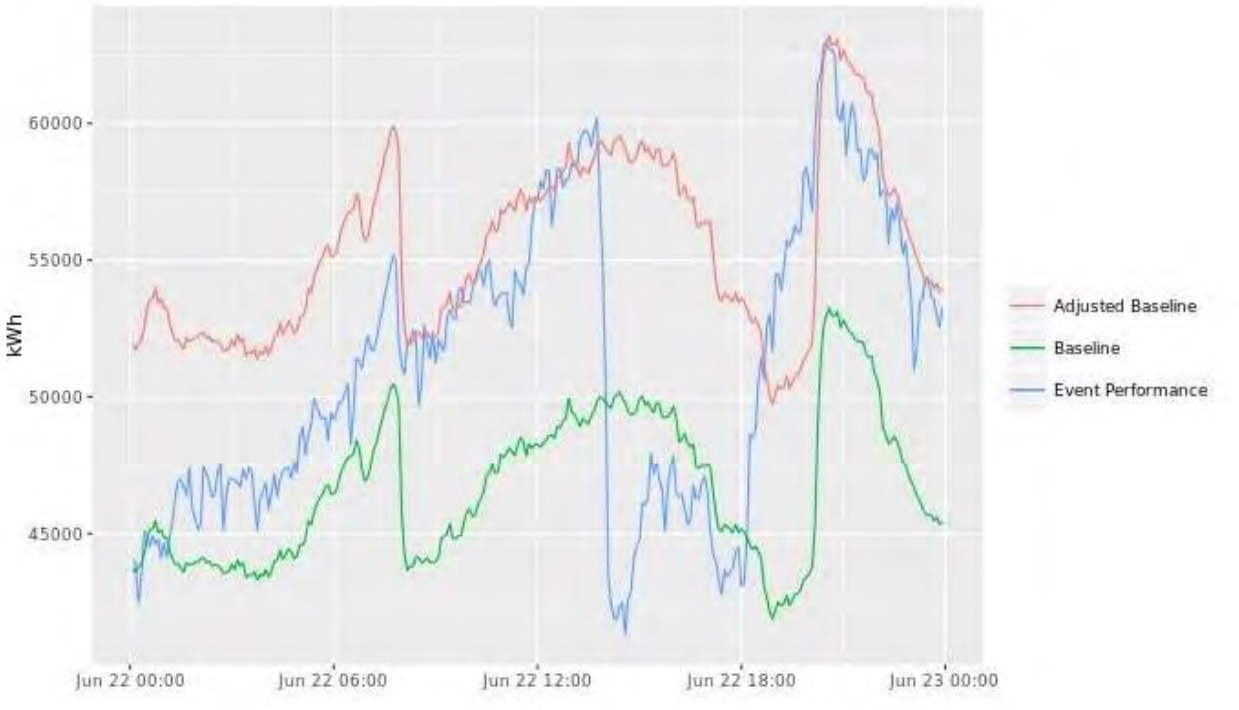


Figure 4-6 June 22nd Peak Saver Event Load Profile

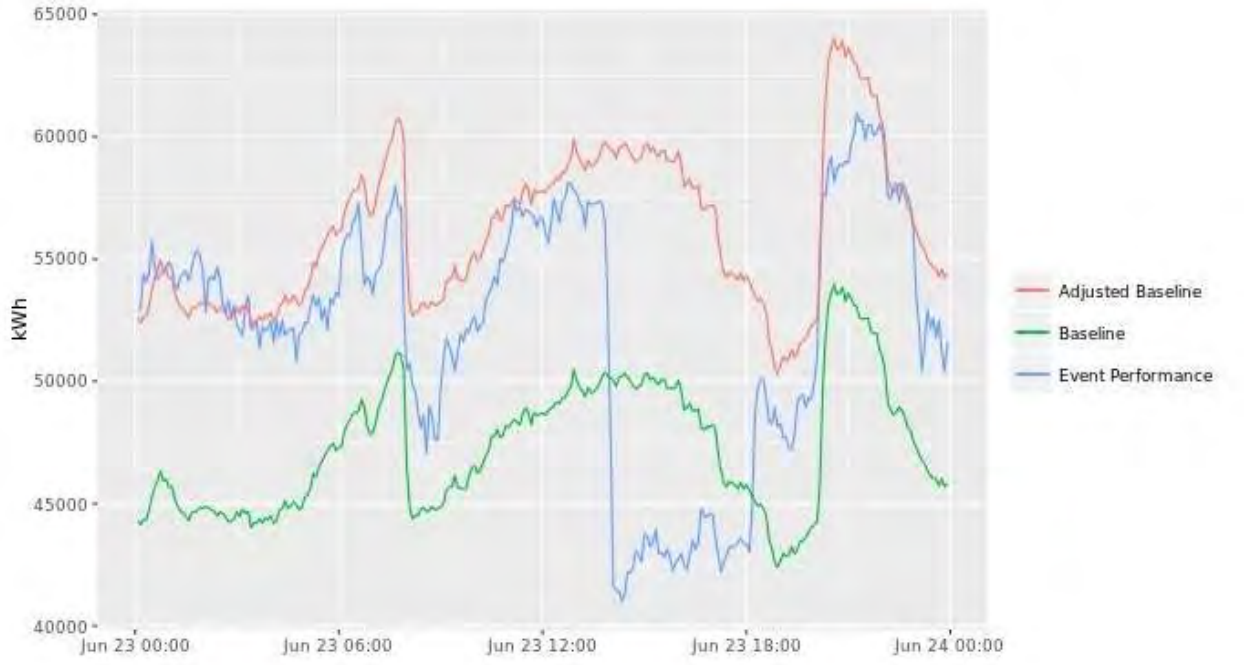


Figure 4-7 June 23rd Peak Saver Event Load Profile

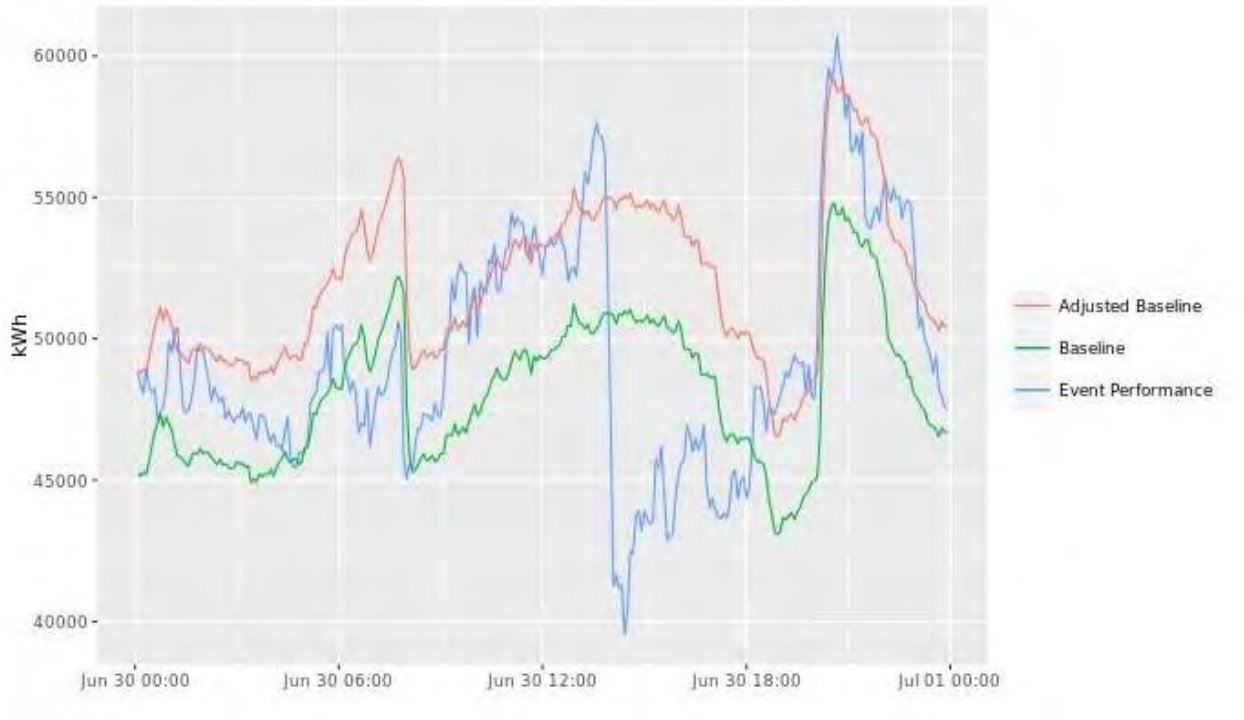


Figure 4-8 June 30th Peak Saver Event Load Profile

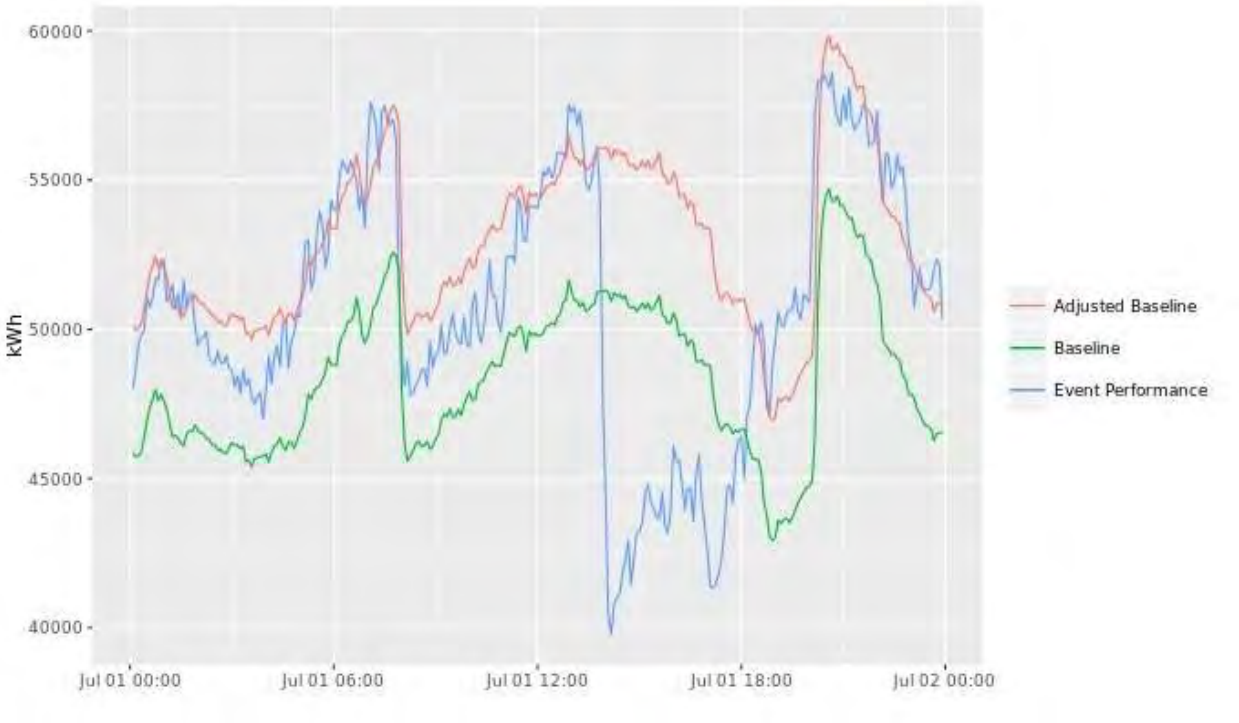


Figure 4-9 July 1st Peak Sever Event Load Profile

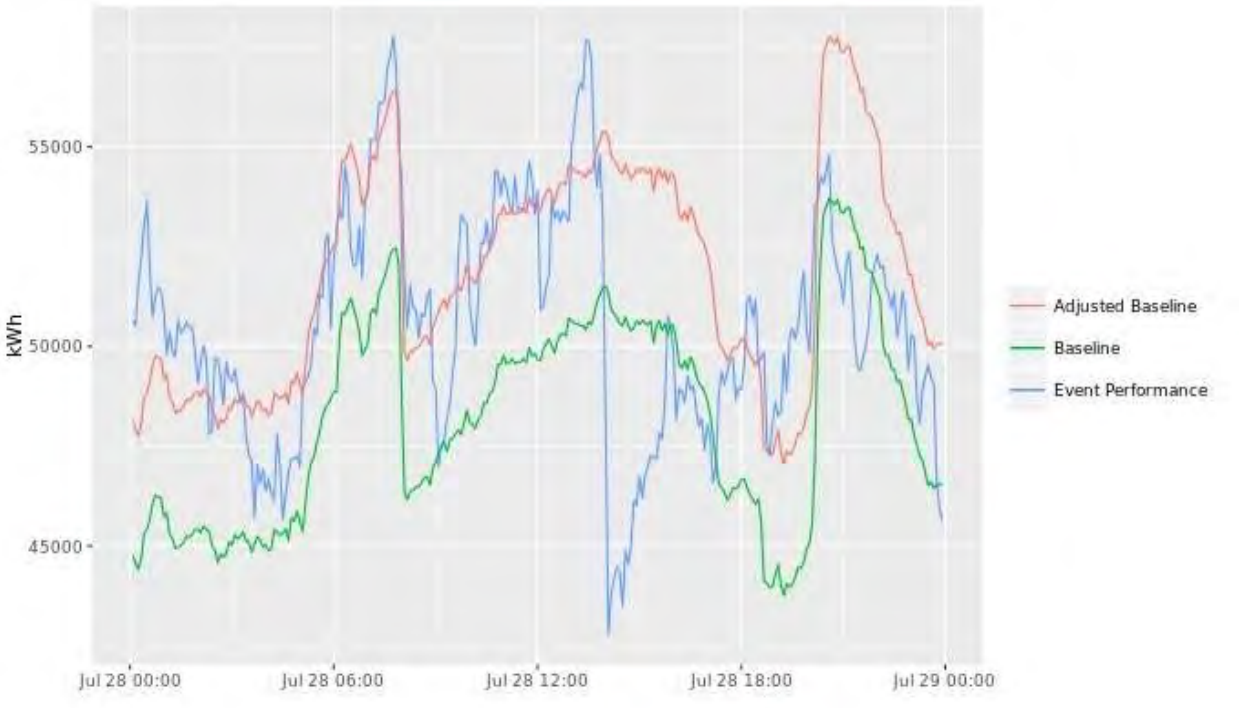


Figure 4-10 July 28th Peak Saver Event Load Profile

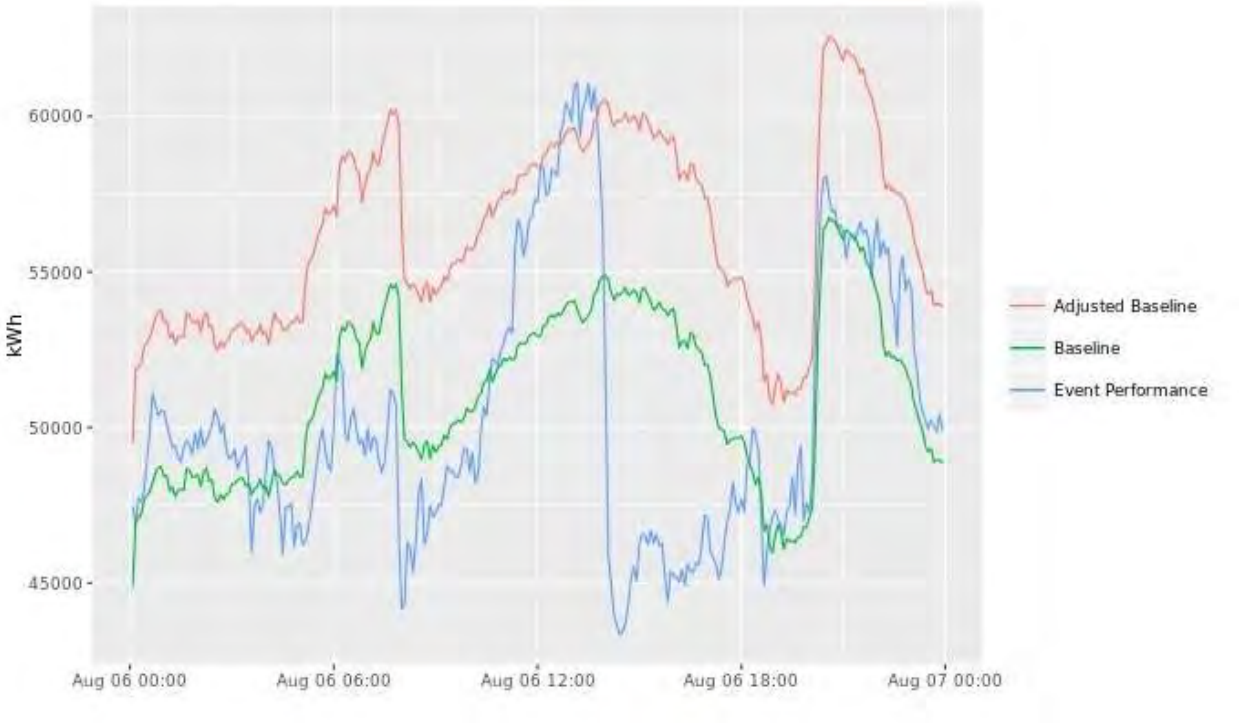


Figure 4-11 August 6th Peak Saver Event Load Profile

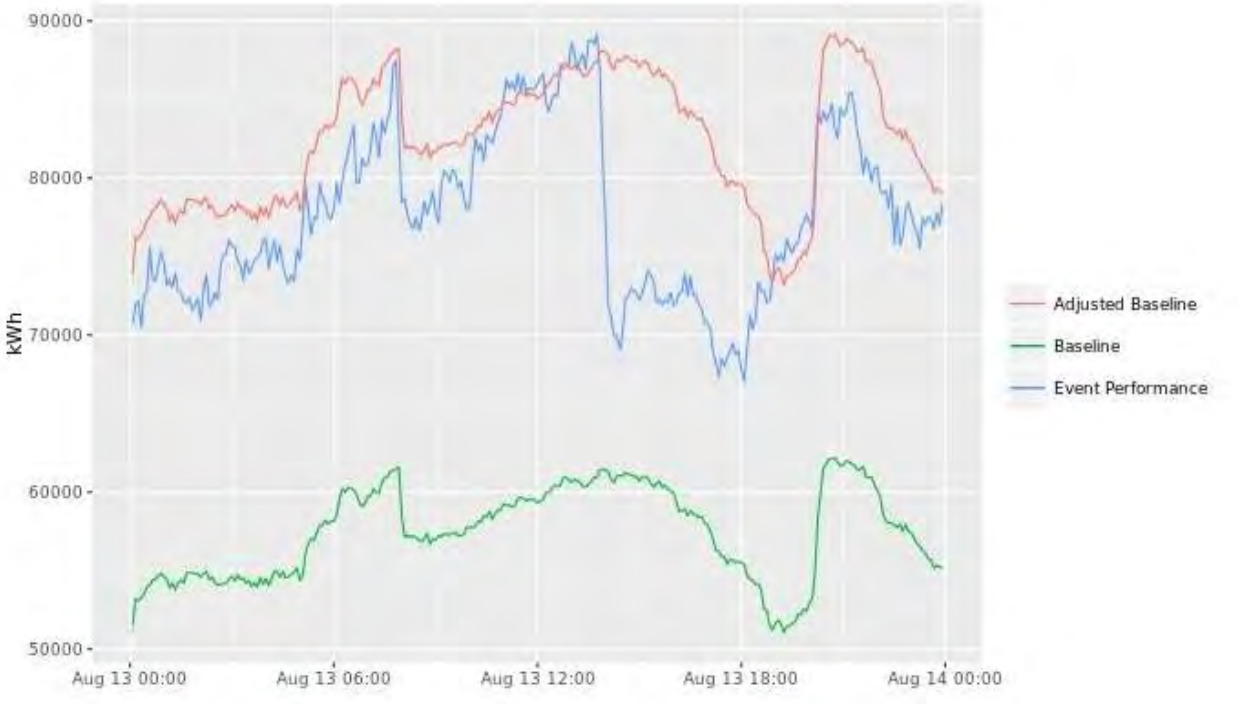


Figure 4-12 August 13th Peak Saver Event Load Profile

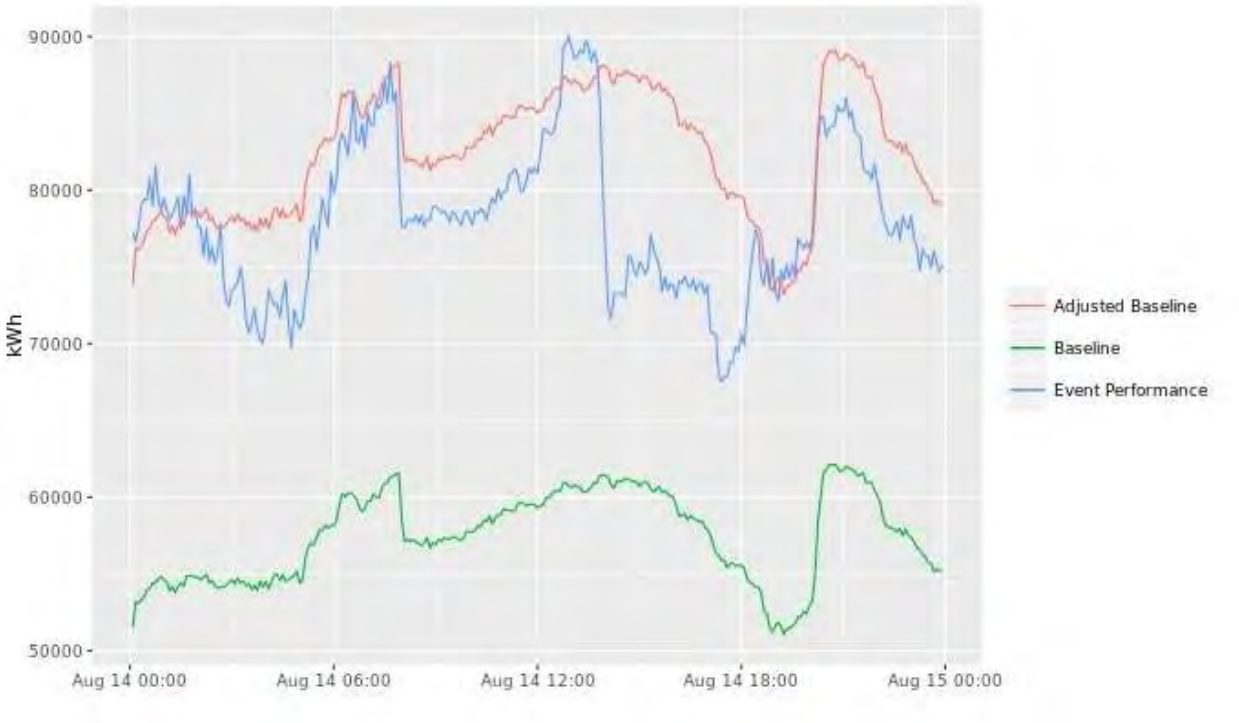


Figure 4-13 August 14th Peak Saver Event Load Profile

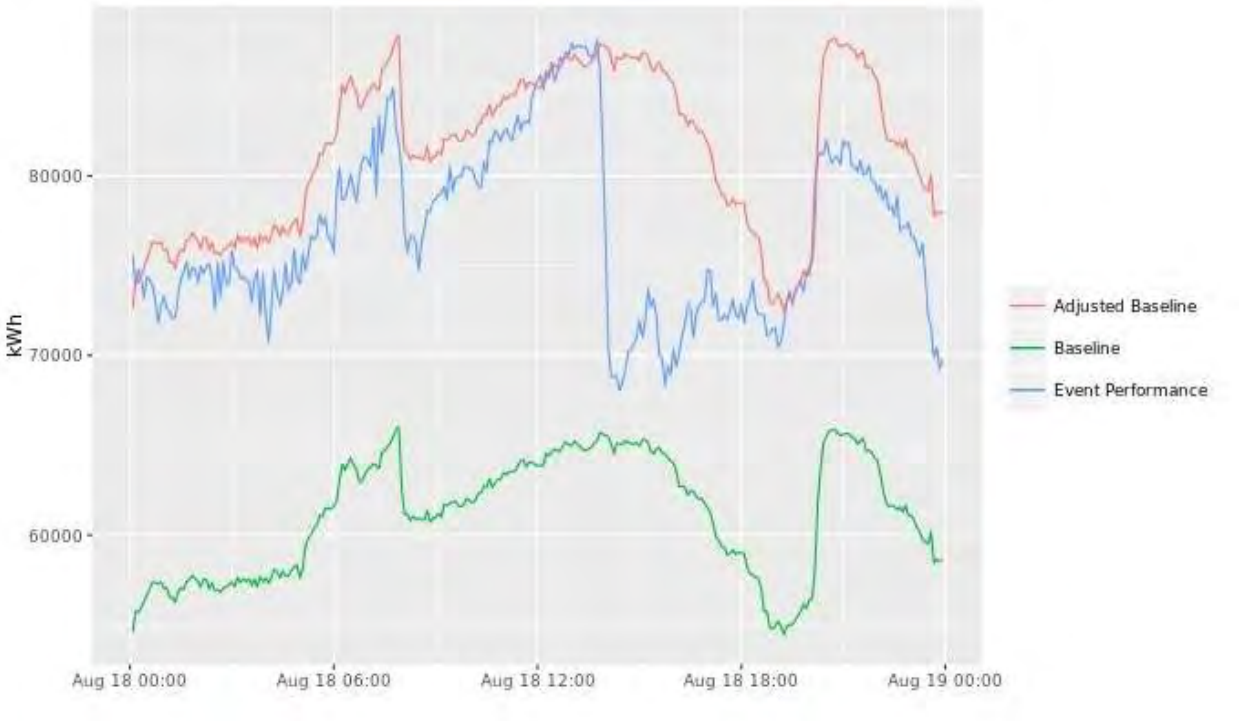


Figure 4-14 August 18th Peak Saver Event Load Profile

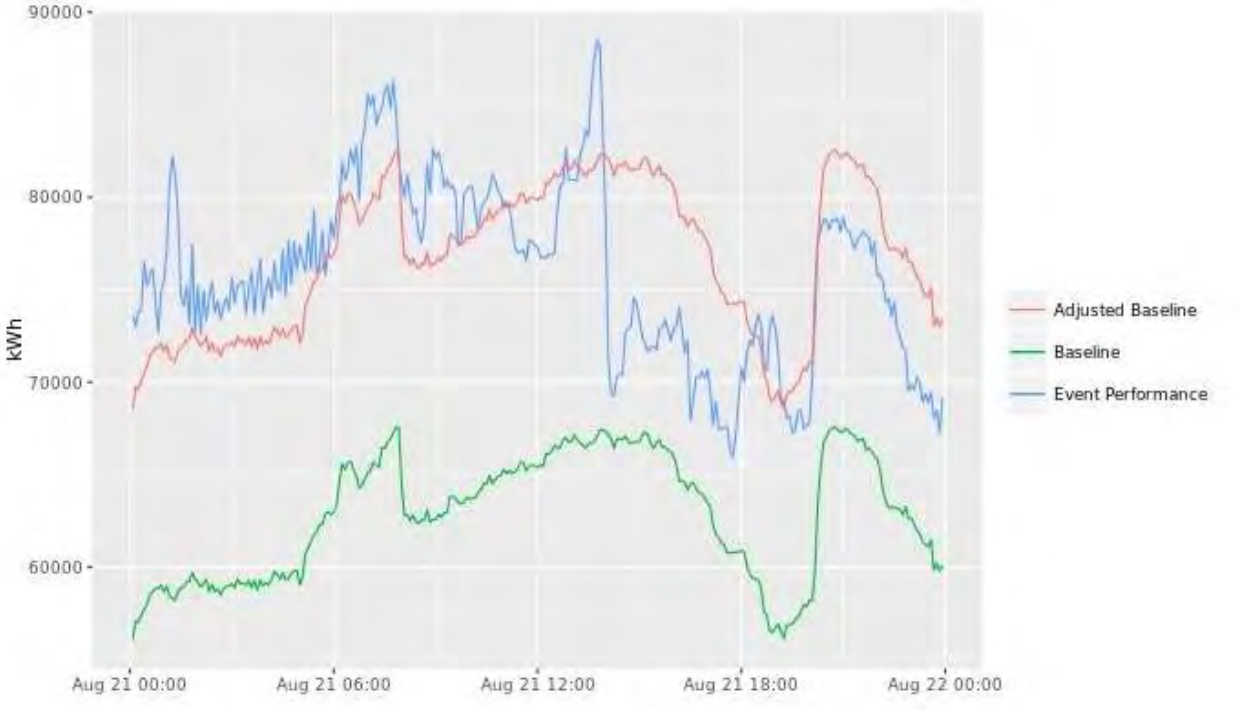


Figure 4-15 August 21st Peak Saver Event Load Profile

5. Refrigerator Recycling

5.1 Program Description

The Refrigerator Recycling Program (RRP) is designed to help customers reduce their energy consumption by old second refrigerators and freezers from their homes to recycle them. The program targets two unit types:

- Primarily, the program targets secondary refrigerators and stand-alone freezers, in order to permanently remove these units from the grid. These units are generally older than primary units, and often located in unconditioned space (such as a garage).
- Further, the program allows for the recycling of older, primary units.

The goal of the program is to reduce the number of old, inefficient refrigerators and freezers that customers have moved to their garages or other locations such as basements and patios. Many areas in which spare units are placed are not space conditioned, and most refrigerators used in that environment operate under a heavy thermal load during the summer. This is exacerbated by the fact the refrigerators are usually quite old and inefficient. Previous studies by the Environmental Protection Agency (EPA), the Department of Energy (DOE) and other utilities have determined that removing these refrigerators, and properly recycling them, performs an environmental and energy saving service.

In 2015, the program was configured as a turnkey, stand-alone energy efficiency initiative. The program was advertised to the public via ads, bill stuffers, point-of-sale flyers and media events. Requirements for program participation include:

1. The refrigerator must be clean, empty, defrosted, and in working condition
2. The unit must be between 10-30 cubic feet.
3. There must be an active PNM account at the pick-up address
4. Participation is limited at two units per customer address per calendar year
5. The unit needs to be plugged in and operational on the day of pickup
6. The water line must be disconnected (if applicable)
7. The resident must provide clear and safe access to the unit.

The program requires that refrigerators to be recycled be in working condition. The customer receives pick-up and removal service in addition to a $50 rebate per recycled unit. The program was cancelled in October 2015 due to the program implementation contractor (JACO Environmental) unexpectedly declaring bankruptcy.

5.2 M&V Methodology

The M&V approach for the Refrigerator Recycling Program is aimed at measuring the following:

- Numbers of refrigerators and freezers collected and recycled;
- Average annual kWh savings per collected appliance;
- Average kW reduction per collected appliance.
- Providing estimates of net-to-gross savings and free-ridership; and
- Estimating cost effectiveness of the RRP program in 2015

Table 7-1 summarizes the inputs needed for gross savings calculations and the source of each input.

Table 5-1 Data Sources for Gross Impact Parameters –Refrigerator Recycling Program

Parameter	***Source***
Number of Units Recycled	Program Tracking Data
Unit Energy Consumption	Regression model developed in prior studies, using unit size, age, and configuration
Location of Installation	Participant Surveys – This value is used to determine peak kW reduction, based upon the share of units used in conditioned vs. unconditioned space.
Net –to-Gross-Ratio	Participant Surveying
Remaining Useful Life (RUL)	Based upon CA DEER 2008 estimates, RUL of: 5 years for refrigerators; 4 years for freezers.

5.2.1 Unit Energy Consumption

The Evaluators verified Unit Energy Consumption (UEC) using a degradation model that was developed for the Department of Energy (DOE) Uniform Methods Project (UMP) Refrigerator Recycling Protocol.[2] The UMP is a DOE initiative aimed at developing a consistent framework and set of protocols for determining the energy savings from specific energy efficiency measures and programs. The project represents a refinement of the body of knowledge supporting energy efficiency EM&V activities and each protocol was written by technical experts within the field and peer-reviewed by industry experts.

In accordance with the UMP Refrigerator Recycling Protocol, the statistical model for determining UEC considers the following independent variables:

[2] http://energy.gov/sites/prod/files/2013/05/f0/53827-7.pdf

- Unit age;
- Unit capacity (cubic feet);
- Dummy indicator for configurations (single-door, side-by-side, etc.);
- Primary/Secondary usage designation;
- Location in conditioned/unconditioned space; and
- Weather (cooling degree days, heating degree days).

Table 5-2 Refrigerator Recycling Regression Model Coefficients

Variable	***Coefficient (Daily kWh)***
Intercept	.582
Age	.027
Pre-1990 Manufacture Date Dummy	1.055
Size (Cubic Feet)	.067
Side-by-Side Configuration Dummy	1.071
Single-Door Configuration Dummy	-1.977
Dummy – Primary Usage	.6054
Interaction: Located in Unconditioned Space X CDD	.020
Interaction: Located in Unconditioned Space X HDD	-.045

Location in conditioned versus unconditioned space was determined via average values from the participant survey. In this, it was found that 74.1% of units were used in conditioned space and 25.9% were used in unconditioned space.

The resulting overall Unit Energy Consumption was as follows:

- Refrigerators: 1,109.41 kWh/year
- Freezers: 908.98 kWh/year

5.2.2 Part-Use Value

The regression model detailed in Section 5.2.1 provides full-year kWh estimates. Many of the units recycled through this program are not used for the full year. The Evaluators estimated these units Part-Use Factors (PUFs) through two metrics:

1) If the customer would keep the unit in use, PUF is equal to the percent time of the year in which the unit was typically running
2) If the customer would transfer their unit, a PUF of 1 was assigned, under the assumption that a customer that receives a used refrigerator is likely to use it as their primary unit.

Combining these two values, the Evaluators determined a PUF value of 0.93 for all units recycled through the program. This results in annual hours of use of 8,147 for the program.

With these data, annual savings for a specific unit are:

$$kWh\ Savings = UEC * Part - Use\ Factor$$

The resulting average savings per unit are:

- Refrigerators: 1,031.75 kWh/year
- Freezers: 845.35 kWh/year

5.2.3 Location of Installation

Data provided by PNM covered implementation through the end of November 2015. The ambient temperature during peak periods affects the efficiency and duty cycle of a refrigerator compressor, and as such this share is used in determining peak kW reduction from appliance recycling. Demand Reduction (kW) is calculated by weighting the annual kWh use based upon the delta T (ambient temperature minus refrigerator temperature). This weight is then increased by the magnitude of the marginal decline in unit efficiency associated with peak-period temperatures, with an average hourly COP calculated based upon the methodology outlined in a NREL 2008 report[3]. Resultantly, the Evaluators calculated kW factors of .000127 and .000247 for conditioned and unconditioned space, respectively.

Part-use occurs most typically in summer months, and as such the Evaluators did not apply the Part Use Value to kW savings. kW savings per unit are:

- Refrigerators: .2517 kW
- Freezers: .1208 kW

5.2.4 Refrigerator Recycling Net Savings Estimation

Free-ridership on a program such as the Refrigerator Recycling Program is aimed at determining what customer behavior would have been with their secondary refrigerator or freezer in the absence of the program. This means determining what proportion of participants would have disposed of their refrigerators or freezers without the program in a way that would have removed the refrigerators permanently from the grid.

There are four categories for what could have happened to a refrigerator or freezer had it not been recycled through the program. These categories are:

- Unit is kept by the household but not used;

[3] NREL, "Technical Support Document: Development of the Advanced Energy Design Guide for Grocery Stores", September, 2008

- Unit is kept by the household and still used;
- Unit is discarded by the household through a method in which the unit would be destroyed; and
- Unit is discarded by the household through a method in which the unit would be transferred and kept in use.

Of these four categories, two are indicative of free-ridership:

- Unit is kept by the household but not used; or
- Unit is discarded by the household through a method in which the unit would be destroyed.

These categories are indicative of free-ridership because the units would have been removed from the grid even if they had not been recycled through the program. Free-ridership is then addressed through participant and non-participant surveying.

5.2.4.1 Participant Surveying

A sample of 66 participants was surveyed. Questions addressing NTGR issues included:

Q-9 Did you attempt to sell or donate your refrigerator prior to participating in the Refrigerator Recycling Program?

Q-11 When replacing a major appliance, what do you typically do with the old unit?

Q-12 What would you have done with your old refrigerator if you had not recycled it through PNM?

In addition, we asked what participants valued most about the program:

Q-13 How important was the rebate in your decision to participate in the Refrigerator Recycling Program?

Q-14 How important was the free pickup service in your decision to participate in the Refrigerator Recycling Program

The results from these surveys were used in providing a free-ridership probability score for each respondent. The process by which free-rider scores were assigned to survey respondents is summarized in Figure 5-1.

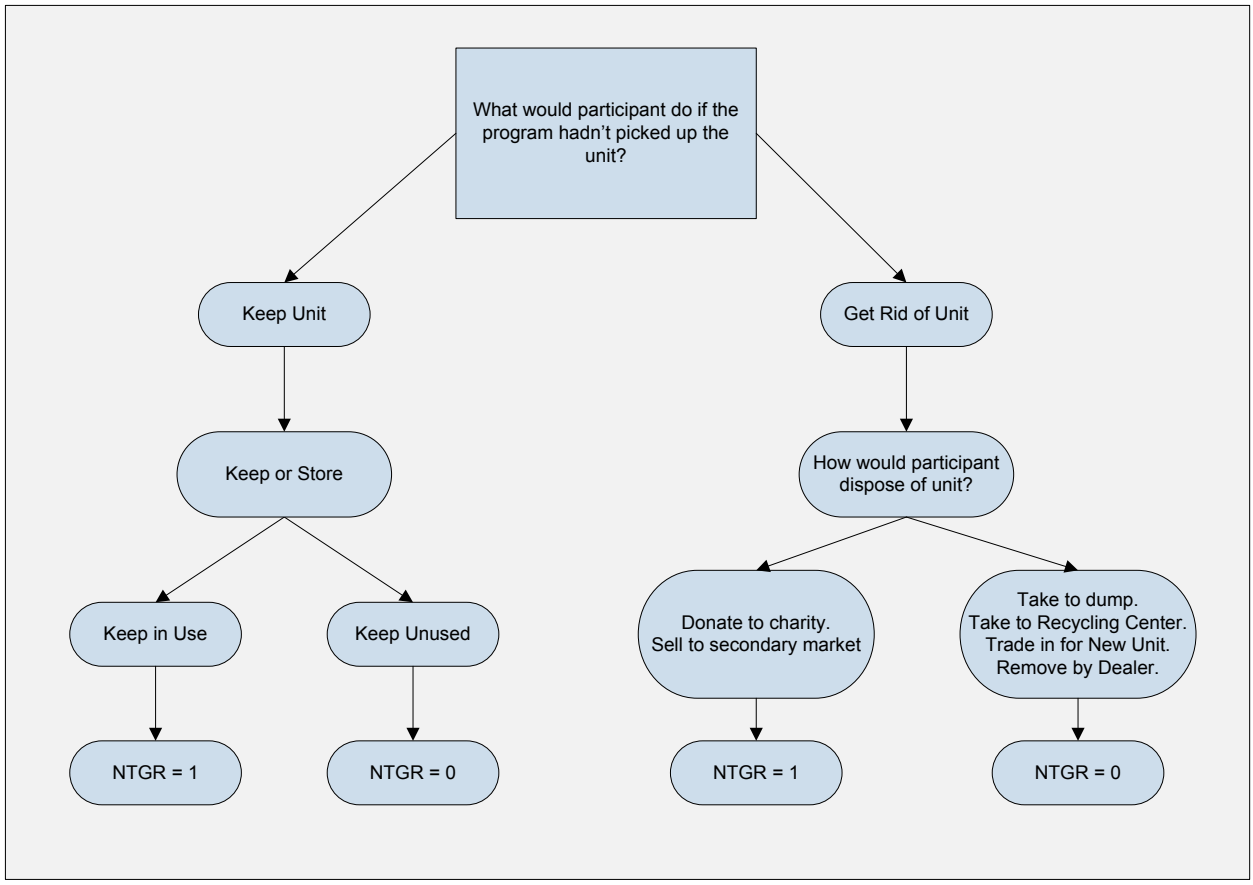


Figure 5-1 Refrigerator Recycling Free-Ridership Flowchart

5.3 Refrigerator Recycling Impact Evaluation

The Evaluators estimated savings from the RRP by surveying a sample of program participants and by using available data on the removed refrigerators to calculate unit-specific savings, using a regression methodology developed through the Uniform Methods Project. The Evaluators achieved the required 90/10 precision for sampling by completing 66 customer surveys. The surveys were used for verifying recycling and addressing net-to-gross issues. The Evaluators then examined the tracking data and calculated unit-specific savings. Table 7-11 presents gross realization for the 2015 Refrigerator Recycling Program.

Table 5-3 2015 RRP Gross Savings Summary

Measure	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		EUL	Lifetime Energy Savings (kWh)		Gross Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post		Ex Ante	Ex Post	
Refrigerators	-	1,631.55	-	6,688,866	5	-	33,444,330	-
Freezers	-	227.91	-	938,342	4	-	3,753,370	-
Total	1,661.00	1,859.46	9,713,822	7,627,208		47,597,730	37,197,699	78.5%

The Evaluators verified that average age for units recycled through the 2015 RRP was 19.79 years for refrigerators and 26.59 years for freezers. Figure 5-2 below presents the age distribution of units recycled through the 2015 RRP.

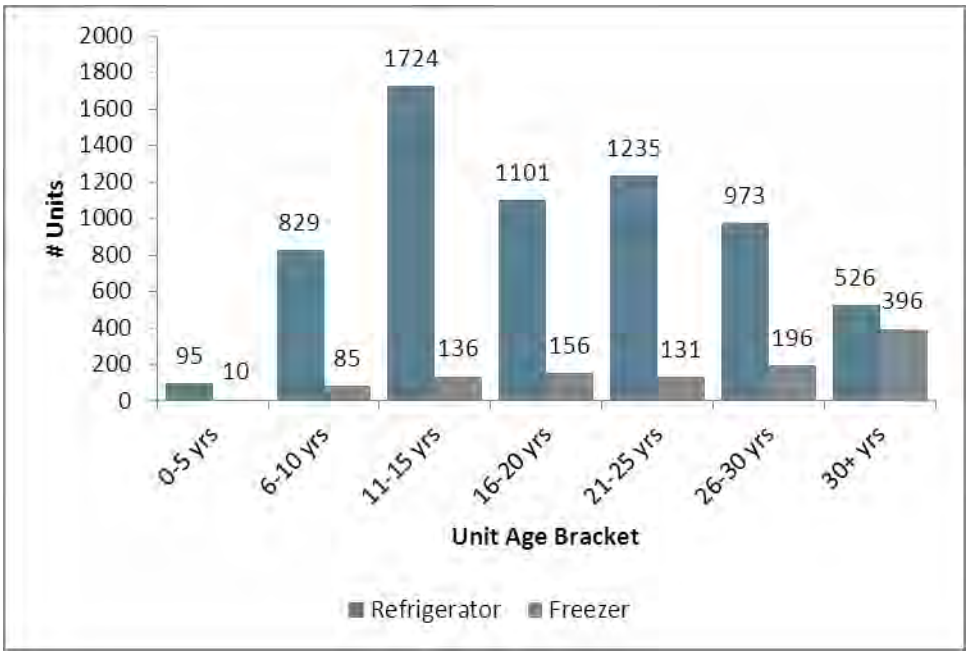


Figure 5-2 Age Distribution of Units in PNM 2015 RRP

Additionally, the Evaluators determined free-ridership for the 2015 RRP through participant surveying, providing a NTGR of 68.2% for all units. This was applied in discounting program savings. The resulting net savings are presented in Table 5-4.

Table 5-4 2015 RRP Net Savings Summary

Measure	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		EUL	Lifetime Energy Savings (kWh)		Net Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post		Ex Ante	Ex Post	
Refrigerators	-	1112.72	-	4,561,807	5	-	22,809,033	-
Freezers	-	155.43	-		4	-	2,559,798	-
Total	1,079.58	1268.15	6,313,985	5,201,756	-	30,938,524	25,368,831	82.4%

5.3.1 Refrigerator Recycling Gross Savings Estimates

Using the regression methodology outlined in Section 5.2.1, the Evaluators calculated UEC based upon unit size, age, defrost type, and configuration. The distribution of savings of recycled units is presented in Figure 5-3 below.

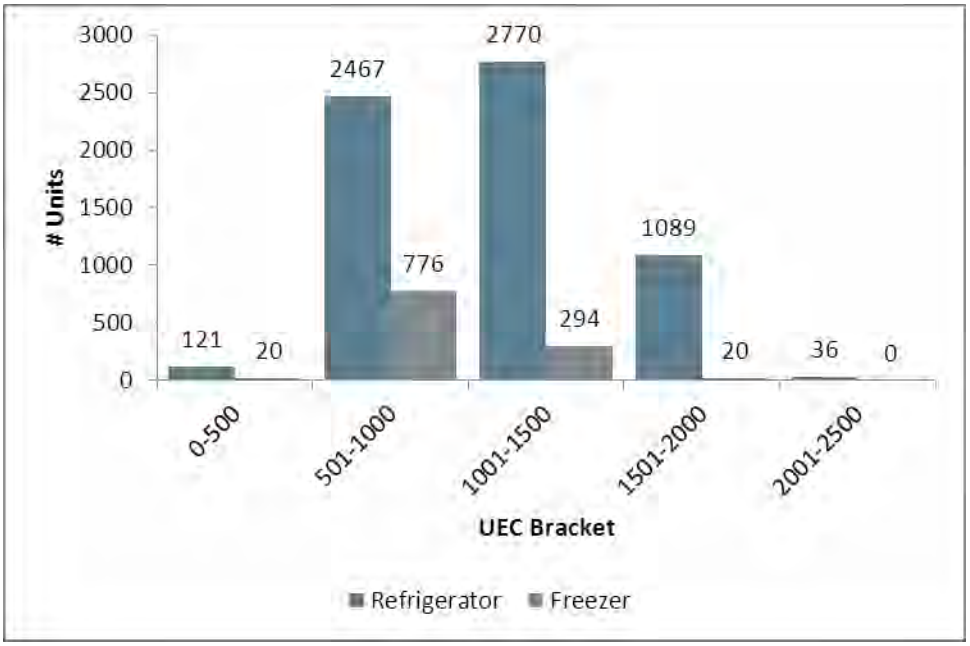


Figure 5-3 UEC Distribution of Refrigerators & Freezers in PNM 2015 RRP

Demand Reduction (kW) is calculated by weighting the annual kWh use based upon the delta T (ambient temperature minus refrigerator temperature). This weight is then increased by the magnitude of the marginal decline in unit efficiency associated with peak-period temperatures, with an average hourly COP calculated based upon the methodology outlined in a NREL 2008 report[4]. As a result, the Evaluators calculated kW factors of .000127 and .000247 for conditioned and unconditioned space, respectively. Our survey results indicated that 71% of the recycled units were used in

[4] NREL, "Technical Support Document: Development of the Advanced Energy Design Guide for Grocery Stores", September, 2008

conditioned space, with 29% used in unconditioned space. Weighting the kW factors by these proportions, the weighted average kW factor is 0.000161 for all units recycled through the program. Multiplying this by the ex post kWh savings estimates by unit type provides gross peak demand reduction of 115.7 kW.

5.3.2 Refrigerator Recycling Net Savings Estimates

The Evaluators evaluated net by estimating free-ridership for the 2015 RRP using the methodology outlined in Section 7.2.2. To obtain net savings for the 2015 RRP, the Evaluators surveyed program participants to develop estimates of free-ridership. As detailed in Section 7.2.2, developing free-ridership estimates for the RRP is dependent upon survey questions addressing what is done to refrigerators absent the program.

5.3.2.1 Participant Behavior in the Absence of the Program

One way to assess the impact of the RRP is to examine what participants would have done with their refrigerators and freezers if the program were not in place. Customers to have options, including giving the unit away, selling on the secondary market, having the appliance dealer remove the unit when purchasing a new unit, or having the unit hauled away to a dump or landfill.

In the participant survey, respondents were asked what methods they had used in the past when getting rid of a major appliance, and what methods were they likely to consider for the refrigerator or freezer if the program were not available. Participants were first asked:

> **Did you attempt to sell or donate your refrigerator prior to participating?**

If they did attempt to sell or donate, they were then asked:

> **Why didn't you follow through with selling or donating?**

The results of these questions are summarized in Table 5-5. The reasons for not following through with the transaction are varied, but several respondents indicated that they found themselves unable to sell the unit at their desired price or that the unit was not in good enough condition to sell.

