Evaluation of 2014
Public Service Company of New Mexico
Energy Efficiency & Demand Response Portfolio

Submitted to:

New Mexico Energy Efficiency Evaluation Committee

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13. Appendix B: Site Reports

This appendix contains the site reports completed in the EM&V of the Commercial Comprehensive Program.

13.1 Retrofit Rebates

Project Number	PNM-11-00632
Program	Commercial Comprehensive
Component	Retrofit Rebates

Summary

The participant is a high tech manufacturing facility that received incentives from PNM for rebuilding (10) condenser water (CW) pumps and installing a 250HP pump motor on CW pump number 12. The evaluators verified the installation of measures and received 3 years of trend data which covers pre and post operating conditions. The evaluators used the facility trend data to calculate the savings. The overall gross kWh realization rate is 113%.

Measurement & Verification Effort

On site, the evaluators verified:

- Installation of pressure differential sensors and transmitters on the condenser water loop;
- Rebuild of (10) condenser water pumps; and
- Installation of 250HP pump motor on CW Pump #12.

The evaluators used facility kW and temperature trend data of the condenser water (CW) pumps, CW loop temperature setpoint, and outside wetbulb temperature. The facility has a total 11 condenser pumps, and during the monitoring period, 10 single-speed pumps were in operational while the one VFD pump was still going through troubleshooting. At any given time, at least 7 pumps are running to circulate the CW loop.

Pump 2, 4, and 8 were not running during the baseline monitoring period, but the evaluators assumed their operating conditions would be similar to other pumps since they have the identical pumps and motors. Pump 1, 3, 5, 6, 7, and 10 clearly showed a drop in power consumption, while Pump 9 showed an increase in power consumption.

Single Speed Pump Energy Consumption for Pre and Post Retrofit

Pump	% kW Pre Retrofit	% kW Post Retrofit
CWP-01	84.93	65.32
CWP-03	85.46	63.44
CWP-05	88.23	64.68
CWP-06	82.40	60.25
CWP-07	88.50	61.95
CWP-10	90.42	60.12
CWP-09	23.01	75.67

The evaluators developed the condenser water pump energy consumption based on trend data. Before the retrofit, the facility had a fixed 70.5°F condenser water temperature setpoint but after the retrofit, the facility implemented a condenser water temperature reset.

$$CWP\ kW_{Pre} = 21.819 \times WB + 95.539$$

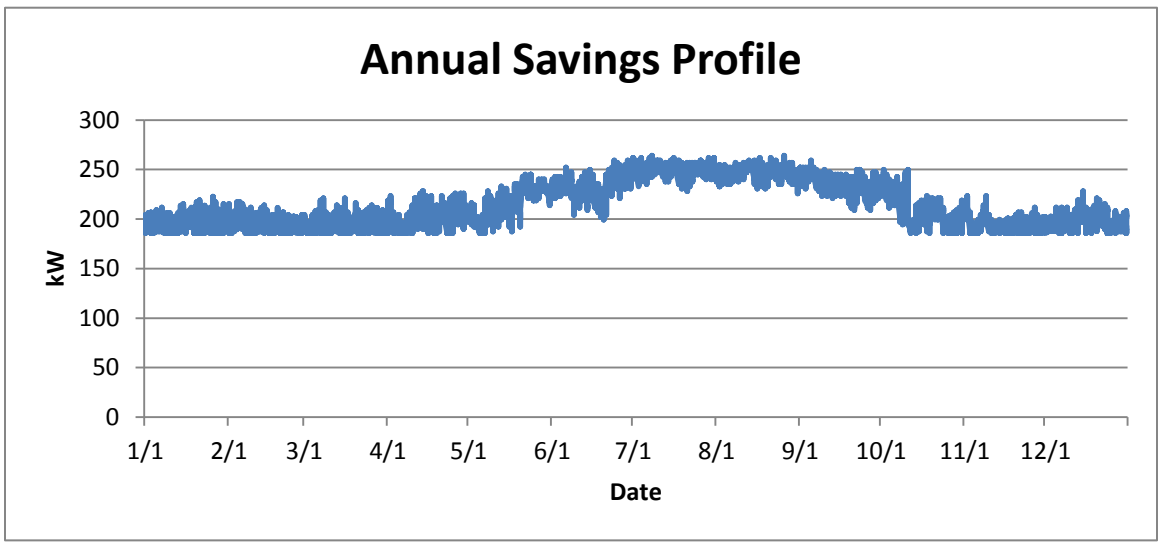
$$CWP\ kW_{Post} = -8.413 \times CW + 23.657 \times WB + 321.217$$

Where,

CW = Condenser Water Temperature, °F

WB = Outside Wet Bulb Temperature, °F

Annual Savings Profile



Results

Verified Gross Savings/Realization Rates

	kWh Savings			***kW Reduction***		
	Expected	***Realized***	***Realization Rate***	***Expected***	***Realized***	***Realization Rate***
CWP Rebuild	1,670,057	1,884,284	113%	191.00	252.42	132%
Total	1,670,057	1,884,284	113%	191.00	252.42	132%

The higher realization rate is mainly due to the number of pumps where were retrofitted. The evaluators verified 10 pumps were rebuilt and that they run at a lower power, while the ex ante analysis assumed only 5 pumps get retrofitted. Based on the facility trend data, the facility runs a minimum of 7 condenser water pumps and run as many as 10 condenser water pumps in the summer.

Project Number	PNM-12-01104
Program	Commercial Comprehensive
Component	Retrofit Rebates

Summary

The participant is a high tech manufacturing facility that received incentives from PNM to implement a condenser water temperature reset. The evaluators were able to verify the installation of the new building management system and the temperature reset strategy during M&V site visit. The evaluators used the facility trend data to calculate the savings. The overall gross kWh realization rate is 94%.