Table 5-5 Customer Attempts at Selling or Donating Unit

Attempt to Sell or Donate?	***% Indicated***	***Reason Indicated***	***% Reason Indicated***
Yes	4.5%		
No	95.5%		
		Couldn't find interested buyer at the price I wanted	0%
		Couldn't find interested buyer/recipient because of the unit's condition	0%
		Decided recycling the unit was more important than selling it	100%
		Other	0%
		Don't Know	0%
n =66		***n = 3***	

Participants are then asked what they have done in the past when disposing of major appliances. Questions addressing this include:

When replacing a major appliance, what do you typically do with the old unit?

The question is open-ended, with customers indicating a wide range of disposal practices. The results of questions pertaining to customer behavior in prior appliance disposals are presented in Table 5-6.

Table 5-6 Customer Behavior in Past Appliance Disposal

Method Indicated	***% Action Indicated***
Taken for recycling	28.2%
Dispose at dump	9.1%
Give to friend/family	12.1%
Donate to charity	13.6%
Have retailer haul away	4.5%
Sell the appliance	3.0%
Other	3.0%
Don't Know	7%
n = 66	

Twenty eight percent indicated than in past appliance disposals they had the unit recycled. An additional 9.1% stated that they disposed of old units at the dump, and 4.5% stated that they had the retailer haul the old unit away. By past behavior, a summary of what occurs with the unit (kept on grid, taken off grid, or unknown), is provided in Figure 5-4.

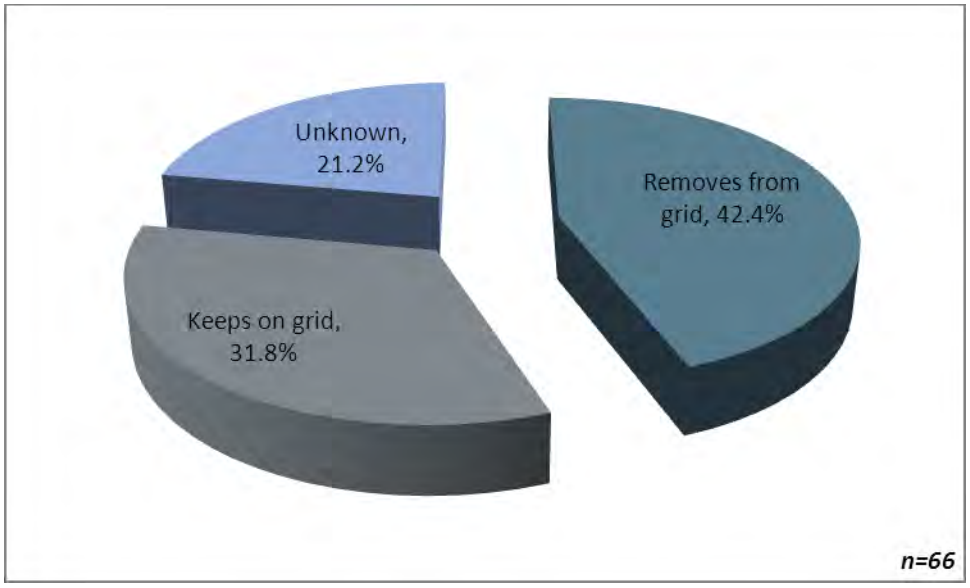


Figure 5-4 Result of Disposal Methods in Prior Appliance Disposals

Following this, respondents are then asked what they would have done with this particular unit in the absence of the program. Respondents are asked:

> **What would you have done with your old refrigerator if you had not recycled it through PNM?**

Table 5-7 Participant Disposal of Units in Absence of Program

Method	*% Indicated*
Continued to use it	9.1%
Sold it	6.1%
Unplugged and stored it	1.5%
Disposed of it	36.4%
Given it away/donated to charity	33.3%
Other/Unknown	0%
Don't know	13.6%
n=66	

When asked about the specific unit recycled, respondents were more likely to indicate answers that are associated with keeping the unit on the grid (such as selling or donating the unit). This is due likely to units being eligible for the program being in better condition than those typically disposed of by program participants. Units belonging to customers who would have kept their unit, given it away, or sold it were likely to have remained on the grid. Units belonging to customers who would have had it hauled to the dump or used recycling companies are likely to have been disposed of. Figure 5-5 summarizes the end results of alternative disposal methods proposed by program participants in the survey.

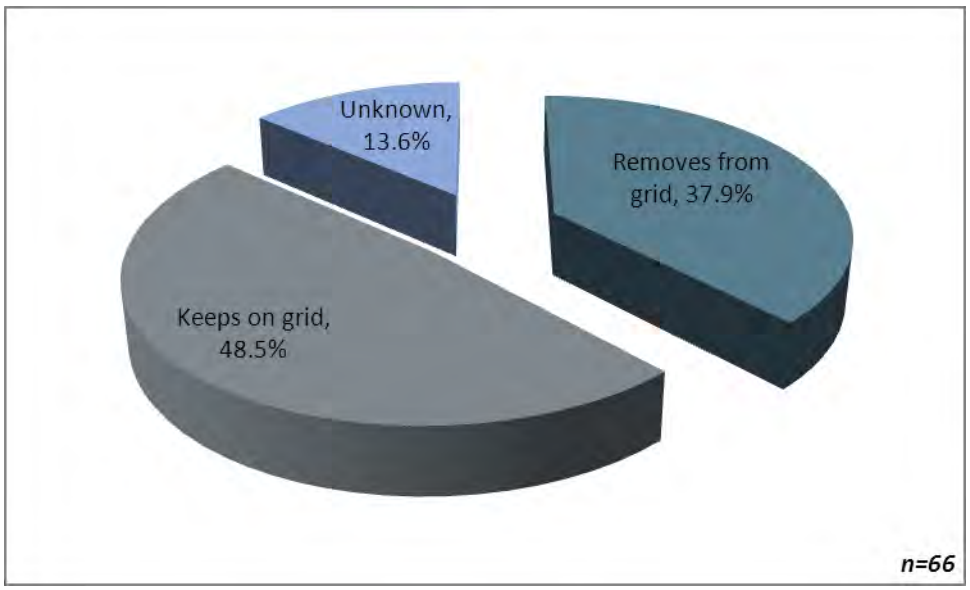


Figure 5-5 Result of Alternative Disposal Methods Indicated by Program Participants

5.4 Refrigerator Recycling Program Process Evaluation

The Evaluators surveyed 66 program participants in the evaluation effort for the 2015 Refrigerator Recycling Program. These surveys were focused on collecting data for development of impact evaluation parameters, but they were also leveraged to collect

data useful for the process evaluation effort. Data collected via participant surveying is used in evaluating:

- Advertising effectiveness and customer awareness of the program;
- Customers' reasons for recycling and the condition of the units;
- Participant appliance disposal practices;
- Customer satisfaction with various program factors; and
- Recommendations for program improvement.

5.4.1 Market Description

This section presents key background data on the target market for the RRP. Data for this section are provided by the Energy Efficiency Potential Study for the State of New Mexico[5] and the American Community Survey (ACS)[6], and surveys with participating market actors.

5.4.1.1 Market Barriers

In reviewing the program offerings and theory, the valuators identified the following market barriers:

- **No driving need to act for primary refrigerators.** Recycling of primary refrigerators is dependent entirely upon PNM households purchasing new units. Given that, there is not a mechanism through with the program could create more transactions through outreach and marketing; the program has to rely upon transactions that would occur anyway, and then intervene to prevent the replaced unit from moving to the secondary market.
- **Competing with the usefulness of the second unit.** For many users of secondary refrigerators and freezers, the need for extra food storage is seen as being worth the cost. Prior research in these types of programs has found that typical program participants are adult-only residences, with a large share of adults without children living in their home that no longer need a second unit[7].
- **Perception of unit removal being a hassle.** Based on interviews with program participants, the Evaluators found that many program participants indicated that

[5] Global Energy Partners, 2011. "Energy Efficiency Potential Study for the State of New Mexico. Volume 2: Electric Energy Efficiency Analysis". Prepared for the Department of Energy under management of the State of New Mexico's Energy, Minerals, and Natural Resources Department's Energy, Conservation, and Management Division.

[6] Bureau of the Census. 2011. *American Community Survey, One-Year Data.*

[7] Innovologie LLC, 2010. "Process and Market Evaluation of Southern California Edison's Appliance Recycling Program, 2006-2008". Prepared for Southern California Edison.

the process of preparing the unit for pick-up was perceived as a hassle. The unit must be cleaned out and defrosted, and some participants could not understand the need for that practice.

- **Competition with the secondary market.** When a household wants to dispose of a functioning secondary refrigerator, they may be inclined to sell in the secondary market or to donate to a friend, family member, or charity. The potential return from selling a secondary unit can be significantly higher than the program incentive ($30); as such the program's perceived benefit may lie more in the convenience of the pick-up and disposal.
- **Wide range of possible messaging to encourage participation.** Messaging for a program such as the RRP could focus on available incentives, the convenience of the pick-up service, savings on bills from removal of old units, or on the environmentally-safe disposal of refrigerant and other components. The receptiveness to each message may vary by market segment.

5.4.2 RRP Longitudinal Performance

Figure 5-6 presents the annual net savings performance of the RRP 2010.

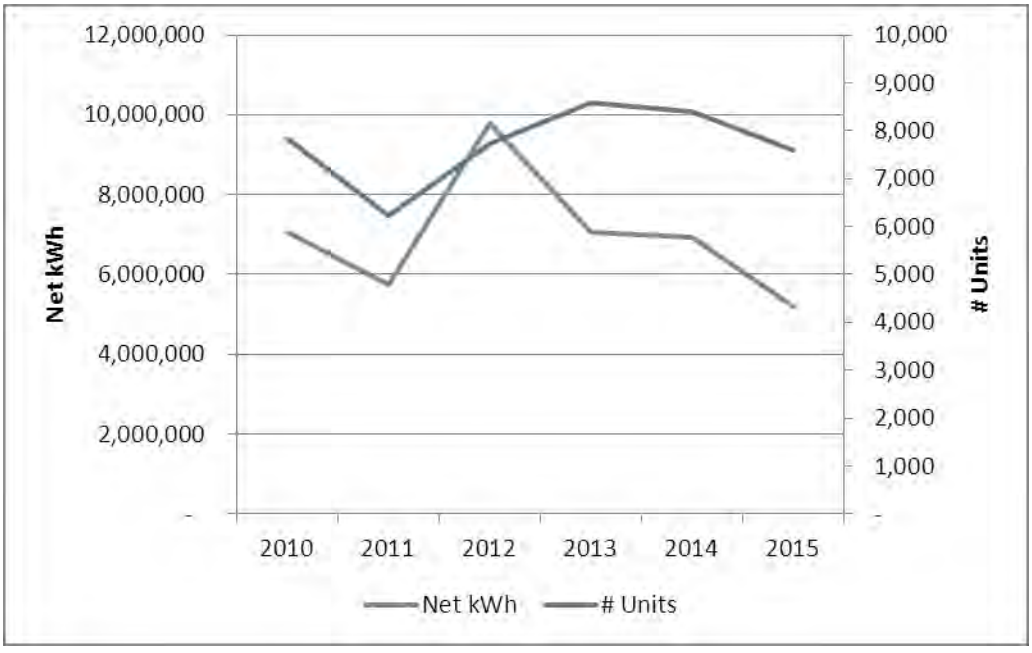


Figure 5-6 RRP Longitudinal Performance – 2010-2015

The Evaluators evaluated the 2010 program year, and savings for 2011 and 2012 were estimated by taking the per-unit average from 2010.

5.4.3 Program Marketing

The marketing efforts for the Refrigerator Recycling Program contained many elements, including:

- Bill Inserts;
- TV Advertisements;
- In-store displays in appliance retailers; and
- Newspaper & Radio advertisements.

Figure 5-7 summarizes the sources of awareness indicated by program participants.

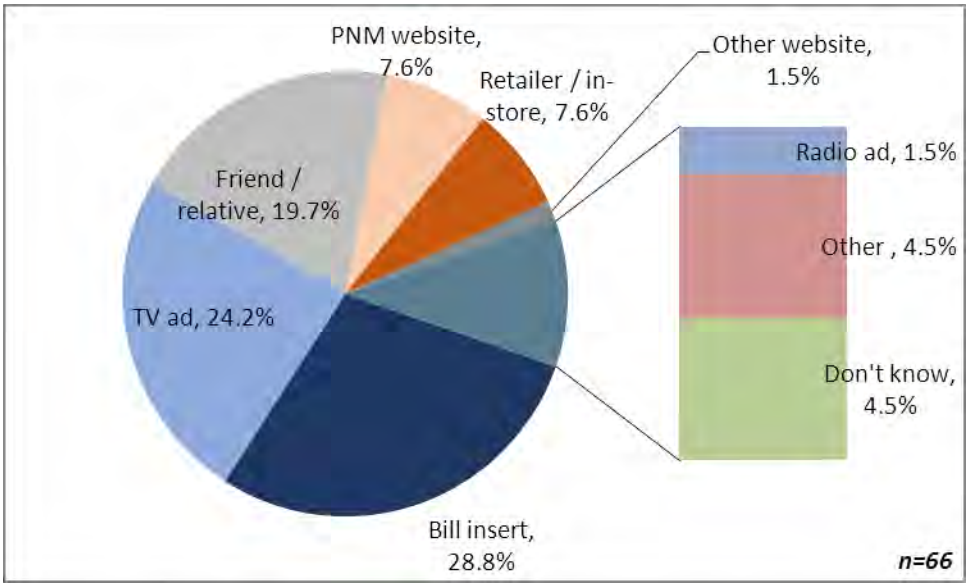


Figure 5-7 Source of Program Awareness– Program Participants

Twenty-nine percent of respondents indicated having learned of the program from PNM bill inserts. Following bill inserts, television advertisements and word of mouth from family and friends were the most commonly indicated sources of awareness.

5.4.4 Usage of Recycled Units

Respondents were asked questions related to the usage of the recycled unit. These questions addressed unit location, condition, and how many months a year the unit was in use. Figure 5-8summarizes these results for refrigerators and freezers.

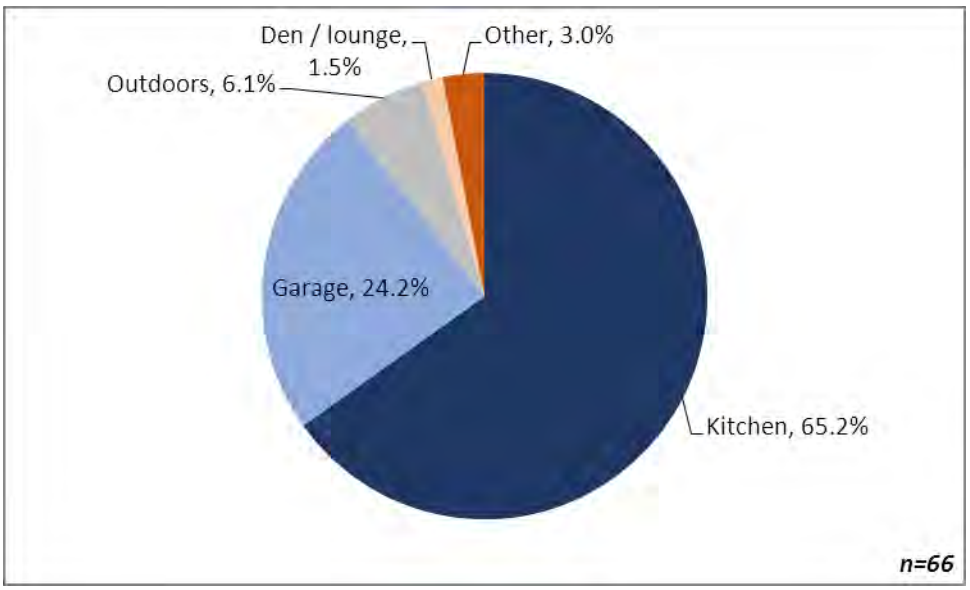


Figure 5-8 Location of Use of Recycled Units

Respondents were then asked to describe the working condition of the recycled refrigerator or freezer. Customers were asked if the unit:

- Was in good working condition;
- If it worked well but needed minor repairs, such as a handle or gasket;
- If it Worked but had serious problems, such as not defrosting properly; or
- If it didn't work at all.

The results are summarized in Table 5-8.

Table 5-8 Condition of Recycled Units

Condition	***% indicated***
In good condition	51.5%
Needed minor repairs	31.8%
Had serious problems	16.7%
Didn't work at all	0%
Don't Know	0%
n=66	

Respondents whether also asked whether they had considered discarding their refrigerator or freezer prior to hearing about the program. Respondents were asked:

> **When did you learn about the PNM Refrigerator Recycling Program and the available rebate?**

As summarized in Table 5-9, an average of 93% of respondents learned of the program either before or during their decision to dispose of their refrigerator or freezer.

Table 5-9 Timing of Learning of Program Relative to Decision to Recycle

Timing of Learning of Program	***% indicated***
Before deciding to recycle	65.2%
After deciding to recycle	4.5%
While deciding to recycle	27.3%
Don't Know	3.0%
n=66	

5.4.5 Motivation to Participate

Using participant survey data, the Evaluators developed profiles of customers' motivations for participating in the RRP and the various factors that influenced the decision. Participants are asked how they would have disposed of their appliances without the program and what influenced that decision.

Figure 5-9 summarizes the reasons given. The top two factors listed by program participants as motivators for program participation were the convenience of the free pickup and the PNM rebate. Reasons under "other" included:

By and large, answers under "Other" focused around a desire to free up the space in the home, no longer needing that much food storage capacity, or finding it a convenient time to remove the unit due to extensive house cleaning or renovation.

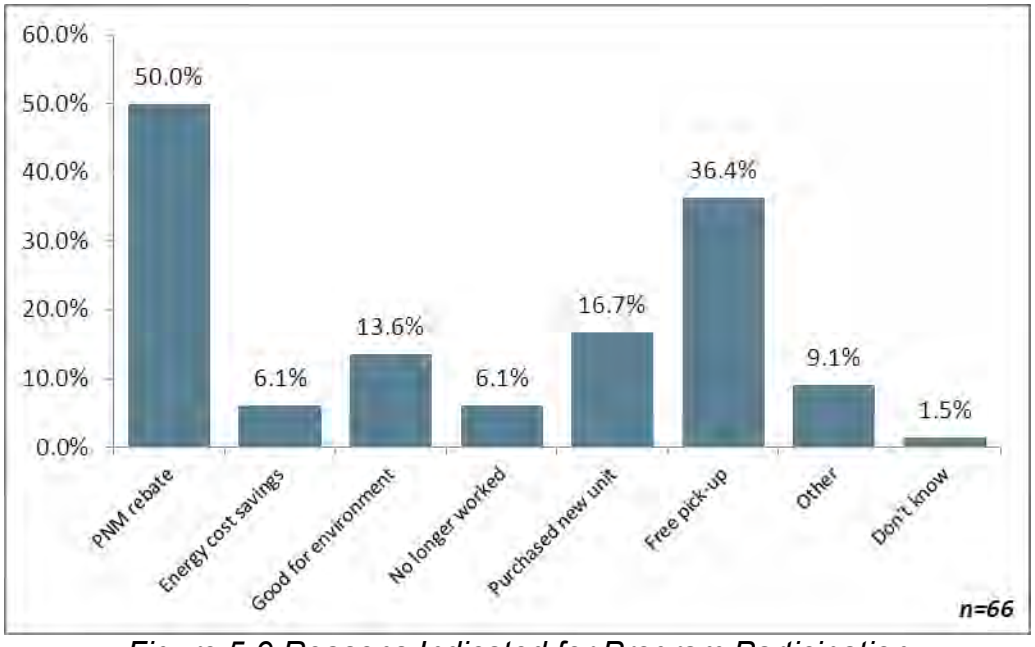


Figure 5-9 Reasons Indicated for Program Participation

5.4.6 Program Satisfaction

The participant survey for the PNM Refrigerator Recycling Program included questions addressing participant satisfaction with an array of specific issues and processes as well as for the program as a whole. Table 5-10 summarizes participant responses when asked to rate satisfaction a scale of 1 to 10, with 1 meaning "Very Dissatisfied" and 10 meaning "Very Satisfied".

Table 5-10 Participant Satisfaction with Program Components

Component	*Very Satisfied*
The scheduling process for recycling	8.95
The work performed by the staff that picked up your appliance	9.45
The wait time between scheduling and pickup	8.82
The wait time to receive the rebate check	7.95
The rebate amount	8.75
Overall satisfaction with the program	9.31
n=66	

Participants were in general quite satisfied with the program. The lowest satisfaction level was found in wait-times to receive rebates (7.95)

5.4.6.1 Participant Narrative Commentary

At the end of the survey, respondents were asked:

> **Do you have any specific comments or suggestions you would like me to relay to PNM about the Refrigerator Recycling Program?**

Responses to this included:

> *"Just keep doing the program it's a wonderful program. I don't know what I would have done with the old refrigerator. Thank you."*
>
> *"It's a good program, but I was disappointed that I didn't get a rebate from PNM, I did get $50 from the recycling program."*
>
> *"I think it's a good program because it stops people from just dumping their refrigerator on the mesa."*
>
> *"It's a very convenient program."*
>
> *"I think it's a good program but they need to make it well known."*
>
> *"Program is very satisfactory to me. Should expand to gas stove, dryers, washers to improve our environment and remove old appliances from neighborhood yards."*

5.4.7 Tracking Data Review

The Evaluators received tracking data through requests to PNM's program manager. Participant updates are provided by JACO to PNM. Each update is an .xls file with two tabs:

- Orders
- Units

The Orders tab contains all customer information, including name, address, phone number, utility customer ID, customer disposition, and all dates associated with scheduling and pickup. The Units tab contains data on each unit picked up, including size, year of manufacture, configuration, refrigerant type, usage pattern, whether the unit was replaced, and the quantity of materials recycled. The Unit tab has more line items as some customers recycle multiple units.

The data was very comprehensive and useful for the evaluation effort. No additional data was needed to support EM&V.

5.4.8 Comparison to Other NM Programs

The Evaluators compared program design for appliance recycling programs implemented by all three NM IOUs. Key findings are summarized in Table 5-11.

Table 5-11 Refrigerator Recycling Program Inter-Utility Comparison

	PNM	***SPS***	***EPE***
Program implementer	JACO	ARCA	JACO
Incentive	$50	$75	$30
Recycles primary units	Yes	Yes, as of 2013	Yes
Size range	10-27 cubic feet	10-30 cubic feet	10-30 cubic feet
Participation limit	Two/year	Two/year	Two/year
Advertised cost savings	$175	$100	Not advertised
Advertised relative savings	"Up to 3x"	Not advertised	"3-4x"
Advertised space savings/clutter	No	Yes	No
Advertised environmental message	No	Yes	Yes
Advertised free pick-up	No	Yes – bolded	Yes – not bolded
Advertised check delivery	4-6 weeks	Within 4 weeks	Not advertised
Market segments	Res & Comm.	Residential	Residential
Extra program components	None	CFL two-pack	None

5.5 Program Recommendations

Based on findings from the process evaluation, we recommend the following program changes:

- **Continue the program, if a qualified implementation contractor may be found.** JACO Environmental was one of two major implementation contractors

for appliance recycling program. Due to the immediate need of relaunching this program, the Evaluators would recommend a one-year sole-sourcing to a qualified firm followed by an RFP for a three-year cycle.

- **Update technical assumptions to reflect increasingly efficient units.** The Unit Energy Consumption of recycled appliances has declined over time. The RRP is recycling increasingly-efficient units, as a greater share of the program consists of units built after 1990 (which saw a major code change for refrigerators). As such, the Evaluators recommend savings values specified in the table below.

Table 5-12 Technical Assumption Recommendations

	Refrigerators	***Freezers***
UEC – kWh	1,109	909
UEC - kW	.27	.13
Part-Use Value	93%	93%
NTGR	68%	68%

- **Advertise an annual cost savings from removal of a second unit.** The PNM marketing materials only indicate that an old refrigerator uses "3 times more electricity than new models, costing hundreds of dollars a year in utility bills". PNM should provide a dollar estimate, based on their residential rates and the ENERGY STAR® refrigerator retirement calculator[8].

[8] http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator

6. Residential Lighting

6.1 Program Description

The Residential Lighting Program (RLP) provided discounted CFLs and LEDs for residential customers to purchase at participating stores. PNM also issues in limited quantities store coupons to customers for specific types of lamps. The program recruited retailers to provide marked down CFLs and LEDs, including:

- Home improvement stores;
- Big box retailers; and
- Club stores.

6.2 Participation Summary

6.2.1 Participating Retailers

In 2015, the RLP had 143 participating retail locations. The total retail locations by facility type are summarized in Figure 6-1.

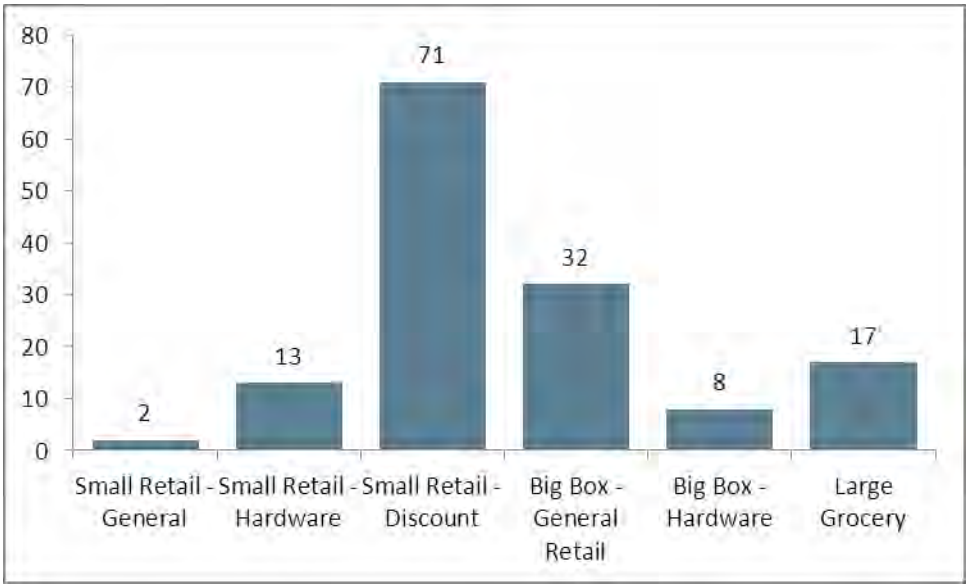


Figure 6-1 RLP – Number of Retail Locations by Business Type

Figure 6-2 summarizes program kWh by store-type.

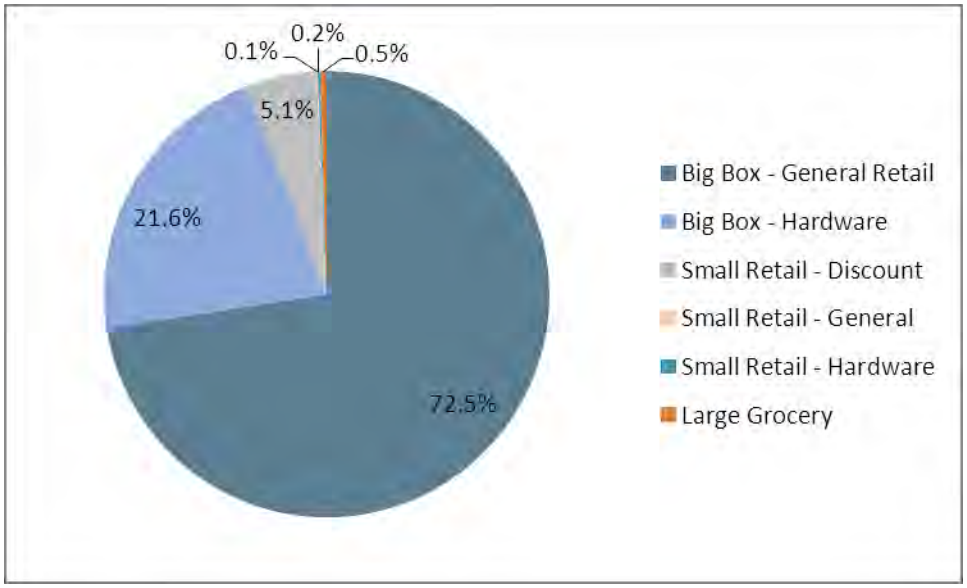


Figure 6-2 % of Program kWh by Store-Type

Further, the Evaluators reviewed the geographic coverage of the registered retailers in the RLP. Figure 6-3 summarizes the number of participant retailers per-1,000 residents by county within PNM service territory. The data is organized in descending order by population. The population data is county-level data from the US Census Bureau.

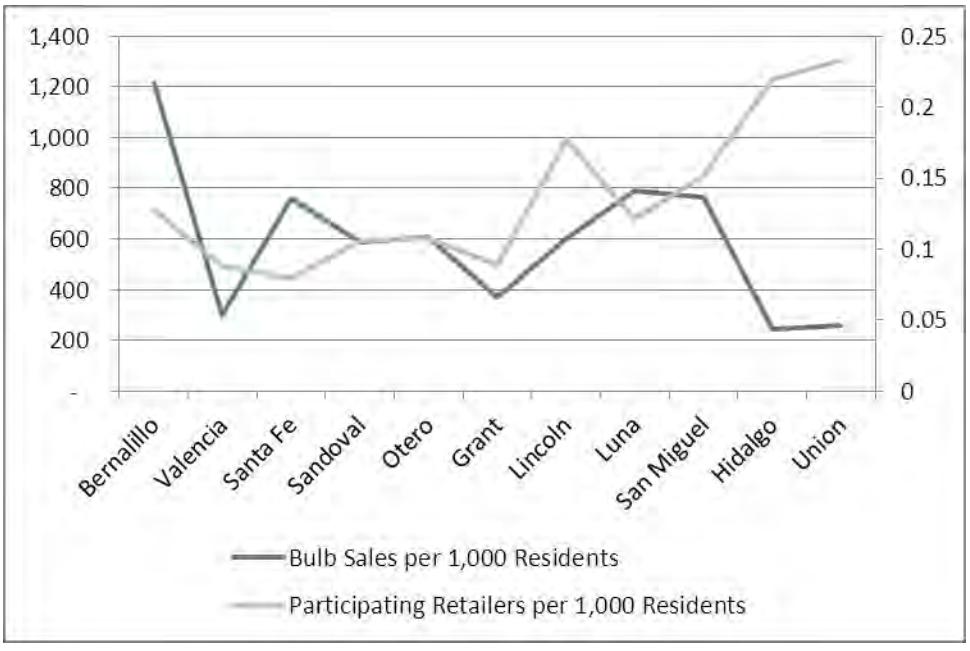


Figure 6-3 Summary of Per-Capita Participant Retail Locations by County

Though there are exceptions within this trend, it is generally the case that higher-population counties in PNM's service territory are demonstrating higher per-capita sales for CFLs and LEDs while being services by fewer per-capita retail locations. This is to some extent conflated with residents of Bernalillo County shopping in neighboring

Valencia and Sandoval County. The Evaluators concluded that program staff have provided adequate retailer support all areas within PNM's service territory, though the lack of big-box retailer options in those areas pose a barrier to increasing per-capital lighting sales. It may be possible to service these areas through grocery stores or pharmacies, but program staff have indicated that some of the major chains in New Mexico were not interested in participating.

6.2.2 Rebated Lamps

The program rebated 1,124,914 lamps in 2015. Within this, the markdown channel comprised:

- 801,149 CFLs; and
- 323,765 LEDs.

Three percent of rebated CFLs were specialty lamps (including high wattage lamps, reflectors, three-way lamps, and decorative lamps). Figure 6-4 summarizes the markdown CFL tallies by bulb type.

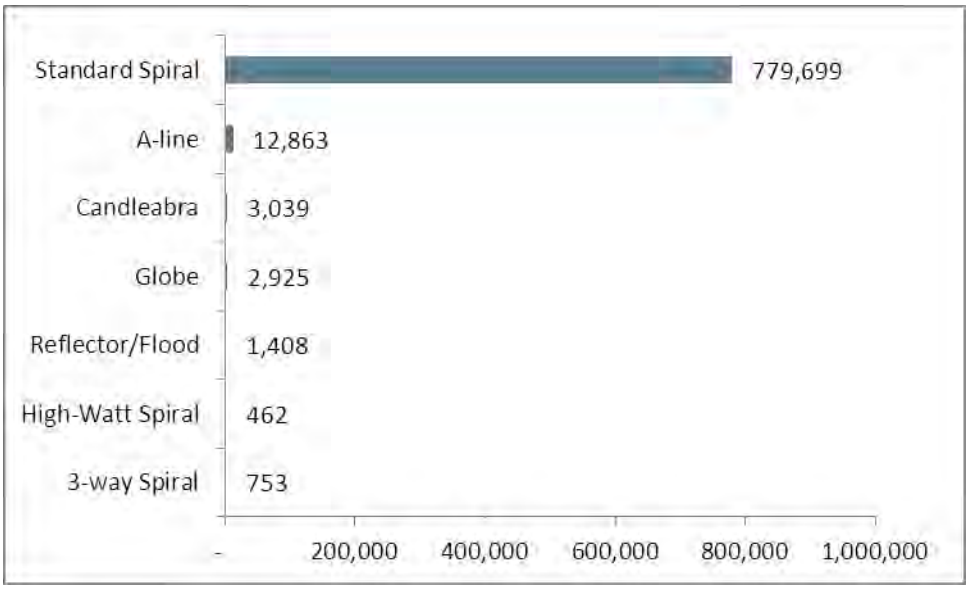


Figure 6-4 Summary of Markdown CFLs

Further, 14,722 LEDs were rebated through the retail markdown channel. This included:

- 8,679 A-line lamps;
- 4,217 reflector/flood lamps; and
- 1,826 LED fixtures.

Figure 6-5 summarizes the share of lighting markdown rebates by retailer type.

- Big Box Retailer comprises all large corporate chain stores (including large hardware store chains);
- Low Income Retailer comprises dollar stores and discount stores that primarily serve low income communities;
- Hardware includes small, independently-owned hardware retailers (including franchises); and
- Grocery includes retailers for whom food products are the primary product sold.

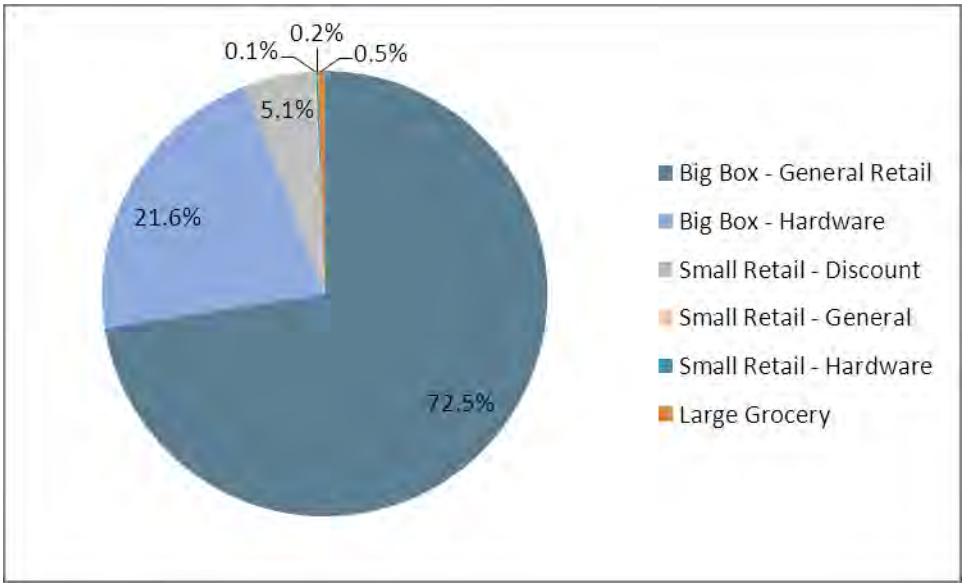


Figure 6-5 Distribution of Lighting Markdowns by Retailer Type

6.3 M&V Methodology

The M&V approach for the Residential Lighting Program is aimed at the following:

- Verifying the numbers of CFLs/LEDs sold as a result of the project;
- Determining the percentage of distributed CFLs/LEDs that are actually installed; and,
- Estimating the rate at which installed CFLs/LEDs are replacing older, inefficient lighting.

Table 6-1 below summarizes the inputs needed for gross savings calculations and the source of each input.

Table 6-1 Sources for Gross Impact Parameters – CFL Buy-Down Program

Parameter	*Source*
CFL/LED Quantities & Specifications	Program tracking data
Hours of Use Per Day	California Residential Lighting Metering Study (KEMA, 2009)
CFL/LED Installation Rate	Intercept surveys with lighting customers at point-of-purchase
Baseline Wattage	New Mexico TRM

6.3.1 RLP Review of Deemed Savings Estimates

The Evaluators reviewed the deemed savings estimates used by PNM for the 2015 RLP. This review included recalculation of savings by line item in PNM program tracking data using New Mexico TRM parameters.

6.3.2 RLP Net Savings Estimates

Evaluation of net savings from the 6.3.1 RLP requires determination of free-ridership through participant surveying. To obtain net savings for the 2015 RLP, the Evaluators surveyed program participants to develop estimates of free-ridership. Developing free-ridership estimates for the RLP is dependent upon survey questions addressing financial ability, prior planning, importance of the rebate in decision making, and likelihood of installing similar equipment absent the program. The methodology for calculating NTGR is detailed in this section.

6.3.2.1 Net-to-Gross Estimation Methodology

Determining the net effects of the lighting discounts requires estimating the percentage of energy savings from efficient lighting purchases that would have occurred without program intervention. Ideally, participating retailers could provide light bulb sales data for non-program time periods or from similar non-program retail locations. This data would provide adequate information from which to calculate the lift in CFL and LED sales attributable to the program price mark downs. However, retailers are reluctant to release sales data for this purpose because of the possibility that the data may be exposed to competitors or otherwise misused.

As a result, evaluating the net effects of the price discounts requires estimating free ridership without non-program sales data. A number of methodologies have been used in similar evaluations across the country. One such methodology is self-report surveys with a sample of customers aimed at determining light bulb purchasing decision making characteristics. The goal of these surveys is to elicit information from which to estimate the number of bulbs that the customer would have purchased in the counterfactual scenario where CFLs and/or LEDs were not discounted. Self-report survey methods for determining free ridership are generally recognized as susceptible to certain biases and error. This may be especially true for upstream price markdown programs, where the

counterfactual scenario of regular retail prices may be difficult to explain or grasp. There have been some efforts to estimate free ridership using consumer demand modeling when there is sufficient price variation within program time periods and products.

This evaluation relies on self-report survey data from intercept surveys. The surveying effort was conducted using in-store intercept methods. These surveys are conducted in-person with customers purchasing qualifying lighting products from participating retailers. The advantage of this methodology is it allows for discussion at the time of purchase, when customers are most likely to adequately describe their purchase making decision process. Surveys were completed at a range of times

Survey respondents were asked a series of questions to elicit feedback regarding influences to their light bulb purchasing decisions. Each respondent was then assigned a free ridership score based on a consistent free ridership scoring algorithm. The free ridership scoring algorithm for the in-store intercept surveys is shown in the figure on the next page.

For the intercept surveys, respondent free ridership scores were calculated individually and then averaged to estimate program level free ridership. The figure below demonstrates the logic in calculating free-ridership scores for each surveyed customer.

6.3.2.2 Data Collection Procedures

Intercept surveying to support NTGR estimates has the potential to introduce bias in responses. The Evaluators took numerous precautions to mitigate these issues, detailed below.

In-store interviews were completed by professional, trained, full-time, interviewers at Research & Polling Inc. These interviewers have been trained and briefed by ADM Associates on the subject matter the survey. These staff are trained on interviewing techniques to mitigate response bias.

The survey instrument was designed to mitigate against a variety of response biases. First, the survey design avoids the use of “leading” questions that make unjustified assumption. As an example of how this is avoided, consider the following two questions included in the survey instrument:

- “Did you plan to purchase light bulbs before you entered the store today?”
- “Before entering the store today, did you plan to purchase this specific bulb type or just light bulbs in general?”

On its own, the second question would be leading because it would presume that a lighting purchase had been planned. This assumption is avoided by asking the first question prior to the second.

Second the survey instrument presents a balanced set of response options for all applicable questions. Response bias may be introduced into a survey when questions are worded such that only one end of a range of response options is presented to the respondent[9]. The survey instrument avoids this by having the full range of response options read to the respondent. For example, questions regarding the likelihood of purchasing a product if it cost more include instructions to the interviewer to read all possible response options (i.e., from Definitely would have purchased to definitely would not have purchased).

Third, the survey instrument is designed to be simple and uses basic, everyday language. Complex survey instruments can lead to excessive cognitive burdens on respondents that may lead to a variety of response biases. Multiple steps in the design were taken to avoid complexity. For example, common language is used and terms of art are avoided. Additionally, the survey instrument "walks" respondents through a line of questioning that aids recall of participant decision making. The questions on respondent decision making is initiated with a few basic fact questions on what lighting purchase, if any, was planned prior to entering the store. This aids respondents by inducing recall of what their initial plans were. Moreover, when more complex questions are asked, such as what they would have purchased had the bulbs cost more, the instrument clearly phrases the choice between standard efficiency and efficient bulbs and provides a specific cost point for the respondent to evaluate. This is followed by a simple four-point response scale that does not required to the respondent to make a very fine distinction in likelihood of purchasing the efficient product in the absence of the program (e.g., rating the likelihood of the purchase on a 100 point scale).

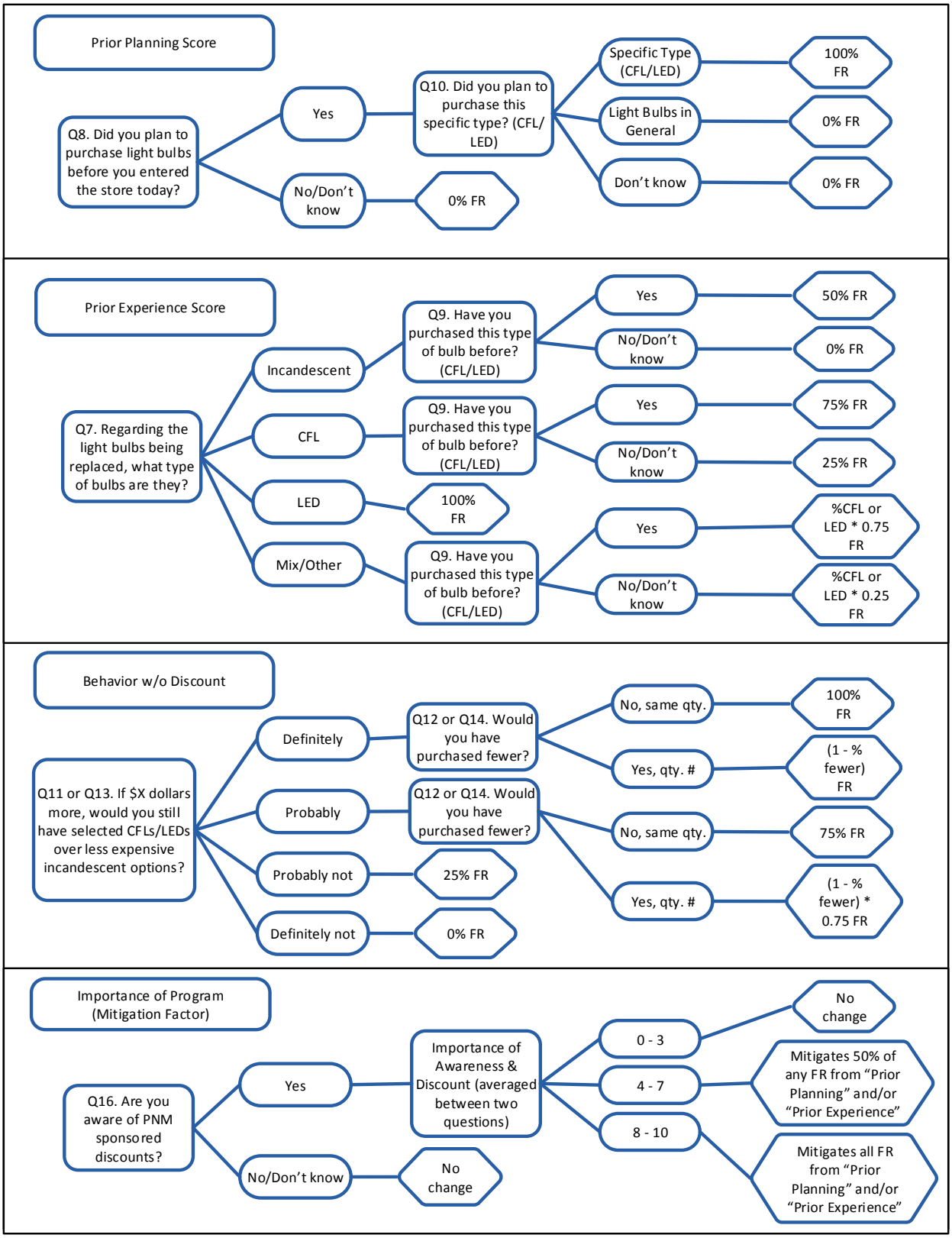
Fourth, biased responding that may be introduced through poor recall is eliminated by administering the survey at the time of purchase. This is particularly important for lighting discount programs because these are low cost purchases that are unlikely to be very salient to the purchaser (as opposed to costlier home retrofits that may require additional deliberation or evaluation of information such as that provided by through an energy assessment).

Fifth, multiple questions are used to assess the same concept. For example, the questions on the likelihood of purchasing the efficient bulbs are followed by questions on the how many would have been purchased if the price was higher. By phrasing the question in different forms, any response tendency to one type of question may be mitigated by another.

While more than one of the previously mentioned survey design characteristics mitigate against socially desirable responding, it is also important to note that it is not clear that

[9] For example, by asking respondents to indicate level of agreement with a statement rather than the level of agreement or disagreement.

this has much impact on responses to these survey questions or that the net effect is to increase free ridership. It is important to note that socially desirable responding is more likely to be a significant issue for topics that are socially sensitive, it is not clear to the Evaluators that preferences for efficient light bulbs is a socially sensitive issue. Furthermore, it is important to note that the net effect of socially desirable responding may be in either direction. On the one hand, respondents may feel that the desired response is to indicate a preference for energy efficiency, which may tend to lead to responses that overestimate free ridership. On the other hand, respondents may feel that it is more socially acceptable to be perceived as savvy cost conscious shoppers taking advantage of a discount or that it is important to portray the program as important and valuable.



The final equation for scoring free ridership is as follows:

*Final Respondent FR Score = 0.2 * Prior Planning FR + 0.2 * Prior Experience FR + 0.6 * Behavior w/o Discount FR - Importance of Program Mitigating Factors*

For the intercept surveys, the "behavior without discount" scoring is the primary determinate of respondents' free ridership scores. This section asked whether the respondent would have purchased the same light bulbs if they had cost the regular retail price. This may be a question that is particularly prone to social desirability bias – the tendency to respond in a manner that might be viewed favorably by others. For this reason, a consistency check was performed. For the intercept surveys, the consistency check was an open-ended question asking the survey taker to describe what made them select the particular bulbs for purchase. If a respondent said anything other than "definitely would not" have purchased the bulbs at retail price, the open-ended question was checked. If a respondent mentioned "price," "good deal," or "program promotion" as a reason for his/her purchase, it was taken to mean he/she might have overestimated their likelihood of purchasing the same bulbs at retail price. In these instances the behavior without discount score was reduced by 50% to control for this potential bias.

6.4 Residential Lighting Program Impact Evaluation

The Evaluators estimated savings from the RLP by conducting an in-store intercept survey with a sample of 108 program participants to determine installation rate and NTGR. Table 6-2 presents gross realization for the 2015 RLP.

Table 6-2 Residential Lighting Gross Realization Summary

Component	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		Lifetime Energy Savings (kWh)		Gross Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post	
CFLs	3,165	2,559.11	27,451,879	20,573,528	296,315,210	131,670,576	-
LEDs		1,209.01		9,719,625		142,878,487	-
Total	3,165	3,768.12	27,451,879	30,293,153	296,315,210	274,549,063	110.4%

Additionally, the Evaluators estimated free-ridership for the RLP via participant surveying, obtaining an overall value of 65.1% for NTGR for participants. The resulting net savings are presented in Table 6-3.

Table 6-3 Residential Lighting Net Realization Summary

Component	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		Lifetime Energy Savings (kWh)		Net Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post	
CFLs	2,416.20	1,773.36	20,943,292	14,256,605	226,061,613	91,242,274	-
LEDs		841.71		6,766,752		99,471,253	-
Total	2,416.20	2,615.06	20,943,292	21,023,357	226,061,613	190,713,527	100.4%

6.4.1 Gross Savings Estimates

The program incentivized 801,149 CFLs and 323,765 LEDs (1,214,914 lamps total) through participating retailers throughout PNM territory. A sample of customers that purchased discounted CFLs and/or LEDs were asked to participate in an in-store survey, providing a name and contact phone number. 108 customers were selected for an intercept survey to collect gross savings and net savings parameters. Gross savings estimates for residential CFLs/LEDs require the following parameters:

- Baseline wattage;
- Installation rate; and
- Hours of use

6.4.1.1 Installation Rate

The Evaluators used existing literature to apply a long-term in-service-rate (ISR) of 96% for CFLs and 100% for LEDs.

6.4.1.2 Hours of Use

The Evaluators applied hours of use to the impact analysis by applying the hours of use listed in the New Mexico TRM. The TRM values were derived from two studies. In a 2009 study of California by KEMA[10], CFL use was monitored in statistically significant samples by room type, with the resulting average daily hours of operation by room type summarized in Table 6-4.

Table 6-4 Daily Hours of Operation by Room Type – NM TRM

Room Type	CFL Hours Per Day
Kitchen	3.5
Living Room	3.3
Outdoor	3.1
Family Room	2.5
Garage	2.5
Utility Room	2.4
Dining Room	2.3
Office	1.9
Bedroom	1.6
Bathroom	1.5
Hall/Entry	1.5
Laundry Room	1.2
Closet	1.4
Other	1.2
Weighted Average	2.24

[10] Ibid

6.4.1.3 Baseline Wattage

Baseline wattage is dependent upon CFL wattage and configuration, i.e., spiral, flood, globe, or candelabra. The Evaluators researched each model number listed in the program tracking data for residential lighting programs run by each of the three New Mexico investor-owned electric utilities to find the appropriate baseline for the model. These results are presented in Table 6-5 through Table 6-7.

Table 6-5 Lighting Baseline – General Service Lamps[11]

Lumen Range	EISA Status	EISA Baseline: 1st Tier	EISA Baseline: 2nd Tier EISA
250-309	Exempt	25	25
310-749	Non-exempt	29	12
750-1,049	Non-exempt	43	20
1,050-1,489	Non-exempt	53	28
1,490-2,600	Non-exempt	72	45
2,601-2,999	Exempt	150	150
3,000-5,279	Exempt	200	200
5,280-6,209	Exempt	300	300

Table 6-6 Lighting Baseline – Reflector/Flood Lamps

Lamp Type	Pre-EISA Incandescent Equivalent	Baseline Wattage – Post-EISA
PAR20	50	35
PAR30	50	35
R20	50	45
PAR38	60	45
BR30	65	Exempt
BR40	65	Exempt
ER40	65	Exempt
BR40	75	65
BR30	75	65
PAR30	75	55
PAR38	75	55
R30	75	65
R40	75	65
PAR38	90	70
PAR38	120	70
R20	≤ 45	Exempt
BR30	≤ 50	Exempt
BR40	≤ 50	Exempt
ER30	≤ 50	Exempt
ER40	≤ 50	Exempt

[11] Tier 1 became effective January 1st, 2014. Tier 2 is effective January 1st, 2020

Table 6-7 Lighting Baseline – Other Specialty Lamps

CFL Wattage	Lumen Range	Baseline Watts
3-Way	250-449	25
	450-799	40
	800-1,099	60
	1,100-1,599	75
	1,600-1,999	100
	2,000-2,549	125
	2,550-2,999	150
Globe (medium & intermediate base, ≤ 750 lumens)	90-179	10
	180-249	15
	250-349	25
	350-749	40
Decorative (shapes B, BA, C, CA, DC, F, G, medium base, ≤ 750 lumens)	70-89	10
	90-149	15
	150-299	25
	300-499	40
	500-1049	60
Globe (Candelabra base, ≤ 1,049 lumens)	90-179	10
	180-249	15
	250-349	25
	350-499	40
	500-1,049	60
Decorative (shapes B, BA, C, CA, DC, F, G, candelabra base, ≤ 1,050 lumens)	70-89	10
	90-149	15
	150-299	25
	300-499	40
	500-1,049	60

6.4.1.4 Peak Demand Reduction

Peak demand reduction is dependent upon the peak coincident factor (PCF), which is defined as the percent of available peak hours in which lighting is operating. PNM's peak period is set on summer weekdays between 3:00 and 6:00 PM. Based upon the KEMA CFL Metering Study, the Evaluators found that the PCF defined for this period is 10.17%, which the Evaluators have applied in the analysis for residential applications.

6.4.1.5 Lifetime Savings

Lifetime savings were determined separately for CFLs and for LEDs, as their respective expected useful life (EUL) estimates vary greatly. For CFLs, the Evaluators applied a EUL of 6.4 years, per the 2015 New Mexico TRM. For LEDs, which are not yet covered by the New Mexico TRM, the Evaluators used the EUL value for screw-base LEDs in residences from the 2015 Pennsylvania TRM. The EUL for LEDs in residential applications is 14.7 years. The EULs for CFLs and LEDs were multiplied by their respective realized annual savings to determine lifetime savings for each measure.

6.4.2 Residential Lighting Net-to-Gross Evaluation

To obtain net savings for the 2015 RLP, the Evaluators surveyed program participants to develop estimates of free-ridership. As detailed in Section 6.3.2, developing free-ridership estimates for the RLP is dependent upon survey questions addressing financial ability, prior planning, importance of the rebate in decision making, and likelihood of installing similar equipment absent the program.

Table 6-8 through Table 6-11 below summarizes the responses to questions addressing free-ridership for the 2015 RLP.

Table 6-8 "Prior Planning" Results

Component	Question	Yes	No	Don't Know
Prior Planning	Question 7: Did you plan to purchase light bulbs before you entered the store today? *n =108*	70.4%	29.6%	0%
	Q8 asked if Q7 = "Yes"	**Specific Type**	**Light Bulbs in General**	**Don't Know**
	Question 8: Before entering the store today, did you plan to purchase this specific bulb type or just light bulbs in general? *n = 76*	61.8%	35.5%	2.6%

Table 6-9 "Prior Experience" Results

Component	Question	Incandescent	CFL	LED	Mixture of lamps	New Fixture or Socket
Prior Experience	Question 6: Regarding the light bulbs being replaced, what type of bulbs are they? *n = 108*	56.5%	24.1%	3.7%	2.8%	12.9%
	Question	**Yes**	**No**	**Don't Know**		
	Question 9: Have you purchased this type of bulb before (i.e. CFL or LED)? *n = 108*	68.5%	30.6%	9.1%		

Table 6-10 "Behavior without Discount" Results

Component	Question	Definitely Would've Still Purchased	Probably Would've Still Purchased	Probably Wouldn't Have Still Purchased	Definitely Wouldn't Have Still Purchased	Don't Know
Behavior Without Discount	Question 10: If the CFLs that you selected cost $1.00 more per bulb, would you still choose CFLs as opposed to less expensive incandescent/halogen options? *n = 57*	17.5%	45.6%	21.1%	5.3%	10.5%
	Question 12: If the LEDs that you selected cost $5 more per bulb, would you still choose LEDs as opposed to less expensive CFLs or incandescent/halogen options? *n = 51*	17.7%	16.1%	45.2%	8.1%	12.9%
	If respondent question 10 and/or 12 = Definitely or probably would've, then:	***Yes, different quantity.***	***No, same quantity.***	***Don't Know***		
	Question 11: Do you think you would have purchased fewer CFLs today at that price? *n = 42*	9.5%	64.3%	26.2%		
	Question 13: Do you think you would have purchased fewer LEDs today at that price? *n = 29*	31.0%	44.8%	24.1%		

Further, for the "Behavior without discount" component, the Evaluators asked an additional open-ended question:

> "Could you briefly describe in your own words what made you choose the specific light bulbs you selected as opposed to other options?"

If responses specifically mentioned key words such as "price", "deal", "discount", or "low-cost", the Evaluators marked the respondent as "verbatim-adjusted". Verbatim-adjusted respondents had their free-ridership score from the "Behavior without discount" component scaled back by 50%. After reviewing the verbatim responses, the Evaluators found that 16.7% of respondents mentioned key words that resulted in the possibility of adjusting their score. This resulted in increased NTGR scoring for 15 survey respondents.

Table 6-11 "Importance of Program" Results

Component	Question	Yes	No	Don't Know
Importance of Program (Mitigating FR factor)	Question 16: Are you aware that PNM is sponsoring discounts on energy efficient light bulbs in this retail store? *n = 108*	24.1%	75.9%	2.4%
	If respondent question 16 = Yes, then:	***1-3 = Not Important***	***4-7 = Somewhat Important***	***8-10 = Very Important***
	Q19: On a scale of 1-10, how important was information from [SOURCE OF AWARENESS] in your decision to purchase this lighting? *n=26*	19.2%	11.5%	69.2%
	If respondent question 16 = Yes, then:	***1-3 = Not Important***	***4-7 = Somewhat Important***	***8-10 = Very Important***
	Question 20: [On a scale of 1 to 10] How important would you say the actual PNM-sponsored price discount was to your decision to purchase the bulbs you have selected? 1 = Not important at all, 10 = Very important *n = 26*	26.9%	7.7%	65.4%
	The mean scores of information and rebate importance from Q19 and Q20 are then examined	***1-3 = Not Important***	***4-7 = Somewhat Important***	***8-10 = Very Important***
	Mean score of Q19 and Q20 *n=26*	15.4%	30.8%	57.7%

In addition to this, sales at discount retailers (such as dollar stores) were credited with 100% NTGR.

This resulted NTGRs of:

- CFLs: 69.3%
- LEDs: 69.7%.

The NTGR for CFLs was driven in-part by their prevalence in discount retailer sales. Without incorporation of the 100% deemed NTGR for discount stores, CFL NTGR is 66.8%.

6.4.3 Retailer Survey Results

The Evaluators completed surveys with 28 retail store representatives. Survey participants included managers and assistant managers at retail locations that participated in the residential lighting program. The surveyed managers represented 28% of total participant locations and 59% of the estimated kWh savings for this program year.

The majority of survey participants (68%) have worked at their company for more than 5 years, and all currently hold management positions at their store location. This indicates that the respondents interviewed are generally familiar with their company and store location.

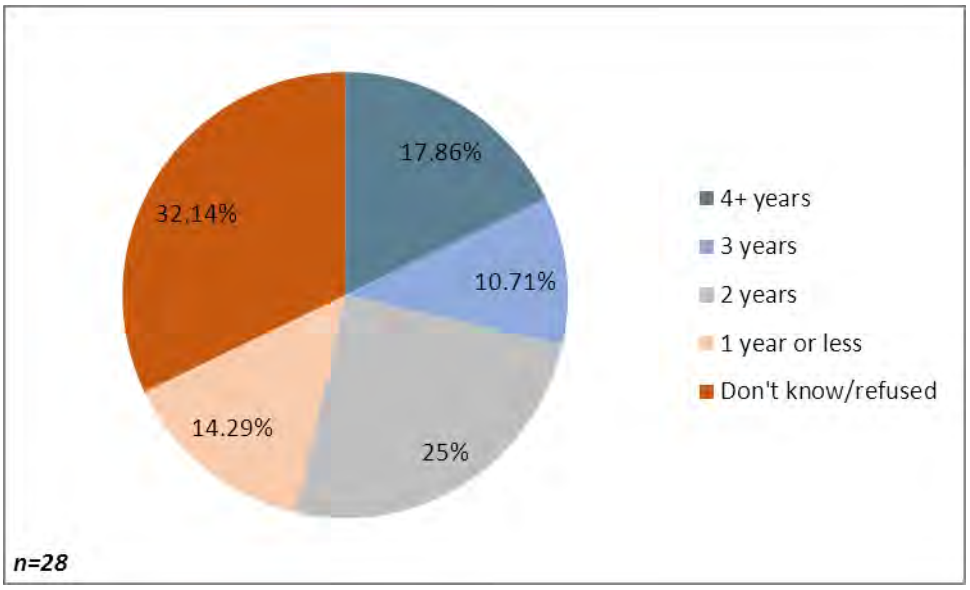


Figure 6-6 Tenure of Program Involvement for Retail Managers

6.4.3.1 Markdown and Rebates

All respondents stated that the current markdown levels were sufficient to encourage customer participation in the program.

A majority (75%) of respondents stated that the markdowns were neither too high nor too low. Four respondents stated that the rebates could be higher. When asked to elaborate, all four retail staff explained that although the rebates as a whole were sufficient, rebates on specialty LED bulbs could be higher.

Almost all (96%) retail staff stated that the sales of the products would be lower if the rebates were not available. Of those retailers, half (48%) stated that the sales would have dropped 25% or more, with the other half of respondents stating that sales would likely lower less than 25% without the program. This indicates that respondents believe that the sales attributable to the program are significant.

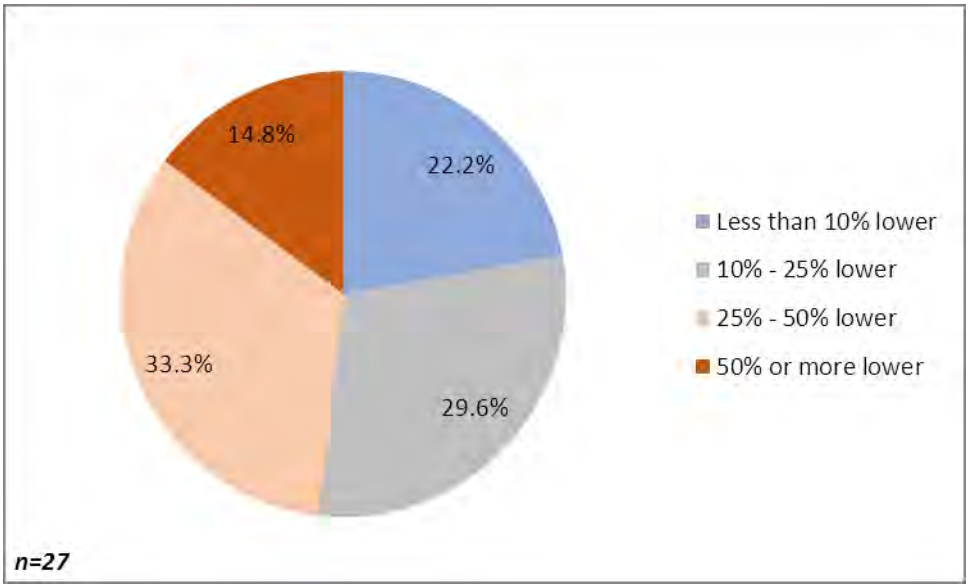


Figure 6-7 Effect of Program on Sales of CFLs and LEDs

The mean values for this question by business type are summarized in Figure 6-8.

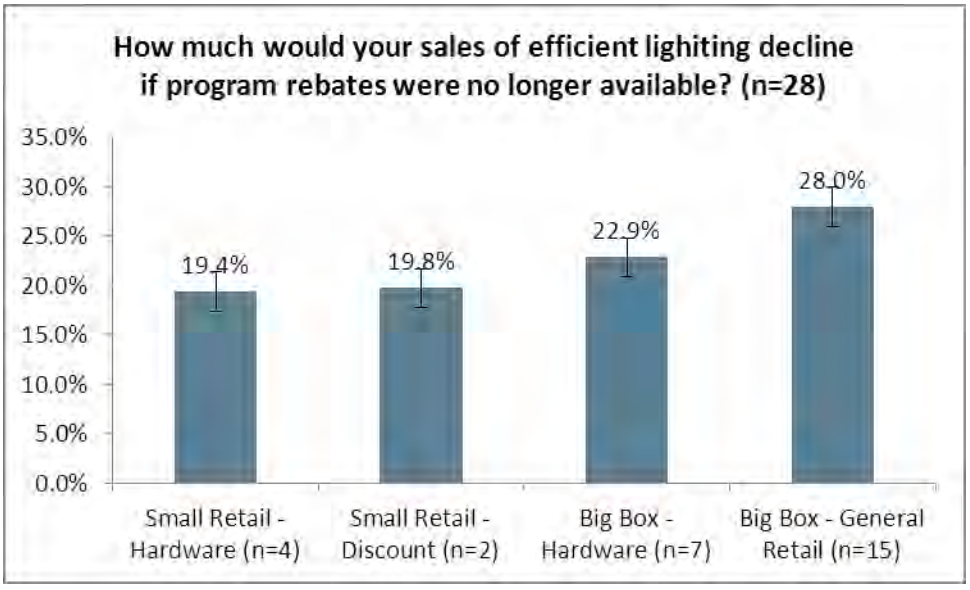


Figure 6-8 Retailer Manager Response – Expected Savings Decline without Rebates

When asked to explain why they thought the rebates affected the sales in this way, most respondents stated that the rebates made the products more affordable to consumers. One retailer each suggested the program increases the demand for LEDs, and that the light bulbs have been advertised successfully though the program.

When asked if the retail location ever offers discounts in addition to the rebates offered through PNM, a quarter of respondents indicated that they have additional sales on items.

Sixty-four percent of retail staff stated that when program rebates are available, they display the products that qualify for a rebate differently. Most of these retailers reported that they would place the bulbs on an end cap when the rebates are available, other answers included next to the register, and in a more prominent place in the aisles.

Three-quarters of retailers reported that there was not a limit to the number of bulbs that a customer could purchase. Other retailers reported a range of limits, including 2 bulbs, 4 bulbs, 5 bulbs, and only placing limits on CFLs. The program enforces a limit of 12 bulbs per customer, but this value is seemingly not known by the interview respondents or was potentially overridden with an internal restriction. Enforcing the limit at the register was the most common strategy.

6.4.3.1 Product Line

When asked if there were lighting products that should be included in the program that are not currently offered a discount, suggestions included expanded selection of LEDs, 100w LED replacement, LED track lighting, linear fluorescents, and expanded selection of dimming LED bulbs.

Fifty-two percent of retailers carried qualifying products before they participated in the program, and 19% expanded the product line to accommodate the program. This indicates that retailers generally already sell these types of products in their stores. The other retailers interviewed did not know if their stores had carried the products before being involved in the program because they did not work at the store at the time that the program was began at that location.

6.4.3.2 Program Representatives

When asked what types of marketing materials and outreach efforts offered by PNM, almost all retailers mentioned some sort of in aisle signage or tags designating the products that are discounted. Thirty-two percent of respondents also stated that the program representatives offer brochures or fliers for customers, and 14.3% mentioned other types of signage.

When asked how effective these marketing materials were, all respondents stated that they are effective.

Apart from program provided marketing materials, six retailers stated that they promote the program through different means. These include placing the products in a different place, signage and aisle flags, and brochures.

When asked if they knew who came to their stores, most retailers stated that they did not know, with four naming the representative.

The most common timeframe retailers reported that PNM representatives came to their store was monthly (31%). Fifteen percent stated that PNM representatives visited weekly, or bimonthly, 19% reported quarterly, and 12% were not sure. The differences in the timeframes follow the amount of kWh savings at a particular store pretty closely. This indicates that the time period that PNM representatives visit the individual stores is based on the needs of the individual retail locations.

Half of retailers reported that program representatives had held in-store promotion days where program representatives came into the stores to speak with customers about the discounted products. All retailers stated that in store promotion days are effective for promoting the rebates.

Sixty-seven percent retailers stated that their store sales staff mentions the lighting markdowns when discussing lighting with customers.

When asked to explain what program staff does while they are at the store, almost all retailers responded that program staff put up materials/aisle tags/other signage in the store. Other activities included speaking with store management and sales staff, organizing products, checking for stock, and speaking with customers about products.

6.4.3.3 Training and Support

Twelve respondents reported that they had received training and support from program staff. Most of these stated that they came and spoke to program staff

When asked how satisfied they were with the training and support offered on a scale of 1 to 5 with 1 being not at all satisfied, and 5 being completely satisfied, all 12 retailers reported either a 4 or a 5.

6.4.3.4 Overall Experience with the Program

When asked to rate their overall experience with the PNM Residential Lighting program on a scale of one to five, all but one respondent rated the program at either four or five. This indicates that retailers are very satisfied with the program and its current offerings.

When asked about the strengths of the program, the most common response was that the affordability of the products because of the rebates. Other strengths mentioned included educating the public about energy savings through LEDs and CFLs, increased sales, and energy savings and efficiency.

Respondents were also asked to identify if they see any particular issues or weaknesses with the program. Notable verbatim responses include:

"The program used to be more verbal, more excitement, now people think it's the regular price. We need more information about the program. Include before and after price on signs because the program has been out so long."

"I wish that the program representatives came more often."

7. Whole House

7.1 Program Description

The Whole House Program offers PNM residential customers an in-home energy assessment and direct installation of low cost measures, along with incentives for other improvements.

The program is implemented by Ecova, Inc. (Ecova). Participants pay $40 for an energy assessment and for a direct installation package that includes up to 20 CFLs, low-flow showerheads, faucet aerators, advanced power strips, LED night lights, and programmable thermostats. During the energy assessment, Ecova staff identifies eligible measures in the home for which the customer can receive a rebate. Eligible measures include:

- Refrigerator replacement;
- Clothes washers;
- Dishwashers;
- Advanced evaporative cooling;
- HVAC early replacement;
- HVAC normal replacement; and
- Window AC units.

In the process of implementing the home energy audits, Ecova will identify income-qualified customers to participate in the Low Income Home Efficiency Program, to be detailed in Chapter 8.

7.2 M&V Methodologies

The M&V approach for the Whole House Program is aimed at measuring the following:

- Verifying the installation and retention of direct install measures;
- Verifying energy savings from rebated measures; and
- Estimating cost effectiveness.

Table 7-1 summarizes the inputs needed for gross savings calculations and the source of each input.

Table 7-1 Data Sources for Gross Impact Parameters – Whole House Program

Parameter	Source
Number of Units Installed	Program Tracking Data
Unit Energy Consumption	ENERGY STAR®
Location of Installation	Program Tracking Data
Measure Retention	On-site verification
NTGR	Participant Surveying

7.2.1 Direct Install Energy Savings

Program staff provided direct installation of CFLs, low flow showerheads, programmable thermostats and faucet aerators. These measures are included in the New Mexico TRM, and this was used as the basis for unit energy savings.

7.2.1.1 CFLs

Energy savings for CFLs require baseline wattage and hours of use. These parameters are collected from program tracking data and current EISA guidelines. Gross energy savings for CFLs were evaluated as:

$$Annual\ kWh\ Savings = \left(W_{base} - W_{post} * HOU * ISR\right)/1000$$

Where:

W_{base} = Baseline wattage (see Table 7-2)

W_{post} = Actual wattage of new CFL (Table 7-2)

HOU = Hours of use as determined by installed location room type (Table 7-3)

ISR = In-service rate or installation rate, 98.4%

1000 = Conversion factor from W to kW

7.2.1.2 Baseline Wattage

The Evaluators researched the size and configuration of CFLs installed through the Whole House Program. These results are presented in Table 7-2.

Table 7-2 CFL Baseline Wattage Table

CFL Wattage	CFL Configuration	Baseline Wattage
9	Globe	29
13	Spiral	43
14	Spiral	43
14	A-lamp	43
14	Reflector	65
23	Spiral	72

7.2.1.3 Hours of Use

The Evaluators applied deemed savings by room type as specified in the New Mexico TRM. These values are summarized in Table 7-3 below.

Table 7-3 Daily Hours of Operation by Room Type – NM TRM

Room Type	*CFL Hours Per Day*
Kitchen	3.5
Living Room	3.3
Outdoor	3.1
Family Room	2.5
Garage	2.5
Utility Room	2.4
Dining Room	2.3
Office	1.9
Bedroom	1.6
Bathroom	1.5
Hall/Entry	1.5
Laundry Room	1.2
Closet	1.4
Other	1.2

These values were applied to line items in program tacking based on the room type listed. The room types did not match those specified in the TRM in some cases; when this occurred the Evaluators translated the tracking data values as follows:

Table 7-4 Room Type Translation – Program Tracking to TRM

Tracking Room Type	*TRM Room Type*
Kitchen	Kitchen
Living Room	Living Room
Exterior	Outdoor
Bedroom	Bedroom
Bathroom	Bathroom
Hall	Hall/Entry
Other	Other

7.2.1.4 Low Flow Devices

Verification of savings from low flow devices was completed as follows:

1) Measure retention rates were determined through on-site verification and participant surveying;
2) Percent of participants with electric water heating was determined through on-site verification and participant surveys; and
3) These two parameters were used to scale usage and savings in accordance with New Mexico TRM procedures.

7.2.1.5 Advanced Power Strips

Advanced Power Strips were provided as a "leave-behind" measure rather than as direct install. Program staff indicated that there were concerns related to customer satisfaction should the installation of a power strip interfere with the operation of a customers' home entertainment system (the example cited by program staff was the erasing of a DVR system). Installation rates were determined through on-site inspection.

7.2.1.6 Rebate Measure Savings

The Whole House Program provides recommendations for appliance replacements in participating homes. This includes pre-qualification for measures that constitute early replacement. Measures offered include:

- ENERGY STAR clothes washers;
- ENERGY STAR dishwashers;
- ENERGY STAR refrigerators;
- Air conditioning early replacement; and
- Evaporative coolers.

A total of 169 rebates were processed in 2015. Rebate quantities are summarized in Figure 7-1.

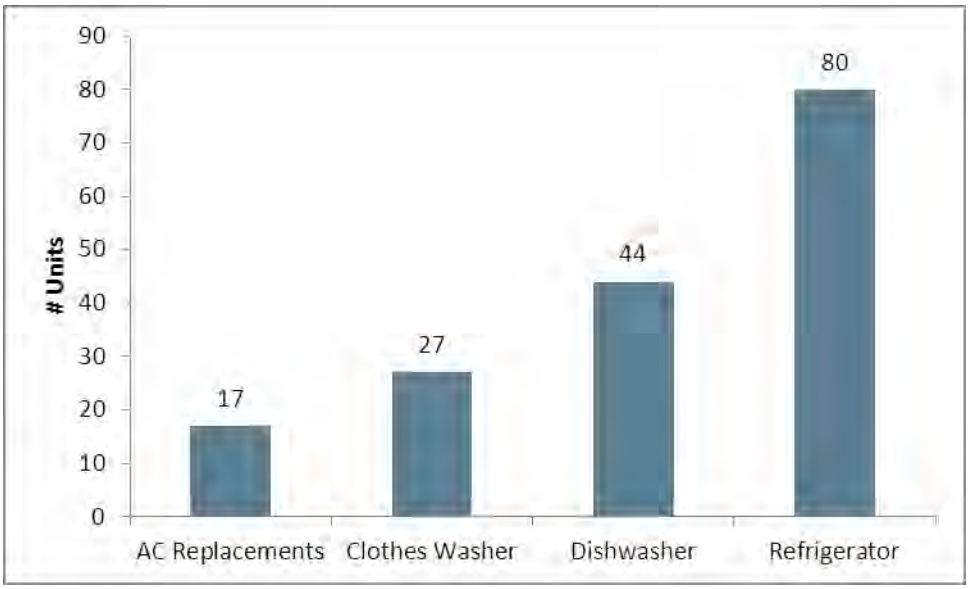


Figure 7-1 Whole House Rebated Equipment

Rebate measures accounted for only 8.1% of program savings, and as a result the Evaluators' review of these measures was limited to a review of deemed documentation provided by Ecova. This was completed early in the 2015 program year and the

deemed values provided were found to be in accordance with ENERGY STAR standards for appliances and the New Mexico TRM values for residential cooling savings.

The Evaluators modified Effective Useful Lives. EULs applied included:

- Clothes washer: 11 years
- Dishwasher: 11 years
- Refrigerator: 20 years
- CEE Tier 1 AC / AC Upgrade: 15 years

7.2.2 Net Savings Estimation

All customers that received an onsite verification visit from an ADM staff member or were surveyed by telephone were asked some variant of the following questions regarding program awareness, prior planning and influence of the program on decisions to purchase new energy efficient equipment. 'Influence of the program' was assessed for measures that had been recommended by the energy auditor to the customer, and also for measures that the customer installed after the audit. This was done in order to assess if the energy auditor's recommendations and the potential for equipment rebates from PNM have any influence on future customer behavior. Savings for measures that were listed as 'recommended' in the tracking data were not claimed in ex ante calculations.

For rebate measures, the Evaluators adopted the ex ante assumed NTGR of 80%.

7.3 Impact Findings

7.3.1 Direct Install Parameter Collection

Key drivers of direct install savings are:

1) Measure retention rates; and
2) Electric water heating rates.

7.3.1.1 In-Service Rates

Measure retention was addressed through on-site verification and telephone surveys. ADM conducted 42 on-site verification visits and 68 telephone surveys to measure retention rates, otherwise known as installation rates or in-service rates (ISR). ISRs were calculated for the measures that Ecova representatives directly installed in customers' homes. Customers were asked if they had removed any of the following equipment since installation:

- CFLs
- LEDs
- LED night lights
- Faucet aerators
- Low flow showerheads
- Programmable thermostats
- Advanced power strips

ADM staff verified counts of measures on-site at the customers' homes during site visits according to information that was given in the tracking data. Further, those customers that were surveyed by telephone were asked, *"did you remove any of the measures, and if so, how many of them did you remove?"* These quantities were compared against quantities listed as installed in the tracking data. The ISRs for the Whole House Program are summarized in Table 7-5.

Table 7-5 In-Service Rates for Direct Install Measures

Measure	ISR
CFLs	85%
LEDs	100%
LED Night Lights	100%
Faucet Aerator	74%
Low-Flow Showerhead	83%
Programmable Thermostat	90%
Advanced Power Strip	29%

The values in Table 7-5 were used to scale the savings for each measure.

7.3.1.2 Electric Water Heating Rate

Through the same sample of on-site and telephone surveying, the Evaluators confirmed the percent of participants which have electric water heating. Overall, 27.5% of sampled participants were found to have electric water heating. This is a significant increase from 2014, in which only 7.58% of sampled participants had electric water heating.

7.3.2 CFL Savings

The Evaluators verified energy savings from CFLs using the room of installation to apply the subspace hours from the New Mexico TRM. This approach was not possible in 2014 due to a lack of data on room of installation, but this field was added in 2015.

Table 7-6 Verified CFL Savings

Measure	# Units Installed	Ex Ante kWh	Gross Ex Post kWh	Realization
9W Globe	4,369	70,341	71,064	101.0%
13W Exterior	20	678	404	59.6%
13W Spiral	9,020	217,382	148,147	68.2%
14W A-Lamp	1,069	24,908	20,240	81.3%
14W Reflector	2,697	62,840	64,949	103.4%
23W Exterior	1,278	70,801	54,267	103.4%
Total	18,453	449,950	359,073	80.3%

Gross realization for CFLs overall was moderately low (80.3%). Reasons for low realization within specific subcategories are detailed as follows:

- **13W Exterior:** the lighting was not installed in exterior sockets. There were two line items in the tracking data for this measure category, and these two were listed as having been installed in Kitchen and in Bedroom spaces. The Evaluators concluded that these were likely mislabeled entries that belonged in the 13W Spiral category.
- **13W Spiral:** the ex ante calculations for this measure used TRM values of 2.24 hours per day. When examining the rooms in which 13W spiral CFLs were installed, the Evaluators found a weighted-average hours of use of 1.76 per day. Eighty-four percent of 13W spiral CFLs were installed in space types with hours of use below the 2.24 TRM average (living room, bedroom, bathroom, hall, and other).
- **14W A-Lamp:** similarly to 13W spiral, 14W A-Lamps were installed in lower-use space types, and had average usage of 2.10 hours per day.

The overall verified gross savings from CFLs are:

- 359,073 kWh;
- 51.30 kW; and
- 2,860,479 lifetime kWh.

7.3.3 LEDs

Savings for LEDs were calculated in a similar manner as detailed for CFLs. Key parameters differed as follows:

Table 7-7 Verified LED Savings

Measure	# Units Installed	Ex Ante kWh	Gross Ex Post kWh	Realization
8W LED Globe	738	18,954	10,737	56.6%
12W LED Reflector	822	31,668	29,189	92.2%
Total	1,560	50,622	39,926	78.9%

Total savings from LEDs are:

- 39,926 annual kWh;
- 4.08 kW; and
- 399,260 lifetime kWh.

7.3.4 LED Night Lights

LED night lights have stipulated savings which differ significantly from other LEDs. LED nightlights operate 11.23 hours per day. A .3W LED nightlight has a mean baseline of 6.79W, detailed in Ecova workpaper vetted by the Evaluators.

When adding LED night lights to the program, the Evaluators stipulated with Ecova and PNM that they may be installed only when there is an existing night light to replace. Absent that, the measure adds load rather than providing energy savings. 55 of the 160 respondents surveyed received at least one night light. Of these, 29.1% stated that the nightlights were installed in empty sockets, rather than replacing existing nightlights. The ISR for these measures is 100%, but savings are reduced by 52.6% to account for the lack of baseline lighting for customers that had night lights installed in empty sockets.

Table 7-8 Verified LED Night Light Savings

Measure	# Units Installed	Ex Ante kWh	Ex Post kWh	Realization
LED Night Light	1,572	41,682	29,555	70.9%

Night lights have no kW savings due to operating outside of peak time (3:00 PM – 6:00 PM). Lifetime savings for LED night lights is 472,886 kWh.

7.3.5 Low Flow Device Savings

Low flow aerators had an ISR of 74% and showerheads had an ISR of 83%. The Evaluators found that 27.5% of participant homes that received low flow devices had electric water heating.

Table 7-9 Low Flow Device Savings

Measure	Expected	Verified	
	kWh	kWh	Therms
Faucet Aerator – Bathroom	10,911	25,367	1,892
Faucet Aerator – Kitchen	2,826	5,108	627
Showerhead	23,628	32,959	8,527

Realization was exceedingly high for low flow devices due to the increased percent of electric water heating (which increase from 7.6% to 27.5% from 2014 to 2015).

7.3.6 Programmable Thermostat Savings

Programmable thermostats were installed in most participating homes. The deemed savings listed was scaled by the retention rate verified through on-site inspection and telephone surveying. Total savings from programmable thermostats were:

- 4,934 kWh;
- 0.0 kW; and
- 49,340 lifetime kWh.

7.3.7 Advanced Power Strips

In on-site inspections, the Evaluators found that most advanced power strips were not installed or were used in a manner which does not provide energy savings (such as using the power strip just for installation of lighting). The ISR for advanced power strips was 29%. Overall savings for this measure is:

- 35,963 kWh;
- 3.67 kW; and
- 359,630 lifetime kWh.

7.3.8 Verified Savings

Ex post gross impact and net savings are given in Table 7-10.

Table 7-10 Net Savings by Measure

Measure	# Units Installed	Ex Ante Savings	Gross Ex Post Savings	NTGR	Net Ex Post Savings
CFLs	18,453	449,950	359,073	100%	359,073
LEDs	1,560	50,622	39,926	100%	39,926
LED Night lights	1,572	41,682	29,555	100%	29,555
Faucet Aerator	1,478	13,737	30,475	100%	30,475
Low-flow Showerhead	647	23,628	32,959	100%	32,959
Programmable Thermostat	170	5,525	4,934	100%	4,934
Advanced Power Strip	2109	124,009	35,963	100%	35,963
ENERGY STAR Clothes washer	27	2,570	2,570	80%	2,056
ENERGY STAR Dishwasher	44	1514	1513.6	80%	1,211
ENERGY STAR Refrigerator	80	36,920	36,920	80%	29,536
AC Upgrade	18	21,895	21,895	80%	17,516
Total:	26,158	772,052	595,784	97.9%	583,204

Table 7-11 summarizes the gross and net savings estimates by measure for the 2015 Whole House Program.

Table 7-11 2015 Whole House Verified Savings Summary

	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		Lifetime Energy Savings (kWh)		Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post	
Gross	82.0	77.1	771,687	595,784	9,889,440	6,135,459	77.2%
Net	80.4	73.5	756,253	583,204	9,691,652	5,927,875	77.1%

7.4 Process Findings

The evaluators conducted a process evaluation of the Whole House Program in order to address a range of issues:

- What measures are participants following the completion of the in-home assessment?
- Is the assessment useful to program participants?
- Are participants satisfied with their experience with the program?

7.4.1 Data Collection Activities

The process evaluation of Whole House included the following data collection activities:

- *PNM Program Staff Interviews*. The evaluators interviewed staff at PNM involved in the administration of the program. These interviews collected initial background information on program history and implementation, as well as capturing any operational changes or new developments in the program.

- *Ecova Program Staff Interviews.* Ecova implements the program. The Evaluators collected information from this interview as to the implementation process and lessons learned in the first year of program implementation.
- *On-site Visits.* The Evaluators staff verified counts and operation of measures claimed as installed by the program.

Participant Surveying. The Evaluators surveyed a sample of program participants to participants to obtain feedback.

Table 7-12 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, timeframe of data collection.

Table 7-12 PNM Whole House Program Data Collection Summary

Target	Component	Activity	N	Role
PNM Program Staff	Senior Program Developer	Interview	1	Overall administration of PNM DSM programs. This manager is involved in the larger strategic decisions associated with the DSM portfolio, and is involved with the overall coordination of utility resources.
Ecova Staff	Program Manager	Interview	1	Administration of program. Oversight of outreach and installation.
Program Participants	-	On-site Visit	40	Verify installation and retention of measures given in the tracking database. Survey participants on program.
Program Participants	-	Survey	160	Residential participants in the Whole House Program were surveyed for impact and process data collection.

7.4.2 Market Description

This section presents key background data on the target market for the Whole House Program. Data for this section are provided by the Energy Efficiency Potential Study for the State of New Mexico[12] and the American Community Survey (ACS)[13], and surveys with participating market actors.

7.4.2.1 Market Characteristics

To provide estimates of available market for PNM service territory, the Evaluators combined ACS results for the following counties:

- Bernalillo
- Valencia

[12] Global Energy Partners, 2011. "Energy Efficiency Potential Study for the State of New Mexico. Volume 2: Electric Energy Efficiency Analysis". Prepared for the Department of Energy under management of the State of New Mexico's Energy, Minerals, and Natural Resources Department's Energy, Conservation, and Management Division.

[13] Bureau of the Census. 2011. *American Community Survey, One-Year Data.*

- Sandoval
- Santa Fe
- Grant
- Hidalgo
- Lincoln
- Luna
- Otero
- San Miguel
- Sierra
- Union

Data from the most recent available ACS indicates that there were a total of 537,365 residences in PNM-served counties as of 2011. Of these, 87.5% are occupied, and of that, 32.9% are low income[14]. Figure 7-2 summarizes a comparison of housing stock of program participants vs. the housing stock of PNM's service territory overall.

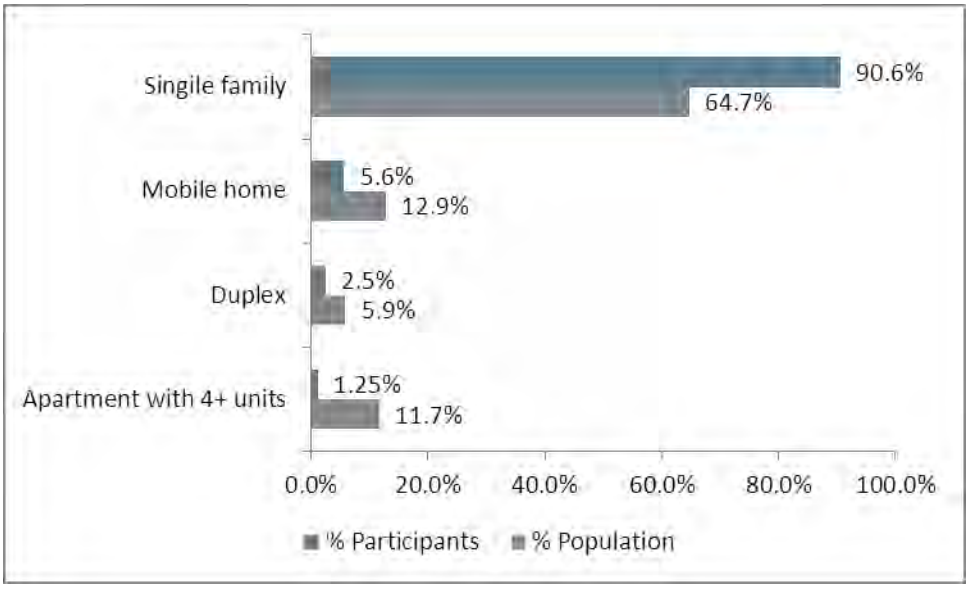


Figure 7-2 Distribution of Residential Buildings Types in PNM Service Territory

A key difference is in the percent of participants in single family homes. Ninety-one percent of program participants occupied single family homes, though single family homes constitute 64.7% of housing stock. This is reflective of the program's targeting of home owners rather than landlords or renters. Ninety-six percent of survey respondents

[14] The evaluators set a cutoff of $35,000 when determining if a household is "low income".

indicated owning their home, compared to PNM's overall home ownership rate of 68.8%.

7.4.2.2 Market Barriers

In reviewing the program offerings and theory, the Evaluators identified the following market barriers:

- **High share of gas space heating and water heating.** Eighty-two percent of survey respondents indicated having natural gas space heating. Eighty percent of survey respondents indicated having natural gas water heating, and 82.5% had natural gas space heating. In addition, PNM's service territory has a relatively mild cooling season and high use of evaporative cooling. This adds significant difficulty to programs with a whole-house approach in that there are limited opportunities to produce kWh savings in a manner that will pass the Utility Cost Test.
- **Difficulty in inducing early replacement.** Most of the program recommendations pertain to the replacement of functioning equipment. In particular, the program attempts to induce early replacement of central air conditioning systems and refrigerators. Participants often do not feel compelled to replace functioning equipment unless it is part of a larger remodel.
- **High share of evaporative cooling.** This, combined with gas space heating, limits the opportunities for the types of building envelope improvements that typically drive savings in whole-house programs.

7.4.2.3 Program Administration

The Whole House Program is overseen by a Senior Program Developer at PNM. The manager's responsibilities are focused primarily on verifying invoices from Ecova and ensuring proper payment based on project costs. Other activities associated with program delivery (marketing, QA/QC, etc.) are handled by the Ecova.

7.4.2.4 Program Implementation and Delivery

The participation process is as follows:

- *Customer Recruitment*. The outreach efforts by Ecova are targeted at residential single-family homeowners. This has included bill inserts, online advertising, and mass media advertising including television, radio, and print media advertisements.
- *In-Home Assessments*. Ecova uses internal staff to complete in-home assessments. At this time, the Ecova staffer identifies qualifying equipment for the rebate component of the program.

- *Installation*. During the in-home assessment, the Ecova staffer then identifies fixtures eligible for installation of CFLs, faucet aerators, and low flow showerheads. With the homeowner's permission, these are then installed.
- *Assessment Summary*. Once direct installation is complete, the homeowner is later provided a brief report summarizing their eligibility for rebates for HVAC and appliance replacements.
- *Application Submittal*. Participants purchase qualifying equipment at their discretion once they have been pre-qualified for a rebate. Their application and associated rebate coupon are submitted to PNM and Ecova.
- *Application Review & Payment*. Staff at Ecova reviews the application and after verifying that measures installed meet program criteria, payment is remitted to the participant. Summaries of payments are sent to PNM for their internal review on a monthly basis.

7.4.1 Participant Demographics

Participants were asked about the size and age of their home as well as their annual household income. Twenty-five percent of participants live in homes that were built within the last 15 years; and 60% live in homes that were built after 1980. Most respondents (53%) live in homes that are 2,000 square feet or smaller. Respondent's annual household incomes are summarized in Figure 7-6.

Figure 7-3 Whole House Program – Annual Household Income

In general, there is an inverse correlation between annual household income and program participation. However, this pattern does not track perfectly.

7.4.2 Program Marketing & Outreach Efforts

PNM markets the Whole House Program through their general mass-market channels. Activities in support of the Whole House Program have included:

- Bill inserts;
- Television advertisements;
- Radio advertisements; and
- Print media.

Survey respondents were asked to identify how they became aware of the Whole House Program. Their responses are summarized in Figure 7-4.

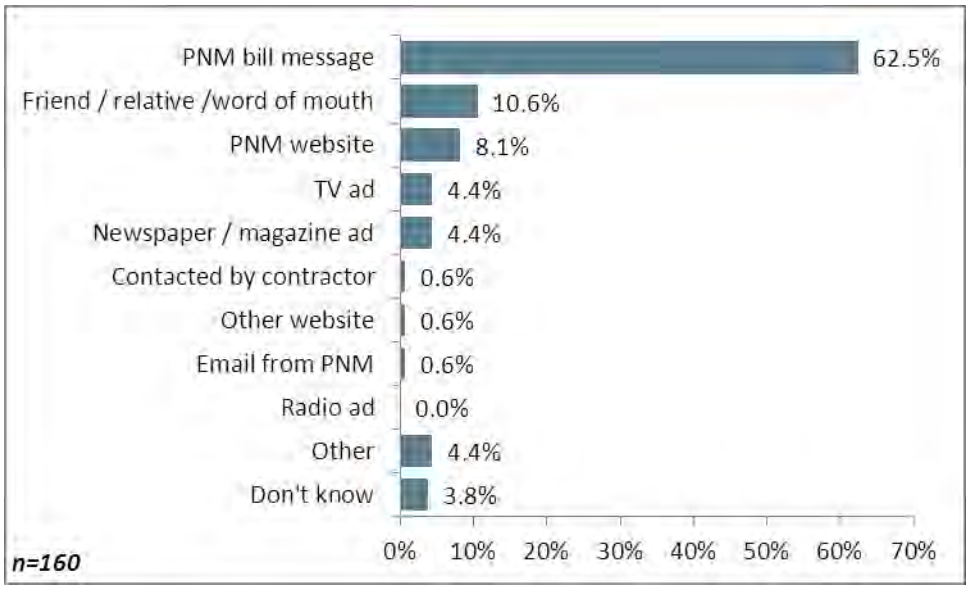


Figure 7-4 Whole House Sources of Program Awareness

Most respondents (63%) learned of the program through a PNM bill message. Other common sources included word of mouth (11%) and the PNM website (8%).

7.4.3 Application Process

Participants in the Whole House Program can sign up by telephone, through the PNM website, and by filling out and mailing a form sent along with a bill insert. Figure 7-5 summarizes how survey respondents signed up for the program.

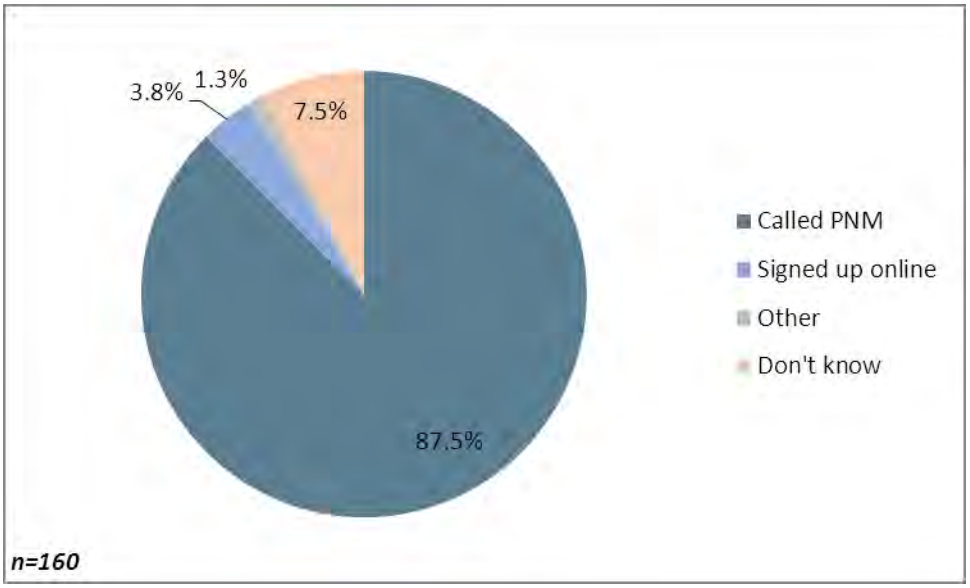


Figure 7-5 Whole House Program – Methods of Sign-up

Eighty-eight percent of survey respondents signed up by telephone, while 4% signed up online. When asked to rate their satisfaction with the application process, average respondent satisfaction was 9.02 out of 10 among those who applied over the phone and 9.50 out of 10 among those who applied online.