Measurement & Verification Effort

On site, the evaluators verified installation of:

- Installation of Trane Adaptiview and connection to Cimplicity Control System
- Implementation of Condenser Water Temperature Reset

The evaluators used facility kW and temperature trend data of cooling tower fans, chillers, chilled water (CHW) loop temperature setpoint, condenser water (CW) loop temperature setpoint, and outside wetbulb temperature. The evaluators developed the chiller plant and cooling tower energy consumption based on outside wetbulb temperature, CHW temperature, and CW temperature.

$$CT\ kW = -2.2181 \times CW + 11.9761 \times WB - 259.3639$$

$$Chiller\ kW = -594.8563 \times CHW + 61.9202 \times CW + 26{,}425.1844$$

Where,

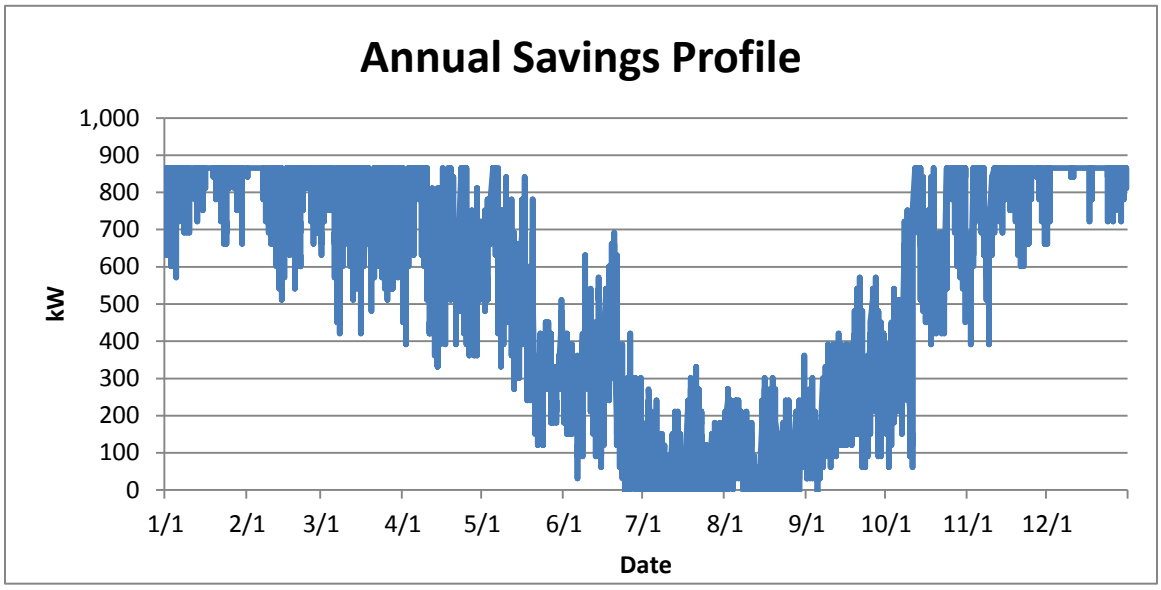
CW = Condenser Water Temperature, °F

CHW = Chilled Water Temperature, °F

WB = Outside Wet Bulb Temperature, °F

The evaluators received the detail CW temperature reset strategy; however, the strategy cannot be disclosed on this report.

Annual Savings Profile



Results

Verified Gross Savings/Realization Rates

Measure	kWh Savings			kW Reduction		
	Expected	Realized	Realization Rate	Expected	Realized	Realization Rate
CW Reset	4,966,208	4,657,872	94%	196.10	27.57	14%
Total	**4,966,208**	**4,657,872**	**94%**	**196.10**	**27.57**	**14%**

The primary savings come from the condenser water temperature reset. By lowering the condenser water loop during non-summer season, there are significant savings from cooling tower fans, pumps, and chillers. The realization rate for peak kW reduction is low because during the summer peak, condenser water temperature is similar to the baseline temperature setpoint which diminishes the savings.

Project Number	PNM-13-01206
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a primary school facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (21) Delamp 4’ 4-lamp T12 fixtures;
- (183) 4’ 3-lamp 28W T8 fixtures, replacing 4’ 4-lamp T12 fixtures;
- (36) 4’ 3-lamp 28W T8 fixtures, replacing 4’ 4-lamp T12 fixtures;
- (31) 4’ 3-lamp 28W T8 fixtures, replacing 4’ 4-lamp T12 fixtures;
- (18) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (20) 4’ 3-lamp 28W T8 fixtures, replacing 4’ 4-lamp T12 fixtures;
- (16) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (2) 4’ 3-lamp 28W T8 fixtures, replacing 4’ 4-lamp T12 fixtures;
- (9) 2’ 2-lamp T8 fixtures, replacing 2’ 2-lamp T12 fixtures;
- (2) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (137) 4’ 3-lamp 28W T8 fixtures, replacing 4’ 3-lamp T12 fixtures;
- (4) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (7) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (1) Delamp 2’ 2-lamp T12 fixture;
- (42) 2W LED Exit signs, replacing 20W Incandescent signs;
- (15) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (14) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (10) 210W LED fixtures, replacing 400W Metal Halide fixtures;
- (10) 31W LED fixtures, replacing 150W Metal Halide fixtures;
- (7) 36W LED fixtures, replacing 150W Metal Halide fixtures;
- (22) 12.6W LED fixtures, replacing 70W Metal Halide fixtures; and
- (6) 9.5W LED downlights fixtures, replacing 75W Incandescent fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF)

determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA ***DEER 2008 Building Type***	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Primary School	Classroom	2,445	2,660	1.295	1.393	0.42
	Dining Area	1,347	1,530	1.295	1.393	0.42
	Kitchen	1,669	1,846	1.295	1.393	0.42
Portable Classroom		2,445	2,608	1.295	1.344	0.42
Secondary School	Office	2,323	2,452	1.295	1.344	0.42
Small Office	Mechanical/Electrical Room	2,594	1,556	1.216	1.313	0.42

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kW_{post}	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW

PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating
HCDF	Heating Cooling Demand Interactive Factor

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
Delamp 4' 4L T12	21	0	188	-	2,445	0	10,533	12,500	1.295	118.7%
4' 4L T12 to 4' 3L T8 28W	183	183	188	76	2,445	1,712	54,681	78,107	1.295	142.8%
4' 4L T12 to 4' 3L T8 28W	36	36	188	76	2,445	1,712	10,757	15,365	1.295	142.8%
4' 3L T12ES to 4' 3L T8 28W	31	31	133	76	2,323	1,626	4,714	7,442	1.295	157.9%
4' 2L T12 to 4' 2L T8 28W	18	18	94	52	1,347	943	2,017	1,809	1.295	89.7%
4' 4L T12 to 4' 3L T8 28W	20	20	188	76	1,347	943	5,976	4,703	1.295	78.7%
4' 2L T12 to 4' 2L T8 28W	16	16	94	52	1,669	1,168	1,793	1,992	1.295	111.1%
4' 4L T12 to 4' 3L T8 28W	2	2	188	76	1,669	1,168	598	583	1.295	97.6%
2' 2L T12 20W to 2' 2L T8	9	9	50	33	2,445	1,712	408	767	1.295	187.9%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	2,323	1,626	224	347	1.295	154.8%
4' 3L T12ES to 4' 3L T8 28W	137	137	133	76	2,445	1,712	20,834	34,616	1.295	166.2%
4' 2L T12 to 4' 2L T8 28W	4	4	94	52	2,594	1,816	448	727	1.216	162.2%
4' 2L T12 to 4' 2L T8 28W	7	7	94	52	2,445	1,712	784	1,277	1.295	162.8%
Delamp 2' 2L T12 20W	1	0	50	-	2,445	0	133	158	1.295	118.4%
2L 20W Inc. Exit to 1L 2W LED Exit	42	42	40	6	8,760	8,760	14,884	16,200	1.295	108.8%
4' 2L T12 to 4' 2L T8 28W	15	15	94	52	2,445	2,445	1,681	1,995	1.295	118.7%
4' 2L T12 to 4' 2L T8 28W	14	14	94	52	2,445	2,445	1,569	1,862	1.295	118.7%
400W MH to 210W LED - Non-Int. Ballast	10	10	453	210	4,313	4,313	13,859	10,480	1.000	75.6%
150W MH to 31W LED - Non-Int. Ballast	10	10	183	31	4,313	4,313	8,669	6,555	1.000	75.6%
150W MH to 36W LED - Non-Int. Ballast	7	7	183	36	4,313	4,313	5,869	4,438	1.000	75.6%
70W MH to 12.6W LED - Non-Int. Ballast	22	22	91	13	4,313	4,313	9,837	7,439	1.000	75.6%

75W Inc. to 9.5W LED - Non-Int. Ballast	6	6	53	10	2,445	2,445	939	826	1.295	87.9%
						Total	**171,208**	**210,188**		**122.8%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
Delamp 4' 4L T12	21	0	188	-	0.42	0.42	3.31	2.31	1.393	69.9%
4' 4L T12 to 4' 3L T8 28W	183	183	188	76	0.42	0.27	17.16	14.84	1.393	86.5%
4' 4L T12 to 4' 3L T8 28W	36	36	188	76	0.42	0.27	3.38	2.82	1.344	83.5%
4' 3L T12ES to 4' 3L T8 28W	31	31	133	76	0.42	0.27	1.48	1.46	1.344	98.7%
4' 2L T12 to 4' 2L T8 28W	18	18	94	52	0.42	0.27	0.63	0.63	1.393	99.5%
4' 4L T12 to 4' 3L T8 28W	20	20	188	76	0.42	0.27	1.88	1.62	1.393	86.4%
4' 2L T12 to 4' 2L T8 28W	16	16	94	52	0.42	0.27	0.56	0.56	1.393	99.5%
4' 4L T12 to 4' 3L T8 28W	2	2	188	76	0.42	0.27	0.19	0.16	1.393	85.3%
2' 2L T12 20W to 2' 2L T8	9	9	50	33	0.42	0.27	0.13	0.15	1.393	117.1%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	0.42	0.27	0.07	0.07	1.344	99.5%
4' 3L T12ES to 4' 3L T8 28W	137	137	133	76	0.42	0.27	6.54	6.70	1.393	102.5%
4' 2L T12 to 4' 2L T8 28W	4	4	94	52	0.42	0.27	0.14	0.13	1.313	92.4%
4' 2L T12 to 4' 2L T8 28W	7	7	94	52	0.42	0.27	0.25	0.25	1.393	101.6%
Delamp 2' 2L T12 20W	1	0	50	-	0.42	0.42	0.04	0.03	1.393	71.7%
2L 20W Inc. Exit to 1L 2W LED Exit	42	42	40	6	1.00	1.00	1.06	1.99	1.393	187.7%
4' 2L T12 to 4' 2L T8 28W	15	15	94	52	0.42	0.42	0.53	0.37	1.393	70.2%
4' 2L T12 to 4' 2L T8 28W	14	14	94	52	0.42	0.42	0.49	0.34	1.393	69.1%
400W MH to 210W LED - Non-Int. Ballast	10	10	453	210	0.00	0.00	0.00	0.00	1.000	N/A
150W MH to 31W LED - Non-Int. Ballast	10	10	183	31	0.00	0.00	0.00	0.00	1.000	N/A

150W MH to 36W LED - Non-Int. Ballast	7	7	183	36	0.00	0.00	0.00	0.00	1.000	N/A
70W MH to 12.6W LED - Non-Int. Ballast	22	22	91	13	0.00	0.00	0.00	0.00	1.000	N/A
75W Inc. to 9.5W LED - Non-Int. Ballast	6	6	53	10	0.42	0.42	0.29	0.15	1.393	51.7%
						Total	**38.11**	**34.58**		**90.7%**