7.4.4 Motivations for Participation

Marketing materials for the Whole House Program use “reducing waste” as the primary message encouraging participation. Survey respondents were asked to identify the reason for their participation. The answers provided were unprompted and were coded into larger categories. Respondents’ answers are summarized in Figure 7-6.

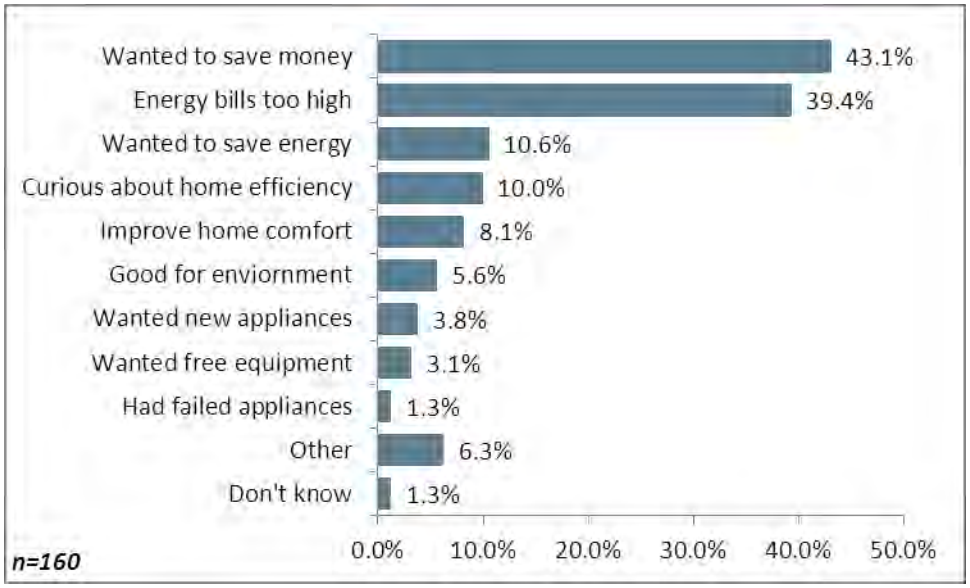


Figure 7-6 Whole House Program – Reasons for Participation

Respondents most commonly indicated financial concerns such as "energy bills were too high" (39.4%) and "wanted to save money" (43.1%) as their primary motivation for participation.

7.4.5 Interactions with Home Assessor

Home assessors from Ecova provide the direct installation of CFLs and water saving measures as well as recommendations and pre-qualification for potential rebates. Respondents were asked to identify their satisfaction with their interactions with the home assessor as well as with any written summary of recommendations provided by the assessor. Satisfaction with interactions with the assessor was rated at 8.88 out of 10 by survey respondents.

Few respondents made specific comments about their interactions with the home assessor. Those who did express concern about their interactions with the assessor commented that the home assessor did not provide either CFLs, power strips or showerheads, did not seem professional, or rushed through the assessment without providing the depth of recommendations that they had been expecting

7.4.6 Home Assessment Report

Fifty-seven percent of respondents recalled receiving recommendations for other improvements to their home after direct install was completed. Of these, 84% recalled receiving a written report summarizing the recommendations from their home assessor. These respondents were asked to identify whether this written summary was useful to them. Of those that received a written summary, 92% identified it as "useful" and 7% indicated that it was "not useful". Compared to the 2014 program year, the percent of

respondents who recalled receiving recommendations and the summary report both fell by approximately 10%. However, those who recalled receiving these reports found them more useful than respondents in the 2014 program year, only 67.4% of whom described the reports as "useful". This may reflect actions by the implementer to limit the households that receive assessment reporting to those with more useful recommendations.

All respondents were asked to explain why they found the report useful or not useful, and their responses were recorded verbatim. Sample responses from those that found it useful include:

"[It] let me know that everything I had already done over the last three years was right."

"[It] let me know what I need to change to be more efficient."

"It gave me cost and savings information and whether or not these savings were worth it to me."

Verbatim responses explaining dissatisfaction with the report included:

"Not a clear assessment as to why our bill is still so high."

"[We] had already talked about it as we walked through the house."

"[It] told us we needed [a] new cooler when we had just installed a new one four weeks before."

Responses from those indicating satisfaction were largely focused on three areas:

- The report was useful in providing reassurances to the participant regarding the efficiency of their home;
- The report helped participants identify further measures that could be taken to improve energy efficiency and helped participants decide whether or not they should adopt these measures; and
- Having a written report helps participants remember what changes were made to their home and helps them plan additional improvements in the future.
- Few participants reported dissatisfaction with the report. The most frequent reason provided for dissatisfaction indicated that some felt the information included in the report was redundant or unnecessary.

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7.4.7 Response to Assessment Recommendations

At the time of the survey, 68% of respondents had not installed any recommended measures. Of those that had installed recommended measures, installations included:

- Two clothes washers;
- Five refrigerators;
- Two dishwashers; and
- One evaporative cooler.

Sixty percent of respondents indicated having no plans to install any recommended measures. Of those that stated that they are likely to install recommended measures, the measures with highest interest were as follows:

- Refrigerator (9%);
- Evaporative cooler (4%);
- Dishwasher (3%); and
- Central AC (3%)

Compared to the 2014 program year, the reported rates of measure installation and the intent to install measures both increased by between 12% and 14%.

7.4.8 Participant Satisfaction

Respondents were asked to rate their satisfaction on a scale of 0-10, with 10 meaning "very satisfied" and 0 meaning "not at all satisfied". Their responses are summarized in Table 7-13.

Table 7-13 Whole House Participant Satisfaction

Component	*Mean Score*	*% Don't Know*
Interactions with the home assessor	8.88	0%
Program application process	9.00	13.8%
Rebate amounts	7.63	81.3%
Wait-time to receive rebates	8.77	45.6%
Range of equipment covered by the program	7.83	85.0%
The quality of the home assessment report	8.53	2.5%
Overall program experience	8.59	27.5%
n=160		

All of these satisfaction levels are fairly high and do not differ significantly from the satisfaction levels reported during the 2015 program year. High instances of "don't know" for "Rebate amounts" and "Wait-time to receive rebates" are due to the large number of survey respondents that only received direct install measures.

7.5 Conclusions & Recommendations

Based on the EM&V effort of the 2015 Whole House Program, the Evaluator's conclusions and recommendations are as follows:

7.5.1 Conclusions

- **The program has high participant satisfaction.** Program participants responded very positively when asked to rate their satisfaction with the application process, rebate amounts, and overall satisfaction.
- **Advanced power strips were often not installed.** The Evaluators found that advanced power strips had an in-service-rate of 29%, accounting for customers that did not install the unit at all and those that used the power strip to plug in items that do not have an idle mode. In particular, elderly customers demonstrated marked difficulty in using the power strip.
- **The program model is not designed to pass the UCT.** This program was designed and launched prior to New Mexico shifting cost-benefit screening from TRC to UCT. This program was too reliant upon Therms savings to boost benefit calculations, and as such it was ill-suited for the UCT framework.
- **Tracking data was significantly improved compared to 2014.** The Evaluators noted in 2014 that tracking data was often provided several months late and was spread to multiple databases. The tracking data was consolidated and further detail on room of installation for CFLs and LEDs was provided.
- **Exterior Lighting was not properly applied in tracking data.** 32.6% of line items that were marked as "Exterior Lighting" (13W Exterior CFL, 23W Exterior CFL) were installed in interior spaces.
- **Installation of LED night lights did not comply with program rules.** Fifty-three percent of respondents that received LEDs reported that they were installed in empty sockets that had no prior night light.

7.5.2 Recommendations

Based on the EM&V findings, the Evaluator recommends the following:

- **Consider tiered direct install packages based upon heating and water heating fuel type.** The Evaluators found that only 12.5% of participants that received low flow devices had electric water heating. If an arrangement cannot be reached with New Mexico Gas to cost-share, PNM should consider developing a package for customers with gas water heating that does not include the low flow devices. This could be provided for a lower co-pay.
- **Limit power strips to one per customer, and develop an educational brochure to be packaged with it.** The Evaluators noted that there were

significantly lower installation rates when participants received multiple power strips. It is recommended that these be limited to one per customer, and that an educational brochure showing (1) how to use the power strip and (2) what types of equipment will provide savings when installed with the power strip be included with the equipment.

- **Enforce installation rules for LED night lights.** The high percent of night lights installed in empty sockets is problematic in that it increases energy use for program participants.
- **Continue with this program channel as planned in 2016 as part of Residential Comprehensive, provided the needed changes can be made to ensure cost-effectiveness.** In its two years as a stand-alone program, the HEC has had low cost-effectiveness due to poor ISRs and a lack of uptake of higher-value rebate measures. The program was designed to pass TRC via the leveraging of incidental natural gas benefits, and soon after this program was approved, New Mexico changed requirements to passing UTC. Examples of the changes needed under the UTC would include only installing low flow devices in homes with electric water heating.

8. Low Income Home Efficiency

8.1 Program Description

The Low Income Home Efficiency Program (LIHEP) offers PNM income-qualified residential customers an in-home energy assessment and free, direct installation of energy efficient measures, along with incentives for other improvements.

The program is implemented by Ecova, Inc. (Ecova). Participants receive an energy assessment and for a direct installation package that includes up to 20 CFLs, low-flow showerheads, faucet aerators, programmable thermostats, and in some cases, refrigerator replacements.

In the process of implementing the home energy audits, Ecova identified income-qualified customers to participate in the Low Income Home Efficiency Program. All other customers who received a home audit were processed through the Whole House Program (see Chapter 5).

8.2 M&V Methodologies

The M&V approach for the Low Income Home Efficiency Program is aimed at measuring the following:

- Verifying the installation and retention of direct install measures;
- Verifying energy savings from rebated measures; and
- Estimating cost effectiveness.

Table 8-1 summarizes the inputs needed for gross savings calculations and the source of each input.

Table 8-1 Data Sources for Gross Impact Parameters – Low Income Home Efficiency Program

Parameter	***Source***
Number of Units Installed	Program Tracking Data
Unit Energy Consumption	ENERGY STAR®
Location of Installation	Program Tracking Data
Measure Retention	On-site verification and customer surveys
NTGR	Deemed – 100%

8.2.1 Direct Install Energy Savings

Program staff provided direct installation of CFLs, low flow showerheads, programmable thermostats and faucet aerators. These measures are included in the New Mexico TRM, and this was used as the basis for unit energy savings.

8.2.1.1 CFLs

Energy savings for CFLs were calculated in the same manner as for Whole House.

8.2.1.2 Electric Water Heater Adjustment Factor

The Evaluators determined through on site visits and the telephone survey that 28.5% of LIHEP customers had electric water heating. This adjustment factor of 28.5% was applied to NM TRM savings from low-flow showerheads and faucet aerators for the program. This is significantly higher than the rate of 7.58% observed in the Whole House Program.

8.2.1.3 In-Service Rates

Measure retention was addressed through on-site verification and telephone surveys. ADM conducted 33 on-site verification visits and 168 telephone surveys to measure retention rates, otherwise known as installation rates or in-service rates (ISR). ISRs were calculated for the measures that Ecova representatives directly installed in customers' homes. Customers were asked if they had removed any of the following equipment since installation:

- CFLs
- LEDs
- Advanced power strips
- Faucet aerators
- Low flow showerheads
- Programmable thermostats

ADM staff verified counts of measures on-site at the customers' homes during site visits according to information that was given in the tracking data. Further, those customers that were surveyed by telephone were asked, *"did you remove any of the measures, and if so, how many of them did you remove?"* These quantities were compared against quantities listed as installed in the tracking data. The ISRs used are summarized in Table 8-2.

Table 8-2 In-Service Rates for Direct Install Measures

Measure	*ISR*
CFLs	93%
Faucet Aerator	95%
Low-Flow Showerhead	94%
Programmable Thermostat	100%
Advanced Power Strip	33%

8.2.1.4 Refrigerator Savings

PNM and Ecova completed early replacement of functioning refrigerators. The Evaluators found that program staff used the results of metering completed by the New Mexico Mortgage Finance Authority as part of their activities in the Department of Energy Weatherization Assistance Program to support deemed savings of 1,011 kWh and .10 kW (the values verified in the 2013 M&V of the Low Income CFL & Refrigerator Replacement Program).

8.2.2 Gross Ex Post Savings Estimation

Data used for the gross ex post savings evaluation included:

- Program tracking data from the main tracking database;
- Program supporting documentation provided by PNM;
- ISRs developed from participant survey data collected through telephone surveying; and,
- Data from relevant secondary sources.

All equipment rebated through the program was subjected to an engineering desk review. The desk review serves a quality assurance function that attests to the dependability of program tracking data and provides assurance that the energy savings reported were supported by appropriate documentation. The desk review provided assurance that:

1. The energy savings and demand reductions are claimed in accordance with the protocols in the *New Mexico Technical Resource Manual* (if applicable)
2. The documentation, specifically rebate applications and product invoices, support the measure rebate numbers that are claimed by the program.

The Evaluators calculated ex post savings by applying the values provided in the New Mexico TRM. Measures not included in the TRM were issued ex post savings values based on planning documents provided to the Evaluators by PNM at the beginning of the 2015 evaluation cycle. The table below shows the type of equipment, the savings value applied to calculate ex post savings, the effective useful life (EUL) and the source of each of those values.

Table 8-3 Ex Post Values, EUL and Sources by Equipment Type

Equipment Type	*# Units Installed*	*Ex Post kWh/unit*	*Ex Post kW/unit*	*Source*	*EUL*	*Source*
CFLs	10,222	19.87	.000101	NM TRM, Table 43	8	NM TRM
Faucet Aerators	914	57.9	N/A	NM TRM, Table 39	10	NM TRM
Low-Flow Showerheads	540	131.5	N/A	NM TRM, Table 34	10	NM TRM
Programmable Thermostats	90	32.6	N/A	PNM Ex Ante Spreadsheets	11	2014 Pennsylvania TRM
LEDs	918	25.83	.000017	PNM Ex Ante Spreadsheets	Mixed	NM TRM
ENERGY STAR Refrigerators	891	1,011	0.10	PNM Ex Ante Spreadsheets	18	CA DEER

The values in Table 8-3 were then multiplied by the quantities for each measure that were given in the tracking data, the ISR and the electric water heater adjustment factor (where applicable) to derive program level savings.

8.2.3 Net Savings Estimation

With this program being targeted at low income customers, a NTGR of 100% was assumed and applied. As a result, net savings are equal to gross savings.

8.3 Impact Findings

8.3.1 CFLs

Through the 2015 Low Income Home Efficiency Program, 10,222 CFLs were installed. Figure 8-1 summarizes the CFLs installed through the program by wattage.

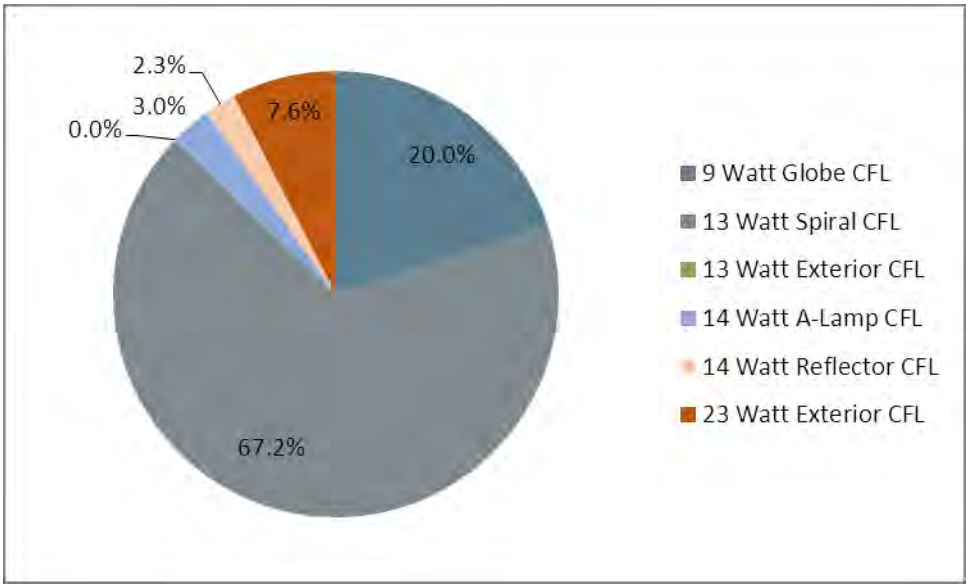

Figure 8-1 Summary of CFLs Installed by Wattage

The Evaluators verified energy savings from CFLs using the room of installation to apply the subspace hours from the New Mexico TRM. This approach was not possible in 2014 due to a lack of data available from Ecova. Program tracking was improved in 2015 and included this data.

Table 8-4 LIHEP Verified CFL Savings

Measure	# Units Installed	Ex Ante kWh	Ex Post kWh	Realization
9W Globe	2,041	32,860	21,313	64.9%
13W Spiral	6,867	165,495	128,254	77.5%
13W Exterior	3	102	95	93.1%
14W A-Lamp	303	7,060	8,556	121.2%
14W Reflector	233	5,429	7,008	130.6%
23W Exterior	775	42,935	37,787	88.0%
Total	10,222	253,880	203,093	80.0%

Gross realization for CFLs overall was moderately low (80.0%). Reasons for low realization within specific subcategories are detailed as follows:

- **9W Globe:** the ex ante calculations for this measure used TRM values of 2.24 hours per day. When examining the rooms in which 9W spiral CFLs were installed, the Evaluators found a weighted-average hours of use of 1.54 per day. Ninety-five percent of 9W globe CFLs were installed in bathroom fixtures (with this being typical of this lighting type).
- **13W Spiral:** the ex ante calculations for this measure used TRM values of 2.24 hours per day. When examining the rooms in which 13W spiral CFLs were

installed, the Evaluators found a weighted-average hours of use of 1.76 per day. Eighty-four percent of 13W spiral CFLs were installed in space types with hours of use below the 2.24 TRM average (living room, bedroom, bathroom, hall, and other).

The overall verified gross savings from CFLs are:

- 203,093 kWh;
- 25.67 kW; and
- 1,299,797 lifetime kWh.

8.3.2 LEDs

Savings for LEDs were calculated in a similar manner as detailed for CFLs. Key parameters differed as follows:

Table 8-5 Verified LED Savings

Measure	# Units Installed	Ex Ante kWh	Ex Post kWh	Realization
8W LED Globe	132	3,432	2,270	66.1%
12W LED Reflector	50	1,950	1,865	95.6%
Total	182	5,382	4,134	76.8%

Total savings from LEDs are:

- 24,853 annual kWh;
- .43 kW; and
- 247,259 lifetime kWh.

8.3.3 LED Night Lights

LED night lights have stipulated savings which differ significantly from other LEDs. LED nightlights operate 11.23 hours per day. A .3W LED nightlight has a mean baseline of 6.79W, detailed in Ecova workpaper vetted by the Evaluators.

When adding LED night lights to the program, the Evaluators stipulated with Ecova and PNM that they may be installed only when there is an existing night light to replace. Absent that, the measure adds load rather than providing energy savings. 38 of the 168 respondents surveyed received at least one night light. Of these, 52.6% stated that the nightlights were installed in empty sockets, rather than replacing existing nightlights. The ISR for these measures is 100%, but savings are reduced by 52.6% to account for the lack of baseline lighting for customers that had night lights installed in empty sockets.

Table 8-6 Verified LED Night Light Savings

Measure	# Units Installed	Ex Ante kWh	Ex Post kWh	Realization
LED Night Light	732	19,471	9,230	47.4%

Night lights have no kW savings due to operating outside of peak time (3:00 PM – 6:00 PM). Lifetime savings for LED night lights is 147,682 kWh

8.3.4 Low-Flow Showerheads and Faucet Aerators

LIHEP installed 1,242 faucet aerators and 540 low-flow showerheads in 2015. Resulting savings calculations for these two measures combined were:

- 142,984 annual kWh; and
- 1,429,438 lifetime kWh.

8.3.5 Programmable Thermostats

LIHEP installed 90 programmable thermostats in 2015. Resulting savings calculations were:

- 2,515 annual kWh; and
- 27,661 lifetime kWh.

8.3.6 Advanced Power Strips

In on-site inspections, the Evaluators found that most advanced power strips were not installed or were used in a manner which does not provide energy savings (such as using the power strip just for installation of lighting). The ISR for advanced power strips was 33%. Overall savings for this measure is:

- 17,832 kWh;
- 1.82 kW; and
- 178,333 lifetime kWh.

8.3.7 Refrigerator Replacements

LIHEP replaced 891 inefficient refrigerators with ENERGY STAR units in 2015. Resulting savings calculations were:

- 907,077 annual kWh;
- 89.10 kW; and
- 16,219,390 lifetime kWh.

8.4 Verified Savings

Table 8-7 summarizes the gross and lifetime savings estimates by measure for the 2015 Low Income Home Efficiency Program. A NTGR of one (1) was applied to the whole program, thus net savings are equal to gross savings.

Table 8-7 2015 LIHEP Verified Savings Summary

Measure	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		EUL Years	Lifetime Energy Savings (kWh)		Gross Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post		Ex Ante	Ex Post	
CFLs	24.64	25.67	253,880	203,093	6.4	1,624,834	1,299,797	80.0%
LEDs	0.68	0.43	5,382	4,134	10	53,820	41,343	76.8%
LED Night lights	0	0	19,471	9,230	16	311,539	147,682	47.4%
ENERGY STAR Refrigerators	89.1	89.1	907,077	907,077	18	16,219,290	16,219,390	100.0%
Faucet Aerators	0	0	64,621	71,913	10	646,213	719,128	111.3%
Low-flow Showerheads	0	0	66,280	71,031	10	662,796	710,310	107.2%
Programmable Thermostats	0	0	2,515	2,515	11	27,661	27,661	100.0%
Advanced Power Strips	5.50	1.82	54,037	17,832	10	540,372	178,323	33.0%
Total:	119.92	117.02	1,373,263	1,286,825	15.03	20,086,525	19,343,634	93.7%

Further, the program produced 14,626 Therms savings from low flow devices installed in homes with gas water heating.

8.5 Process Findings

The Evaluators conducted a process evaluation of LIHEP in order to address a range of issues:

- What measures are participants following the completion of the in-home assessment?
- Is the assessment useful to program participants?
- Is the program successful in identifying qualifying low income customers?
- Are participants satisfied with their experience with the program?

8.5.1 Data Collection Activities

The process evaluation of LIHEP included the following data collection activities:

- *PNM Program Staff Interviews*. The evaluators interviewed staff at PNM involved in the administration of the program. These interviews collected initial

background information on program history and implementation, as well as capturing any operational changes or new developments in the program.

- *Ecova Program Staff Interviews*. Ecova implements the program. The Evaluators collected information from this interview as to the implementation process and lessons learned in the first year of program implementation.
- *On-site Visits.* The Evaluators staff verified counts and operation of measures claimed as installed by the program.
- *Participant Surveying*. The Evaluators surveyed a sample of program participants to obtain feedback.

Table 8-8 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, timeframe of data collection.

Table 8-8 PNM LIHEP Program Data Collection Summary

Target	Component	Activity	N	Role
PNM Program Staff	Senior Program Developer	Interview	1	Overall administration of PNM DSM programs. This manager is involved in the larger strategic decisions associated with the DSM portfolio, and is involved with the overall coordination of utility resources.
Ecova Staff	Program Manager	Interview	1	Administration of program. Oversight of outreach and installation.
Program Participants	-	On-site Visit	19	Verify installation and retention of measures given in the tracking database. Survey participants on program.
Program Participants	-	Survey	160	Residential participants in the Low Income Home Efficiency Program were surveyed for impact and process data collection.

8.5.2 Market Description

This section presents key background data on the target market for the LIHEP. Data for this section are provided by the Energy Efficiency Potential Study for the State of New Mexico[15] and the American Community Survey (ACS)[16], and surveys with participating market actors.

[15] Global Energy Partners, 2011. "Energy Efficiency Potential Study for the State of New Mexico. Volume 2: Electric Energy Efficiency Analysis". Prepared for the Department of Energy under management of the State of New Mexico's Energy, Minerals, and Natural Resources Department's Energy, Conservation, and Management Division.

[16] Bureau of the Census. 2011. *American Community Survey, One-Year Data.*

8.5.2.1 Market Characteristics

To provide estimates of available market for PNM service territory, the Evaluators combined ACS results for counties within the territory (see section 5.5.2.1 for list of counties).

Data from the most recent available ACS indicates that there were a total of 537,365 residences in PNM-served counties as of 2011. Of these, 87.5% are occupied, and of that, 32.9% are low income[17]. Figure 8-2 summarizes a comparison of housing stock of program participants vs. the housing stock of PNM's service territory overall.

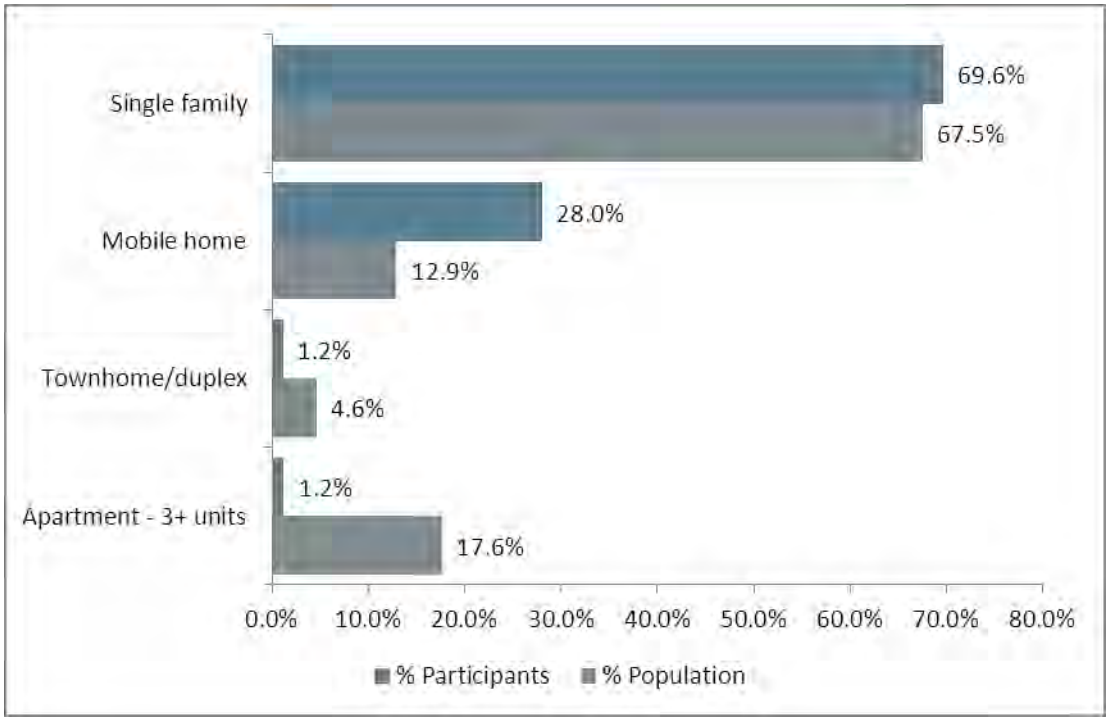

Figure 8-2 Distribution of Residential Buildings Types in PNM Service Territory

A key difference is in the percent of participants in single family homes. Seventy percent of program participants occupied single family homes, which closely reflects that single family homes constitute 67.5% of housing stock. Eighty-two percent of survey respondents indicated owning their home, compared to PNM's overall home ownership rate of 68.8%.

8.5.2.2 Market Barriers

In reviewing the program offerings and theory, the Evaluators identified the following market barriers:

- **High share of gas space heating and water heating.** Seventy percent of survey respondents indicated having natural gas space heating. Seventy-seven

[17] The evaluators set a cutoff of $35,000 when determining if a household is "low income".

percent of survey respondents indicated having natural gas space heating and 74.4% have gas water heating. In addition, PNM's service territory has a relatively mild cooling season and high use of evaporative cooling. This adds significant difficulty to programs with a whole-house approach in that there are limited opportunities to produce kWh savings in a manner that will pass the Utility Cost Test.

- **Lack of cooperation from landlords.** Landlords of properties rented by low income customers are typically not invested in energy efficiency for their tenants. As such this segment is often left out of the program. Only 18.0% of LIHEP participants reported renting their homes, which is a lower percentage than would be expected given the overall home-ownership ratio (68.8%) of PNM's service territory.

8.5.3 Program Theory & Design

The LIHEP is designed to provide a comprehensive introduction to energy efficiency to low income residents in PNM's service territory. The program provides an in-house assessment through which receive free, direct installation of CFLs, faucet aerators, programmable thermostats, low flow showerheads, and in some cases, refrigerator replacements. .

8.5.3.1 Program Administration

LIHEP is overseen by a Senior Program Developer at PNM. The manager's responsibilities are focused primarily on verifying invoices from Ecova and ensuring proper payment based on project costs. Other activities associated with program delivery (marketing, QA/QC, etc.) are handled by Ecova.

8.5.3.2 Program Implementation and Delivery

The participation process is as follows:

- *Customer Recruitment*. The outreach efforts by Ecova are targeted at residential single-family homeowners. This has included bill inserts, online advertising, and mass media advertising including television, radio, and print media advertisements. In 2015, PNM and Ecova also worked with community outreach groups to increase awareness of the program.
- *In-Home Assessments*. Ecova uses internal staff to complete in-home assessments. At this time, the Ecova staffer identifies qualifying equipment for the rebate component of the program.
- *Installation*. During the in-home assessment, the Ecova staffer identifies fixtures eligible for installation of CFLs, faucet aerators, and low flow showerheads. With the homeowner's permission, these are then installed.

- *Assessment Summary*. Once direct installation is complete, the homeowner is later provided a brief report summarizing their eligibility for rebates for HVAC and appliance replacements.
- *Application Submittal*. Participants purchase qualifying equipment at their discretion once they have been pre-qualified for a rebate. Their application and associated rebate coupon are submitted to PNM and Ecova.
- *Application Review & Payment*. Staff at Ecova reviews the application and after verifying that measures installed meet program criteria, payment is remitted to the participant. Summaries of payments are sent to PNM for their internal review on a monthly basis.

8.5.4 Program Marketing & Outreach Efforts

PNM markets LIHEP through their general mass-market channels. Activities in support of LIHEP have included:

- Bill inserts;
- Television advertisements;
- Radio advertisements; and
- Print media.

Survey respondents were asked to identify how they became aware of LIHEP. Their responses are summarized in Figure 8-3.

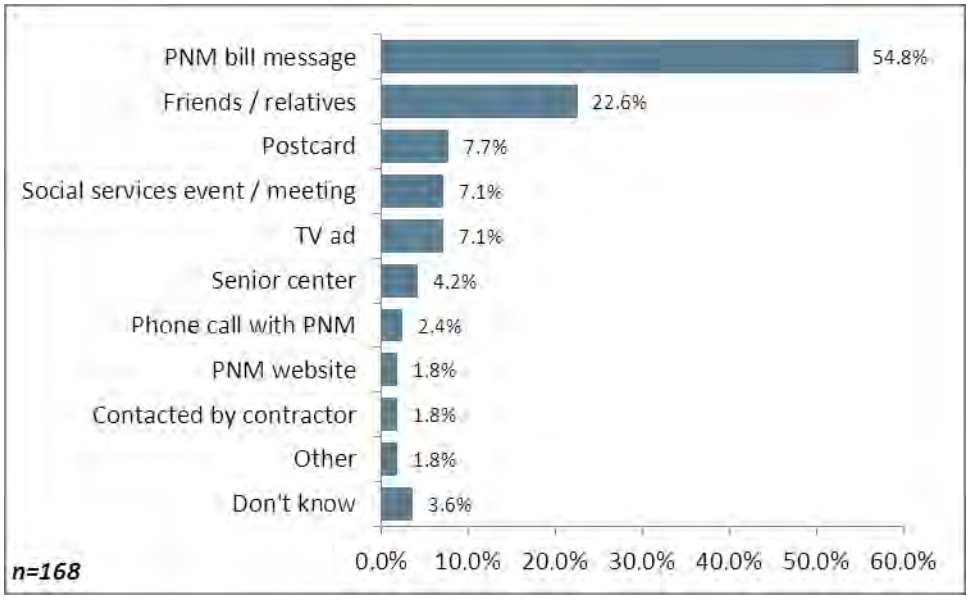

Figure 8-3 LIHEP Sources of Program Awareness

The most commonly indicated source of program awareness was a bill message from PNM (54.8%). Other commonly indicated sources were word of mouth from friends and relatives (22.6%), postcards from PNM (7.7%) and meetings for other social services such as food banks or budget classes (7.1%). Sources of awareness differed significantly compared to 2014, during which 32.5% of respondents learned of the program through referral from another low income social services program. Program marketing relied much more heavily on direct mail in 2015 and this had a demonstrable effect in being the most-commonly cited source of program awareness.

8.5.5 Application Process

Participants in LIHEP can sign up by telephone, through the PNM website, and by filling out and mailing a form sent along with a bill insert. Seventy-six percent of survey respondents signed up by telephone. Another 16% indicated they signed up for the program through some other means – often through community outreach groups. Three percent of the survey respondents indicated they had signed up for the program online.

8.5.6 Motivations for Participation

Marketing materials and presentations for LIHEP use "reducing energy bills" as the primary message encouraging participation. Survey respondents were asked to identify the reason for their participation. The answers provided were unprompted and were coded into larger categories. Respondents' answers are summarized in Figure 8-4.

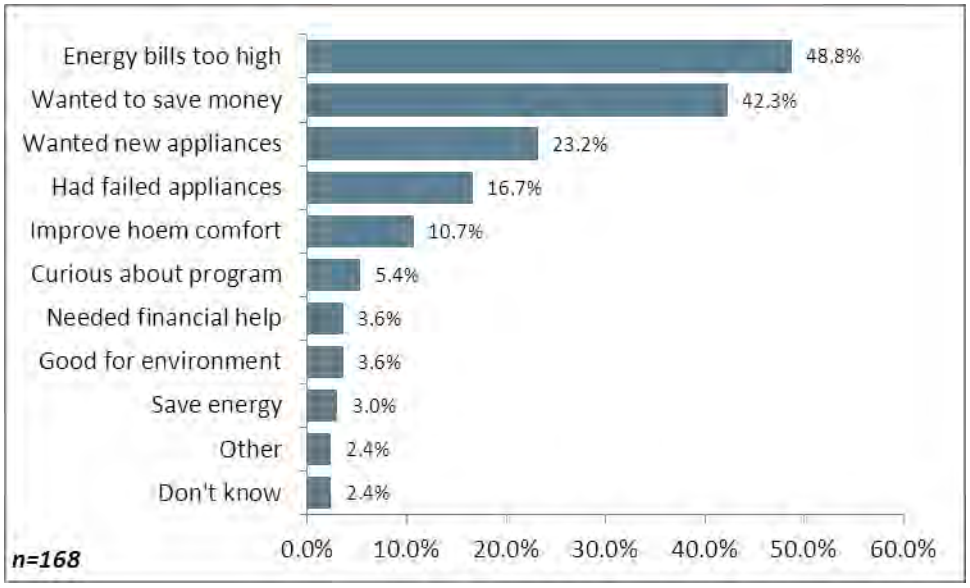

Figure 8-4 LIHEP – Reasons for Participation

Respondents most commonly indicated financial concerns such as "energy bills too high" (49%) and "wanted to save money" (42%) as their primary motivation for

participation. Appliance issues and the desire to get new appliances were also commonly indicated (16.7% and 23.2%, respectively).

8.5.7 Interactions with Home Assessor

Home assessors from Ecova provide the direct installation of CFLs, water saving measures and refrigerator replacements, as well as recommendations and pre-qualification for potential rebates. Respondents were asked to identify their satisfaction with their interactions with the home assessor. Satisfaction with the assessor was rated at 9.56 out of 10 by survey respondents.

8.5.8 Refrigerator Replacement

Seventy-eight percent of program participants received a new refrigerator, and this measure accounted for 70.4% of kWh savings. Respondents were read a series of statements, to which they were asked to rate on a scale of 1-5, with "1" meaning "strongly disagree" and "5" meaning "strongly agree".

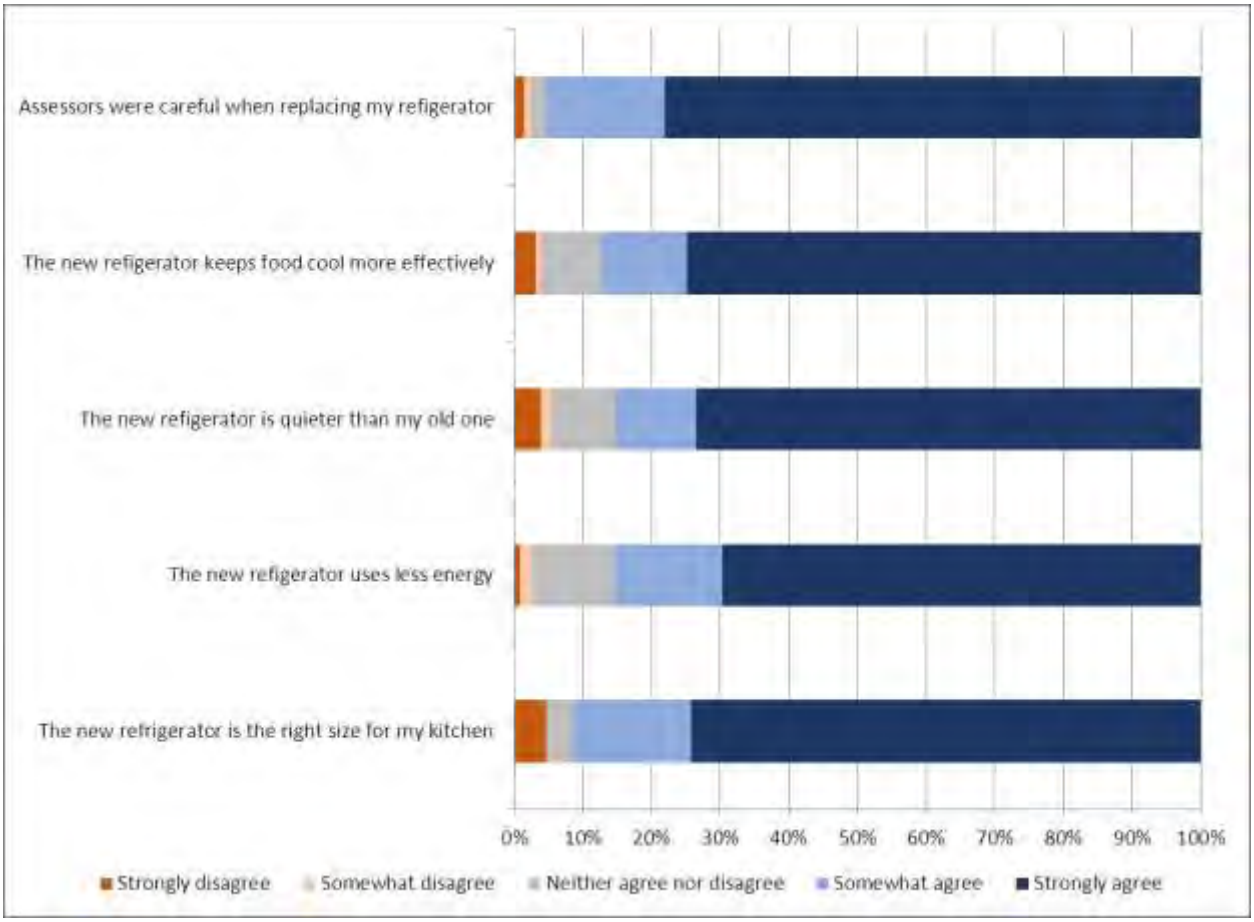

Figure 8-5 Participant Opinions of New Refrigerator

Respondents indicated high satisfaction in this battery of questions pertaining to the refrigerator. The most commonly-cited issue by respondents was that the unit was not the right size for their kitchen (4.7% "strongly disagree"). When asked to clarify, these respondents were unanimous in stating that the new unit was too small for their needs. Program staff may want to consider having a larger model available for low income households with greater occupancy.

8.5.9 Participant Satisfaction

Respondents were asked to rate their satisfaction on a scale of 0-10, with 10 meaning "very satisfied" and 0 meaning "not at all satisfied". Their responses are summarized in Table 8-9.

Table 8-9 LIHEP Participant Satisfaction

Component	*Mean Score*	*% Don't Know/Not Applicable*
Interactions with the home assessor	9.56	2%
Program application process	9.49	4%
Service provided by installing contractors	9.64	2%
Overall program experience	9.46	1%
n=168		

Overall, satisfaction levels are quite high. Respondents' rating of the overall program experience in particular has increased by almost two points compared to the previous program year. When asked to provide open-ended feedback regarding their experience in the program, respondents offered positive comments such as the ones recorded below:

"It's wonderful. I am so grateful. I never expected anyone to give me all these things."

"When I found out I would receive the refrigerator I couldn't believe it. The gentleman from PNM who helped us was so nice and patient."

"The guy was really courteous and professional. He did a great job explaining everything to me so that I could understand."

"They installed a refrigerator and the lady was very nice. I really did need a new refrigerator."

"Refrigerator works very well. My bill went down."

While participant experiences were largely positive, respondents did provide some criticisms as well. The two most commonly-reported sources of dissatisfaction were dissatisfaction with the quality or size of the refrigerator or a feeling that participants had missed out on some components of the program. A sample of the responses is recorded below:

"The refrigerator leaks water and I have to clean it up every day. It leaks about half a cup every day."

"I didn't receive anything else but the lightbulbs. I don't understand why I didn't receive anything else. He never even mentioned the other items to me."

"Refrigerator is way too small. Smaller than the one I had. For the size of my family I need a bigger one."

8.6 Conclusions & Recommendations

Based on the EM&V effort of the 2015 LIHEP, the Evaluator's conclusions and recommendations are as follows:

8.6.1 Conclusions

- **The program has very high participant satisfaction.** Program participants responded very positively when asked to rate their satisfaction with the overall process, and found that the installers were courteous and careful with their homes. Further, most respondents were very satisfied with the observed savings on their bill.
- **Savings for globe lighting are significantly lower than for other CFLs and LEDs.** This type of lighting is most-commonly installed in bathroom fixtures, and as such the TRM value of 2.24 hours per day overstates the savings from this lamp type.
- **Installation of LED night lights did not comply with program rules.** Fifty-three percent of respondents that received LEDs reported that they were installed in empty sockets that had no prior night light.
- **Power strips had ISR issues.** Advanced power strips had low in-service rates as a leave-behind measure. Many were not installed at all and others that were installed were used for equipment that does not have an idle setting (and as a result provides no savings when used in an advanced power strip).

8.6.2 Recommendations

Based on the EM&V findings, the Evaluator recommends the following:

- **Enforce installation rules for LED night lights.** The high percent of night lights installed in empty sockets is problematic in that it increases energy use for program participants.
- **Consider tiered direct install packages based upon heating and water heating fuel type.** The Evaluators found that only 12.5% of participants that received low flow devices had electric water heating. If an arrangement cannot

be reached with New Mexico Gas to cost-share, PNM should consider developing a package for customers with gas water heating that does not include the low flow devices. This could be provided for a lower co-pay.

- **Limit power strips to one per customer, and develop an educational brochure to be packaged with it.** The Evaluators noted that there were significantly lower installation rates when participants received multiple power strips. It is recommended that these be limited to one per customer, and that an educational brochure showing (1) how to use the power strip and (2) what types of equipment will provide savings when installed with the power strip be included with the equipment.
- **Consider offering a larger unit for high-occupancy households.** Five percent of survey respondents that received a refrigerator stated that it was too small for their needs. This may warrant further research but program staff should consider offering a larger model for low income households with above-average occupancy.
- **Continue with this program channel as planned in 2016 as part of Residential Comprehensive, provided the needed changes can be made to ensure cost-effectiveness.** In its two years as a stand-alone program, the HEC has had low cost-effectiveness due to poor ISRs and a lack of uptake of higher-value rebate measures. The program was designed to pass TRC via the leveraging of incidental natural gas benefits, and soon after this program was approved, New Mexico changed requirements to passing UTC. Examples of the changes needed under the UTC would include only installing low flow devices in homes with electric water heating.

9. Residential Stay Cool

9.1 Program Description

The Residential Stay Cool Program provides residential PNM customers with financial incentives for the purchase of efficient cooling equipment and pool pump equipment. Equipment rebated through the program includes:

- Advanced evaporative coolers;
- Advanced evaporative cooler window units;
- Direct-indirect evaporative cooling units;
- CEE Tier 1 air conditioning units;
- ENERGY STAR qualified window air conditioning units; and
- Variable speed drive (VSD) pool pumps.

Higher rebates are given for customers who install new advanced, whole house evaporative coolers than to those who upgrade their whole house AC system to Tier 1 AC units. The program is designed to incentivize customers to switch from refrigerated air conditioning to evaporative cooling. The rebate amounts by equipment type that were issued are summarized in Table 9-1.

Table 9-1 Residential Stay Cool Program Rebate Amounts

Equipment Type	***Rebate Amount***
Advanced Evaporative Cooler (Window Unit)	$100
Advanced Evaporative Cooler (Whole House Unit)	$300
ENERGY STAR Room AC	$25
CEE Tier 1 AC	$100
CEE Tier 2 AC	$200
CEE Tier 3 AC	$300
VSD Pool Pump	$300

9.2 M&V Methodologies

The M&V approach for the Residential Stay Cool Program is aimed at measuring the following:

- Verifying the how many customers participated in the program;
- Verifying how many measures were rebated through the program;
- Verifying energy savings from rebated measures; and

- Estimating cost effectiveness.

Table 9-2 summarizes the inputs needed for gross savings calculations and the source of each input.

Table 9-2 Data Sources for Gross Impact Parameters – Residential Stay Cool Program

Parameter	Source
Number of Units Installed	Program Tracking Data
Unit Energy Consumption	New Mexico TRM
NTGR	Participant Surveying

9.2.1 Ex Ante Review

For all measures in the Residential Stay Cool program, a review of ex ante savings was conducted to verify that the expected savings for each measure fell within an acceptable range of deemed savings given in the New Mexico TRM. However, some equipment rebated through the program was not included in the most recent version of the TRM. In those cases, the evaluators reviewed ex ante savings assumptions against existing research, work papers and other TRMs. Additionally, at the end of 2015, PNM provided to the Evaluators expected savings values for some measures not covered by the NM TRM via Excel spreadsheets. The table below shows the type of equipment, the savings value applied to calculate ex ante savings, and the source of that value.

Table 9-3 Ex Ante Values and Sources by Equipment Type

Equipment Type	kWh/unit	kW/unit
Advanced Evaporative Cooler (Window Unit)	517	0.94
Advanced Evaporative Cooler (Whole House Unit)	1,961	1.99
ENERGY STAR Room AC	80	0.14
CEE Tier 1 AC	177	.09
CEE Tier 2 AC	314	.12
CEE Tier 3 AC	719	.35
VSD Pool Pump	1,041	0.40

The tracking data did not include any rebates for direct-indirect evaporative cooling units; therefore, they were not included in ex ante calculations.

9.2.2 Tracking Data Review

The Evaluators received a tracking database from PNM that was developed by CLEAResult. The initial gathering and compiling of tracking data is crucial in facilitating a smooth evaluation effort, and as such the evaluators reviewed this tracking data in order to verify that it contained the required data to:

(1) Recreate energy savings calculations;

(2) Contact participants and trade allies; and

(3) Ensure proper rebate payment amounts;

In order to calculate gross savings, the tracking data should contain the following pieces of information:

- Measures installed;
- Quantities of measures installed;
- Customer contact information; and
- Expected savings.

Quantities of CEE Tier 1 AC rebates were missing. Quantities of Tier 1 ACs were developed by dividing the total rebate amount per customer by the standard rebate for that measure ($100).

The tracking data was also absent of ex ante savings information for all measures. Thus the Evaluators calculated ex ante savings by applying the values as appropriate from Table 9-3 and multiplying those values by quantities installed.

9.2.3 Gross Ex Post Savings Estimation

Data used for the gross ex post savings evaluation included:

- Program tracking data from the main tracking database;
- Program supporting documentation provided by PNM;
- Participant survey data collected through telephone surveying; and,
- Data from relevant secondary sources.

All equipment rebated through the program was subjected to an engineering desk review. The desk review serves a quality assurance function that attests to the dependability of program tracking data and provides assurance that the energy savings reported were supported by appropriate documentation. The desk review provided assurance that:

1. The energy savings and demand reductions are claimed in accordance with the protocols in the New Mexico Technical Reference Manual (if applicable)

2. The documentation, specifically rebate applications and product invoices, support the measure rebate numbers that are claimed by the program.

The Evaluators calculated ex post savings by applying the values provided in the New Mexico TRM. Measures not included in the TRM were issued ex post savings values

based on planning documents provided to the Evaluators by PNM in 2015. The table below shows the type of equipment, the savings value applied to calculate ex post savings, the effective useful life (EUL) and the source of each of those values.

Table 9-4 Ex Post Values, EUL and Sources by Equipment Type

Equipment Type	*Ex Post kWh/unit*	*Ex Post kW/unit*	*EUL*	*EUL Source*
Advanced Evaporative Cooler (Window Unit)	517	0.94	15	NM TRM
Advanced Evaporative Cooler (Whole House Unit)	1,961	1.99	15	NM TRM
ENERGY STAR Room AC	80	0.14	13	2013 Oklahoma Residential Deemed Savings Document
CEE Tier 1 AC	177	.09	15	DEER 2011
CEE Tier 2 AC	314	.12	15	DEER 2011
CEE Tier 3 AC	719	.35	15	DEER 2011
VSD Pool Pump	1,041	0.40	10	DEER 2011

The values in Table 9-4 were then multiplied by the quantities for each measure that were given in the tracking data to derive program level savings.

9.2.4 Net Savings Estimation

Net to gross scores were calculated separately for evaporative coolers and AC units. The Evaluators surveyed 160 program participants to assess NTGR per participant; 80 customers who had purchased high efficiency AC units and 80 who purchased new evaporative cooling units. These scores were then used to derive two program level NTGRs for evaporative and refrigerated cooling.

Based on a C.V. of .5 (as detailed in Section 2.4.1), this survey effort yielded 90% confidence and ±8.3% sample precision for each of the two program channels addressed (evaporative coolers and window units).

NTGRs were scored based on asking the customer what they had installed before the new unit, what they actually did install for cooling, and what they would have installed absent the rebate. Specifically, customers were asked:

What was the primary cooling system in your home prior to this?

If PNM's incentive for [MEASURE] were not available, would you have installed different equipment?

What type of cooling system would you have installed?

Survey responses were scored based on the answers to the questions above and the type of unit they purchased. These responses fell into one of five categories of what the customer would have installed without the availability of the rebate versus what they installed with the rebate. These categories and their corresponding NTGRs are detailed in Table 9-5.

Table 9-5 NTGR Scoring for Residential Stay Cool Program

Installed with rebate	***Installed without rebate***	***NTGR***
No change to decision	No change to decision	0
High efficiency evaporative cooler	Standard evaporative cooler	0.5
High efficiency evaporative cooler	Standard AC unit	1
High efficiency AC	Evaporative cooler	0
High efficiency AC	Standard AC unit	1

The average NTGR for the evaporative cooling units rebated through the program was 44.4%. For high efficiency AC units, the averaged NTGR was 33.8%. The NTGR for refrigerated air systems is significantly lower than observed in most programs nationally. However, the residential HVAC market in New Mexico is largely unique in having evaporative cooling as a viable alternative

Due to low participation with the VSD pool pump measure, the Evaluators issued this measure a NTGR of 100%.

9.3 Impact Findings

The majority of rebates issued through the program were for whole house advanced evaporative coolers. Therefore the majority of savings realized through the program were due to this measure. The Evaluators received two data files from PNM:

1) A summary file of rebated equipment; and
2) A detailed file with customer- and unit-specific information.

There were discrepancies between the two files, as shown in Figure 9-1. The Evaluators used totals from the detailed file when summarizing program impacts. The differences were not in a consistent direction (the detail file had more units for some measures, less for others), but overall this reduced savings due to a shortfall of 24 central evaporative coolers.

In total, 3,092 customers installed 3,197 units through the program in 2015.

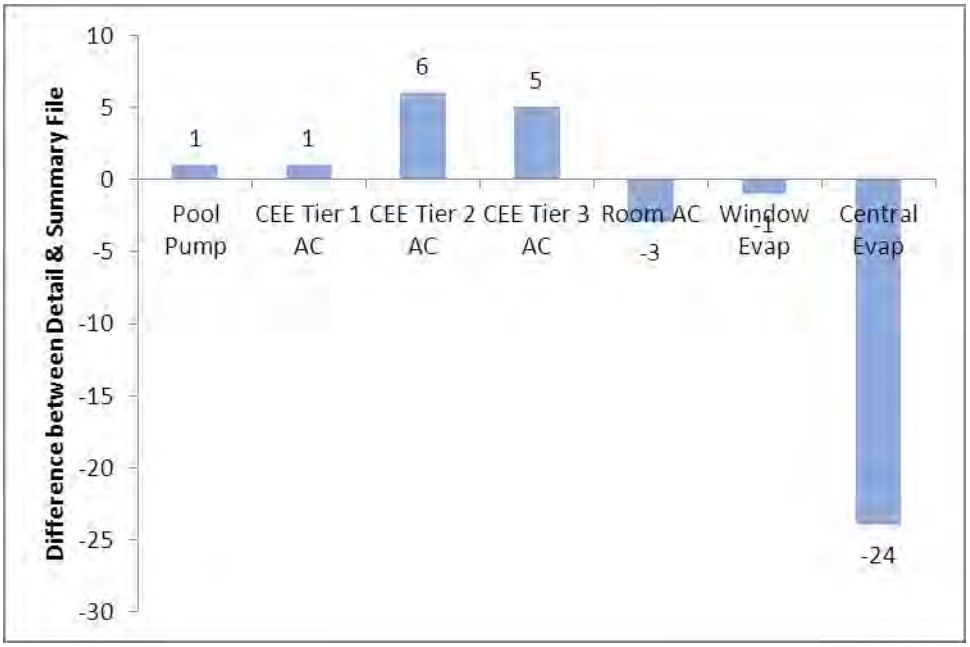

Figure 9-1 Difference in Unit Counts – Detail File vs. Summary File

9.4 Verified Savings

Table 9-6 summarizes the gross and net savings estimates by measure for the 2015 Residential Stay Cool Program.

Table 9-6 2015 Residential Stay Cool Verified Savings Summary

Measure	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		EUL Years	Lifetime Energy Savings (kWh)		Gross Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post		Ex Ante	Ex Post	
Advanced Evap	5094.40	5,046.64	5,020,160	4,973,096	15	75,251,360	74,596,440	99.1%
Window Evap	96.82	95.88	53,251	52,734	15	798,765	791,010	99.0%
Room AC	44.66	44.24	25,520	25,280	15	382,800	379,200	99.1%
CEE Tier 1 AC	5.76	5.85	11,328	11,505	15	169,920	172,575	101.6%
CEE Tier 2 AC	7.44	8.16	19,468	21,352	15	292,020	320,280	109.7%
CEE Tier 3 AC	10.85	12.60	22,289	25,884	15	334,335	388,260	116.1%
Pool Pump VSD	29.20	29.60	75,993	77,034	10	759,930	770,340	101.4%
Total:	5,289.13	5,242.97	5,228,009	5,186,885	14.96	77,989,130	77,418,105	99.2%

Net savings are presented in Table 9-7.

Table 9-7 Residential Stay Cool Program Net Savings

	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		EUL Years	Lifetime Energy Savings (kWh)		Net Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post		Ex Ante	Ex Post	
Total:	1,421.4	2,336.8	1,731,843	2,336,902	14.84	25,834,871	34,668,354	134.9%

9.5 Process Findings

The Evaluators conducted a process evaluation of Residential Stay Cool Program in order to address a range of issues:

- How well did PNM staff, implementation staff, market contractors, and participating customers work together? Are there data tracking and/or communication efficiencies that can be gained?
- How do participants hear about the program? What percentage is contacted directly by PNM or implementation staff? What percentage learns of the program through retailers and other contractors? What percentage hears about the program through another avenue and then contacts PNM?
- Were the program participants satisfied with their experience? What was the level of satisfaction with the available rebates, the application process, and other aspects of program participation? What are the perceived energy and non-energy benefits associated with the program?
- Were there any significant changes or obstacles during the program year? What are the lessons learned for the current program year, and how can they inform future program strategy?
- How effectively are participants being directed towards other PNM programs, such as the Whole House Program? To what extent are program staff and market actors engaging in cross-promotion of PNM programs?

To address these questions, the Evaluators process evaluation activities included a review of program materials, participant customer surveys, and interviews with program staff.

9.5.1 Data Collection Activities

The process evaluation of Residential Stay Cool Program included the following data collection activities:

- *CLEAResult Program Staff Interviews*. CLEAResult implements the program. The Evaluators collected information from this interview as to the implementation process and lessons learned in the first year of program implementation.

- *Participant Surveying*. The Evaluators surveyed a sample of program participants to obtain feedback.

Table 7-12 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, timeframe of data collection.

Table 9-8 Residential Stay Cool Program Data Collection Summary

Target	Component	Activity	N	Role
CLEAResult Staff	Program Manager	Interview	1	Administration of program. Oversight of outreach and installation.
Program Participants	-	Survey	160	Residential participants in the Residential Stay Cool Program were surveyed for impact and process data collection.

9.5.2 Program Theory & Design

The Residential Stay Cool Program is designed to provide residential PNM customers with financial incentives for the purchase of efficient cooling and pool pump equipment. Rebates for these measures included:

- Advanced evaporative coolers
- Advanced evaporative cooler window units
- Direct-indirect evaporative cooling units
- ENERGY STAR qualified window A/C units
- Variable speed drive (VSD) pool pumps

Higher rebates are given for customers who install new advanced, whole house evaporative coolers than to those who upgrade their whole house AC system to CEE Tier 1-3 AC units. The program is designed to incentivize customers to switch from refrigerated air conditioning to evaporative cooling.

9.5.3 Program Marketing & Outreach Efforts

PNM markets the Residential Stay Cool program through their general mass-market channels. The activities in support of the program have included:

- Bill inserts;
- Television advertisements;
- Radio advertisements; and
- Print media.

Typically though, respondents become aware of the program at the time they are seeking to replace a failed unit and have contacted an HVAC contractor or equipment dealer.

Figure 9-2 summarizes the timing of learning about the program. Evaporative cooling participants were significantly more likely to learn about the program early in their decision-making process. Refrigerated air participants were over twice as likely (25.0% compared to 11.3%) to have learned of the program after already having selected the equipment they eventually purchased and five times as likely (12.5% compared to 2.5%) to have learned of the program after their equipment was already installed.

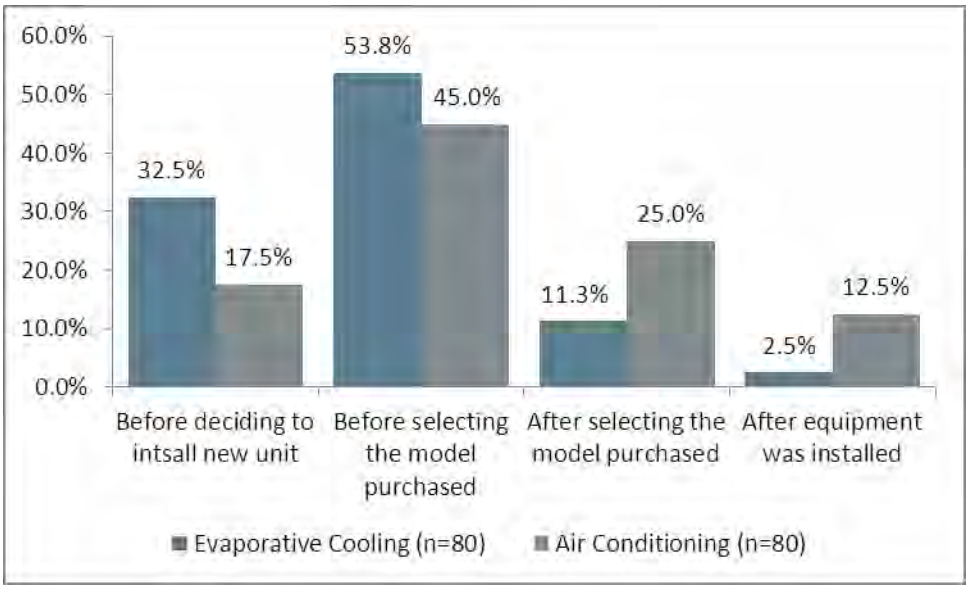

Figure 9-2 Timing of Learning about PNM Program

Survey respondents were asked to identify how they became aware of the Residential Stay Cool Program. Their responses are summarized in Figure 9-3.

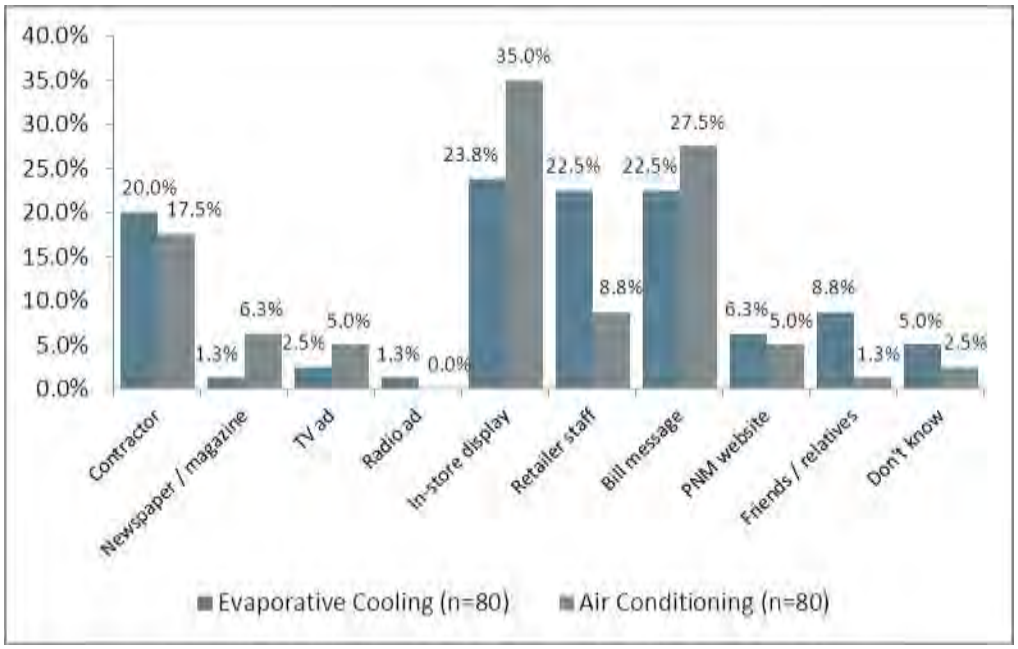

Figure 9-3 Sources of Residential Stay Cool Program Awareness

The most significant difference in the customer experience can be seen in "in-store display" and "retailer staff" responses. Evaporative cooling participants were significantly more likely to indicate having been helped by retailer staff than refrigerated air participants (22.5% compared to 8.8%), while refrigerated air participants were more likely to have learned about the program from an in-store display (35.0% to 23.8%).

Respondents were then asked what sources of information they most value when deciding on an energy efficiency project. A list of potential sources was read off, with respondents rating the sources on a scale of 1-10, with 1 meaning "Not Important at All" and 10 meaning "Very Important". Figure 9-4 summarizes the scoring of importance of various reasons by respondents.

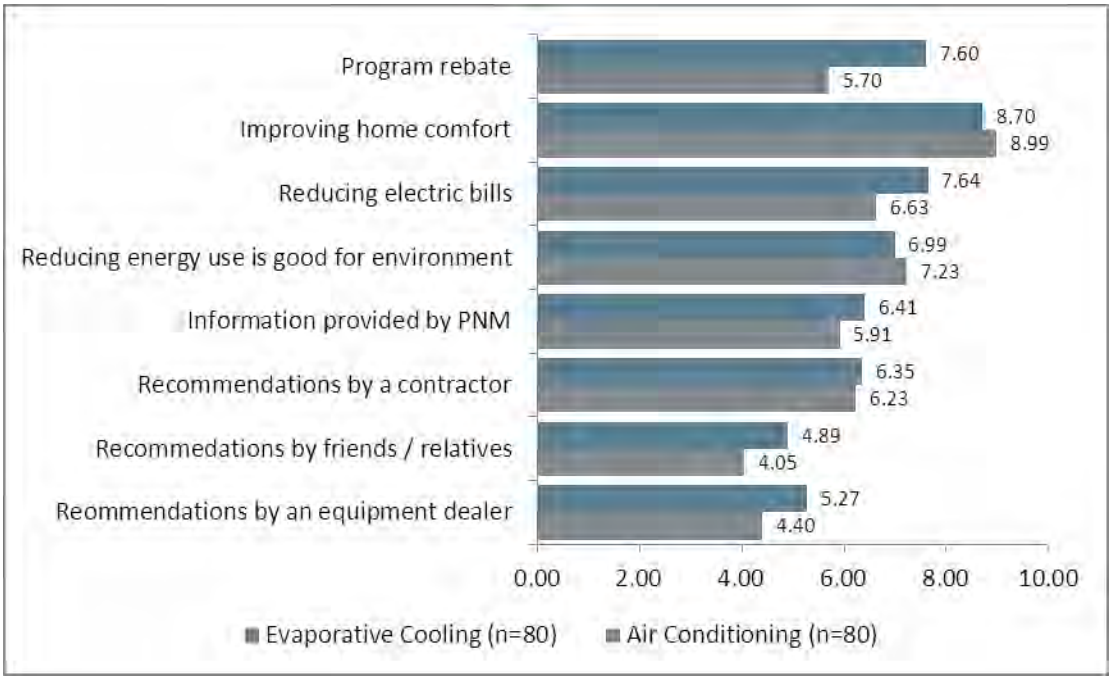

Figure 9-4 Residential Stay Cool – Motivation for Participation

9.5.4 Participant Satisfaction

Respondents were asked to rate their satisfaction on a scale of 1-10, with 10 meaning "very satisfied" and 1 meaning "not at all satisfied". Their responses are summarized in Figure 9-5.

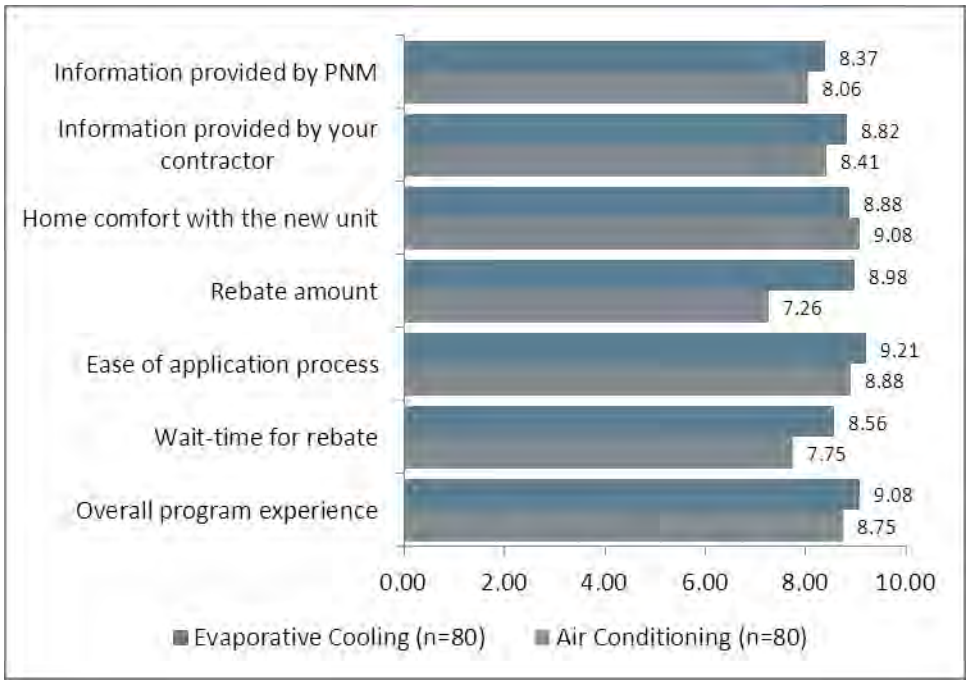

Figure 9-5 Residential Stay Cool Participant Satisfaction

9.5.5 Analysis of Demographics

The Evaluators reviewed participant demographics to attempt to discern whether there were any key drivers or predictors of customer decision-making.

9.5.5.1 Evaporative Cooling

Finding 1: Residents of older homes are more likely to report having had to change the equipment they intended to buy in order to qualify for the rebate.

There is a general trend where an individual is more likely reporting having had to change the equipment they intended to buy in order to qualify for the rebate if they live in an older home. This relationship is visualized below.

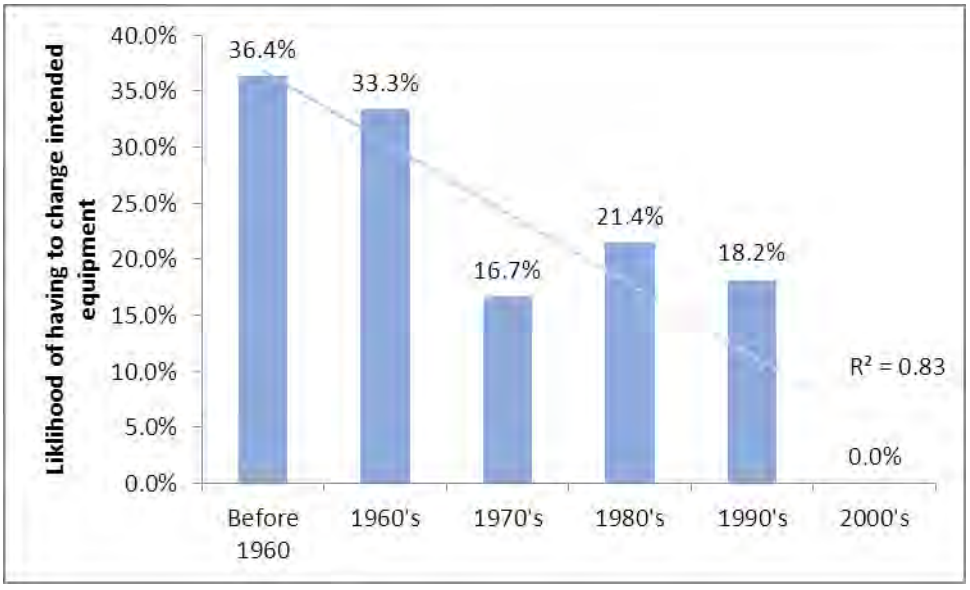

Figure 9-6 Likelihood of Having to Change Intended Equipment Based on Home Age

Examining the answers provided by participants about which type of equipment they had originally intended to buy, it appears that the most common change made was that participants purchased a larger and more advanced model than they had originally intended in order to qualify for the rebate.

Finding 2: Respondents in higher income tiers are less likely than respondents from lower income tiers to consider financial incentives

The relationship between income tier and the reported importance of financial incentives in the decision to participate is visualized below.

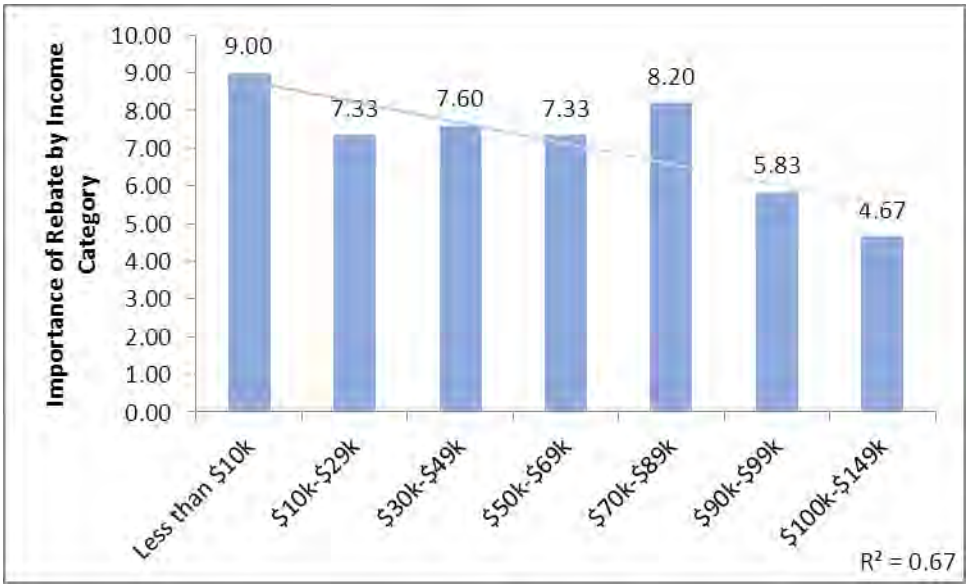

Figure 9-7 Importance of Program Rebate by Income Bracket

9.6 Conclusions & Recommendations

Based on the EM&V effort of the 2015 Residential Stay Cool Program, the Evaluator's conclusions and recommendations are as follows:

9.6.1 Conclusions

1. **The program has very high participant satisfaction.** Program participants responded very positively when asked to rate their satisfaction with the overall process, time to receive rebate check and ease of the application process. Further, most respondents were very satisfied with the performance of the new equipment.
2. **There are inconsistencies between summary and detail data.** The Evaluators found that the summary data over-stated savings by .8%.
3. **Evaporative cooling participants were more likely to have been helped by retailer staff.** The most significant difference in the customer experience can be seen in "in-store display" and "retailer staff" responses. Evaporative cooling participants were significantly more likely to indicate having been helped by retailer staff than refrigerated air participants (22.5% compared to 8.8%), while refrigerated air participants were more likely to have learned about the program from an in-store display (35.0% to 23.8%).

9.6.2 Recommendations

Based on the EM&V findings, the Evaluators recommend the following:

1. **Develop more accurate reconciliation of detailed tracking to summary tracking.**
2. **Identify marketing approaches that reach refrigerated air customers prior to their decision-making.** Refrigerated air survey respondents were significantly more likely to indicate having learned of the program after having selected their equipment or after already having completed installation.

10. Home Energy Reports

The Home Energy Reports (HER) Program is an educational program run by Opower, a third party implementer for PNM. The program provides educational materials to a sample of PNM residential customers, in which their usage is compared against similar households. The program is designed to encourage behavioral change and program participation on the part of the recipients of the Home Energy Report.

The HER Program provides feedback to residential participants that will help them change energy use habits to save energy. The program achieves this through the use of a personalized report delivered to participating households. The information included in the report shows the energy use pattern of the household compared against that of their peers and neighbors and recommends particular actions a participant can take to reduce their household's electricity usage.

The HER Program provides recipients with the following items:

- A comparison of last month's electricity costs for the recipient and for two groups of "similar homes" ("all similar homes" and "efficient similar homes")
- A graph that compares monthly electric use for each of the previous 12 months for the recipient vs. two groups of about similar homes

A list of simple actions the household could take to reduce electricity usage.

10.1 Control Group Validity Testing

Opower developed a sample for their recipient and control group to be utilized in the 2015 HER Program. The control group is intended to provide a baseline for comparison for the recipient group, allowing for quantification of net kWh and kW impacts of the program. The sample drawn by Opower when the program launched comprised of:

- 56,171 recipients; and
- 10,499 non-recipients.

As a first step in verifying energy savings from the HER Program, the Evaluators analyzed the sample design developed by Opower to ensure:

1) That the control group is representative of the recipient group in terms of billed kWh usage; and
2) That the control group is geographically representative of the recipient group.

10.1.1 Comparison of Usage

Billing data from the recipient and control groups were tested for statistically significant differences. These differences were tested for statistical significance by assessing the P score on the standard T distribution. The table below summarizes average daily consumption in each of the baseline period months. Average daily consumption (kWh/day), the standard error[18], the magnitude of difference, and the probability score associated with that difference value on the T distribution.

Table 10-1 Baseline Period Comparison of Daily kWh Usage

Observation	Recipient Group Consumption		Control Group Consumption		Difference	PR > T
	Mean	SE	Mean	SE		
December 2012	45.33	0.093	45.46	0.24	0.125	0.6215
January 2013	41.33	0.081	41.39	0.23	0.061	0.7984
February 2013	36.46	0.065	36.65	0.20	0.185	0.3746
March 2013	31.18	0.060	31.08	0.15	-0.101	0.5231
April 2013	30.90	0.083	30.83	0.14	-0.070	0.6641
May 2013	40.79	0.100	40.74	0.19	-0.051	0.8136
June 2013	49.43	0.091	49.56	0.23	0.125	0.6206
July 2013	46.89	0.083	46.94	0.21	0.042	0.8527
August 2013	44.16	0.064	44.16	0.19	0.000	0.9993
September 2013	32.72	0.061	32.90	0.19	0.182	0.3618
October 2013	32.13	0.085	32.14	0.14	0.011	0.9482
November 2013	40.60	0.092	40.60	0.20	0.002	0.9924
December 2013	43.26	0.086	43.43	0.22	0.167	0.4796

Each month is shown to have high P scores; this is interpreted as there being a low probability of the two values being statistically different. On this basis, the Evaluators concluded that the recipient and control group are matched in terms of daily usage in each of the baseline period months.

This is seen further in the figure below, which summarizes monthly use of the two groups.

[18] Defined as standard deviation divided by the square root of the observation count.

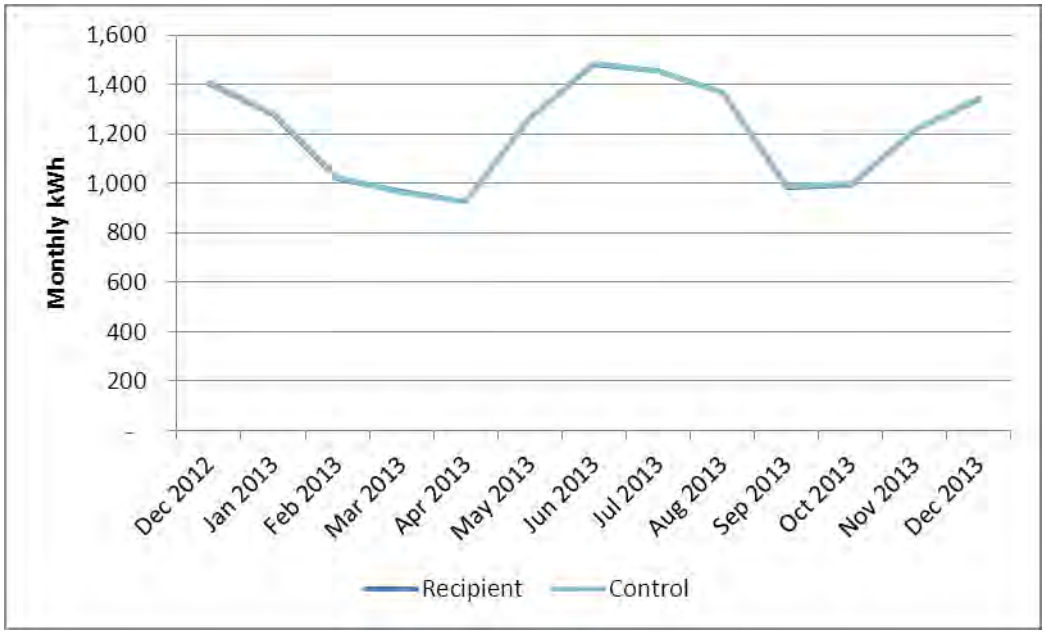

Figure 10-1 Monthly Consumption of Recipient & Control Groups

Based on the usage profile shown above, ADM concludes that this first wave of the program was targeted at homes with refrigerated air cooling and electric heating (though we cannot discern what is the mix of electric radiant versus heat pump space heating). This does not affect the validity of the comparison, however, in that the usage data reflects that the space heating equipment configuration of the two groups must be similar.

10.1.2 Comparison of Geography

The Evaluators opted to review the two populations on the basis of geography in addition to consumption. This will serve as a reasonable proxy for demographic differences which may not be captured in baseline usage, but may impact responsiveness to the Home Energy Report.

The recipient and control groups are of unequal size (with the recipient group being roughly five times the size of the control group). As such, the geographic distribution was assessed on the basis of percent of the overall population rather than absolute numbers. All Opower customer identification numbers were grouped according to the county of their address.

Table 10-2 Geographic Distribution of Recipient & Control Groups

County	Recipient Group	Control Group	Difference
Bernalillo	58.04%	58.44%	0.41%
Sandoval	14.61%	14.52%	-0.09%
Santa Fe	9.36%	9.30%	-0.06%
Valencia	7.67%	7.41%	-0.26%
Otero	4.67%	4.76%	0.09%
Grant	1.90%	1.85%	-0.05%
Lincoln	1.38%	1.22%	-0.16%
Luna	1.11%	1.25%	0.14%
San Miguel	0.85%	0.90%	0.05%
Hidalgo	0.22%	0.16%	-0.06%
Union	0.20%	0.19%	-0.01%

Two counties show differences that could be considered significant. Bernalillo and Valencia County each show differences that would test positive for statistical significance. However, the population of Valencia County is largely comprised within the Albuquerque metropolitan area. When combined, the aggregate difference between the recipient and control group for these two counties is .15% and not statistically significant.

10.2 Group Attrition

The Evaluators tracked group attrition over 2015 in order to ensure savings were tied to the correct number of active accounts in the program. In January 2015, there were 54,042 active recipient accounts. Figure 10-2 summarizes total program dropouts over 2015.

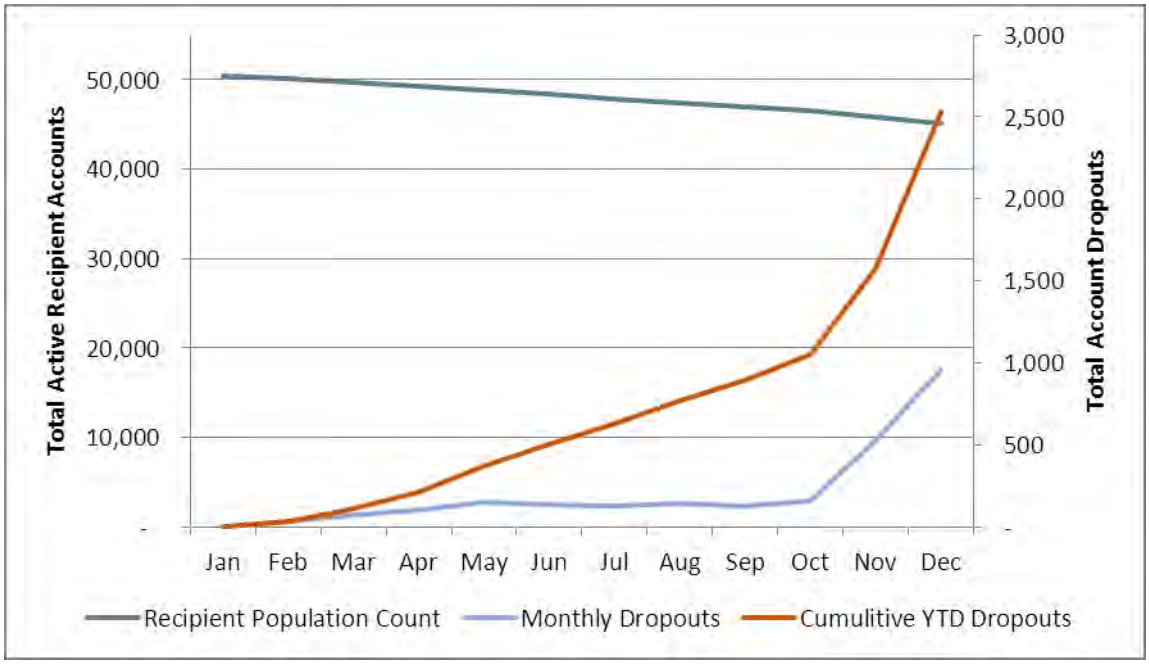

Figure 10-2 PNM Home Energy Report Dropout Summary

Program dropouts occurred at a regular pace until November. From February through October, 117 customers dropped out of the program per month. In November and December, this increased to 741 per month.

10.3 Regression Model Specification and Results

The Evaluators utilized a post-only model with pre-usage controls. Other model specifications were tested (including fixed effects), but the post-only model was found to provide the highest precision level in results. The model specification applied uses one year of pre-treatment data to construct control variables which capture the primary drivers of a household's energy use.

The model specification is as follows:

$$Usage_{it} = \alpha_0 + \beta * treatment_i$$
$$+\alpha_1 * PreUsage_i$$
$$+\alpha_2 * PreSummer_i$$
$$+\alpha_3 * PreWinter_i$$
$$+\gamma * mm_t$$
$$+\delta_1 * mm_t * PreUsage_i$$
$$+\delta_2 * mm_t * PreSummer_i$$
$$+\delta_3 * mm_t * PreWinter_i$$

$+\varepsilon_{it}$

Where

- *i* denotes the *i*th customer
- *t* denotes the first, second, third, etc. month of the post-treatment period
- $Usage_{it}$ is the average daily use for read *t* for household *i* during the post-treatment period
- $PreUsage_i$ is the average daily usage across households *i's* available pre-treatment billing reads.
- $PreWinter_i$ is the average daily usage over the months of December January, February, and March over household *i's* available pre-treatment meter reads.
- $PreSummer_i$ is the average daily usage over the months of June, July, August, and September over household *i's* available pre-treatment meter reads.
- mm_t is a vector of month-year dummies

And parameter definitions are:

- α_0 is an intercept term
- α_1, α_2 , α_3 are effects of control variables $PreUsage_i$, $PreWinter_i$, $PreSummer_i$ on $Usage_{it}$ in the reference month.
- $\delta_1, \delta_2, \delta_3$ are the effect of the control variables in each month-year (mm_t) of the post period.
- ε_{it} is an error term.

The results of the regression model are listed in Table 10-3.

Table 10-3 Regression Coefficients & Model Details

Variable Description	*Regression Coefficient*	*Standard Error*	*T-Stat*	*PR > |T|*
INTERCEPT	2.7983	0.1524	18.36	<.0001
TREATMENT	-0.51948	0.03598	-14.44	<.0001
AVG_PREUSAGE	-0.26345	0.02471	-10.66	<.0001
AVG_PREUSAGE_WINTER	0.10153	0.01107	9.17	<.0001
AVG_PREUSAGE_SUMMER	1.08967	0.01236	88.15	<.0001
FEB	-0.14494	0.21165	-0.68	0.4935
MAR	-0.377	0.21195	-1.78	0.0753
APR	-0.80658	0.21248	-3.8	0.0001

Variable Description	*Regression Coefficient*	*Standard Error*	*T-Stat*	*PR > |T|*
MAY	-0.87746	0.21295	-4.12	<.0001
JUN	-0.05461	0.21338	-0.26	0.798
JUL	1.66554	0.21399	7.78	<.0001
AUG	1.67582	0.21461	7.81	<.0001
SEP	0.75562	0.21515	3.51	0.0004
OCT	0.27772	0.21569	1.29	0.1979
NOV	0.58727	0.21675	2.71	0.0067
DEC	1.20921	0.21789	5.55	<.0001
AVG_PREUSAGE:FEB	0.51265	0.03504	14.63	<.0001
AVG_PREUSAGE:MAR	1.13895	0.03512	32.43	<.0001
AVG_PREUSAGE:APR	1.78622	0.03522	50.71	<.0001
AVG_PREUSAGE:MAY	1.62265	0.03534	45.92	<.0001
AVG_PREUSAGE:JUN	0.35691	0.03544	10.07	<.0001
AVG_PREUSAGE:JUL	-0.08474	0.03557	-2.38	0.0172
AVG_PREUSAGE:AUG	-0.08363	0.03566	-2.35	0.019
AVG_PREUSAGE:SEP	0.62038	0.03575	17.35	<.0001
AVG_PREUSAGE:OCT	1.45406	0.03585	40.55	<.0001
AVG_PREUSAGE:NOV	0.96352	0.03602	26.75	<.0001
AVG_PREUSAGE:DEC	0.24002	0.03628	6.62	<.0001
AVG_PREUSAGE_WINTER:FEB	-0.1963	0.01569	-12.51	<.0001
AVG_PREUSAGE_WINTER:MAR	-0.3774	0.01573	-23.99	<.0001
AVG_PREUSAGE_WINTER:APR	-0.52733	0.01578	-33.42	<.0001
AVG_PREUSAGE_WINTER:MAY	-0.28867	0.01583	-18.24	<.0001
AVG_PREUSAGE_WINTER:JUN	0.67664	0.01588	42.62	<.0001
AVG_PREUSAGE_WINTER:JUL	0.97705	0.01593	61.32	<.0001
AVG_PREUSAGE_WINTER:AUG	0.97194	0.01597	60.85	<.0001
AVG_PREUSAGE_WINTER:SEP	0.46131	0.01602	28.8	<.0001
AVG_PREUSAGE_WINTER:OCT	-0.24502	0.01606	-15.25	<.0001
AVG_PREUSAGE_WINTER:NOV	-0.29344	0.01614	-18.18	<.0001
AVG_PREUSAGE_WINTER:DEC	-0.07369	0.01625	-4.54	<.0001
AVG_PREUSAGE_SUMMER:FEB	-0.39871	0.01752	-22.75	<.0001
AVG_PREUSAGE_SUMMER:MAR	-0.91763	0.01756	-52.25	<.0001
AVG_PREUSAGE_SUMMER:APR	-1.46887	0.01761	-83.4	<.0001
AVG_PREUSAGE_SUMMER:MAY	-1.51385	0.01767	-85.68	<.0001
AVG_PREUSAGE_SUMMER:JUN	-1.10582	0.01772	-62.41	<.0001
AVG_PREUSAGE_SUMMER:JUL	-0.94814	0.01778	-53.33	<.0001
AVG_PREUSAGE_SUMMER:AUG	2.7983	0.1524	18.36	<.0001

Variable Description	*Regression Coefficient*	*Standard Error*	*T-Stat*	*PR > |T|*
AVG_PREUSAGE_SUMMER:SEP	-0.51948	0.03598	-14.44	<.0001
AVG_PREUSAGE_SUMMER:OCT	-0.26345	0.02471	-10.66	<.0001
AVG_PREUSAGE_SUMMER:NOV	0.10153	0.01107	9.17	<.0001
AVG_PREUSAGE_SUMMER:DEC	1.08967	0.01236	88.15	<.0001

10.4 kWh Savings Results

The regression results from Table 10-3 were converted to kWh savings on a monthly basis. The resulting monthly savings are summarized in Table 10-4.

Table 10-4 Home Energy Reports Monthly Savings

Month	*kWh Savings*
January 2015	812,441
February 2015	754,722
March 2015	801,088
April 2015	767,859
May 2015	787,158
June 2015	753,459
July 2015	769,959
August 2015	762,551
September 2015	731,812
October 2015	749,024
November 2015	714,389
December 2015	727,461
Total	9,131,923

That process was conducted for the post months (May – December) and then summed up to reach a total of 101.0 kWh savings per participant, increased from 77.26 kWh per participant in 2014. Using the number of 2015 program participants by month, the results were scaled up to equal 9,131,923 kWh. These numbers are summarized in Table 10-5.

Table 10-5 Home Energy Reports Savings Summary

2015 kWh Savings (Per Participant)	*2015 Average Monthly Participants*	*2015 Program kWh Savings*	*kW Savings*
190.1	48,037	9,131,923	1,035.4

Energy saving reported by Opower totaled 9,274,000. The Evaluators' findings are 98.5% of this amount.

10.5 Therms Savings

The Evaluators calculated estimated Therms savings for the HERP has follows:

1) In reviewing billing data for the recipient group and discussion with Opower, the Evaluators found that 34.7% of recipients had electric space heating (determined by comparing winter use to shoulder-season use).
2) In a literature review of natural gas home energy report program evaluations, it was found that the typical range of natural gas energy savings was between .8% and 1.0%. This is often lower than electric savings observed in Home Energy Reports due to their being less discretionary gas usage.

On this basis, the Evaluators determined that a conservative estimate of Therms could be applied for purposes of developing TRC estimates. The resulting Therms are:

$$Therms = 53{,}616\ households * 688\frac{Therms}{household} * 65.3\%\ gas\ heating * .8\%\ reduction$$
$$= 192{,}702\ Therms$$

11. Commercial Comprehensive

11.1 Program Description

The Commercial Comprehensive Program (CCP) is a commercial DSM program that provides rebates for a range of prescriptive and custom measures. The program has three components:

- Retrofit Rebates
- New Construction Rebates
- QuickSaver Direct-Install (run through PNM trade allies)
- Building Tune-Up
- Midstream HVAC

The program provides prescriptive and custom rebates for measure categories including:

- Lighting;
- HVAC;
- Motors;
- Refrigeration;
- Building Envelope;
- Whole-Building Efficiency

The program is run through a third-party implementer, DNV KEMA.

11.2 M&V Methodology

Evaluation of the Commercial Comprehensive Program (CCP) requires the following:

- Stratified Random Sampling, selecting large saving sites with certainty (as detailed in Section 2.4.2);
- Review of deemed savings parameters for prescriptive projects;
- On-site verification, end-use metering, and DOE-2 simulation in projects where savings are uncertain;
- Interviewing of program participants from each component as well as PNM Trade Allies.

Parameters required for evaluation of the CCP are presented in Table 11-1 below.

Table 11-1 Data Sources for Gross Impact Parameters – Commercial Comprehensive Program

Parameter	***Source***
Project Details	Program Tracking Data
Energy Efficient Equipment Specifications	Manufacturer's Literature
Lighting Hours of Operation	Comparison of deemed values with CA DEER values, on-site metering for projects with uncertainty
HVAC Interactive Factors	Simulations of archetypical buildings using Albuquerque NM TMY Weather Data
Lighting Peak Coincident Factor	Review of deemed values, assignment of new values based upon facility operating hours should deemed values not provide accurate estimates
Equivalent Full-Load Cooling Hours (EFLH)	PNM Deemed values, reviewed by the Evaluator through simulation of archetypical facilities with Albuquerque or Santa Fe NM TMY Weather Data
Facility Billing Data (For Calibration of Large Cooling Simulation Models)	PNM Profiler Tool

11.2.1 Commercial Comprehensive Program Components

The CCP is divided into four components:

- Retrofit Rebates
- New Construction
- QuickSaver™ Direct Install
- Building Tune-up

The four components have separate samples in order to account for component-specific idiosyncrasies.

11.2.2 Prescriptive vs. Custom Classification

The protocols by which individual projects within the CCP were evaluated varied dependent upon whether the project was classified as prescriptive vs. custom. For projects evaluated with prescriptive protocols, the Evaluator applied deemed values for key parameters, including annual runtime of lighting and equivalent full load hours for cooling. For projects evaluated with a custom protocol, the Evaluator conducted on-site

monitoring or simulation as appropriate in estimating savings. In the 2015 evaluation, the Evaluator applied custom protocols to the following projects:

- Those listed as "Custom" by the program implementation staff;
- Prescriptive projects within the "Certainty Stratum"[19]; and
- Projects where it was found that prescriptive protocols were either inappropriately applied or insufficiently certain.

All projects within the certainty stratum were evaluated using custom protocols due to their high contribution to variation. These sites are the higher savers, accounting for 33% of CCP program-level expected gross savings. Additionally, the results of these sites are not extrapolated to other facilities, as all sites within the certainty stratum are case studies, and representative only of themselves.

11.2.3 Commercial Comprehensive Lighting Gross Savings Estimates

The 2015 CCP provided rebates for lighting retrofits, delamping, occupancy sensors, and installation of high efficiency lighting as part of new construction projects. The subsections below present the savings calculation methodology for each of these measure types.

11.2.3.1 Gross Savings Methodology for High Efficiency Lighting Retrofits

To calculate annual savings from lighting retrofits, the Evaluator applies the following equation:

$$Annual\ kWh\ Savings = \left(kW_{base} - kW_{post}\right) * Hours * HCEF$$

Parameters for this equation are defined in Table 11-2.

Table 11-2 Parameters for kWh Savings Calculation of Lighting Retrofit Measures

Parameter	Definition
kW_{base}	Total Baseline Fixtures x $W/Fixture_{base}$ / 1000W/kW
kW_{post}	Total Installed Fixtures x $W/Fixture_{post}$ / 1000W/kW
Hours	Annual Hours of Operation
HCEF	Heating/Cooling Energy Interactive Factor

[19] "Certainty Stratum" is the stratum of sites with highest savings, for which the M&V results are not extrapolated to other (non-sampled) projects. This term is discussed in greater detail in Section 2.4.

Following this, the Evaluator calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during the hottest summer weekdays. To provide the peak savings estimate for lighting, the facility's average runtime during the period of 3:00 – 6:00 PM on all summer weekdays was applied, in order to better reflect typical operation during the occurrence of a system peak. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = (kW_{base} - kW_{post}) * HCDF * PCF$$

Parameters for this equation are defined in Table 11-3 below.