Results

The kWh realization rate for PNM-13-01206 is 122.8% and the kW realization rate is 90.7%. The kWh realization rate is high due to the ex post calculations using higher baseline hours of operation for the fixtures with occupancy sensors installed in the retrofit. The evaluators could not verify (107) 28W T8 lamps, 26 12.6W wallpacks, and seven 210W LED pole fixtures.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
Delamp 4' 4L T12	12,500	2.31	118.7%	69.9%
4' 4L T12 to 4' 3L T8 28W	78,107	14.84	142.8%	86.5%
4' 4L T12 to 4' 3L T8 28W	15,365	2.82	142.8%	83.5%
4' 3L T12ES to 4' 3L T8 28W	7,442	1.46	157.9%	98.7%
4' 2L T12 to 4' 2L T8 28W	1,809	0.63	89.7%	99.5%
4' 4L T12 to 4' 3L T8 28W	4,703	1.62	78.7%	86.4%
4' 2L T12 to 4' 2L T8 28W	1,992	0.56	111.1%	99.5%
4' 4L T12 to 4' 3L T8 28W	583	0.16	97.6%	85.3%
2' 2L T12 20W to 2' 2L T8	767	0.15	187.9%	117.1%
4' 2L T12 to 4' 2L T8 28W	347	0.07	154.8%	99.5%
4' 3L T12ES to 4' 3L T8 28W	34,616	6.70	166.2%	102.5%
4' 2L T12 to 4' 2L T8 28W	727	0.13	162.2%	92.4%
4' 2L T12 to 4' 2L T8 28W	1,277	0.25	162.8%	101.6%
Delamp 2' 2L T12 20W	158	0.03	118.4%	71.7%
2L 20W Inc. Exit to 1L 2W LED Exit	16,200	1.99	108.8%	187.7%
4' 2L T12 to 4' 2L T8 28W	1,995	0.37	118.7%	70.2%
4' 2L T12 to 4' 2L T8 28W	1,862	0.34	118.7%	69.1%
400W MH to 210W LED - Non-Int. Ballast	10,480	0.00	75.6%	N/A
150W MH to 31W LED - Non-Int. Ballast	6,555	0.00	75.6%	N/A
150W MH to 36W LED - Non-Int. Ballast	4,438	0.00	75.6%	N/A
70W MH to 12.6W LED -	7,439	0.00	75.6%	N/A

Non-Int. Ballast				
75W Inc. to 9.5W LED - Non-Int. Ballast	826	0.15	87.9%	51.7%
Total	**210,188**	**34.58**	**122.8%**	**90.7%**

Project Number	PNM-13-01315
Program	Commercial Comprehensive
Component	Retrofit Rebate

Project Background

The participant is a hotel facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (7) 1-lamp 3W LED exit signs, replacing (7) 2-lamp 50W incandescent exit signs;
- (88) 1-lamp 3W LED exit signs, replacing (88) 2-lamp 50W incandescent exit signs;
- (1) 2’ 2-lamp T8 fixture, replacing (1) 2’ 2-lamp T12 fixture;
- (2) 2’ 2-lamp T8 fixtures, replacing (2) 2-lamp T12 U-tube fixtures;
- (96) 2’ 3-lamp T8 fixtures, replacing (96) 2-lamp U-tube fixtures;
- (15) 2’ 3-lamp T8 fixtures, replacing (15) 2-lamp U-tube fixtures;
- (22) 4’ 1-lamp 25W T8 fixtures, replacing (22) 4’ 1-lamp T12 fixtures;
- (67) 4’ 1-lamp 25W T8 fixtures, replacing (67) 4’ 1-lamp T12 fixtures;
- (360) 4’ 1-lamp 25W T8 fixtures, replacing (360) 4’ 1-lamp T12 fixtures;
- (3) 4’ 1-lamp 25W T8 fixtures, replacing (3) 4’ 1-lamp T12 fixtures;
- (23) 4’ 1-lamp 25W T8 fixtures, replacing (23) 4’ 2-lamp T12 fixtures;
- (21) 4’ 1-lamp 25W T8 fixtures, replacing (21) 4’ 2-lamp T12 fixtures;
- (120) 4’ 2-lamp 25W T8 fixtures, replacing (120) 4’ 2-lamp T12 fixtures;
- (17) 4’ 2-lamp 25W T8 fixtures, replacing (17) 4’ 2-lamp T12 fixtures;
- (1) 4’ 2-lamp 25W T8 fixtures, replacing (1) 4’ 2-lamp T12 fixtures;
- (9) 4’ 2-lamp 25W T8 fixtures, replacing (9) 4’ 2-lamp T12 fixtures;
- (25) 4’ 2-lamp 25W T8 fixtures, replacing (25) 4’ 2-lamp T12 fixtures;
- (4) 4’ 2-lamp 25W T8 fixtures, replacing (4) 4’ 2-lamp T12 fixtures;
- (14) 4’ 2-lamp 25W T8 fixtures, replacing (14) 4’ 2-lamp T12 fixtures;
- (8) 4’ 2-lamp 25W T8 fixtures, replacing (8) 4’ 2-lamp T12 fixtures;
- (42) 4’ 2-lamp 25W T8 fixtures, replacing (42) 4’ 2-lamp T12 fixtures;
- (96) 3W LED lamps, replacing (96) 40W incandescent lamps;
- (3100) 3W LED lamps, replacing (3100) 40W incandescent lamps;
- (38) 7W LED lamps, replacing (38) 40W incandescent lamps;
- (42) 7W LED lamps, replacing (42) 40W incandescent lamps;
- (139) 15W LED lamps, replacing (139) 40W incandescent lamps;
- (160) 15W LED lamps, replacing (160) 65W incandescent lamps;
- (40) 15W LED lamps, replacing (40) 65W incandescent lamps;

The evaluator verified the participant had removed:

- (220) 4’ 1-lamp T12 fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Monitored data was used as follows:

- For fixture retrofits, metered hours of use were applied to baseline and post conditions in calculating savings

Lighting Retrofit Monitoring Strategy & Results

Space:	Logger Type	Quantity	Annual Hours	HCEF	HCDF	PCF
Hotel - Meeting Rooms	TOU Lighting Logger	1	1,173	1.372	1.399	0.20
Hotel - Restaurant	TOU Lighting Logger	1	826	1.372	1.399	0.18
Hotel – Bar, Cocktail Lounge	TOU Lighting Logger	1	7,919	1.372	1.399	0.86
Hotel - Housekeeping	TOU Lighting Logger	1	8,760	1.372	1.399	1.00
Hotel - Engineering	TOU Lighting Logger	1	1,040	1.372	1.399	0.14
Hotel - Ballroom	TOU Lighting Logger	2	1,520	1.372	1.399	0.30

Savings for the lighting measures were also calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	CA DEER 2008 Space Type	Annual Hours – Non-CFLs	Annual Hours – CFLs	HCEF	HCDF	PCF
Hotel	Corridor	7,884	5,913	1.372	1.566	0.90
	Office	3,317	3,006	1.372	1.566	0.71
	Laundry	4,154	3,586	1.372	1.566	0.79
	Dining Area	3,485	3,108	1.372	1.566	0.83

	Bar, Cocktail Lounge	3,820	3,275	1.372	1.566	0.83
	Kitchen	4,524	3,641	1.372	1.566	0.88
	Lobby	7,884	5,913	1.372	1.566	0.90
	Guest Room	799	799	1.372	1.566	0.11
Large Office	Mechanical/Electrical Room	2,692	1,647	1.216	1.313	0.81
	Restroom	2,594	3,957	1.216	1.313	0.81
Storage	Storage (Conditioned)	3,441	2,780	1.052	1.540	0.70
Exterior	Exterior	4,313	4,313	1.000	1.000	0.00

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
2L 50W Inc. Exit to 1L 3W LED Exit	7	7	100	3	8,760	8,760	7,111	8,161	1.372	114.8%
2L 50W Inc. Exit to 1L 3W LED Exit	88	88	100	3	8,760	8,760	89,394	102,592	1.372	114.8%
2' 2L T12 20W to 2' 2L T8	1	1	50	33	8,760	8,760	178	204	1.372	114.6%
2L T12 U-Tube to 2' 2L T8	2	2	72	33	8,760	8,760	817	937	1.372	114.7%
2L T12 U-Tube to 2' 3L T8	96	96	72	47	1,520	1,520	25,134	5,005	1.372	19.9%
2L T12 U-Tube to 2' 3L T8	15	15	72	47	1,173	1,173	3,927	604	1.372	15.4%
4' 1L T12 to 4' 1L T8 25W	22	22	47	24	8,760	8,760	5,299	6,081	1.372	114.8%
4' 1L T12 to 4' 1L T8 25W	67	67	47	24	4,313	4,313	15,175	6,646	1.000	43.8%
4' 1L T12 to 4' 1L T8 25W	360	360	47	24	1,173	1,173	86,713	13,325	1.372	15.4%
4' 1L T12 to 4' 1L T8 25W	3	3	47	24	2,692	2,692	723	226	1.216	31.3%
4' 2L T12 to 4' 1L T8 25W	23	23	94	24	8,760	8,760	16,861	19,350	1.372	114.8%
4' 2L T12 to 4' 1L T8 25W	21	21	94	24	1,040	1,040	15,395	1,859	1.216	12.1%
4' 2L T12 to 4' 2L T8 25W	120	120	94	46	8,760	8,760	60,322	69,228	1.372	114.8%
4' 2L T12 to 4' 2L T8 25W	37	37	94	46	7,884	7,884	18,599	19,211	1.372	103.3%
4' 2L T12 to 4' 2L T8 25W	19	19	94	46	3,485	3,485	9,551	4,361	1.372	45.7%
4' 2L T12 to 4' 2L T8 25W	129	129	94	46	4,524	4,524	64,846	38,433	1.372	59.3%
4' 2L T12 to 4' 2L T8 25W	17	17	94	46	4,154	4,154	8,546	4,651	1.372	54.4%
4' 2L T12 to 4' 2L T8 25W	1	1	94	46	8,760	8,760	503	577	1.372	114.8%
4' 2L T12 to 4' 2L T8 25W	9	9	94	46	3,317	3,317	4,524	1,966	1.372	43.5%
4' 2L T12 to 4' 2L T8 25W	25	25	94	46	3,317	3,317	12,567	5,461	1.372	43.5%
4' 2L T12 to 4' 2L T8 25W	4	4	94	46	2,692	2,692	2,011	629	1.216	31.3%
4' 2L T12 to 4' 2L T8 25W	14	14	94	46	8,760	8,760	7,038	7,158	1.216	101.7%
4' 2L T12 to 4' 2L T8 25W	8	8	94	46	3,441	3,441	4,021	1,390	1.052	34.6%

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 2L T12 to 4' 2L T8 25W	42	42	94	46	8,760	8,760	21,113	18,583	1.052	88.0%
40W Inc. to 3W LED - Int. Ballast	96	96	29	3	1,520	1,520	37,199	5,205	1.372	14.0%
40W Inc. to 3W LED - Int. Ballast	3100	3100	29	3	799	799	1,201,202	88,356	1.372	7.4%
40W Inc. to 7W LED - Int. Ballast	38	38	29	7	7,919	7,919	13,133	9,083	1.372	69.2%
40W Inc. to 7W LED - Int. Ballast	42	42	29	7	826	826	14,515	1,047	1.372	7.2%
40W Inc. to 15W LED - Int. Ballast	139	139	29	15	1,173	1,173	36,392	3,132	1.372	8.6%
65W Inc. to 15W LED - Int. Ballast	160	160	65	15	1,520	1,520	83,780	16,684	1.372	19.9%
65W Inc. to 15W LED - Int. Ballast	40	40	65	15	8,760	8,760	20,945	21,304	1.216	101.7%
Delamped 4' 1L T12	220	0	47	0	7,884	0	108,286	111,846	1.372	103.3%
						Total	**1,995,818**	**593,295**		**29.7%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
2L 50W Inc. Exit to 1L 3W LED Exit	7	7	100	3	1.00	1.00	0.86	1.06	1.566	123.4%
2L 50W Inc. Exit to 1L 3W LED Exit	88	88	100	3	1.00	1.00	10.80	13.37	1.566	123.8%
2' 2L T12 20W to 2' 2L T8	1	1	50	33	1.00	1.00	0.02	0.03	1.566	139.4%
2L T12 U-Tube to 2' 2L T8	2	2	72	33	1.00	1.00	0.10	0.12	1.566	121.6%
2L T12 U-Tube to 2' 3L T8	96	96	72	47	0.30	0.30	3.04	1.13	1.566	37.2%
2L T12 U-Tube to 2' 3L T8	15	15	72	47	0.20	0.20	0.47	0.12	1.566	25.3%
4' 1L T12 to 4' 1L T8 25W	22	22	47	24	1.00	1.00	0.64	0.79	1.566	123.4%
4' 1L T12 to 4' 1L T8 25W	67	67	47	24	0.00	0.00	1.83	0.00	1.000	0.0%
4' 1L T12 to 4' 1L T8 25W	360	360	47	24	0.20	0.20	10.48	2.59	1.566	24.7%
4' 1L T12 to 4' 1L T8 25W	3	3	47	24	0.81	0.81	0.09	0.07	1.303	80.2%
4' 2L T12 to 4' 1L T8 25W	23	23	94	24	1.00	1.00	2.04	2.52	1.566	123.7%