Table 11-3 Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

Parameter	Definition
kW_{base}	Total Baseline Fixtures x $W/Fixture_{base}$ / 1000W/kW
kW_{post}	Total Installed Fixtures x $W/Fixture_{post}$ / 1000W/kW
PCF	Peak Coincident Factor: % Time During Peak Period in Which Lighting is Operating
HCDF	Heating/Cooling Demand Interactive Factor

11.2.3.2 Gross Savings Methodology for High Efficiency Lighting in New Construction Applications

The 2015 CCP provided rebates to facilities that installed lighting and lighting controls as part of new construction projects. Calculations of savings for lighting in new construction applications differs from retrofits in that the baseline is denominated in W/ft^2 for the space type. This is to capture the reduction in Lighting Power Density (LPD) generated by the project. Annual savings from an LPD reduction are calculated as:

$$Annual\ kWh\ Savings = \left(\frac{kW}{ft^2}_{base} - \frac{kW}{ft^2}_{post}\right) * Hours * HCEF * ft^2$$

Parameters for this equation are defined in Table 11-4 below.

Table 11-4 Parameters for kWh Savings Calculation of Lighting New Construction Measures

Parameter	Definition
kW/ft^2_{base}	Baseline LPD as Set by Building Code or Industry Standard
kW/ft^2_{post}	Total Installed Fixtures x $W/Fixture_{post}$ / 1000W/kW / Sq. Ft.
Hours	Annual Hours of Operation
HCEF	Heating/Cooling Energy Interactive Factor
Ft^2	Square Footage of the Facility

In a manner similar to lighting retrofits, the Evaluator then calculates peak savings for the measure. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = \left(\frac{kW}{ft^2}_{base} - \frac{kW}{ft^2}_{post}\right) * PCF * HCDF * ft^2$$

The parameters for this equation are defined in Table 11-5.

Table 11-5 Parameters for Peak Demand (kW) Savings Calculation of Lighting New Construction Measures

Parameter	Definition
kW/ft^2_{base}	Baseline LPD as Set by Building Code or Industry Standard
kW/ft^2_{post}	Total Installed Fixtures x $W/Fixture_{post}$ / 1000W/kW / Sq. Ft.
PCF	Peak Coincident Factor: % Time During Peak Period in Which Lighting is Operating
HCDF	Heating/Cooling Demand Interactive Factor
Ft^2	Square Footage of the Facility

11.2.3.3 Gross Savings Methodology for Lighting Controls in Retrofit & New Construction Applications

The methodology to be detailed encompasses the Evaluator's gross savings methodology for all lighting control measures, including:

- Occupancy Sensors;
- Photocell Controls; and
- Daylighting Controls;

The methodology for this measure does not differ between retrofit and new construction applications as in a new construction application, the measure is considered as a retrofit to the installed lighting. Annual kWh savings from lighting controls are calculated as follows:

$$Annual\ kWh\ Savings = \left(Hours_{base} - Hours_{post}\right) * kW_{post} * HCEF$$

This captures savings attributable to a reduction in operating hours as a result of the lighting controls. In instances where controls are installed alongside a lighting retrofit, savings from occupancy sensors are calculated using the installed kW of the energy efficient lighting, in order to account for dissynergies (i.e., a simultaneous lighting retrofit and lighting control installation saves less than each of the two measures would have individually). The Evaluator then calculated peak savings for lighting controls as:

$$Peak\ kW\ Savings = \left(PCF_{base} - PCF_{post}\right) * kW_{post} * HCDF$$

Savings from lighting controls are attributable to a reduction in the facility's Peak Coincident Factor, that is, after installation of lighting controls, the facility lighting operates for fewer hours within the 3:00 – 6:00 PM range.

11.2.4 Commercial Comprehensive Cooling Gross Savings Estimates

Gross savings estimates for facilities participating in the 2015 CCP are evaluated by one of two methodologies:

- Calibrated DOE-2 simulation, for large retrofits; and
- Equivalent Full Load Hour calculations for smaller retrofits.

11.2.4.1 DOE-2 Simulation Modeling

In evaluating the 2015 CCP, the Evaluator performed DOE-2 simulation modeling of large cooling retrofits for a range of facility types using eQuest software. Before making the analytical runs for each sample site with HVAC measures, we prepare a Model Calibration Run. This is a base case simulation to ensure that the energy use estimates from the simulations have been reconciled against actual data on the building's energy use. This run is based on the information collected in an on-site visit pertaining to types of equipment, their efficiencies and capacities, and their operating profiles. Current operating schedules are used for this simulation, as are local weather data covering the study period. The Model Calibration Run is made using actual weather data for a time period corresponding to the available billing data for the site.

The goal of the model calibration effort is to have the results of the DOE-2 simulation come within approximately 10% of the patterns and magnitude of the energy use observed in the billing data history. In some cases, it may not be possible to achieve

this calibration goal because of idiosyncrasies of particular facilities (e.g., multiple buildings, discontinuous occupancy patterns, etc.).

Once the analysis model has been calibrated for a particular facility, there are three steps in our procedure for calculating estimates of energy savings for HVAC measures installed or to be installed at the facility.

- First, we perform an analysis of energy use at a facility under the assumption that the energy efficiency measures are not installed.
- Second, we analyze energy use at the facility with all conditions the same but with the energy efficiency measures now installed.
- Third, we compare the results of the analyses from the preceding steps to determine the energy savings attributable to the energy efficiency measure.

Following this, the Evaluator determines peak kW savings by examining the reduction observed in the summer peak provided in the Typical Meteorological Year (TMY) dataset. The time picked is set to match the conditions under which PNM observes its typical system peaks.

11.2.4.2 Equivalent Full Load Hours (EFLH) Calculations

For simpler cooling measures, including Package Terminal Heat Pumps (PTHPs) and Roof Top Units (RTUs), the Evaluator applies deemed EFLH values along with specifications of installed capacity and efficiency in evaluating savings. The general form through which kWh savings are calculated in this manner is:

$$Annual\ kWh\ Savings = \#Units \times Cap \times \left(\frac{12}{SEER_{base}} - \frac{12}{SEER_{post}}\right) \times EFLH$$

Parameters for this equation are defined in Table 11-6.

Table 11-6 Parameters for kWh Savings Calculation of HVAC Retrofits

Parameter	***Definition***
#Units	Quantity of Rebated HVAC Units
Cap	Unit Capacity (Measured in Tons)
$SEER_{base}$	Baseline SEER
$SEER_{Post}$	Installed SEER
EFLH	Equivalent Full Load Hours (Encompassing both heating and cooling hours in cases of heat pumps)

EFLH values are provided in PNM's C&I Workpapers for business cooling measures. The Evaluator tests these values via DOE-2 simulation modeling of archetypical building types using Albuquerque or Santa Fe NM TMY weather data, and revises EFLH by

facility type where appropriate. Following this, the Evaluator calculates peak kW savings by the following equation:

$$Annual\ kWh\ Savings = \#Units \times Cap \times \left(\frac{12}{EER_{base}} - \frac{12}{EER_{post}}\right) \times EFLH$$

EER is used in peak demand calculations as it reflects unit efficiency during peak weather conditions.

11.2.5 Commercial Comprehensive Refrigeration Gross Savings Estimates

As with cooling, refrigeration measures are split between prescriptive and custom applications, with the Evaluator applying engineering algorithms for prescriptive and DOE-2 for custom applications, respectively. Measures falling under the prescriptive category include:

- Anti-Sweat Heater (ASH) Controls;
- Electronically Commutated Motors (ECMs);
- Reach-in Night Covers.

11.2.5.1 Gross Savings Methodology for Anti-Sweat Heater Controls

To determine the savings from Anti-Sweat Heater (ASH) controls, the Evaluator used metered data collected from similar facilities in other territories to develop a model based upon power consumption correlated with dew point temperature. TMY weather data for the appropriate weather zone (typically Albuquerque or Santa Fe) is then input into the model and provides estimates of the reduction in usage of anti-sweat heaters when controls are applied. In this monitoring effort, ASH Controller operation was metered on both the frame heater and door heater circuits. In order to calculate interactive effects, the kW reduction from the reduced runtime for the ASH controllers is then divided by the Coefficient of Performance (COP) of the refrigeration system serving the cooler or freezer. The energy savings are then normalized to a per-door savings estimate to determine overall savings for each facility's retrofit.

11.2.5.2 Gross Savings Methodology for Electronically Commutated Motors

To calculate savings from installation of ECM and fan controls, the Evaluator applied monitoring data from evaporator fan circuits of reach/walk in refrigeration units in other territories. By extrapolating monitoring data an average daily profile of fan operation was able to be obtained. Baseline operation of the evaporator fan assumes a 24 hour continuous operation of a shaded pole motor. The Evaluator assumes that the baseline fan motors have an efficiency of 30% compared to the 70% efficiency of the ECMs. In order to calculate the interactive effects, the kW reduction for each hour was divided by the COP of the refrigeration system. The annual savings was calculated by subtracting

the as-built energy consumption form the baseline, which assumed a constant operating profile.

11.2.5.3 Gross Savings Methodology for Night-Cover Retrofits

Calculation of savings from reach-in night cover retrofits require verification of square footage, facility operating hours, and efficiency of the refrigeration system serving the units. Using this data, the Evaluator calculated savings as follows:

$$Annual\ kWh\ Savings = \ 0.2 \times \left(\Delta T \times Days \times \frac{\Delta Eff}{COP}\right)^{1.08} \times A^{20}$$

Where

ΔT = Temperature Difference between freezers/coolers and store temperature

Days = Total night cover hours converted to days

ΔEff = Efficiency rate on how well night covers prevent infiltration. 1 means perfectly sealed

COP = Coefficient of Performance of Coolers / Freezers

A = Surface Area covered by night covers

11.2.6 Commercial Comprehensive Whole-Building Gross Savings Estimates

The New Construction Rebates program component provides incentives for whole-building efficiency, taking a wide-scale approach in estimating savings for an entire facility build to exceed minimum code. Components that can contribute to a whole-building incentive may include (but are not limited to):

- Lower lighting power density;
- High efficiency HVAC systems;
- Building shell improvements (Cool-roofs, window glazing, etc.); and
- Refrigeration improvements.

To evaluate savings from whole-building projects, the Evaluator takes a similar approach as with large cooling retrofits, in calibrating and developing a DOE-2 simulation model of the facility. Where possible, the Evaluator calibrated to billing data observed after the facility's construction was complete, then extrapolated to match expected typical occupancy patterns for the facility. Using the occupancy immediately after completion of construction would provide an inaccurate (and exceedingly low)

[20] Commercial Facilities Contract Group 2006-2008 Direct Impact Evaluation, Appendix E, ADM Associates, Inc., February 18, 2010

savings estimate, as it generally takes some time for a facility to be fully commissioned and occupied. For example, if PNM provided a whole-building rebate for a new office building, the savings from the office building would be calculated at a typical occupancy rate (with some small number of offices at any given time vacant and available to lease). Immediately after construction is finished, the building would be largely unoccupied, but that is a temporary condition that would likely resolve within the first year. Given the long measure life of whole-building projects, the Evaluator extrapolates to "typical year" savings by adjusting occupancy to match normal business patterns.

11.3 Impact Findings

The PNM Commercial Comprehensive Program (CCP) contains four components:

(1) Commercial Retrofit Rebates;

(2) Commercial New Construction Rebates;

(3) QuickSaver Direct Installation; and

(4) Building Tune-Up

The main features of the approach used for the impact evaluation are as follows:

- Data for the study have been collected through review of program materials, on-site inspections, and end-use metering. Based on data provided by PNM, sample designs were developed for on-site data collection for the impact evaluation. Sample sizes were determined that provide savings estimates for the program with ±10% precision at the 90% confidence level.
- On-site visits were used to collect data for savings impacts calculations. The on-site visits were used to verify installations and to determine any changes to the operating parameters since the measures were first installed. Facility staff were interviewed to determine the operating hours of the installed system and to locate any additional benefits or shortcomings with the installed system. For some sites, monitoring of lighting or HVAC equipment was conducted to obtain more accurate information on operating characteristics.

Gross savings were estimated using proven techniques, including engineering calculations using industry standards and verification of computer simulations developed by program contractors to determine energy savings. Table 11-7 summarizes the total participation in the 2015 CCP.

Table 11-7 2015 CCP Participation Summary

Component	Sub-Component	# Applicants	# Projects	Expected kWh	Expected kW
Retrofit Rebates	*N/A*	182	269	25,857,809	3,738.51
New Construction	*N/A*	43	60	6,819,249	1,432.54
QuickSaver	*N/A*	239	322	9,723,394	1,994.72
Building Tune-Up	*Building Operator Certification*	14	24	2,043,908	0.0
Building Tune-Up	*AC Tune-Up*	15	34	345,045	0.0
Building Tune-Up	*RCs*	5	5	0	0
Midstream	*HVAC*	2	9	130,781	1.0
Midstream	*Vending Controls*	35	59	401,388	0.0
Total	*Total*	535	782	45,321,574	7,166.77

Data provided by PNM showed that during 2015, there were 782 projects by 535 applicants for all program components, which were initially expected to provide gross savings of 45,321,574. The resulting overall sample is presented in Table 11-8.

Table 11-8 CCP Sample Summary

Component	# Sites in Population	Site Visit Sample Size	# Interviews	# Sites Represented in Interviews
Retrofit Rebates	269	23	25	40
New Construction	60	10	0	0
QuickSaver	322	22	47	47
Total	810	54	72	123

In 2015, the CCP's Retrofit Rebates component covered a wide range of measure categories, paying rebates for:

- Lighting;
- HVAC (replacement and tune-up);
- Motors;
- Food Service;
- Refrigeration;
- Plug Loads;
- Building Envelope improvements;
- Advanced AC Tune-up
- Building Operator Certification; and
- Retro-commissioning

11.3.1 CCP Gross Savings Estimates

Sampling for evaluation of PNM's CCP was developed using the Stratified Random Sampling procedure detailed in Section 2.4.2. This procedure provides 90% confidence and +/- 10% precision with a significantly reduced sample than random sampling would require, by selecting the highest saving facilities with certainty, thereby minimizing the variance that non-sampled sites can contribute to the overall results.

11.3.1.1 Retrofit Rebates Sample Design

The participant population for Retrofit Rebates was divided into five strata. Table 11-9 summarizes the strata boundaries and sample frames for the Retrofit Rebates component.

Table 11-9 Retrofit Rebates Sample Design

	Stratum 1	***Stratum 2***	***Stratum3***	***Stratum 4***	***Stratum 5***	***Totals***
Strata boundaries (kWh)	<30,000	30,000 – 150,000	150,000 – 375,000	375,000 – 1,000,000	> 1,000,000	
Number of sites	157	78	21	10	3	269
Total kWh savings	1,657,867	5,379,028	4,943,488	6,381,369	7,496,056	25,857,809
Average kWh	10,560	68,962	235,404	638,137	2,498,685	96,126
Standard deviation of kWh savings	7,749	30,761	69,744	185,546	1,531,522	317,714
Coefficient of variation	.73	.44	.30	.29	.61	3.31
Final sample	6	5	3	4	3	22

11.3.1.2 Retrofit Rebates Site-Level Realization

Sites chosen within each stratum are visited in order to verify installation of rebated measures and to collect data needed for calculation of ex post verified savings. The realization rates for sites within each stratum are then applied to the non-sampled sites within their respective stratum. Table 11-10 presents realization at the stratum level, with Table 11-11 presenting results at the site level.

Table 11-10 Summary of kWh Savings for Retrofit Rebates by Sample Stratum

Stratum	***Expected kWh Savings***	***Realized kWh Savings***	***Realization Rate***
5	7,496,056	7,401,842	98.7%
4	2,694,314	2,672,820	99.2%
3	814,951	960,174	117.8%
2	296,002	227,870	77.0%
1	100,554	79,076	78.6%

Table 11-11 shows the expected and realized energy savings for the program by project.

Table 11-11 Expected and Realized Savings by Project

Project ID(s)	City	Facility Type	Measure Category	Expected kWh Savings	Realized kWh Savings
PNM-14-01426	Rio Rancho	Industrial	HVAC	4,137,620	4,401,694
PNM-14-01774	Rio Rancho	Industrial	HVAC	2,254,525	2,087,469
PNM-14-01732	Santa Fe	Government	Lighting	1,103,911	912,679
PNM-15-02149	Albuquerque	Industrial	Motors	830,694	999,278
PNM-14-01657	Multiple	Grocery	Lighting	704,379	708,826
PNM-14-01702	Rio Rancho	Retail/Service	Lighting	600,620	570,204
PNM-15-01896	Albuquerque	Industrial	HVAC	558,622	394,512
PNM-15-01872	Multiple	Restaurant	Lighting	357,796	388,850
PNM-14-01778	Albuquerque	Office	Lighting	298,762	395,829
PNM-15-02004	Multiple	Government	Lighting	158,393	175,495
PNM-14-01781	Albuquerque	Retail/Service	Lighting	92,027	59,274
PNM-15-01841	Albuquerque	Retail/Service	Lighting	68,635	92,789
PNM-15-07597	Albuquerque	Industrial	HVAC	64,244	4,916
PNM-14-01756	Rio Rancho	Retail/Service	Lighting	37,836	36,035
PNM-15-01849	Santa Fe	Office	Lighting	33,260	34,856
PNM-15-01906	Albuquerque	Hotel/Motel	Lighting	25,942	13,805
PNM-15-01881	Albuquerque	Miscellaneous	Lighting	20,779	19,572
PNM-15-01886	Deming	Retail/Service	Lighting	15,872	18,958
PNM-15-01832	Albuquerque	Restaurant	Lighting	14,326	6,164
PNM-15-01866	Albuquerque	School/K-12	Lighting	14,063	11,037
PNM-14-01806	Albuquerque	Office	Lighting	9,572	9,540

11.3.1.3 Retrofit Rebates Program-Level Gross Realization

Using the realization rates presented in Table 11-10, the Evaluators extrapolated results from sampled sites to non-sampled sites in developing program-level gross savings estimates. Table 11-12 presents results by stratum for the Retrofit Rebates component.

Table 11-12 Retrofit Rebates Program-Level Gross Realization by Stratum

Stratum	# Sites	Expected kWh Savings	Realized kWh Savings	kWh Gross Realization Rate	Expected kW Savings	Realized kW Savings	kW Gross Realization Rate
5	4	7,496,056	7,401,842	98.7%	815.54	1,047.59	145.4%
4	9	6,381,369	6,330,460	99.2%	496.44	506.32	85.6%
3	21	4,943,489	5,824,407	117.8%	837.32	831.21	99.3%
2	78	5,379,028	4,140,922	77.0%	1,136.56	810.99	71.4%
1	157	1,657,867	1,303,753	78.6%	452.65	97.86	21.6%
Total	269	25,857,809	25,001,384	96.7%	3,738.51	3,293.97	88.1%

11.3.1.4 Retrofit Rebates – Causes of Low Realization

Table 11-13 summarizes the causes of savings shortfalls for Retrofit Rebates projects with low realization.

Table 11-13 Retrofit Rebates – Causes of Low Realization

Project ID(s)	Expected kWh Savings	Realized kWh Savings	Realization Rate	Causes of Low Realization
PNM-14-01732	1,103,911	912,679	82.7%	The project is a lighting retrofit at multiple government facilities. Evaluators used lighting loggers to record operation in the major buildings included as part of this project, resulting in a revision away from deemed values.
PNM-15-01896	558,622	394,512	71.0%	The project entailed central plant optimization at an industrial facility. The evaluator used the similar methodology used to calculate ex ante, however, the Evaluators used additional independent trend data and assumptions to estimate the baseline chiller plant operation, such as the cooling demand setpoint for the secondary chiller to operate and the chiller efficiency was averaged over three chillers as any combination can be used to balance the annual operating hours. Both evaluator and implementer had to introduce those assumptions because the true baseline trend data was not available and significantly more data was available after phase I of the project completed.
PNM-14-01781	92,027	59,274	64.4%	The project is a lighting retrofit at a retail facility. The baseline calculation used T12's and 100W metal halides. The Evaluators verified through a review of on-site spare lighting from the prior configuration that the baseline equipment was 32W T8s and 60W metal halides.
PNM-15-01597	64,244	4,916	8.0%	This project entailed compressor system upgrades at an industrial facility. The low realization rate is due to unanticipated reduction of consumption during the post-retrofit period. This is a silicon wafer manufacturing facility, and they go through cycles of research and development (when compressor use is low) and manufacturing (when compressor use is high), and the ex-ante calculations did not take this product development

				cycle into account.
PNM-15-01906	25,942	13,805	53.2%	The project is a lighting retrofit at a hotel. The ex ante calculations used 6,874 hours annually, which is the value for a hotel lobby. The Evaluators found that the retrofit was completed in a mix of common area and guest room spaces, and reduced hours of use accordingly.
PNM-15-01832	14,326	6,164	43.0%	The project is a lighting retrofit at a restaurant. The baseline calculation used 60W halogen lamps. The Evaluators verified through a review of on-site spare lighting from the prior configuration that the baseline equipment was 30W halogen lamps.
PNM-15-01866	14,063	11,037	78.5%	The project is alighting retrofit at a K-12 school. The Evaluators found that the facility had a preexisting occupancy sensor for this space and hours of use were reduced in accordance with TRM protocols.

11.3.1.5 New Construction Rebates Sample Design

The New Construction Rebates sample was developed in the same manner as the Retrofit Rebates Sample. Stratification differed only due to the limited population size (29 facilities); the population was divided into four strata instead of five. Table 11-14 below presents the stratification procedure for New Construction Rebates.

Table 11-14 New Construction Rebates Sample Design

	Stratum 1	***Stratum 2***	***Stratum 3***	***Stratum 4***	***Totals***
Strata boundaries (kWh)	<50,000	50,000 – 150,000	150,000 – 400,000	>400,000	
Number of sites	25	22	10	3	60
Total kWh savings	576,742	1,968,245	2,739,830	1,534,432	6,819,249
Average kWh Savings	23,070	89,466	273,983	511,477	113,654
Standard deviation of kWh savings	14,159	30,543	73,369	75,710	132,394
Coefficient of variation	.61	.34	.27	.15	1.16
Final design sample	2	3	4	1	10

11.3.1.6 New Construction Rebates Site-Level Realization

Sites chosen within each stratum are visited in order to verify installation of rebated measures and to collect data needed for calculation of ex post verified savings. The realization rates for sites within each stratum are then applied to the non-sampled sites within their respective stratum. Table 11-15 presents realization at the stratum level, with Table 11-16 presenting results at the site level.

Table 11-15 Summary of kWh Savings for New Construction Rebates by Sample Stratum

Stratum	***Expected kWh Savings***	***Realized kWh Savings***	***kWh Realization Rate***	***Expected kW Savings***	***Realized kW Savings***	***kW Realization Rate***

4	530,259	410,696	77.45%	121.90	71.10	58.33%
3	1,044,162	792,894	75.94%	236.19	60.04	24.42%
2	245,912	229,582	93.96%	41.13	58.51	143.00%
1	44,627	68,395	153.26%	8.69	25.70	295.74%

Table 11-16 New Construction Rebates Site-Level Realization

Project ID(s)	City	Facility Type	Measure Category	Expected kWh Savings	Realized kWh Savings
PNM-15-02077	Los Lunas	School/K-12	Lighting, HVAC	530,259	410,696
PNM-15-01853	Santa Fe	School/K-12	Lighting, HVAC	390,303	369,914
PNM-15-02172	Albuquerque	Multifamily	Lighting, HVAC	260,332	213,643
PNM-14-01740	Tularosa	Miscellaneous	Lighting	207,007	60,535
PNM-15-01852	Santa Fe	School/K-12	Lighting, HVAC	186,520	148,802
PNM-14-01815	Santa Fe	Miscellaneous	Lighting, HVAC, Motors	107,227	74,081
PNM-15-01913	Albuquerque	Retail/Service	Lighting, HVAC	86,671	112,186
PNM-14-01769	Albuquerque	School/K-12	Whole-facility	52,014	43,315
PNM-14-01587	Albuquerque	Restaurant	Lighting, HVAC	29,407	47,694
PNM-15-01924	Los Lunas	Retail/Service	Lighting	15,220	20,701

11.3.1.7 New Construction Rebates Program-Level Realization

Using the realization rates presented in Table 11-15, the Evaluator extrapolated results from sampled sites to non-sampled sites in developing program-level gross savings estimates. The results of this are presented in Table 11-17.

Table 11-17 New Construction Rebates Program-Level Gross Realization by Stratum

Stratum	# Sites	Expected kWh Savings	Realized kWh Savings	kWh Gross Realization Rate	Expected kW Savings	Realized kW Savings	kW Gross Realization Rate
4	3	1,534,432	1,188,417	77.5%	260.25	151.80	58.3%
3	10	279,830	2,080,627	75.9%	571.48	139.56	24.4%
2	22	1,968,245	1,849,363	94.0%	457.67	654.46	143.0%
1	25	576,742	883,915	153.3%	143.14	423.32	295.7%
Total	60	6,819,249	6,002,322	88.0%	1,432.54	1,369.14	95.6%

11.3.1.8 New Construction Rebates – Causes of Low Realization

Table 11-18 summarizes the causes of savings shortfalls for New Construction projects with low realization.

Table 11-18 New Construction Rebates – Causes of Low Realization

Project ID(s)	Expected kWh Savings	Realized kWh Savings	Realization Rate	Causes of Low Realization
PNM-15-02077	530,259	410,696	77.5%	The project is a K-12 school that installed above-

				code lighting and HVAC. Lighting savings calculations for this project used 4,000 annual operating hours. The TRM uses annual hours of 2,399 for this facility type (Secondary School).
PNM-15-02172	260,332	213,643	82.07%	The project is a multifamily housing facility that installed above-code lighting and HVAC. Project used stipulated hours. Evaluators found multiple space types for which it was concluded that deemed savings were not adequate. End-use metering resulted in a reduction in hours of operation. This was mitigated in-part by increased heating savings; HVAC savings were calculated assuming gas space heating when the efficient systems were heat pumps.
PNM-14-01740	207,007	60,535	29.24%	The project is a horse breeding facility that installed above-code lighting. The facility was labeled "Miscellaneous". End-use metering for a period of 6 months resulted in annual hours of use of 1,131.
PNM-15-01852	186,520	148,802	79.78%	The project is a K-12 school that installed above-code lighting and HVAC. Lighting savings calculations for this project used 4,000 annual operating hours. The TRM uses annual hours of 2,399 for this facility type (Secondary School).
PNM-14-01815	107,227	74,081	69.09%	The facility is an entertainment venue that installed above-code lighting and HVAC systems. HVAC system savings were overstated due to long periods of low occupancy (particularly during daytime). Further, lighting retrofits were calculated using 4,000 hours per year, which is significantly higher than could be supported based on operation schedules of the facility.
PNM-14-01769	52,014	43,315	83.28%	The project was a whole-building rebate for an Industrial Arts facility in a public school. This facility has no summertime operation as the educational program it supports is only offered during the regular school year.

11.3.1.9 QuickSaver Sample Design

The QuickSaver program component provides direct installation of simple lighting and refrigeration measures to small businesses, with PNM Trade Allies receiving a rebate after discounting the installation cost of preapproved energy efficient equipment. The stratification procedure for the QuickSaver component is summarized in

Table 11-19 below.

Table 11-19 QuickSaver Rebates Sample Design

	Stratum 1	***Stratum 2***	***Stratum3***	***Stratum 4***	***Stratum 5***	***Totals***
Strata boundaries (kWh)	<20,000	20,000 – 40,000	40,000 – 80,000	80,000 – 200,000	> 200,000	
Number of sites	184	74	39	20	5	322
Total kWh savings	1,673,568	2,124,943	2,076,310	2,405,062	1,443,509	9,723,394
Average kWh Savings	9,095	28,715	53,239	120,253	288,702	30,197
Standard deviation of kWh savings	5,226	6,069	9,308	35,051	97,501	45,736
Coefficient of variation	.57	.21	.17	.29	.34	1.51
Final design sample	9	4	3	4	2	22

11.3.1.10 QuickSaver Site-Level Realization

Sites chosen within each stratum are visited in order to verify installation of measures and to collect data needed for calculation of ex post verified savings. realization rates for sites within each stratum are then applied to the non- within their respective stratum. Table 11-20 presents realization at the stratum level, with

Table 11-21 presenting results at the site level.

Table 11-20 Summary of kWh Savings for QuickSaver Rebates by Sample Stratum

Stratum	Expected kWh Savings	Realized kWh Savings	kWh Realization Rate	Expected kW Savings	Realized kW Savings	kW Realization Rate
5	512,467	500,682	97.69%	92.85	23.46	25.27%
4	512,024	504,974	98.62%	83.85	26.00	31.01%
3	152,525	153,034	100.33%	39.46	14.63	37.08%
2	116,376	107,600	92.46%	28.06	8.30	29.58%
1	84,758	76,777	90.58%	21.92	13.64	62.23%

Table 11-21 QuickSaver Expected and Realized Savings by Project

Project ID	City	Facility Type	Measure Category	Expected kWh Savings	Realized kWh Savings
7239	Alamogordo	Retail/Service	Lighting	295,976	295,364
7881	Albuquerque	Warehouse	Lighting	216,521	205,318
7744	Albuquerque	Parking lot	Lighting	195,887	192177
7219	Albuquerque	Other	Lighting	108,969	102,808
7238	Alamogordo	Retail/Service	Lighting	104,386	91,362
7209	Albuquerque		Lighting	102,782	118,627
7300	Albuquerque	Retail/Service	Lighting	57,230	55,750
4260	Albuquerque	Retail/Service	Lighting	48,026	50,176
7189	Santa Fe	Grocery	Lighting	47,269	47,108
7385	Albuquerque	Retail/Service	Lighting	32,961	32,069
7361	Albuquerque	Retail/Service	Lighting	30,091	29,624
7139	Albuquerque	Office	Lighting	29,251	20,080
6202	Albuquerque	Hotel/Motel	Lighting	24,073	25,827
7137	Albuquerque	Restaurant	Lighting	15,547	15,077
7313	Los Lunas	Retail/Service	Lighting	15,288	14,974
7236	Ruidoso	Office	Lighting	14,833	10,704
6753	Albuquerque	Retail/Service	Lighting	11,427	11,110

7134	Albuquerque	Office	Lighting	9,614	4,246
7234	Ruidoso	Retail/Service	Lighting	8,385	8,359
6438	Albuquerque	Retail/Service	Lighting	6,684	9,103
7353	Albuquerque	Restaurant	Lighting	2,090	1,954
7018	Albuquerque	Restaurant	Lighting	890	1,250
			Total:	823,916	784,326

11.3.1.11 QuickSaver Program-Level Gross Realization

Using the realization rates presented in Table 11-20, the Evaluator extrapolated results from sampled sites to non-sampled sites in developing program-level gross savings estimates. Table 11-22 presents results by stratum for the QuickSaver component of the CCP.

Table 11-22 QuickSaver Program-Level Gross Realization by Stratum

Stratum	# Sites	Expected kWh Savings	Realized kWh Savings	kWh Gross Realization Rate	Expected kW Savings	Realized kW Savings	kW Gross Realization Rate
5	5	1,443,509	1,410,164	97.69%	255.55	64.58	25.27%
4	20	2,405,062	2,371,873	98.62%	429.00	133.03	31.01%
3	39	2,076,310	2,083,162	100.33%	464.37	172.19	37.08%
2	74	2,124,943	1,964,723	92.46%	471.23	139.39	29.58%
1	184	1,673,568	1,515,918	90.58%	374.58	233.10	62.23%
Total	322	9,723,394	9,345,840	96.12%	1,994.73	742.29	37.2%

Though realization for kWh was high (96.12%) the Evaluators found significant issue with peak kW savings (37.2%). Nine of the 22 sites sampled were exterior lighting, and all but one of them reported expected kW savings[21]. These eight sites had 0% kW realization, and this had significant impact when extrapolated to the program population.

11.3.1.12 Building Tune-Up

The Building Tune-Up (BTU) program channel provides incentives for:

- AC Tune-up;
- Retrocommissioning; and
- Building Operator Certification (BOC).

The Building Tune-Up channel reporting kWh savings for the following categories:

- AC Tune-Up:345,046
- Retrocommissioning: 0

[21] For further detail, see the following site reports in Appendix A: QS-6753, QS-7189, QS-7238, QS-7239, QS-7300, QS-7313, QS-7353, QS-7361, QS-7385, QS-7744

- Building Operator Certification: 2,043,908

BOC was completed throughout 2015, with savings estimates based on weather-normalized per-square foot savings from other studies. The Evaluators concluded that the savings from BOC were not yet evaluable, as there was not sufficient time elapsed for the program training to be applied.

11.3.1.13 Midstream Rebates

In 2015, PNM added Midstream Rebates to Commercial Comprehensive. This program channel provides point-of-sale (POS) rebates to commercial customers via participating distributors. The program channel launched in November of 2015, and in two months of operation provided 532,169 kWh and 62.28 kW.

Program participation was comprised largely of vending misers. Vending misers accounted for 75.4% of program kWh. The deemed savings applied for program vending misers was in line with prior values approved by the Evaluators for use in El Paso Electric Company's programs elsewhere in New Mexico.

11.3.2 Commercial Comprehensive Net Savings Estimates

The Evaluator estimated net savings for all components of the Commercial Comprehensive Program via detailed participant surveying of a representative sample of decision makers from each program component. These questionnaires were used to provide estimates of free-ridership, with a separate estimate developed for each measure category. The subsections to follow will present the Evaluator's NTGR estimates by measure category for each program component, and the associated net savings.

11.3.2.1 Retrofit Rebates Net Savings Estimates

The Evaluator used PNM tracking data on measure details by site in order to aggregate gross savings by measure category within each stratum in the population. NTGR for each measure type was then applied to verify ex-post savings within each stratum in order to develop net realization estimates. In Table 11-23, verified gross savings by measure category are summarized in order to prepare for application of measure-specific NTGRs. Table 11-24 then presents similar results for verified gross kW savings.

Table 11-23 Retrofit Rebates Stratum-Level Verified Gross kWh Savings by Measure Category

Measure Category	Stratum 5 Verified Gross kWh Savings	Stratum 4 Verified Gross kWh Savings	Stratum 3 Verified Gross kWh Savings	Stratum 2 Verified Gross kWh Savings	Stratum 1 Verified Gross kWh Savings
Lighting	3,316,226	2,807,196	3,870,060	3,571,412	1,144,833

HVAC	4,085,616	2,689,592	1,862,848	413,988	101,052
Motors	-	-	-	49,610	-
Refrigeration	-	833,672	69,782	105,912	20,910
Food Service	-	-	21,717	-	16,152
Building Envelope	-	-	-	-	20,806
Total	7,401,842	6,330,460	5,824,407	4,140,922	1,303,753

Table 11-24 Retrofit Rebates Stratum-Level Verified Gross kW Savings by Measure Category

Measure Category	Stratum 5 Verified Gross kW Savings	Stratum 4 Verified Gross kW Savings	Stratum 3 Verified Gross kW Savings	Stratum 2 Verified Gross kW Savings	Stratum 1 Verified Gross kW Savings
Lighting	731.02	225.74	545.09	708.71	86.41
HVAC	316.57	198.43	278.12	83.61	6.68
Motors	-	-	-	8.20	-
Refrigeration	-	82.15	4.50	10.47	0.53
Food Service	-	-	3.51	-	0.02
Building Envelope	-	-	-	-	4.22
Total	1,047.59	506.32	831.22	810.98	97.86

With verified savings compiled by stratum and by measure, the Evaluator then applies measure-category NTGRs to estimate program net savings. These are summarized in Table 11-25 and Table 11-26 below. The Evaluators applied 2014 NTGR values by measure category and did not develop new NTGR estimates for 2015.

Table 11-25 Retrofit Rebates Stratum Level Verified Net kWh Savings by Measure Category

Measure Category	Measure NTGR	Stratum 5 Verified Net kWh Savings	Stratum 4 Verified Net kWh Savings	Stratum 3 Verified Net kWh Savings	Stratum 2 Verified Net kWh Savings	Stratum 1 Verified Net kWh Savings
Lighting	72.0%	2,387,682	2,021,181	2,786,444	2,571,417	824,280
HVAC	93.2%	3,807,795	2,506,700	1,736,174	385,837	94,180
Motors	100%	-	-	-	49,610	-
Refrigeration	81.8%	-	681,943	57,082	86,636	17,105
Food Service	100%	-	-	21,717	-	16,152
Building Envelope	100%	-	-	-	-	20,806
Total	81.6%	6,195,477	5,209,824	4,601,417	3,093,500	972,523

Table 11-26 Retrofit Rebates Stratum Level Verified Net kW Savings by Measure Category

Measure Category	Measure NTGR	Stratum 5 Verified Net kW Savings	Stratum 4 Verified Net kW Savings	Stratum 3 Verified Net kW Savings	Stratum 2 Verified Net kW Savings	Stratum 1 Verified Net kW Savings
Lighting	72.0%	526.33	162.53	392.46	510.27	62.21
HVAC	93.2%	295.04	184.94	259.20	77.92	6.23

Motors	100%	-	-	-	8.20	-
Refrigeration	81.8%	-	67.20	3.68	8.56	0.44
Food Service	100%	-	-	3.51	-	0.02
Building Envelope	100%	-	-	-	-	4.22
Total	80.5%	821.37	414.67	658.85	604.95	73.12

11.3.2.2 New Construction Rebates Net Savings Estimates

Due to the limited number of participants and survey respondents, net to gross for the New Construction component was addressed at the facility level rather than the measure category level using NTGR values aggregated from prior program years. For the New Construction component, an overall NTGR of 83.4% was found, resulting in net savings of:

- 5,005,937 kWh; and
- 1,141.87 kW.

11.3.2.3 QuickSaver Net Savings Estimates

The net savings estimation for QuickSaver yielded a lower NTGR than observed in prior years. The Evaluators'' estimate of NTGR was 87.4%. One item of note is that in 2015, the program changed eligibility to allow for customers up to 150 kW connected load. This was done in part as a result of intervention in PNM's program filing by the Southwest Energy Efficiency Project (SWEEP), with PNM and DNVGL concurring with SWEEP's finding that customers with connected loads of 100-150 kW need higher services levels from the program as they are unlikely to have onsite energy managers.

As a result of this change, the QuickSaver program had a much larger average project size than compared to prior years. As demonstrated in Figure 11-1, in 2015 QuickSaver shifted towards larger projects. The top 10% of projects (in terms of project-level kWh savings) accounted for 44.6% of program savings, as opposed to 32.6% and 31.8% of total savings in 2014 and 2013 respectively. Further, average project size increased from a 2013-2014 average of 20,385 to 30,197. The Evaluators conclude that the survey findings in 2015 reflect this in that these "large small businesses" do not have the same level of financial need or lack of background in energy efficiency that is typically expected of small business customers, even though they are unlikely to have onsite energy management staff.

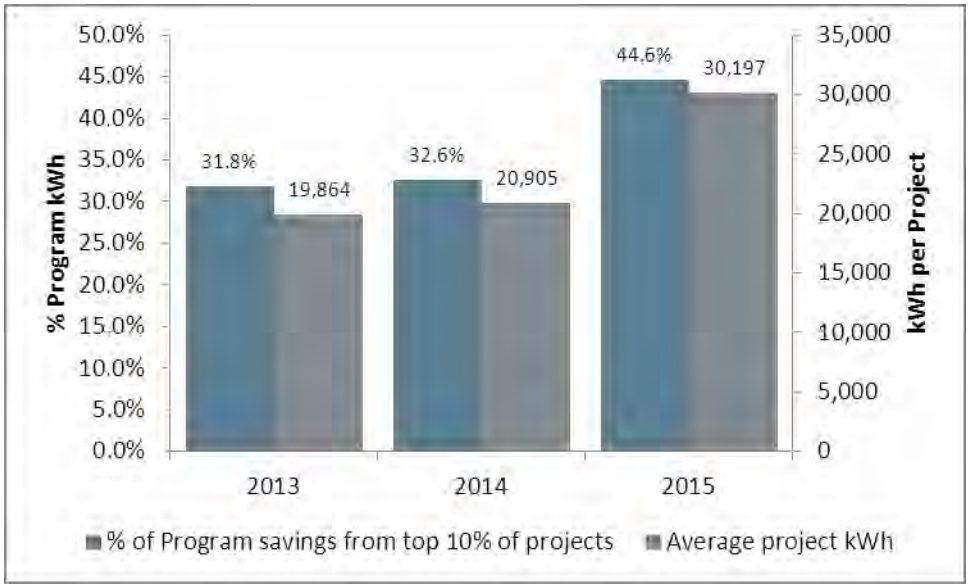

Figure 11-1 Comparison of QuickSaver Project Sizes: 2013-2015

The resulting net savings are summarized in Table 11-27.

Table 11-27 QuickSaver Direct Install Stratum-Level Verified Net kWh Savings

Stratum	NTGR	Verified Net kWh	Verified Net kW
5	87.4%	1,232,483	56.44
4	87.4%	2,073,017	116.27
3	87.4%	1,820,684	150.49
2	87.4%	1,717,168	121.83
1	87.4%	1,324,912	203.73
Total	87.4%	8,168,264	648.76

11.3.3 Commercial Comprehensive Net Realization Summary

After evaluating the three program components, the Evaluator compiled net savings to provide an overall net realization rate. Gross and net savings results are summarized in Table 11-28 and Table 11-29.

Table 11-28 Commercial Comprehensive Gross Realization

Component	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		Lifetime Energy Savings (kWh)		Gross Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post	
Retrofit Rebates/NC	5,171.04	4,744.55	32,677,057	31,003,706	362,715,333	339,326,812	94.9%
QuickSaver	1,995.00	742.29	9,723,394	9,345,840	116,680,728	112,150,080	96.1%
Building Tune-Up	-	-	2,388,953	2,388,953	14,333,718	14,333,718	100.0%
Midstream	62.28	62.28	532,169	532,169	7,982,535	7,982,535	100.0%
Total	7,228.32	4,663.11	45,321,573	43,270,668	501,712,314	473,793,145	95.5%

Table 11-29 Commercial Comprehensive Net Realization

Component	Peak Demand Reduction (kW)		Annual Energy Savings (kWh)		Lifetime Energy Savings (kWh)		Net Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post	Ex Ante	Ex Post	
Retrofit Rebates/NC	4,229.90	3,714.83	26,729,833	25,078,678	296,701,142	274,479,053	93.8%
QuickSaver	1,839.39	648.76	8,964,969	8,168,264	107,579,631	98,019,171	91.1%
Building Tune-Up	0.00	0.00	2,078,389	2,078,389	12,470,335	12,470,335	100.0%
Midstream	49.82	49.82	425,735	425,735	6,386,028	6,386,028	100.0%
Total	6,119.11	4,413.41	38,198,926	35,751,066	423,137,136	391,354,587	93.6%

11.4 Process Findings

This chapter presents the results of the process evaluation of the Commercial Comprehensive Program[22]. The process evaluation focuses on aspects of program policies and organization, as well as the program delivery framework. The process evaluation is largely based upon participant surveying and a review of program documentation.

The process chapter begins with a discussion of the overall progress of the program and potential for meeting its goals. The chapter also includes discussion relating to certain issues that are critical to the future success of the program. This discussion is followed by an analysis of strategic planning and process recommendations, and concludes by highlighting key findings from the surveys of trade allies and customer participants.

11.4.1 Overall Program Success

The CCP has at this point become well-established, with utility staff, program implementation staff, trade allies, and PNM customers having learned the minutiae of the program and its offerings

In Figure 11-2 and Figure 11-3 below, savings by measure category are presented by year in terms of their share of total program savings over the course of this history of the CCP.

[22] During the data collection process, customers were asked for responses in terms of the specific program component utilized. However, for the purposes of this study, Commercial Comprehensive Program refers to all analyzed programs, including Commercial Retrofit Rebates, New Construction Rebates, and Quick Saver Direct Install.

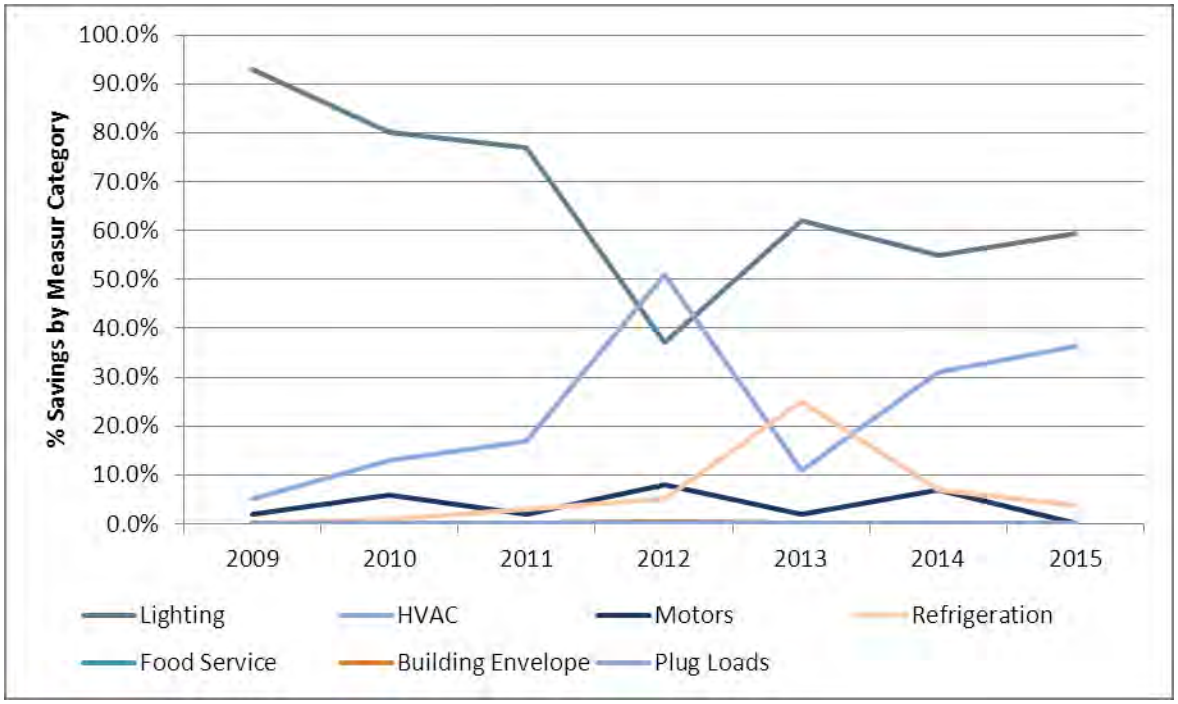

Figure 11-2 Retrofit Rebates Savings by Measure Category by Year

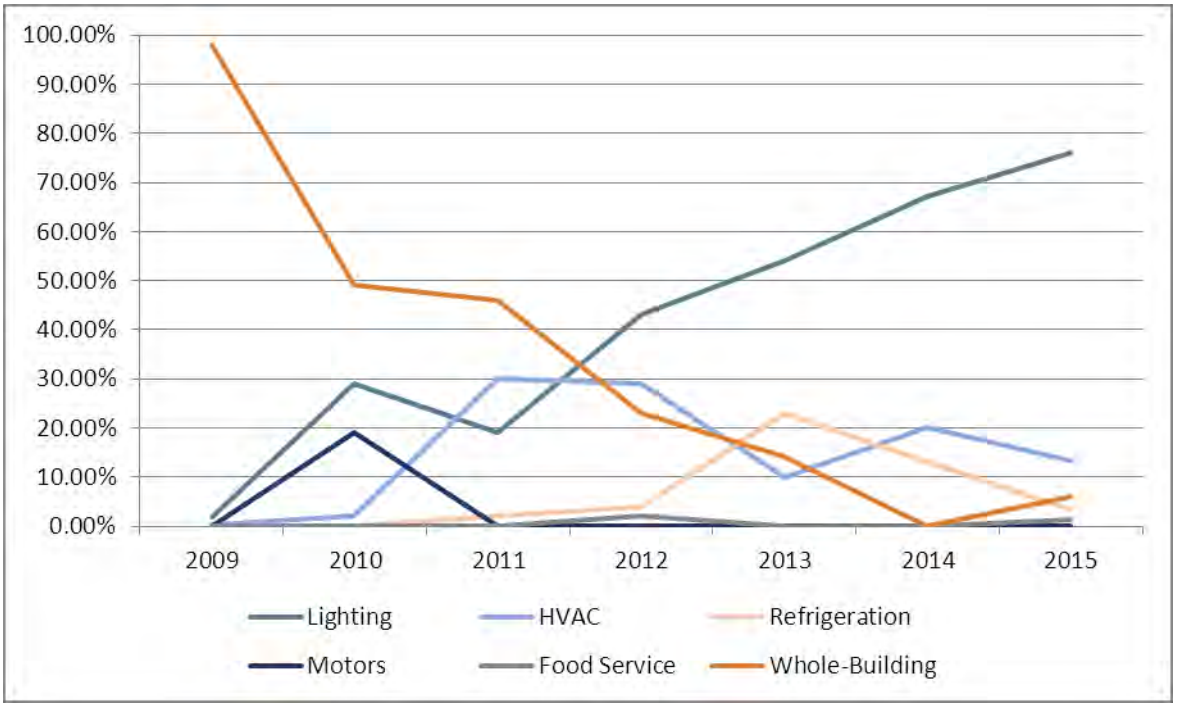

Figure 11-3 New Construction Savings by Measure Category by Year

As seen in Retrofit Rebates, the CCP is achieving a greater degree of diversity in measure uptake. Measure categories (and savings levels) for New Construction do not

serve as a good indicator of program success in this regard in that New Construction projects do not consistently flow into the program; they are dependent upon available funds for construction and an economy that can support expansion, and as such the flow of such projects is uneven and volatile.