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 2L T12 to 4' 1L T8 25W	21	21	94	24	0.14	0.14	1.86	0.27	1.303	14.5%
4' 2L T12 to 4' 2L T8 25W	120	120	94	46	1.00	1.00	7.29	9.02	1.566	123.7%
4' 2L T12 to 4' 2L T8 25W	37	37	94	46	0.90	0.90	2.25	2.50	1.566	111.2%
4' 2L T12 to 4' 2L T8 25W	19	19	94	46	0.83	0.83	1.15	1.19	1.566	103.1%
4' 2L T12 to 4' 2L T8 25W	129	129	94	46	0.88	0.88	7.84	8.53	1.566	108.9%
4' 2L T12 to 4' 2L T8 25W	17	17	94	46	0.79	0.79	1.03	1.01	1.566	97.8%
4' 2L T12 to 4' 2L T8 25W	1	1	94	46	1.00	1.00	0.06	0.08	1.566	131.7%
4' 2L T12 to 4' 2L T8 25W	9	9	94	46	0.71	0.71	0.55	0.48	1.566	87.8%
4' 2L T12 to 4' 2L T8 25W	25	25	94	46	0.71	0.71	1.52	1.33	1.566	87.6%
4' 2L T12 to 4' 2L T8 25W	4	4	94	46	0.81	0.81	0.24	0.20	1.303	82.3%
4' 2L T12 to 4' 2L T8 25W	14	14	94	46	1.00	1.00	0.85	0.88	1.303	103.5%
4' 2L T12 to 4' 2L T8 25W	8	8	94	46	0.70	0.70	0.49	0.41	1.540	84.4%
4' 2L T12 to 4' 2L T8 25W	42	42	94	46	1.00	1.00	2.55	3.10	1.540	121.5%
40W Inc. to 3W LED - Int. Ballast	96	96	29	3	0.30	0.30	4.49	1.17	1.566	26.0%
40W Inc. to 3W LED - Int. Ballast	3100	3100	29	3	0.11	0.11	145.15	13.88	1.566	9.6%
40W Inc. to 7W LED - Int. Ballast	38	38	29	7	0.83	0.83	1.59	1.09	1.566	68.7%
40W Inc. to 7W LED - Int. Ballast	42	42	29	7	0.18	0.18	1.75	0.26	1.566	14.8%
40W Inc. to 15W LED - Int. Ballast	139	139	29	15	0.20	0.20	4.40	0.61	1.566	13.9%
65W Inc. to 15W LED - Int. Ballast	160	160	65	15	0.30	0.30	10.12	3.76	1.566	37.1%
65W Inc. to 15W LED - Int. Ballast	40	40	65	15	1.00	1.00	2.53	2.61	1.303	103.1%
Delamped 4' 1L T12	220	0	47	0	0.90	0.90	13.09	14.57	1.566	111.3%
						Total	**241.17**	**88.75**		**36.8%**

Results

The kWh realization rate for PNM-13-01315 is 29.7% and the kW realization rate is 36.8%. This facility is undergoing a multi-phase retrofit project and the evaluator was unable to verify some fixtures in the application. The hours of operation were determined by on-site monitoring for a representative sample of locations. The realization rate for kWh and kW is low mainly because the verified lighting hours of operation are lower than those used to perform the ex ante calculations. Ex post calculations followed EISA standards for incandescent lamps and contributed to the lower realization rate for kWh and kW.

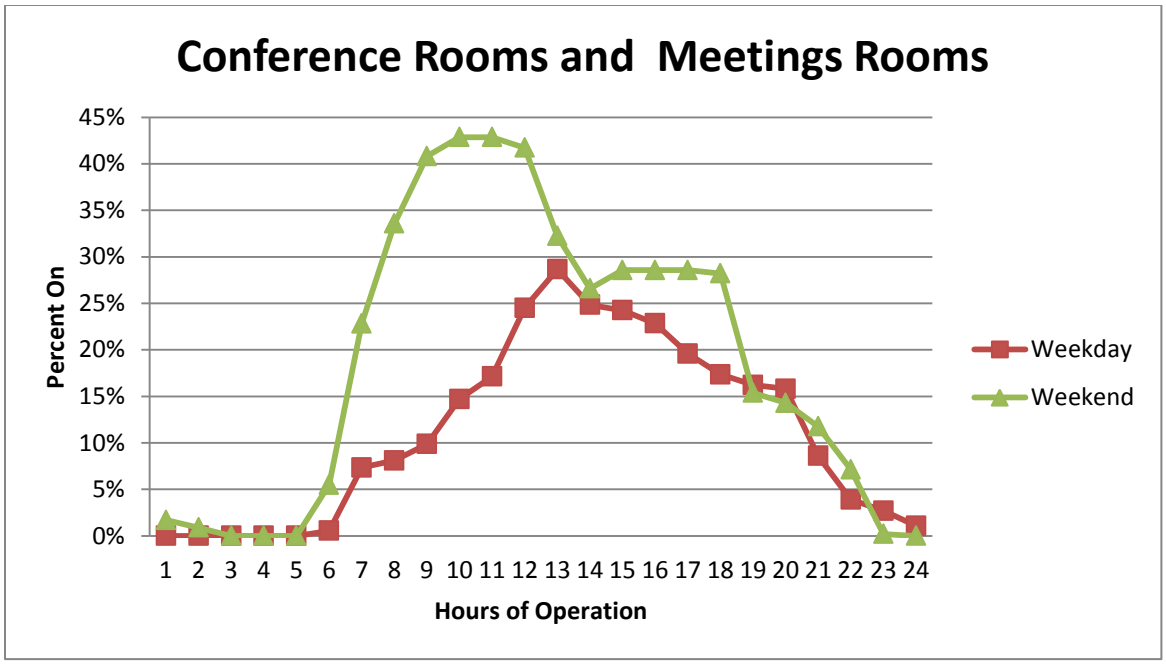
Verified Gross Savings & Realization Rates

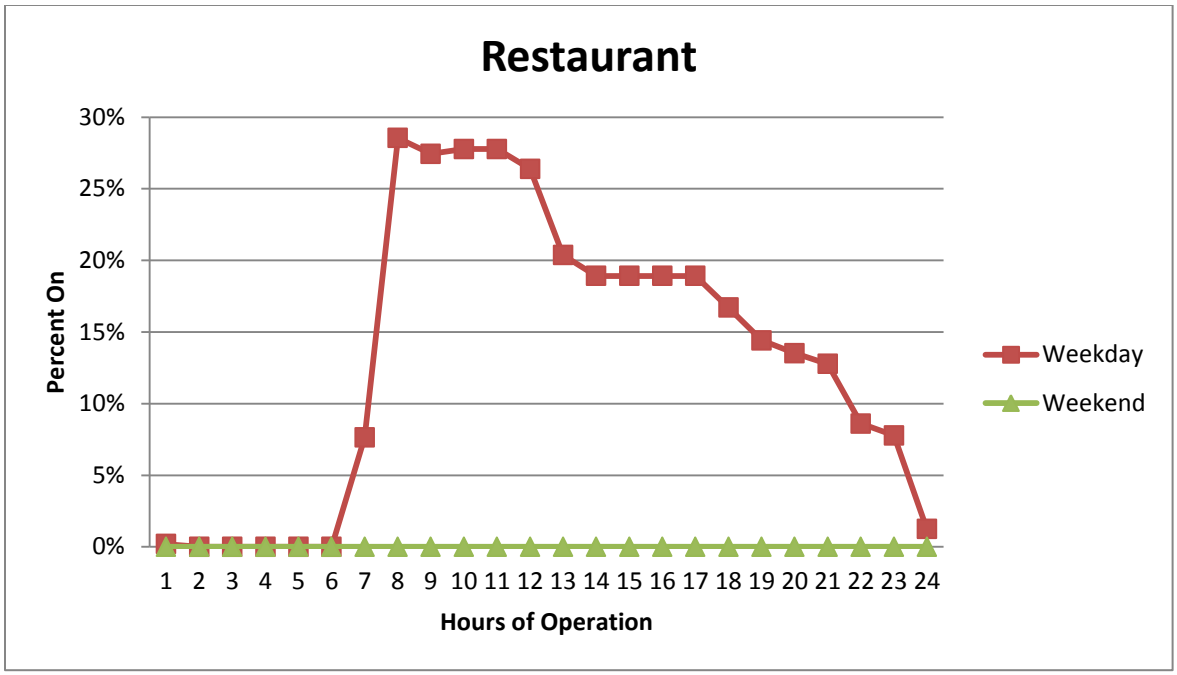
Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
2L 50W Inc. Exit to 1L 3W LED Exit	8,161	1.06	114.8%	123.4%
2L 50W Inc. Exit to 1L 3W LED Exit	102,592	13.37	114.8%	123.8%
2' 2L T12 20W to 2' 2L T8	204	0.03	114.6%	139.4%
2L T12 U-Tube to 2' 2L T8	937	0.12	114.7%	121.6%
2L T12 U-Tube to 2' 3L T8	5,005	1.13	19.9%	37.2%
2L T12 U-Tube to 2' 3L T8	604	0.12	15.4%	25.3%
4' 1L T12 to 4' 1L T8 25W	6,081	0.79	114.8%	123.4%
4' 1L T12 to 4' 1L T8 25W	6,646	0.00	43.8%	0.0%
4' 1L T12 to 4' 1L T8 25W	13,325	2.59	15.4%	24.7%
4' 1L T12 to 4' 1L T8 25W	226	0.07	31.3%	80.2%
4' 2L T12 to 4' 1L T8 25W	19,350	2.52	114.8%	123.7%
4' 2L T12 to 4' 1L T8 25W	1,859	0.27	12.1%	14.5%
4' 2L T12 to 4' 2L T8 25W	69,228	9.02	114.8%	123.7%
4' 2L T12 to 4' 2L T8 25W	19,211	2.50	103.3%	111.2%
4' 2L T12 to 4' 2L T8 25W	4,361	1.19	45.7%	103.1%
4' 2L T12 to 4' 2L T8 25W	38,433	8.53	59.3%	108.9%
4' 2L T12 to 4' 2L T8 25W	4,651	1.01	54.4%	97.8%
4' 2L T12 to 4' 2L T8 25W	577	0.08	114.8%	131.7%
4' 2L T12 to 4' 2L T8 25W	1,966	0.48	43.5%	87.8%
4' 2L T12 to 4' 2L T8 25W	5,461	1.33	43.5%	87.6%
4' 2L T12 to 4' 2L T8 25W	629	0.20	31.3%	82.3%
4' 2L T12 to 4' 2L T8 25W	7,158	0.88	101.7%	103.5%
4' 2L T12 to 4' 2L T8 25W	1,390	0.41	34.6%	84.4%
4' 2L T12 to 4' 2L T8 25W	18,583	3.10	88.0%	121.5%
40W Inc. to 3W LED - Int. Ballast	5,205	1.17	14.0%	26.0%
40W Inc. to 3W LED - Int. Ballast	88,356	13.88	7.4%	9.6%
40W Inc. to 7W LED - Int. Ballast	9,083	1.09	69.2%	68.7%