Savings for the QuickSaver program channel dropped by 26.6% in 2014 compared to 2013 and displayed similar savings in 2015. Implementation staff attribute this to saturation in the small business market in PNM's service territory. With the high program uptake in prior years, the opportunities for lighting retrofits have been reduced.

11.4.1.1 Measure Uptake by Facility Type

To maintain performance in future program years, the CCP will need to look for deeper savings in program participants, as opportunities for lighting retrofits will decline. Table 11-30 below summarizes the share of savings by measure category for each facility type in the Retrofit Rebates and QuickSaver components.

Table 11-30 Retrofit Rebates & QuickSaver Savings by Measure Category by Facility Type

Facility Type	N	Lighting	HVAC	Motors	Refrigeration	Food Service	Envelope
Art Gallery/Museum	11	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Assembly/Worship	29	94.0%	6.0%	0.0%	0.0%	0.0%	0.0%
College/University	19	79.8%	18.4%	0.0%	0.0%	1.8%	0.0%
Entertainment	7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Government	24	95.7%	4.2%	0.0%	0.0%	0.0%	0.0%
Grocery	24	80.4%	5.0%	0.0%	11.8%	2.8%	0.0%
Hotel/Motel	26	80.6%	19.4%	0.0%	0.0%	0.0%	0.0%
Industrial	26	33.1%	66.3%	0.5%	0.0%	0.0%	0.0%
Medical	11	99.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Multifamily	6	98.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Office	69	80.6%	19.0%	0.0%	0.0%	0.0%	0.0%
Parking lot	4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Restaurant	72	99.8%	0.0%	0.0%	0.0%	0.2%	0.0%
Retail/Service	202	85.6%	5.4%	0.0%	9.0%	0.0%	0.0%
School/K-12	21	34.9%	65.1%	0.0%	0.0%	0.0%	0.0%
Warehouse	50	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall:	601	70.8%	26.0%	.1%	2.8%	.1%	0.0%

Table 11-31 presents the average, median and range of the incentives for firms participating in retrofit measures. The average total incentive was $5,885 while the median $1,036. Values were generally skewed high by one large project that received an incentive of $297,292, accounting for 17.3% of all Retrofit Rebate incentive dollars.

Table 11-31 Average and Median Incentive for Retrofit Participants

Average	Median	Range
$6,980	$1,502	$9-$248,257

The Retrofit Rebates component had 269 participating facilities in 2015. Figure 11-4 presents the distribution of participants in the Retrofit Rebates component by facility type and savings.

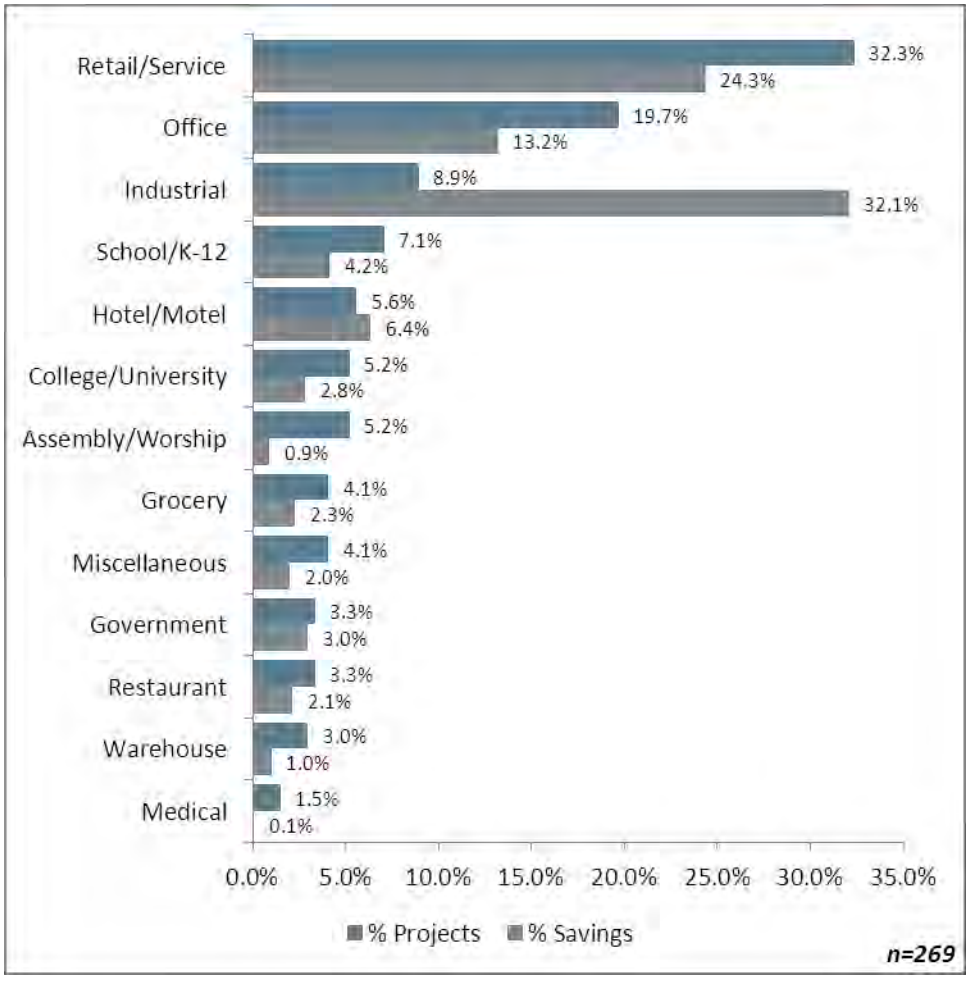

Figure 11-4 Retrofit Rebates Distribution Participation & Savings by Facility Type

11.4.1 Commercial New Construction Rebates Customer Profile

Table 11-32 summarizes the average, median and range of the incentives for New Construction project applications. The average total incentive was $9,887 while the median was to $4,970. Total incentives for projects range as high as $53,087.

Table 11-32 Average and Median Incentive for New Construction Customers

Average	Median	Range
$9,887	$4,970	$181 - $53,087

The New Construction Rebates program had 60 applications in 2015. Figure 11-5 presents the distribution of participants by facility type.

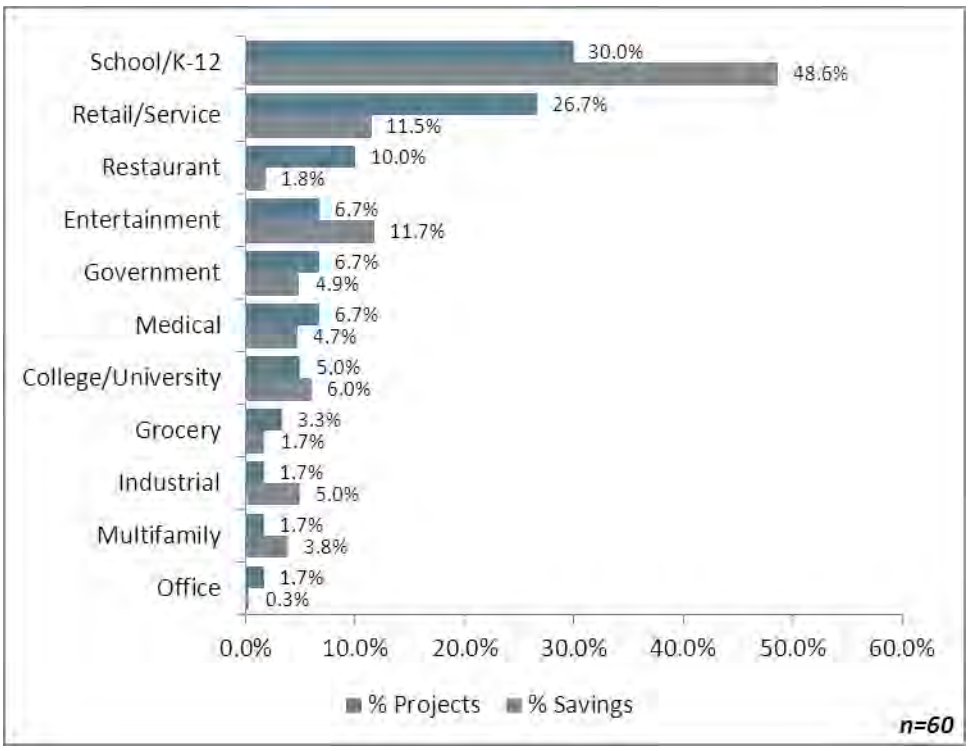

Figure 11-5 New Construction Rebates Distribution of Participants by Facility Type

K-12 schools encompassed the bulk of program participation and savings in the New Construction Rebates component.

11.4.2 QuickSaver Customer Profile

Table 11-33 presents the average, median and range of the incentives for firms participating in the QuickSaver component.

Table 11-33 Average and Median Incentive for QuickSaver Participants

Average	Median	Range
$3,038	$1,591	$82-$45,050

The QuickSaver component had 322 participating facilities in 2015. Figure 11-6 presents the distribution of participants in the QuickSaver component by facility type. Unlike Retrofit Rebates and New Construction, the share of participation and the share of savings are highly correlated, with no facility type constituting an outsized share of savings relative to their share of participation.

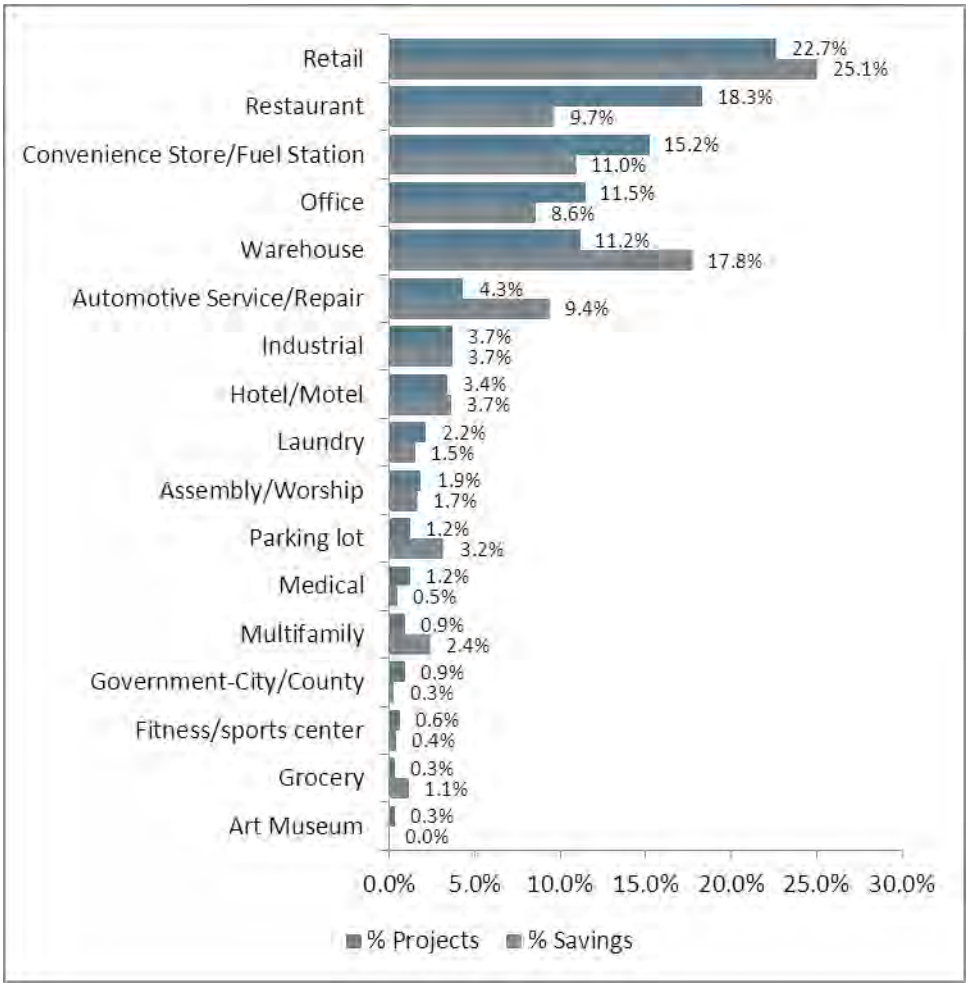

Figure 11-6 QuickSaver Distribution of Participants & Savings by Facility Type

11.4.3 Retrofit Rebates Customer Outcomes

The Public Service Company of New Mexico utilizes multiple marketing strategies to make customers aware of its programs. The program partners with trade allies such as lighting contractors, motor vendors, HVAC companies, engineering firms and others who promote programs with their customers. PNM has a website where customers can learn about various measures and obtain forms. Programs are also marketed through talks and presentations delivered to trade ally organizations, business and professional associations, and other types of organizations. PNM also directly contacts customers with information.

A survey was conducted to collect data about customer decision-making, preferences, and perspective of the Commercial Comprehensive Program. In total, respondents accounting for 40 Retrofit Rebates projects responded. The pool of New Construction survey participants was exceedingly limited, as most of the participation came from

multiple projects from a small number of organizations that were non-responsive to the survey.

11.4.3.1 How Customers Learn About the Program

Table 11-34 displays the customer responses to how they learned about the program. The percentages are the percentages of respondents. Because respondents could provide more than one response the total is greater than 100%. The most common way customers learned about the program was directly through PNM representatives. Another 28.6% learned about the program through an equipment vendor or building contractor. This is to be expected since the program attempted to leverage the contacts of trade allies and other building professionals. Sources of information are more limited in scope for New Construction due to the smaller number of projects.

Table 11-34 How Customer Decision Makers Learned about the Program

	Retrofit Rebates
An equipment vendor or building contractor	36.0%
Approached directly by PNM Staff	20.0%
Friends or colleagues (i.e., word of mouth)	24.0%
The PNM website	5.0%
An architect, engineer or energy consultant	4.0%
Other	8.0%
n	**25**

11.4.3.2 Influence in Decision-Making

Respondents were asked to rate a series of possible sources of information on a scale of 0-10, with 0 meaning “not influential at all” and 10 meaning “very influential” in their decision-making for their project in 2015. Friends and colleagues were rated the highest at 6.58 out of 10, followed by equipment vendors at 5.92.

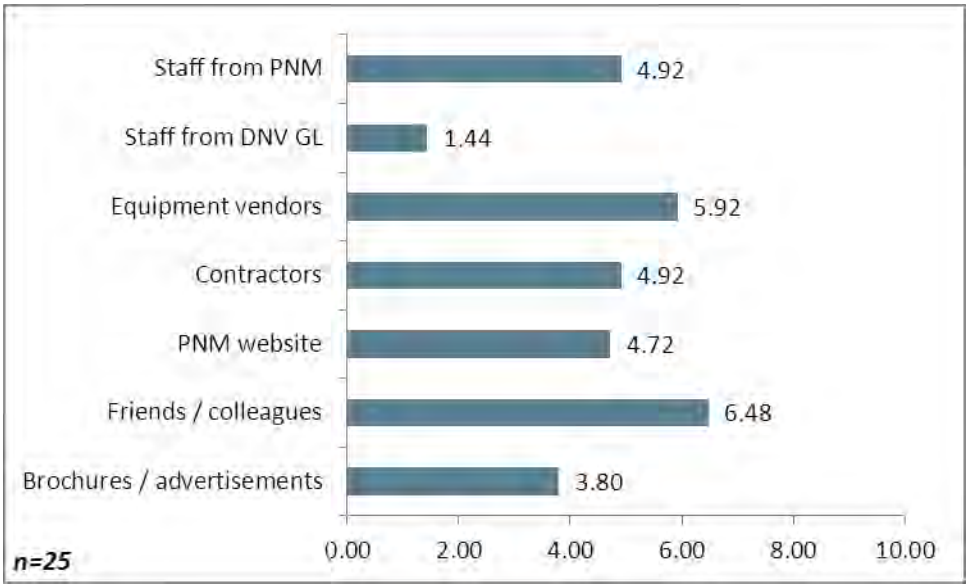

Figure 11-7 Retrofit Rebates – Influence of Sources of Information

11.4.3.3 Lighting Project Specification

Seventeen of 25 respondents for this survey completed lighting projects. Respondents were asked to provide further detail on the process of designing and completing their lighting retrofit. Figure 11-8 summarizes the parties involved in the specification of the equipment to be included in the lighting retrofits, as well as how often they were indicated as the “most important” source of information.

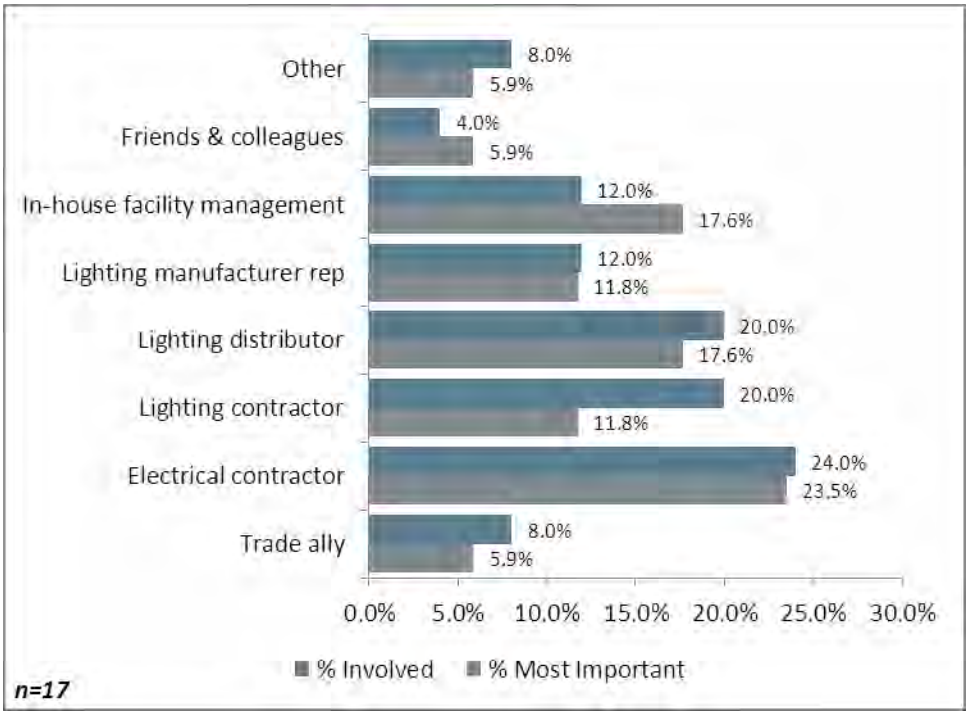

Figure 11-8 Parties Involved in Lighting Retrofit

Of those that indicated a vendor or contractor as the most important source of information, 70% indicated that they worked with them on projects prior to this one. All respondents that listed a vendor or contractor as the most important source of information stated that that organization recommended specific lighting models to them, and 90% installed the exact lighting which was recommended.

Respondents were asked to specify how long the lighting design specification took. Responses varied widely, with a low of “a couple of minutes” in a small retail facility to a high of eight years in a public sector facility.

Respondents were further asked to identify whether the lighting level changed following the completion of the project. As shown in Figure 11-9, 76.5% of respondents stated that their lighting was brighter after the retrofit. All but one respondent indicated that the lighting level after the retrofit matched what they had desired. One respondent that stated that the lighting level had not changed expressed disappointment as they had thought their facility would have brighter lighting after the retrofit.

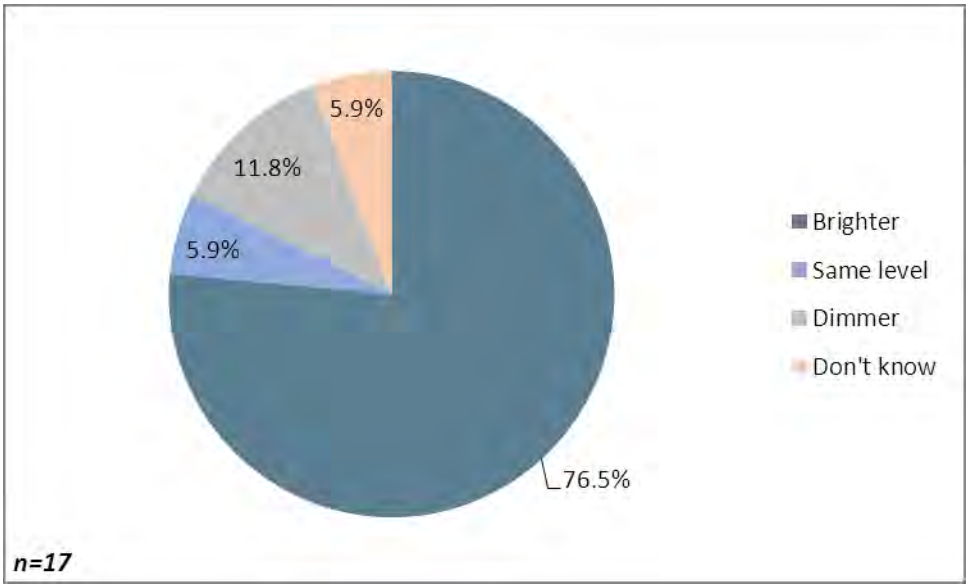

Figure 11-9 Lighting Level after Retrofit

11.4.3.4 Application Process

Respondents were asked a series of questions pertaining to the application process. Responses pertaining to contribution to the application process and to questions about the level of effort required at provided in the subsequent figures.

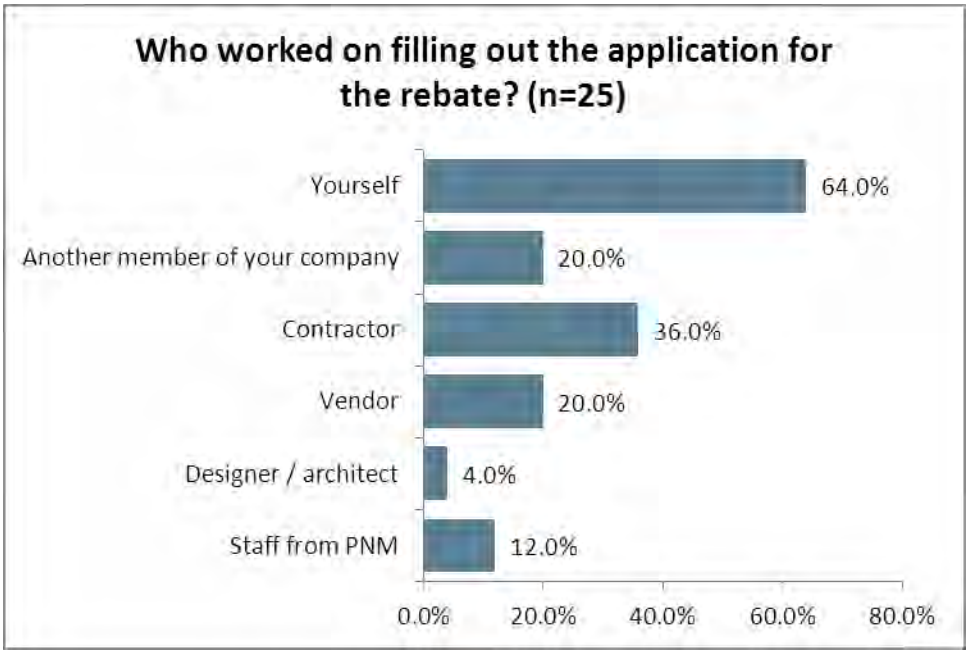

Figure 11-10 Reported Contributors to the Application Process

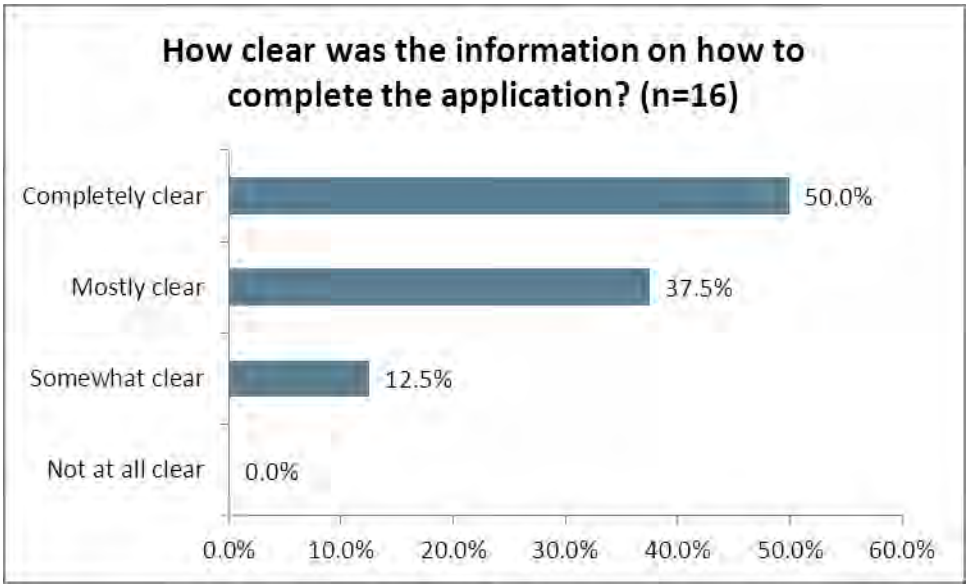

Figure 11-11 Clarity Level of Application

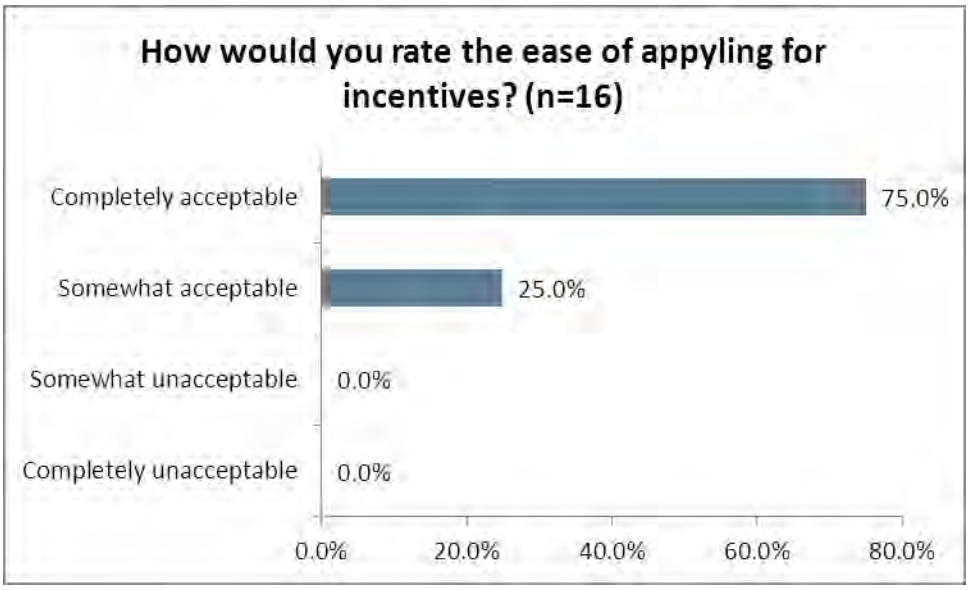

Figure 11-12 Ease of Applying for Incentives

11.4.3.5 Customer Decision Making

Before participating in the program, respondents were asked if they had installed any similar equipment, and 48.0% indicated having done so. Respondents were then asked if they had planned to install the energy efficient equipment before participating in the program and 48.0% said they did have plans. Of those that said they did have plans, 100.0% stated that they would have installed this equipment without the program rebates, and 92.3% stated that would have installed the same equipment. Participants

were then asked about their previous experience with PNM programs and the importance it had in their decision to install energy efficient equipment. Fifty-six percent had previously participated, and 92.9% of prior participants said that it was somewhat to very important in making the decision. Eighty-percent would have been financially able to install the equipment without financial incentives.

Respondents were then asked to identify what they would have changed in their project if rebates were not available. Their answers are summarized in Figure 11-13.

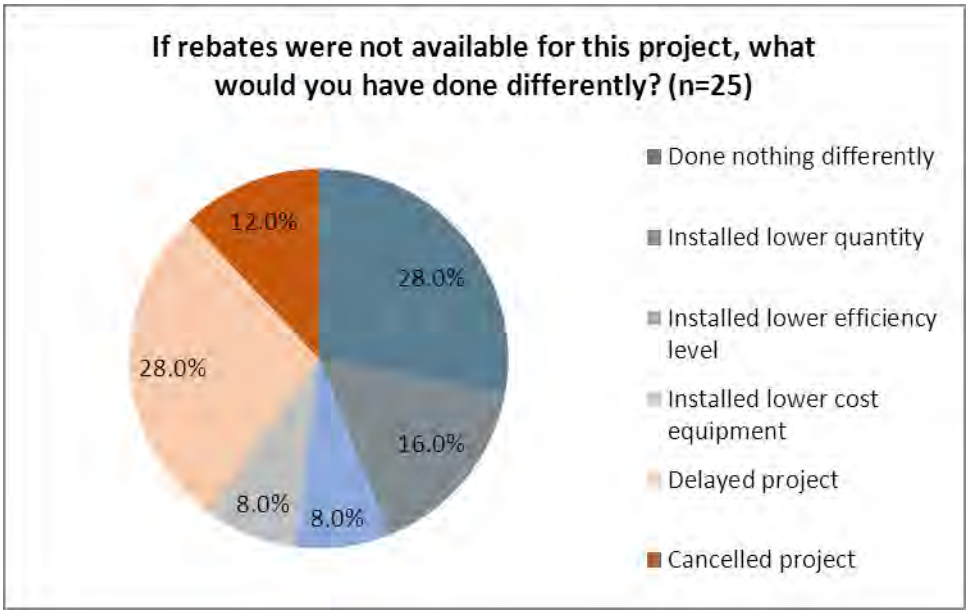

Figure 11-13 What Respondents Would Have Done Differently

Respondents were also asked an additional question to detail their likelihood of installing without a program-provided incentive.

Table 11-35 Financial Incentive Influence on QuickSaver Installation

If PNM had not provided a financial incentive, how likely would you have been to install the same equipment?	
Definitely would have installed	44.0%
Probably would have installed	32.0%
Probably would not have installed	16.0%
Definitely would not have installed	8.0%
n	**25**

An important question is when respondents learned about the program. As shown in Table 11-36, 56.0% of respondents learned about the program before they planned equipment replacements, and 40.0% learned about it during planning equipment replacement. More than a quarter of respondents indicated that they had learned about

the program after the equipment had been specified and/or installed. Though the program design is such that

Table 11-36 When Customer Decision Makers Learned about the Program

	Retrofit Rebates
Before planning for replacing the equipment began	56.0%
During your planning to replace the equipment	40.0%
Once equipment had been specified but not yet installed	4.0%
After equipment was installed	4.0%
Don't know	0%
n	**25**

11.4.3.6 Satisfaction with the Program

Respondents were asked about their levels of satisfaction with selected aspects of the program on a scale of 1 to 10 where 1 is very dissatisfied and 10 is very satisfied. Table 11-37 tabulates the results.

Table 11-37 Customer Decision Maker Satisfaction with Selected Elements Program Experience

Element of Program Experience	***Mean Score***	***Don't Know***	***n***
Energy cost savings	9.00	12.0%	25
Incentive amount	8.33	4.0%	25
Information provided by your contractor	9.17	8.0%	25
Quality of the work conducted by your contractor	9.71	4.0%	25
Overall program experience	9.58	4.0%	25

Overall program experience scored very high with a mean score of 9.58. Respondents reported the greatest satisfaction with the performance of the installed equipment, the elapsed time until receiving the incentive, and the quality of work by their contractor..

11.4.4 QuickSaver Customer Outcomes

A separate survey was conducted to collect data about QuickSaver participants, including their decision-making, preferences, and perspective on the program. A total of 30 decision makers responded to the survey, representing 41 facilities. In order to provide aggregated results, the analysis will be based on the total number of facilities rather than the number of decision makers responding to the survey.

11.4.4.1 How Customers Learn of the Program

Table 11-38 displays the customer responses to how they learned about the program. The percentages are the percentages of respondents. The most common way

customers learned about the program was from a vendor or contractor (30.0%). Further, 15.7% listed staff from PNM or DNVGL. Outside of these groups, many respondents learn of the program through their colleagues and word of mouth, with 20.0% indicating this as how they learned of the program. One new development in 2015 was 10% of respondents stating that they learned of the program from a customer that purchased from them. This occurred at three businesses. The Evaluators examined these responses to see if they were any commonalities between these three participants, but none could be found. They were an automobile dealership, a stationary store, and an athletic equipment store. Further, they did not share geographic commonality either, in that two were in Albuquerque and one was in Santa Fe.

Table 11-38 How Customer Decision Makers Learned about the QuickSaver Program

Source Indicated	***Percent of Respondents***
Approached by a PNM or DNV staff	15.7%
Friends or colleagues (i.e., word of mouth)	20.0%
Vendor/Contractor	30.0%
Past experience with the program	13.3%
Customer at my business was a contractor	10.0%
Don't know	10.0%
n	**30**

11.4.4.2 Influence in Decision-Making

Respondents were asked to rate a series of possible sources of information on a scale of 0-10, with 0 meaning "not influential at all" and 10 meaning "very influential" in their decision-making for their project in 2015. Contractors were rated the highest at 6.90 out of 10, followed by staff from PNM at 6.37.

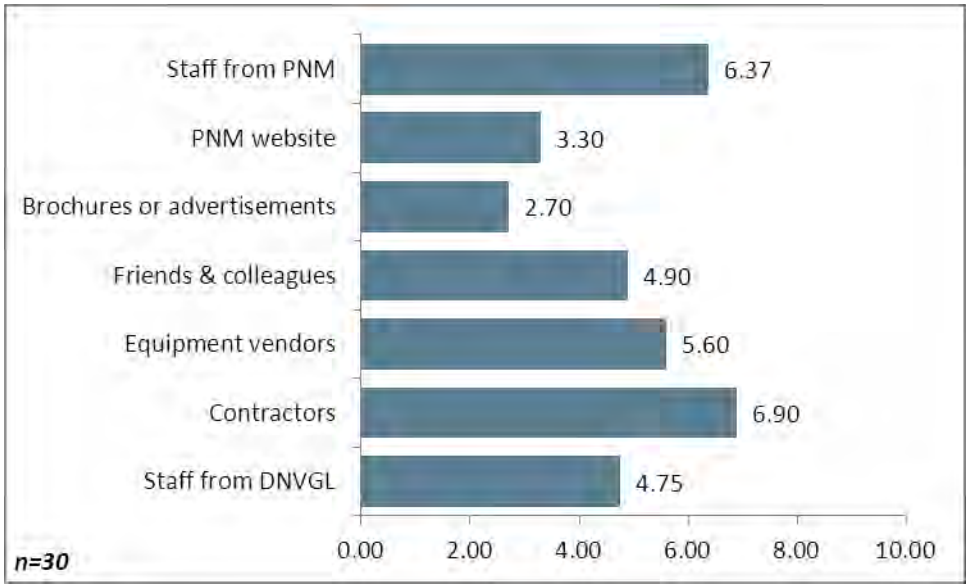

Figure 11-14 QuickSaver – Influence of Sources of Information

11.4.4.3 Timing of learning of the Program

Participants were also asked when they had heard about the QuickSaver program. As shown in Table 11-39, 76.7% of respondents found out about the program before planning to replace equipment, and 20.0% learned about it during equipment replacement planning. Further, 3.3% percent of the respondents indicated learning about the program once equipment was specified but not yet installed.

Table 11-39 When Customer Decision Makers Learned about the Program

When did you learn of the Program?	*Percent of Respondents*
Before planning for replacing the equipment began	76.7%
During your planning to replace the equipment	20.0%
Once equipment had been specified but not yet installed	3.3%
After equipment was installed	0%
Don't Know	0%
n	**30**

Respondent responses about when they had heard about the program were cross-tabulated with whether they had previous plans to install energy efficiency measures. Of the participants who indicated that they learned of the program before beginning equipment replacement planning, 94.0% of them had not had prior plans to install equipment. This implies that the program directly influenced these responders to make energy efficiency improvements.

Table 11-40 When Customer Decision Maker Learned about the QuickSaver Program, by Whether There Were Plans to Install Equipment

Had Plans to Install Measure Before Participating	Before Planning For Replacing the Equipment Began	During Your Planning to Replace the Equipment	Once Equipment Had Been Specified But Not Yet Installed	After Equipment Was Installed	Don't Know
Yes	50.0%	41.7%	8.3%	0%	0%
No	94.4%	5.6%	0%	0%	0%

11.4.4.4 Lighting Project Specification

All respondents for this survey completed lighting projects. Respondents were asked to provide further detail on the process of designing and completing their lighting retrofit. Figure 11-15 summarizes the parties involved in the specification of the equipment to be included in the lighting retrofits.

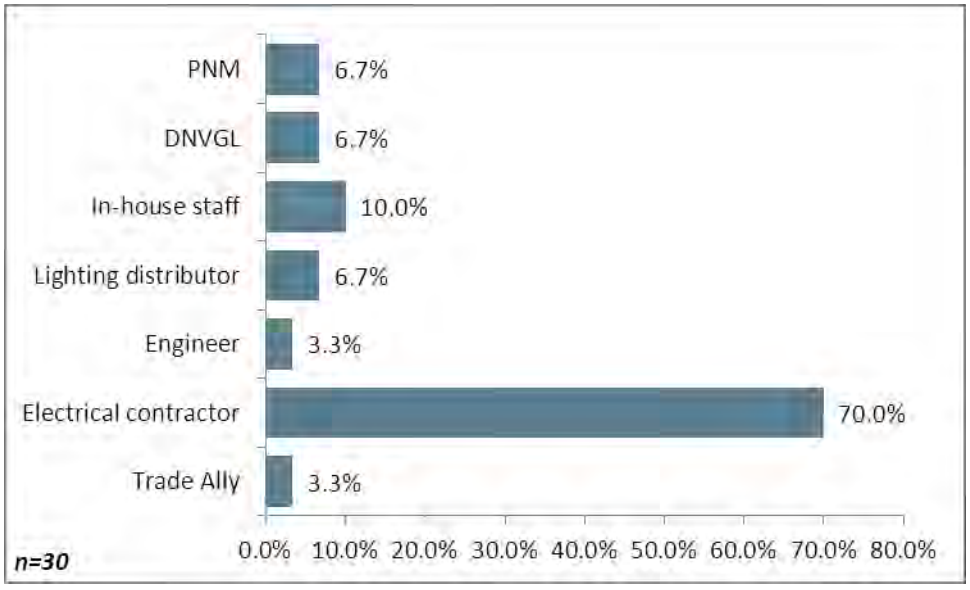

Figure 11-15 Parties Involved in Lighting Retrofit

Of those that indicated a vendor or contractor, 40% indicated that they worked with them on projects prior to this one. Eighty-nine percent of respondents that listed a vendor or contractor as having been involved in the decision stated that specific lighting models were recommended, and 93.8% installed the exact lighting which was recommended.

Respondents were asked to specify how long the lighting design specification and installation took. Answers to this are summarized in Figure 11-16.

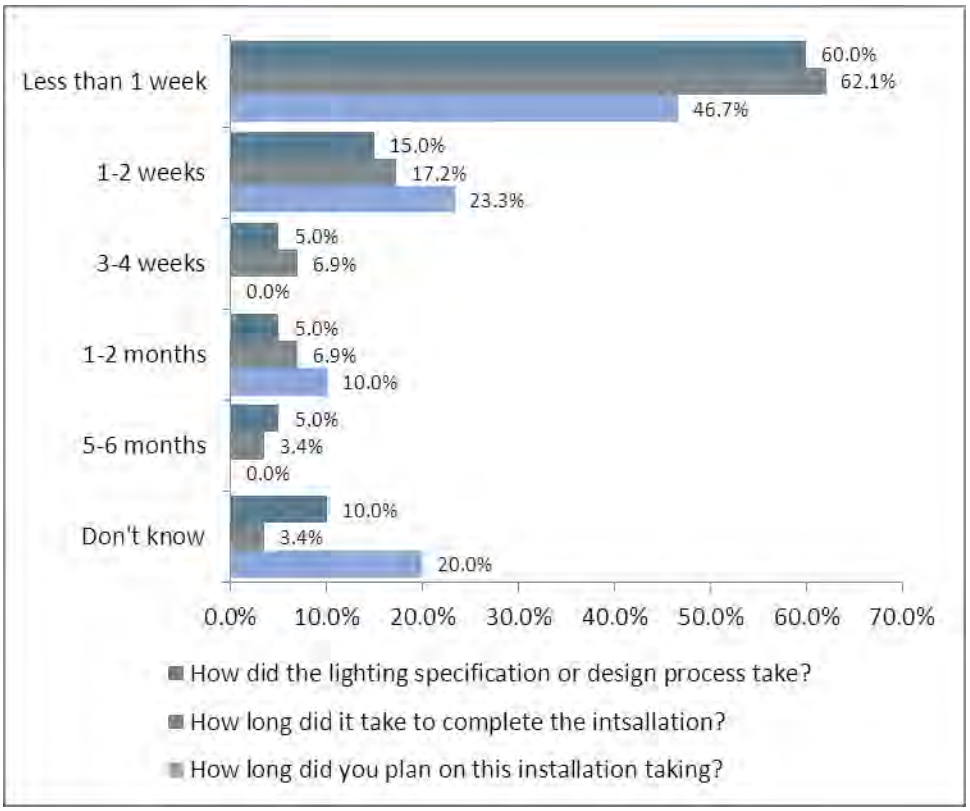

Figure 11-16 Timeline for Project Completion

Survey respondents generally indicated that installation took less time than anticipated.

Respondents were further asked to identify whether the lighting level changed following the completion of the project. As shown in Figure 11-17, 63.3% of respondents stated that their lighting was brighter after the retrofit. Eighty-seven percent of respondents indicated that the lighting level after the retrofit matched what they had desired.

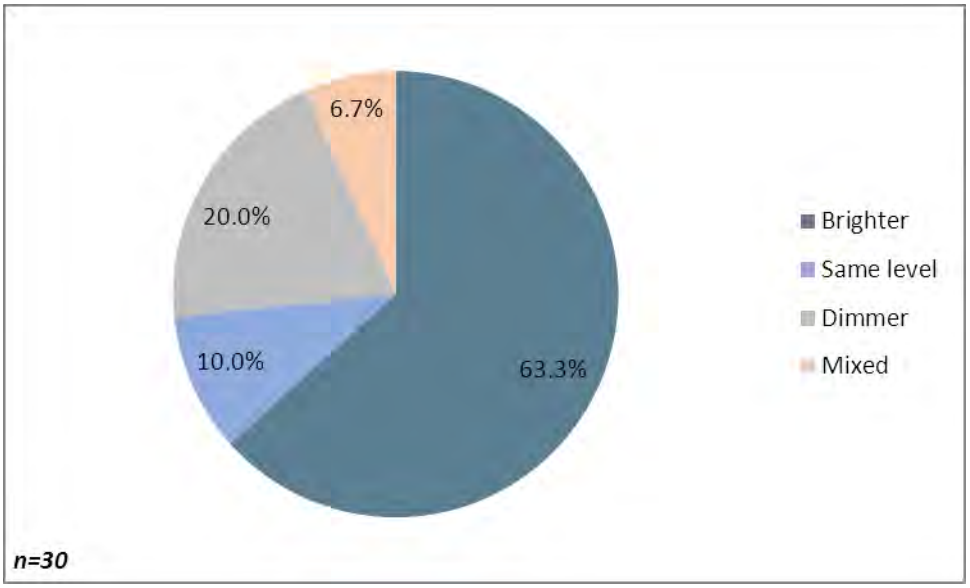

Figure 11-17 Lighting Level after Retrofit

11.4.4.5 Customer Decision Making

Before participating in the program, respondents were asked if they had installed any similar equipment, and 30.0% indicated having done so. Respondents were then asked if they had planned to install the energy efficient equipment before participating in the program and 40.0% said they did have plans. Of those that said they did have plans, 25.0% stated that they would have installed this equipment without the program rebates, and 50.0% stated that would have installed the same equipment. Thirty-six percent stated that they would have been financially able to install the equipment without financial incentives, and 56.7% stated that they would not have been financially able.

Respondents were then asked to identify what they would have changed in their project if rebates were not available. Their answers are summarized in Figure 11-18.

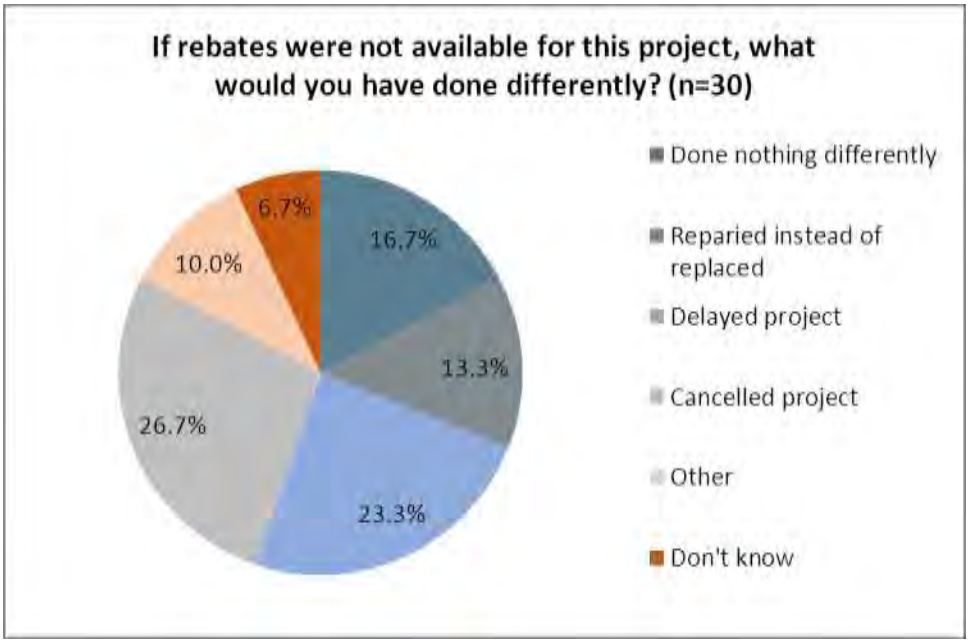

Figure 11-18 What Respondents Would Have Done Differently

Respondents were also asked an additional question to detail their likelihood of installing without a program-provided incentive. Their responses are summarized in Table 11-41.

Table 11-41 Financial Incentive Influence on QuickSaver Installation

If PNM had not provided a financial incentive, how likely would you have been to install the same equipment?	
Definitely would have installed	6.7%
Probably would have installed	20.0%
Probably would not have installed	50.0%
Definitely would not have installed	16.7%
Don't know	6.7%
n	**30**

11.4.4.6 Satisfaction with the Program

Respondents were asked about their levels of satisfaction with selected aspects of the program on a scale of 1 to 10, where 1 is very dissatisfied, 10 is very satisfied. Table 11-42 shows the results.

Table 11-42 Customer Decision Maker Satisfaction with Selected Elements

Element of Program Experience	Mean Score	Don't Know	n
Energy cost savings from this project	8.65	33.3%	**30**
Incentive Amount	8.75	6.7%	**30**
Information Provided by your contractor	8.32	6.7%	**30**
Quality of Work Conducted by your contractor	8.55	3.3%	**30**
Quality of lighting in your facility	8.77	0%	**30**
Overall program experience	8.48	3.3%	**30**

11.5 Building Operator Certification

The Evaluators surveyed students and teachers that participated in the BOC program channel. The findings from these surveys are presented in the following subsections.

11.5.1 Student Survey

11.5.1.1 Participant Outcomes

An online survey was conducted to collect data about participant decision-making, preferences, and feedback on the Building Operator Certification (BOC) Program. In total, 11 participants completed surveys for the BOC program out of the 18 participants in the program. The survey results provide a qualitative discussion of participant responses.

11.5.1.2 Participant Characteristics

Survey respondents represented a varying range of facility types. As shown in Table 11-43, 54.5% of respondents reported belonging to schools or colleges/universities and 18.2% of respondents reported belonging to offices or government facilities. Note that the percentage equals more than 100% because some respondents categorized their facility as more than one type. The remaining respondents reported a range of other facility types including hospitals, manufacturing, and a wastewater treatment.

Table 11-43 Respondent Facility Types

	Response	***Percentage of Respondents (n =11)***
What is your facility type?	School/University	54.5%
	Office	18.2%
	Government	18.2%
	Hospital/Medical	9.1%
	Waste Water Treatment	9.1%
	Other - Manufacturing	9.1%

Survey respondents were asked a series of questions related to their current employment positions such as job titles and length of employment in their current role. The respondents represent a wide variety in employment roles, which includes building engineers, facility managers, energy specialist, and directors. Almost half of the respondents supervise the operation and maintenance work, while the remaining respondents perform the work (36%), and some have administrative roles (27%). When asked how long they had worked in this role, respondents provided a wide range of responses, ranging from just over one year to 33 years. The average length at their current role was approximately 12 years. This suggests that BOC participants are fairly experienced in their roles and industries, and that they are likely very familiar with the equipment and processes of their facilities.

Respondents were also asked about the number of locations they oversaw for their facilities. Respondents said they were responsible for one to 149 locations. Thirty-six percent of respondents were responsible for only one facility location, 27% were responsible for four to eight locations, another 27% were responsible for 20 to 55 facilities, and one respondent was responsible for 149 locations.

11.5.1.3 Program Awareness and Information Channels

BOC participants were asked a series of questions to gain insight into general program and rebate awareness and to gauge participant interaction with various marketing and information channels.

The most common way BOC participants learned about BOC program was through PNM program staff (63.6%). Alternatively, if they respondents were not directly contact by PNM staff, their employer or manager told them about the program (36.4%). All of the respondents who indicated they learned about the program through their employer said that their employer encouraged them to get certified in the program. One respondent said that they also learned about the program through advertisements.

Respondents were also asked about their awareness of the energy efficiency programs offered through PNM. Seventy-three percent of respondents said they were aware of the programs. Respondents were asked to specify which PNM programs their facilities had participated in the past year. Table 11-44summarizes their responses. Almost two-thirds of the respondents said their facilities participated in the Power or Peak Saver programs. There was also high participation in the New Construction and Retrofit Rebates programs as well.

Table 11-44 Facility Participation in PNM Programs

	Response	***Yes***	***No***	***Don't know***
Which programs did your facility participate in this past year?	Quick Saver	18.2%	54.5%	27.3%
	Retrofit Rebates	45.5%	36.4%	18.2%
	New Construction	54.5%	27.3%	18.2%
	Building Tune Up	27.3%	63.6%	9.1%
	Power/Peak Saver	63.6%	27.3%	9.1%
	Refrigerator Recycling	27.3%	54.5%	18.2%

11.5.1.4 BOC Training and Courses Feedback

Respondents were asked for feedback regarding the BOC training courses. Twenty-seven percent of respondents said that some courses could be improved upon in some capacity. Specifically, they said:

> *"I would like to know more about sub-metering to isolate the largest users of gas, electricity and water."*
>
> *"I would like to see less book time and more hands on problem solving sessions. Data analyzing, collecting etc."*
>
> *"Hand out reading material before class."*

Ninety-one percent of respondents said that the certification program is helpful and useful towards their day-to-day job responsibilities. They were asked to expand on why the certification program is helpful, and responded that the training:

> *"Brings awareness to issues we may be overlooking."*
>
> *"Keeps me looking for ways to save on energy and breakdowns before they happen."*

"I look for ways to reduce cooling and heating by, changing set points based on outside temp and occupancy load."

Overall, the respondents said that it has brought a new awareness to their job due to the BOC training courses.

When asked how if the respondents had completed either Level 1 or both Level 1 and Level 2 of BOC training, respondents reported that all of them had completed Level 1 and only 36% of respondents were interested in pursuing Level 2 of the BOC training. Some reasons for not pursuing Level 2 BOC training included studying for other professional exams (PE exam), the financial ability to continue taking classes, and time.

11.5.1.5 Importance of Participating

Respondents were asked to rate on a scale of 1 to 10, where 1 being "not important at all" and 10 being "very important" on how important it was to their employer and themselves to get BOC certification. On average, the mean score for importance of certification to their employer was 6.09 and the importance to themselves was 8.72. These findings show that it was more important to the employee to get certification personally rather than from their employer. Respondents were asked to clarify why it was important for their employer to get certified. They said:

"My employer recognizes the need for knowledge and energy savings."

"[It] was important to me as a supervisor to get staff additional training."

"Help me in my day to day job and energy audits."

They were also asked why it was important for them to get certified and responded:

"Wanted to send other employees and wanted to get a feel for the class load and what they offer."

"I learned many new ideas in the BOC classes that I am able to implement at my work."

"Great to learn new material and see the whole energy picture."

11.5.1.6 Tuition Rebate Importance

Respondents were asked about the timing of when they learned about the tuition rebate; 27% of respondents did know about the tuition rebate when they had learned about the program. When asked about the importance of the PNM tuition rebate in the decision to participate in the BOC training, the majority of participants (82%) reported that the rebate was very important and the remaining 18% said the rebate was somewhat important. Only 27% would have been financially able to attend the BOC training without the tuition rebate. Respondents were also asked about the likelihood of

participating in the program without the tuition rebate. Table 11-45shows the responses. Only 27.3% of respondents probably would have participated without the tuition rebate.

Table 11-45 Importance of the Tuition Rebate

	Response	***Percent of Respondents (n=11)***
If the tuition rebate had not been available, how likely would you have been to participate in the BOC course trainings anyway?	Definitely would have participated	0%
	Probably would have participated	27.3%
	Probably would not have participated	54.5%
	Definitely would not have participated	18.2%

11.5.1.7 Participant Actions Following BOC Training

Respondents were asked if any energy efficiency improvements had been made to their facilities since they attended the BOC training courses. This individual question relates only to the timing of projects, and does not yet take into account free ridership levels or whether the participant received a separate incentive for the energy efficiency improvements. Thus, respondents provided information about any energy efficiency improvement since the program, even if the BOC Program did not influence the implementation.

Respondents were asked about a wide range of measures and maintenance activities that may have generated electric or natural gas savings. The equipment and other measures addressed by this portion of the survey include:

- Boiler/hot water/steam system;
- Chiller/chilled water system;
- Cooling tower optimization;
- Domestic hot water changes;
- Economizer and ventilation controls;
- HVAC equipment scheduling and set-point;
- Fan optimization/air distribution;
- Lighting; and
- Water pump optimization.

Additionally, respondents were given the opportunity to provide details about any equipment implementations or maintenance activities that do not fall under these listed categories. As shown in Table 11-46, the most common set of actions taken after the BOC training courses were changes to lighting (45.5%), and HVAC equipment scheduling or set-point changes (36.4%). One respondent said that they started an energy management program. In general, many of the respondents had implemented energy efficiency actions before taking any of the BOC training courses.

Table 11-46 Energy Efficiency Actions Before and After BOC Training

Energy Efficiency Category Actions	***Action Taken Before BOC***	***Action Taken After BOC***	***Action Not Taken***	***Don't Know***
Boiler/hot water/steam system changes	54.5%	18.2%	27.3%	0%
Chiller/chilled water system changes	54.5%	0%	36.4%	9.1%
Cooling tower optimization	27.3%	18.2%	36.4%	18.2%
Domestic hot water changes such as new faucets, showerheads, or water heaters	54.5%	9.1%	27.3%	9.1%
Economizer and/or ventilation control changes	54.5%	18.2%	27.3%	0%
HVAC equipment scheduling or set-point changes	54.5%	36.4%	9.1%	0%
Fan optimization / air distribution changes	27.3%	27.3%	27.3%	18.2%
Lighting changes	45.5%	45.5%	9.1%	0%
Water pump optimization changes	36.4%	27.3%	27.3%	9.1%
Other changes	18.2%	18.2%	18.2%	45.5%
N=11				

Respondents were asked to think about the energy efficiency improvements they made at their facility after participating in the BOC courses and the likelihood of having completed similar projects at their facilities. Table 11-47 summarizes their responses.

Table 11-47 Likelihood of Implementing Similar EE Project w/o BOC Courses

	Response	Percent of Respondents (n=11)
If you hadn't participated in the BOC training, how likely would you have been to complete similar improvements to your facility?	Definitely would have completed similar improvements	9.1%
	Probably would have completed similar improvements	36.4%
	Probably would not have completed similar improvements	45.5%
	Definitely would not have completed similar improvements	0%
	Don't know	9.1%

11.5.1.8 Actions Undertaken Following BOC Training

After respondents were asked about the kinds of energy efficient actions they implemented after taking BOC courses, they specified the types of actions they implemented at their facilities. The next nine subsections details the types of changes made at the respondents' facilities.

11.5.1.8.1 Boiler, Hot Water, Steam System Changes

Two respondents implemented changes to the boiler, hot water or steam system in their facilities. The actions they made in their facilities resulted in moderate energy savings, in their opinions. One respondent tuned up the boiler(s) and installed hot water pumps VFD(s) while the other respondent tuned up the boiler(s), installed combustion van VFDs, and replaced the current boilers with high efficiency boilers. Both respondents received rebates from the utility for implementing these actions.

11.5.1.8.2 Cooling Tower Optimization

Two respondents implemented changes to the cooling towers at their facilities. The actions they made in their facilities resulted in moderate energy savings. One respondent reset the condenser water temperature and increased the cooling tower maintenance. Although two respondents said they had implemented changes, the other respondent was unsure of the exact actions taken at their facility. Both respondents said they received rebates from the utility for implementing these actions.

11.5.1.8.3 Domestic Hot Water Changes

Two respondents implemented domestic hot water changes into their facility after taking the BOC courses. In their opinion, the actions they made in their facilities resulted in measurable, but insignificant energy savings. The respondent implemented low flow faucet aerators and pre-rinse spray valves, but the other respondent said they did not

install any water measures. Only one respondent received rebates from the utility for implementing these actions.

11.5.1.8.4 Economizer and Ventilation Control Changes

Two respondents implemented domestic hot water changes into their facility after taking the BOC courses. One respondent said the actions they made in their facilities resulted in moderate energy savings while the other respondent said there were no measureable energy savings. The respondent who expressed the actions resulted in moderate energy savings repaired a broken economizer, scheduled the heaters, and reset the supply air temperature, and received a rebate from the utility for the actions. The other respondent who expressed no measureable energy savings implemented an economizer and outdoor air control and reset the supply air temperature, but did not receive a rebate from the utility.

11.5.1.8.5 HVAC Equipment Scheduling or Set-Point Changes

Four respondents implemented HVAC changes into their facility after taking the BOC courses. One respondent said the actions they made in their facilities resulted in significant energy savings, one said it resulted in moderate energy savings, and the other two respondents said there were measurable, but insignificant energy savings. Respondents chose to implement several actions including scheduling optimum starts for the AHU system, match AHU schedule to space occupancy, schedule the boilers and exhaust fans, schedule pumps and return/exhaust fans, reset the supply air temperature, and reduce simultaneous heating and cooling. None of the respondents received rebates from the utility for implementing these actions.

11.5.1.8.6 Fan Optimization / Air Distribution Changes

Three respondents implemented changes to the fan optimization and air distribution at their facilities. In their opinions, two respondents said the actions they made in their facilities resulted in moderate energy savings, and the other said it resulted in measurable, but insignificant energy savings. The respondents who expressed the actions resulted in moderate energy savings implemented between 4 and 13 actions. Only one of these respondents received a utility rebate for the actions. The respondent, who expressed measureable, but insignificant energy savings, scheduled AHU and duct static pressure reset, and utilized VFDs for fans. This respondent did not receive any rebates from the utility for implementing these actions.

11.5.1.8.7 Lighting Changes

Five respondents implemented changes to lighting in their facilities after taking the BOC courses. Respondents said that these actions produced energy savings ranging from measurable, but insignificant savings to significant. The most common action taken was installing occupancy sensors (80%). Others implemented daylighting/photocells on

interior fixtures, replaced linear fluorescents and exit signs with LEDs, replaced incandescent lamps with CFLs or LEDs, and replaced standard lamps with reduced wattage lamps. Only two respondents received a rebate from the utility after implementing these actions.

11.5.1.8.8 Water Pump Optimization Changes

Three respondents implemented changes to the water pump in their facilities. The respondents said these changes produced no measurable savings, some measurable but insignificant savings, or moderate energy savings. The respondent who expressed the actions had resulted in moderate energy savings implemented VFDs for the pumps and received a rebate from the utility. The respondent who said the actions had resulted in some measurable savings adjusted the freeze protection sequence for the pumps, improved CHW and HW flow control, reduced the flow by increasing system Delta T, and also used VFDs for the pumps. This respondent did not receive a rebate from the utility. The last respondent who said there were no measurable savings did not specifically implement any of the actions listed.

11.5.1.9 Participant Satisfaction with the Program

Respondents were asked about their levels of satisfaction with selected aspects of the program including feedback on the courses, aspects of the application, and their overall program experience. Responses were provided on a scale of 1 to 10 where 1 meant “very dissatisfied” and 10 meant “very satisfied.” Table 11-48 shows participant satisfaction by each selected program element.

Table 11-48 Participant Satisfaction Ratings by Program Element

Element of Program Experience	Satisfaction Rating (n = 11)						
	Very Satisfied	Satisfied	Neither Satisfied nor Dissatisfied	Dissatisfied	Very Dissatisfied	Mean Score	Don't know
Classroom training	63.6%	18.2%	18.2%	-	-	8.36	-
Location of the training	81.8%	9.1%	9.1%	-	-	9.00	-
Time required to complete training	81.8%	-	18.2%	-	-	8.55	-
Variety of courses in training	72.7%	18.2%	9.1%	-	-	8.64	-
Difficulty of courses	27.3%	45.5%	9.1%	9.1%	-	7.40	9.1%
BOC instructors	72.7%	18.2%	9.1%	-	-	9.09	-
Application process	36.4%	54.5%	9.1%	-	-	8.09	-
Wait time to receive the rebate	45.5%	36.4%	-	-	-	8.44	18.2%
Service from the utility staff	63.6%	18.2%	-		-	9.00	18.2%
Overall program	72.7%	27.3%	-	-	-	8.91	-

Overall, participants reported high satisfaction levels for all program elements, most notably with the course instructors and the tuition rebate application process. Course instructors were also highly rated (9.09 average score), which suggests that the BOC Program uses well-qualified and effective training staff. Other elements also rated highly included the service from the utility staff (9.00), the location of the training (9.00), and the variety of courses in the training (8.64). All of the survey respondents were either satisfied or very satisfied with their overall BOC Program experience (8.91 mean score). There was only one reported instance of dissatisfaction with a single component of the program, the difficulty of courses. The respondent did not clarify why they were dissatisfied with the difficulty of the courses.

11.5.1.10 Participant Recommendations and Overall Impressions

Overall, the participant survey findings show overall satisfaction with the BOC program. A majority of course feedback has been positive, and many of the respondents have provided commentary that praises the BOC classes for their relevance, effectiveness, and structure. Most of the respondents who provided feedback for program incentives indicated that the financial support was valuable and influential in their decision to participate. Additionally, the majority of respondents cited that BOC courses have been particularly useful to them in their current employment and have been able to implement specific energy saving initiatives as a result of new information learned through BOC training. These results suggest that the BOC Program has been very well-received by participants, and that participant satisfaction is high. From the participant perspective,

there are very few issues or weaknesses in program structure or delivery that require attention.

11.5.2 BOC Course Instructors

11.5.2.1 Course Instructor Outcomes

The evaluators completed four interviews with instructors in the BOC program. The interviews were completed during November, and respondents were recruited from a list of program instructors provided by PNM. Interviews used a discussion guide addressing the following topics:

- Length of time instructors had been teaching in the program and the courses that were taught;
- Work experience as it relates to the BOC program;
- Evaluation of the current BOC program curriculum;
- Evaluation of current BOC program course content;
- Evaluation of facilities where BOC program courses are taught;
- Evaluation of BOC program student motivation to learn;
- Evaluation of BOC program administration; and
- Suggestions for changes and improvements.

In the following subsections, extensive verbatim quotations are used to illustrate key points. While the words are those of the respondents, the quotations have been edited for brevity and appropriateness and to make the quotations easier to read.

11.5.2.2 Length of Time Teaching and Number of Courses Taught

The instructors have taught in the BOC program between one and three years. During their time teaching, each instructor has taught a number of courses. All have taught the courses multiple times, and taught between 2 and 25 courses over the past three years. As a group, the individuals who were interviewed are experienced instructors.

11.5.2.3 Specific BOC Program Courses Taught

The interviewed instructors teach a range of courses, from benchmarking, controls, water efficiency and many others. Instructors reported that they often teach the same courses each year.

> *"I have covered all of the topics in Level 1 at some point."*
>
> *"Benchmarking, Controls Fundamentals, and 4 Low Cost Ops for Improvements."*
>
> *"Basic control course (Twice - BOC 104) and Advanced Controls."*

11.5.2.4 Related Work Experience

As a group, the interviewed instructors bring a great deal of related experience to the classes that they teach. This experience allows the instructors to present an appropriate "real world" perspective in the classes and provide practical examples of theoretical topics. When asked about their work experience as it related to the BOC courses, the respondents replied they had experience in:

> *"Energy modeling, benchmarking, analysis, Energy Star & LEED projects, and commissioning."*
>
> *"Residential & commercial energy auditing, envelope consulting including constructability reviews & quality assurance observations. The auditing provides direct experiential material for the courses...Weatherization workforce training that I do, while directed at residential construction, is relevant experience as regards teaching adults and also basic fundamentals of building science, envelope integrity, IEQ, small scale mechanical systems."*
>
> *"Structural design (single-family, multifamily, and light commercial), and energy auditing (single-family, multifamily, commercial and institutional)."*
>
> *"I am a mechanical engineer and worked as a research engineer for 10 years. And then worked as a facilities engineer for 25 years…Lots of experience in HVAC in buildings. I've done some energy efficiency work as well."*

11.5.2.5 Current Teaching and/or Work Outside of the BOC Program

Three out of the four instructors interviewed currently teach outside the BOC Program. Two of these instructors teach courses related to building operations. Three of four instructors do other works aside from teaching the BOC program.

11.5.2.6 Feedback on BOC Program Curriculum

In general, instructors feel that the BOC Program curriculum cover the necessary material and are valuable to program participants. Overall, the instructors believe the BOC program is good and the material is well-rounded. Others gave more detailed feedback regarding the increased use of visual materials, engaging activities, and more exercises as well as more focus on key areas for the Level 2 curriculum. More specifically, these respondents said:

> *"Teaching from curriculum developed by someone else can be a challenge in that the logic applied to the flow may not match one's own…I would prefer to see more images and less text on the slides. While that requires the instructor have it all in their head and not rely on the slides so much, it would make for more interesting visual material. I think they could*

all benefit from more exercises. I try to incorporate as much hands on as possible as it keeps students more engaged."

"For Level 1 we have selected optional courses that better fit our area and building operations. As a whole, the Level 1 curriculum is reasonably up-to-date and provides a good basis. Level 2 seems a little bit lacking in really helping to focus on key areas."

11.5.2.7 Appropriateness of Topics Covered by the Curriculum

All of interviewed instructors reported that the topics being taught are the "right" topics, although several explained that there is room for improvement with suggestions of keeping the references updated and the inclusion of more information on electrical systems.

"Some of the references should be updated, but the topics are good."

"Of the three that I've taught, I think they are very appropriate."

"The topic choices are good, except there could be more about electrical systems. There is a Level 1 curriculum for this topic, but it is generally replaced by other pertinent regional topics."

"Of the courses I taught, I thought it was very thorough in the topics it did cover."

None of the instructors thought the included course topics in the BOC curriculum were unnecessary.

11.5.2.8 Assessment of Course Materials

The experience and knowledge of the instructors enhance the course content, and instructors reported that they routinely use supplemental materials to enhance the given course materials. This provides a deeper learning experience for the students and tends to provide a more practical application of the information. Instructors noted that the materials that are provided, books and slides, cover the appropriate content.

As noted above, instructors explained that they often supplement the provided course materials with their own materials. This typically occurs when the instructor has specific knowledge and experience to offer, and the supplementary materials they choose to include are web links, props, local case studies and experiences, examples of diagnostic tools, and other visuals or images.

"In general the course materials are quite good. Some topics/technologies are moving quickly which means that the instructor must augment a little, but modification is limited or materials no longer sync."

"Props, examples of diagnostic tools, faucets etc. for water class. Additional images and examples where appropriate."

"Local case studies and experiences. Dependent upon topic, I will add in additional props and activities."

"On a couple of occasions, I have brought current info on important energy efficiency in building systems and other information from my own research."

11.5.2.9 Evaluation of Course Facilities

Instructors generally have no criticisms of the locations and facilities where the courses are taught. The BOC courses are taught at a community college, which the instructors agree is an ideal setting. All of the instructors said it was a good environment for teaching, the rooms are large enough and have adequate seating, and the appropriate teaching materials are available in the classrooms. Although one instructor had a problem with a noisy fan in the classroom, they later reported the problem to the college.

"In general, the locations have been good. Most have provided the opportunity to look at some of the examples in real-life."

"Facility was good. There was one problem with a fan system (noisy), and we couldn't turn the system off. They are aware of the problem."

"Very professional and great for the type of courses."

11.5.2.10 Student Readiness and Motivation

According to instructors, most of the students they teach have enough prior understanding and experience to benefit from the courses. The readiness of students to take the courses varies, as some have little experience while others have extensive experience in the specific field. All the instructors believe that their students are generally motivated to learn. Half of the instructors said that they had taught students who were not sufficiently challenged by the courses, but concluded that those who currently worked in a facility were able to apply the material as it related to their positions.

"For the most part, yes. Those that are currently working in a facility tend to have lots of examples, participate in the courses, ask questions, and I think benefit from them. I had one series with a group, none of whom were currently working in facilities and many of them never had. This group was more challenging. Being able to readily apply the material and relate it to current situation is pretty important."

"I think that was particularly the case. I was really impressed by the students. They were very eager to learn. They were very interested in the information and well-chosen. Very knowledgeable."

"In general, yes. Only a few times has there been a student who was not prepared for the course."

11.5.2.11 Program Administration

Instructors reported that the program is very well administered from their perspective and receive sufficient support from staff members.

11.5.2.12 Satisfaction with the Program

Overall, none of the instructors had major dissatisfactions with any area of the program. One instructor reported a minor dissatisfaction with regard to course materials. This instructor noted that the program could benefit from a change in formatting of the slideshows in terms of the flow of information.

"…The format of the slide shows can be difficult and not as straightforward as I would arrange it."

11.5.2.13 Suggestions for Improvement

Instructors suggested several areas for minor improvements or changes. These suggestions included online testing, soliciting revisions to the slide shows, and including information on the effectiveness of energy efficiency equipment in older buildings.

"Online test taking for a more stringent environment."

"Solicit revisions to the slide shows from those in the field. While we might all have different approaches to the content, we have all taught from it. Some of the slide shows feel like they were developed in an office and not put to the test."

"Older buildings and whether EE equipment is effective and/or the renewable systems are effective."

Finally, instructors were asked for feedback on any other aspect of the BOC program. All the instructors said that the BOC program was a good program and that it helps boost the local industry as well as help educate local facility managers.

11.5.2.14 Conclusions and Recommendations

According to instructors, the BOC Program seems to be working well and is able to provide students with the knowledge they need to serve as building/facility operators. Instructors have no major dissatisfactions with the program and thus no major suggestions for improvements or changes. Administrators provide the needed support,

materials are appropriate both in content and level of difficulty, and the instructors are an experienced and engaged group.

The following suggestions for improvement and changes may be considered:

- Solicit instructor feedback and suggestions on course materials which includes up-to-date information, case studies and local examples, visual formatting of slides, and other information.
- Periodically review the current curriculum, using a panel of building operators or experienced professionals, to ensure that all necessary topics are included, that any unnecessary topics are removed, and that the curriculum remains fresh, relevant, and up-to-date.

11.6 Distributor Discount Program

The Evaluators reviewed multiple midstream programs to assess how Public Service Company of New Mexico's (PNM) Distributor Discount Program (DDP) compared in terms of available measures, program design, and incentives. This comparison is intended to provide context as to whether the PNM's DPP aligns with regional practices in terms of those program components. The programs used in this comparison are all in several phases of implementation (e.g., from pilot to comprehensive phase), and this review does not take program scale (e.g., number of participants, etc.) into consideration, rather only the program structure (e.g., incentive levels).

Table 11-49 below provides a summary of the programs reviewed. In all, 13 other midstream programs were reviewed, and due to the small number of HVAC-specific programs identified, the search was expanded to include programs designed for a variety of end-uses. For instance, PNM's DDP offers incentives on several HVAC measures to distributors, which are passed on through to the non-residential customer. However, the Evaluators also research midstream programs that incentivize lighting, kitchen equipment or IT-related measures. Most of these programs passed on a discount to the customer, but some split the incentive between the customer and the distributor or added alternative incentives, such as training.

11.6.1.1 Measure Selection Comparison

The eligible measures offered by the PNM's DPP are very much in-line with other program offerings from around the county, which emphasizes packaged terminal air conditioners (PTAC), packaged terminal heat pumps (PTHP), packaged and split system AC units, and packaged and split system heat pumps.

The most significant observed difference for the DPP is the level of transparency around which measures are offered, and what their associate incentive levels are. Only one other of the 13 electric HVAC midstream programs reviewed published both the full list

of measures, along with their associated incentive levels. This was National Grid's Upstream HVAC Program, which however, does not seem to have a program-specific webpage. The information is found when you search their website, and then click on a PDF link provided in the brief program description.[23] Two other programs, such as Duke Energy's Smart $aver Program, listed neither the specific measures nor their incentive levels, but instead listed the end-use types and statements such as, "get up to 50% off energy-efficient products – directly from your distributor."[24] CenterPoint's A/C Distributor Program[25] published a high-level of HVAC measures available, but no indication of what the incentives for the program are.

The lighting midstream programs were much more likely to publish both the measures and the incentive levels, with five of the eight listing both, and one additional program that stated, "20% off of […] commercial lighting."[26] However, the discount outlined was found on the participation agreement link on the program's webpage, rather than stated directly on the webpage for the Energy Efficiency Dealer Network Program[27] itself.

The PNM's DPP program webpage lists the measures for the DPP very clearly and presented directly on the landing page. The level of transparency allows for easier participation, which may be why this program has been so successful in terms of both participation levels and savings claimed.

11.6.1.2 Incentive Level Comparison

PNM's DPP targets incentives of $40 per ton for each HVAC unit purchased from the distributor, with a $20 per ton bonus on unitary and split air conditioning systems and air source heat pumps. The bonus is based on 1.0 efficiency improvement over minimum qualifying SEER/IEER levels. There were very few other programs to compare these incentives to. The only other non-residential midstream electric HVAC program that published incentives for each measure listed was the National Grid's Upstream HVAC Program.

[23] National Grid's Upstream HVAC Program measure and incentive PDF: https://www.nationalgridus.com/media/pdfs/bus-ways-to-save/ee6167_upstreamhvac_10_15.pdf

[24] Duke Energy's Smart $aver Program website: https://www.duke-energy.com/kentucky-business/energy-management/midstream.asp

[25] CenterPoint's A/C Distributor Program webpage: http://www.centerpointenergy.com/en-us/residential/save-energy-money/electric-efficiency-programs/a-c-distributor-program?sa=HO

[26] Alliant Energy's Energy Efficiency Dealer Network participation agreement: http://www.alliantenergy.com/SaveEnergyAndMoney/ForDealers/ParticipationGuidelines/index.htm

[27] Alliant Energy's Energy Efficiency Dealer Network Program webpage: http://www.alliantenergy.com/SaveEnergyAndMoney/ForDealers/

When comparing PNM's DPP to the incentive per ton for HVAC measures listed for the National Grid Upstream Program, the incentives were lower in the DPP. However, with the bonus for efficiency level, the incentives become closer in comparison as the efficiency level increases. The lower incentive levels could be for several reasons, such as the maturity of energy efficiency programs in the Northeast or cost of living differences between New Mexico and Rhode Island.

11.6.1.3 Program Delivery Comparison

The midstream approach provides through distribution channels, which are most often a direct pass-through to the customer purchasing the unit, and are based on the size of the unit or level of efficiency. However, in some cases, these are combined with additional incentives directly to the distributor, which are intended to encourage them to exceed the average efficiency level sold or possibly to exceed the number of units initially agreed upon.

As described above, PNM's DPP offers a bonus incentive to the customer for increased levels of efficiency, but not to the distributor. For some of the programs reviewed it was unclear as to who the received the incentive, or whether portions of the incentive were split and provided to both the customer and the distributor. For instance, the CenterPoint A/C Distributor Program did not clearly indicate whether the incentives were provided in full to the customer. Also, in Alliant Energy's Energy Efficiency Dealer Network Program it lists an additional incentive to distributors that provide training and participate in trade shows. Alliant Energy will reimburse the distributor up to 50% of costs associated with those activities, as long as those funds are available. This additional incentive may be necessary to encourage participation in that program. PNM requires distributors to pass on at least 40% of the incentive to the customer, but this fact is not specified on the program website.

Table 11-49 Distributor Discount Program - Regional Benchmarks

Program	State	Sponsor	Program Type	Measures offered	Incentive levels
Distributor Discount Program	NM	Public Service Company of New Mexico (PNM)	HVAC; with other measures being added soon.	Packaged terminal air conditioners (PTAC), packaged terminal HP (PTHP), packaged and split system AC units, and packaged and split system HP	*PTAC and PTHP; $40/ton *Unitary and split system AC systems and air source HPs; $40/ton, with a $20/ton efficiency bonus (based on 1.0 efficiency improvement over minimum qualifying SEER/IEER)

C&I Upstream HVAC/HP Program	MA	MassSaves (Cape Light Compact, National Grid, Unitil)	HVAC	AC Systems: Air Cooled Unitary & Split (new condenser and new coil) Water & Evaporatively Cooled HP Systems: Air cooled Water source Ground water Ground loop Other: Control and fan motor options	Not found on website. Note: the link on the website states that the incentive levels are available, but are not there once you follow the path to the PDF.
Upstream HVAC Eligible Product List and Incentives	RI	National Grid	HVAC	AC Systems: Air Cooled Unitary & Split (new condenser and new coil) Water & Evaporatively Cooled HP Systems: Air cooled Water source Ground water Ground loop Other: Control and fan motor options (when installed with new HVAC equip.) Note: there is no program-specific webpage, there is a link to a PDF.	Unitary HP systems (air cooled) < 5.4 (split); Tier 1 $70/ton; Tier 2 $125/ton < 5.4 (packaged); Tier 1 $70/ton; Tier 2 $125/ton ≥ 5.4 to < 11.25; Tier 1 $50/ton; Tier 2 $80/ton ≥ 11.25 to < 20; Tier 1 $50/ton; Tier 2 $80/ton ≥ 20 to < 63; Tier 1 $30/ton; Tier 2 $50/ton ≥ 63; Tier 1 $30/ton; Tier 2 $50/ton Unitary HP (water source); $80/ton Groundwater – water source HP(open & closed loop); $150/ton Control and fan motor options (when applicable) Dual Enthalpy Economizer; $250 Demand Control Ventilation; $200 ECM Fan; $1500 Note: needs to meet or exceed the min SEER/EER/IEER requirements.
A/C Distributor Program	TX	CenterPoint Energy	HVAC	HVAC measures: *1.5 ton to 5 ton systems (No NC) *AHRI-matched systems that meet or exceed 16 SEER/12 EER (plus 8.6 HSPF for HP)	Not listed
Smart Ideas® Energy Efficiency Program Business Products Discounts	IL	ComEd	Battery chargers and NEMA Premium transformers	3 Phase, high frequency battery chargers Single or 3 phase NEMA Premium electrical transformers Note: this information is not directly on the webpage for the program.	*Battery chargers; $184/charger *Dry-type transformers; incentive scales per kVa; 15 to 750 kVa with incentives of $63 to $750 per transformer
Cogged V-Belt Pilot Program	OH	Dayton Power AEP Ohio & Light and MEEA	Cogged V-belts for HVAC	Not listed	Not listed

Energy Efficiency Dealer Network	WI & IA	Alliant Energy	EE product MTP and offers incentives on measures and additional MT activity	Measures: Geothermal and water heaters, agricultural equipment, heating and cooling equipment, programmable thermostat and ducts, commercial food service equipment, commercial lighting, and equipment financed through Other: Trade show assistance and training reimbursement Note: this information was not directly on the webpage for the program.	For qualifying measures which are not listed: *10% incentive on geothermal & water heaters. *20% incentive for ag. Equipment, heating & cooling equip., prog. T-stat & ducts, food service equip., lighting, & equip. financed through IPL's Low Interest Financing Program. *Up to 50% off trade show assistance and training reimbursement Note: did not provide a specific list of measures or their associated incentive level.
Distributor LED Replacement Lamps Program	CA	Pacific Gas and Electric (PG&E) Company	Lighting	LED Accent, surface, pendant, track and recessed downlight fixtures, excluding screw-in or pin-based LED lamps Note: this information is not listed directly on the webpage for the program, but found in a lighting catalog link.	*≥25 to 18 watt LED fixture; $30/fixture *12 to 17 watt LED fixture; $25/fixture *11 to 9 watt LED fixture; $20/fixture *7 to 8 watt LED fixture; $15/fixture
C&I Bright Opportunities Lighting Program	MA	MassSaves (National Grid, Cape Light Compact & Eversource)	Lighting	Linear Fluorescent Lamps (LFL), LED lamps and LED fixtures Note: this information was not found directly on the webpage for the program, but through a link to the measure list and incentive levels.	Linear Fluorescent Lamps (LFL); $2/fixture PAR20/BR20; $10/fixture PAR30/BR30; $20/fixture PAR38/BR40; $25/fixture A-line, 40/60W equivalent; $10/fixture A-line, 75/100W equivalent; $15/fixture Decorative Lamps; $5/fixture TLED, 4ft and 2ft Instant Fit lamps; $5/fixture MR16/PAR16/GU10; $10/fixture G24 LED – 2pin & 4-pin; $19/fixture LED Downlight Kit, <25W; $25/fixture LED Downlight Kit, >25W; $30/fixture 4' LED Stairwell Kit w/sensor, <55W; $100/fixture 2' LED Stairwell Kit w/sensor, <55W; $75/fixture

CLIP Program	WV	Appalachian Power	Lighting	CFL, LED, & LED retrofit kits	$1.50/lamp CFL bulb (twist, general replacement) $2.00/lamp CFL bulb (dimmable, reflector product, etc.) $6.00/lamp A19, A21 shaped LED bulb or Candie shaped LED bulb $8.00/lamp on any reflector LED products (BR30, PAR30, PAR38, PAR20, etc.) $10.00/lamp on any downlight LED retrofit kit
Lighting to Go Program	WA	Snohomish County Public Utility District (SNOPUD)	Lighting	LED & LED retrofit kits	LED Decorative lamps; $5 LED Omni-directional (A-lamp); $5 LED MR16; $15 LED Directional PAR20; $20 LED Directional PAR30; $15 LED Directions PAR38, PAR40; $20 LED T8; $6 LED Recessed can retrofit kit; $25 LED Exterior Wall Pack: 1-34W; $75 LED Exterior Wall Pack: 35-99W; $150 LED Exterior Wall Pack: ≥100W; $225
Instant Savings for Business Program	MD	Southern Maryland Electric Cooperative (SMECO)	Lighting	Linear Fluorescent Lamps (LFL), LED lamps, LED fixtures, and LED trim kits Note: this information was found directly on the webpage for the program.	$2 off reduced wattage fluorescent lamps (T8) $2 off reduced wattage fluorescent lamps (T5/T5 HO) $6 off LED A19 lamps $8 off LED A21 lamps $6 off LED Candelabra and Globes $7 off LED integral replacement lamps (BR 20/30/40) $7 off LED integral replacement lamps (R 20/30/40) $8 off LED MR16 lamps $9 off LED PAR20 $11 off LED PAR30/38 lamps $15 off LED recessed small trim kits (less than 8") - standard output $30 off LED recessed small trim kits (less than 8") - high output $30 off LED recessed large trim kits

Smart $aver Incentive Program - Midstream Channel	KY	Duke Energy	Lighting, food service, HVAC & IT-related measures	Not listed	Not listed. Note: The website states the following, "get up to 50% off energy-efficient products – directly from your distributor."
Online Energy Store	PA	Philadelphia Electric Company (PECO)	Online store	Lighting, controls, thermostats, water-related, weatherization and other found through the online store.	Note: the PECO webpage links directly to a store with the measures and their prices, and if you are a PECO customer a 20% discount is applied at checkout.

11.6.2 Vendor Response

Distributors were asked a series of questions about their businesses. When asked how they describe their business, two distributors identified their business as an independent manufacturer's representative, one stated their business was an independent HVAC equipment distributor, and one stated they were a manufacturer.

All four distributors surveyed stated that they were more of a distributor than an installer, and only one of the four distributors surveyed stated that their company performs HVAC installations as well as sell HVAC equipment.

As seen in Table 11-50, distributors involved in the program distribute HVAC equipment across the state of New Mexico, with all distributors surveyed working in the greater Albuquerque area.

Table 11-50 Distribution Area

	Response	***(n=4)***	***Percent of Respondents***
What is your HVAC distribution area within New Mexico?	Greater Albuquerque Area	4	100%
	Santa Fe	3	75%
	Roswell	3	75%
	Las Cruces	2	50%
	Farmington	3	75%
	Gallup	3	75%
	Hobbs	2	50%
	Clovis	2	50%
	Deming	2	50%
	Silver City	3	75%

11.6.2.1 Marketing and Product Offerings

Three of four vendors interviewed stated that energy efficient HVAC equipment is a focus of marketing efforts or product offerings. Two of these distributors stated that they promote energy efficient HVAC equipment through direct contact with customers, and one stated that they focus on the efficiency rating and program incentives to sell these products to customers. When asked to rate the importance of HVAC equipment sales to their marketing efforts, the three distributors rated it with an average score of 7.7. This indicates that for these distributors, HVAC equipment has a significant impact on their marketing efforts, and changes the way that they market their products.

The one distributor that stated that they do not focus on energy efficient products in their marketing efforts stated that they do upsell higher efficient units or product lines at least some of the time. All distributors stated that they typically discussed the distributor discount program with customers.

All distributors reported that they carry at least one, but fewer than five manufacturers of equipment that qualify for the distributor discount program.

11.6.2.2 Interactions with Customers

All four distributors stated that they check to ensure that the customer is within the PNM service territory before selling products to them through the program.

When asked how quickly a customer typically receives an item from the distributor, three of four distributors stated that if the product is in stock, a customer typically receives it either immediately or within one to two days. One distributor stated that this was not applicable because they only sell custom equipment.

When an item is out of stock, or custom made in the case of one distributor, the time a customer typically receives the product for half of the distributors is 2-4 weeks, and half is 31-60 days.

11.6.2.3 Effect of Program on Business

When asked if the stock of high efficiency units has changed since signing up for the program, half of participants stated that their stock had stayed the same, one stated that it had increased approximately 15%, and one stated that the question was not applicable to their business model.

All four distributors stated that the program rebate influenced their company's sales of energy efficient equipment. When asked how important the program rebate was on the decision on what to stock at their locations, half rated it as neither influential nor uninfluential, one rated it as not at all influential, and one refused.

11.6.2.4 Experience with other Programs

Distributors were asked whether they had been involved in the Retrofit Rebates program prior to working with the Distributor Discount Program. The Retrofit Rebates Program provided commercial and industrial customers with custom and standard rebates for a range of energy efficient equipment.

One distributor had worked with the Retrofit Rebates Program before becoming involved in the Distributor Discount Program. This distributor stated that they think the Distributor Discount Program is better implemented because the Retrofit Rebates Program was more complicated to work with, and the Distributor Discount Program is much more straightforward.

11.6.2.5 Distributor Satisfaction with Program

Distributors were asked to rate their satisfaction on various components of the program using a scale of 0-5, with 5 meaning “very satisfied” and 0 meaning “not at all satisfied”. Their responses are summarized in Table 11-51.

Table 11-51 Distributor Satisfaction with Program

Component	***Mean Score (n=4)***
Application process to sign up for the program	4.25
Application process to receive a rebate	4.5
Customer service from program staff	4.25
Rebate amounts	3.5
Range of equipment covered by the program	3.0
Overall program experience	3.5

Distributors were generally satisfied with the program, however there were several program elements that they generally scored more neutrally. Distributors were most satisfied with the application process both to receive the rebate and to sign up for the program. They were also generally satisfied with the customer service they received from program staff, although one distributor stated that there were long waiting periods to receive feedback from staff.

Distributors rated the range of equipment covered by the program neutrally, as neither satisfied nor dissatisfied. Distributors were asked why they gave this score. Two distributors stated that they would like a wider range of equipment to qualify for the program. One distributor stated that although most of the products they have submitted have been approved for the rebate, they would like more options other than rooftop HVAC units. When asked to give examples of additional equipment covered under the

program, distributors listed Variable Refrigerant Flow systems and Chiller units as two categories they would like the program expanded to include.

The rebate amounts and the overall program experience were rated slightly positively by distributors, with the average of both being 3.5. One distributor stated that the rebate amounts for some equipment was too low to change the minds of customers to purchase energy efficient HVAC equipment.

None of the four distributors had issues with the distributor participation agreement when signing up for the program. This indicates a general level of satisfaction with signing up for the program, and operating under the program with some room for improvement.

11.7 Conclusions & Recommendations

Based on the EM&V effort of the 2015 CCP, the Evaluator's conclusions and recommendations are as follows:

11.7.1 Conclusions

1. **The CCP has very high participant satisfaction.** Program participants responded very positively when asked to rate their satisfaction with various components of the program. Satisfaction was high for all metrics, including incentive amounts, service provided by PNM staff, DNV-GL staff, and Trade Allies, ease of application processes, and performance of equipment installed.
2. **The Building Tune-Up channel was not ready for evaluation.**
3. **Industrial retrofit projects displayed poor realization.** The Evaluators conducted M&V of industrial process retrofits at three separate plants. One plant is an ongoing program participant whom has proven to provide accurate engineering estimates on their process improvements. The other two relied more heavily on DNVGL calculations. The Evaluators found that in both of these projects, savings were severely overestimated as a result of a short metering period.
4. **Documentation for QuickSaver does not support Effective Useful Life calculations.** There are discrepancies in the data collected for Retrofit Rebates and New Construction compared against QuickSaver. QuickSaver provides much greater detail on the line items installed but does not present the measure lives.

11.7.2 Recommendations

Based on the EM&V findings, the Evaluator recommends the following:

1. **Use a minimum of two weeks of metered data for industrial projects.** Some industrial projects were metered for one week, and realization for these projects varied widely.
2. **Add measure lives to QuickSaver tracking.** The lifetime kWh field in the Retrofit Rebates and New Construction data is very useful in supporting EM&V; if possible, program staff should add a similar field to QuickSaver tracking.
3. **Verify that all savings are reported.** The Evaluators found numerous instances where tracking data for custom projects failed to show a claimed kW or lifetime kWh value. These values were filled in based on EULs from other similar projects.
4. **Conduct periodic review of BOC materials.** Solicit instructor feedback and suggestions on course materials which includes up-to-date information, case studies and local examples, visual formatting of slides, and other information. Periodically review the current curriculum, using a panel of building operators or experienced professionals, to ensure that all necessary topics are included, that any unnecessary topics are removed, and that the curriculum remains fresh, relevant, and up-to-date.

12. Large Commercial & Industrial Self Direct

Customers with annual use exceeding seven million kWh may receive credits for qualifying incremental expenditures made towards energy efficiency improvements at their facilities. These credits may be used to offset up to 70.0% of the energy efficiency tariff rider.

In accordance with 13-00310-UT Final Rule, the Evaluators must review all Self Direct projects.

12.1 M&V Summary

In 2015, there were three Self Direct projects. The projects were as follows:

- **PNM2015-SD1:** This project was an interior lighting retrofit at an educational facility. This project included the installation of 30 250W LEDs replacing 450W high pressure sodium fixtures and replacement of T-12s and 150W incandescent lamps with LEDs. .
- **PNM2015-SD2:** This project was an interior lighting retrofit at an educational facility, with LEDs replacing a mix of incandescent and halogen lamps.
- **PNM2015-SD3:** This project was an interior lighting retrofit at an educational facility, with LEDs replacing a mix of incandescent and halogen lamps.

Savings for these two projects were developed via engineering studies completed by the Self Direct participants. The Evaluators reviewed these engineering studies and found them to be accurate in calculating project savings. The verified Self Direct savings are summarized in Table 12-1. Net-to-gross ratio for this program is 100%. Reports for Self-Direct projects are included in Appendix B.

Table 12-1 Self Direct Realization Summary

Project	*Expected kWh*	*Verified kWh*	*kWh Realization*	*Expected kW*	*Verified kW*	*kW Realization*
PNM2015-SD1	80,417	80,417	100.0%	14.6	14.6	100.0%
PNM2015-SD2	78,741	78,741	100.0%	14.3	14.3	100.0%
PNM2015-SD3	28,271	28,271	100.0%	5.1	5.1	100.0%
Total	187,429	187,429	100.0%	34.0	34.0	100.0%

13. Appendix A: Tables for PNM Annual Report

This section contains tables formatted for PNM's annual report submission.

Program	*Participants or Units*	*Annual Savings (kWh)*	*Annual Savings (kW)*	*Lifetime Savings (kWh)*	*Total Program Costs*
Residential Lighting	1,124,914	21,023,357	2,615.06	190,713,527	$2,510,018
Residential Comprehensive	13,609	9,408,687	3,795.47	85,308,694	$5,266,022
Low Income Easy Savings	7,199	1,334,119	92.87	20,943,292	$467,762
LI CFL & Refrigerator	3,648	245,377	38.17	3,397,407	$154,124
Student Efficiency Kits	5,810	790,741	87.15	8,540,003	$233,676
Home Energy Reports	55,000	9,131,923	1,035.40	9,131,923	$564,190
Multifamily	2	15,182	0	136,638	$384,039
Commercial Comprehensive	1,132	35,751,066	4,413.41	391,354,587	$7,049,168
Large Customer Self-Direct	3	187,429	34.00	2,811,435	$0
Power Saver	45,541	580,762	42,220.00	580,762	$5,578,276
Peak Saver	103	811,680	17,198.00	811,680	$1,666,340
Market Transformation	0	0	0	0	$405,220
Aggregate Portfolio	1,256,961	79,280,323	71,529.53	713,729,948	$24,278,835

Program	*Participants or Units*	*Participant Costs*	*Cost per kWh Saved*	*2015 Economic Benefits*	*Total Economic Benefits*
Residential Lighting	1,124,914	$2,196,957	$0.01	$1,027,287	$11,401,550
Residential Comprehensive	13,609	$237,728	$0.06	$694,531	$8,375,000
Low Income Easy Savings	7,199	$0	$0.02	$70,323	$728,125
LI CFL & Refrigerator	3,648	$0	$0.05	$15,216	$304,832
Student Efficiency Kits	5,810	$0	$0.03	$70,323	$728,125
Home Energy Reports	55,000	$0	$0.06	$422,358	$422,358
Multifamily	2	$2,733	$2.81	$572	$4,510
Commercial Comprehensive	1,132	$11,473,080	$0.02	$1,43,912	$23,425,195
Large Customer Self-Direct	3	$62,406	$0.00	$10,122	$187,225
Power Saver	45,541	$0	$9.61	$5,508,356	$5,508,356
Peak Saver	103	$0	$2.05	$2,265,441	$2,265,441
Market Transformation	0	$0	N/A	$0	$0
Aggregate Portfolio	1,256,961	$13,972,904	$0.03	$10,084,529	$53,350,717

14. Appendix B: Site Reports

This appendix contains the site reports completed in the EM&V of the Commercial Comprehensive Program.

14.1 Retrofit Rebates