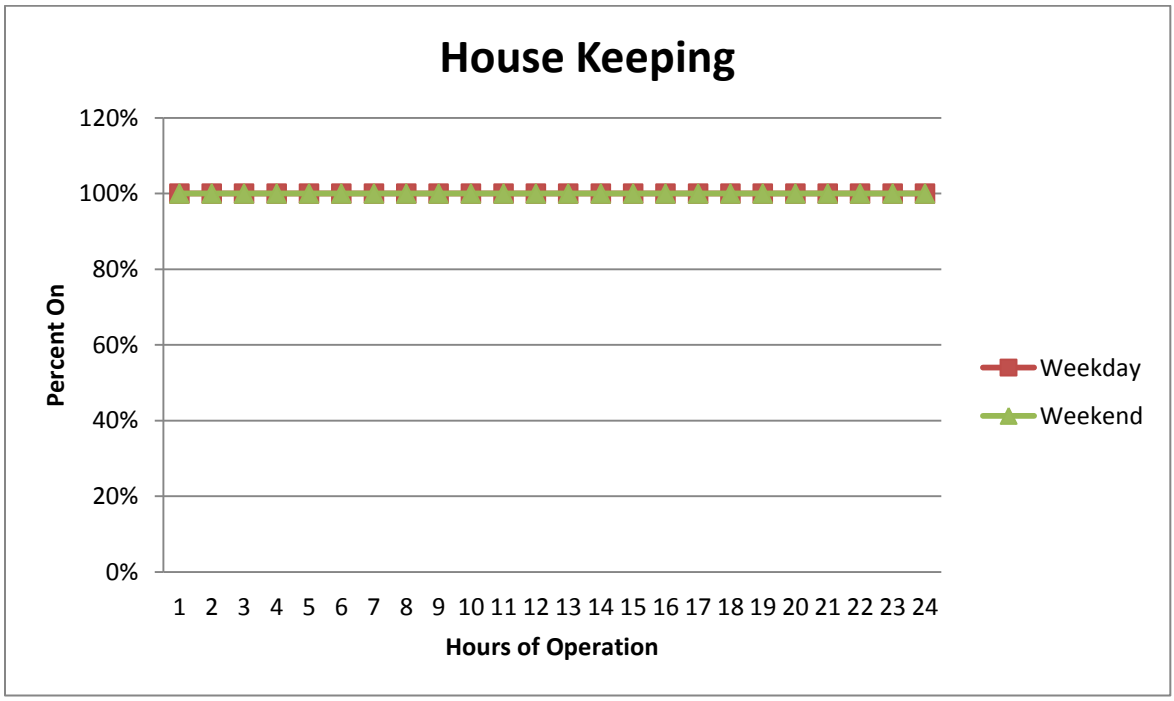
Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
40W Inc. to 7W LED - Int. Ballast	1,047	0.26	7.2%	14.8%
40W Inc. to 15W LED - Int. Ballast	3,132	0.61	8.6%	13.9%
65W Inc. to 15W LED - Int. Ballast	16,684	3.76	19.9%	37.1%
65W Inc. to 15W LED - Int. Ballast	21,304	2.61	101.7%	103.1%
Delamped 4' 1L T12	111,846	14.57	103.3%	111.3%
Total	**593,295**	**88.75**	**29.7%**	**36.8%**

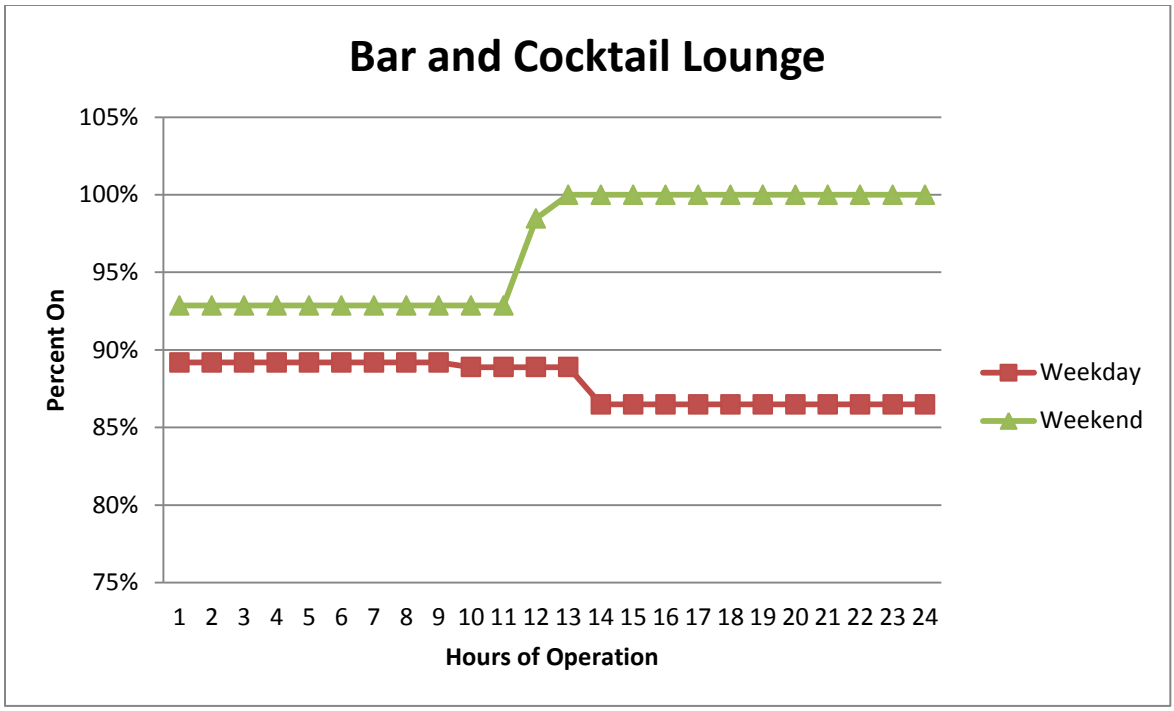
Appendix

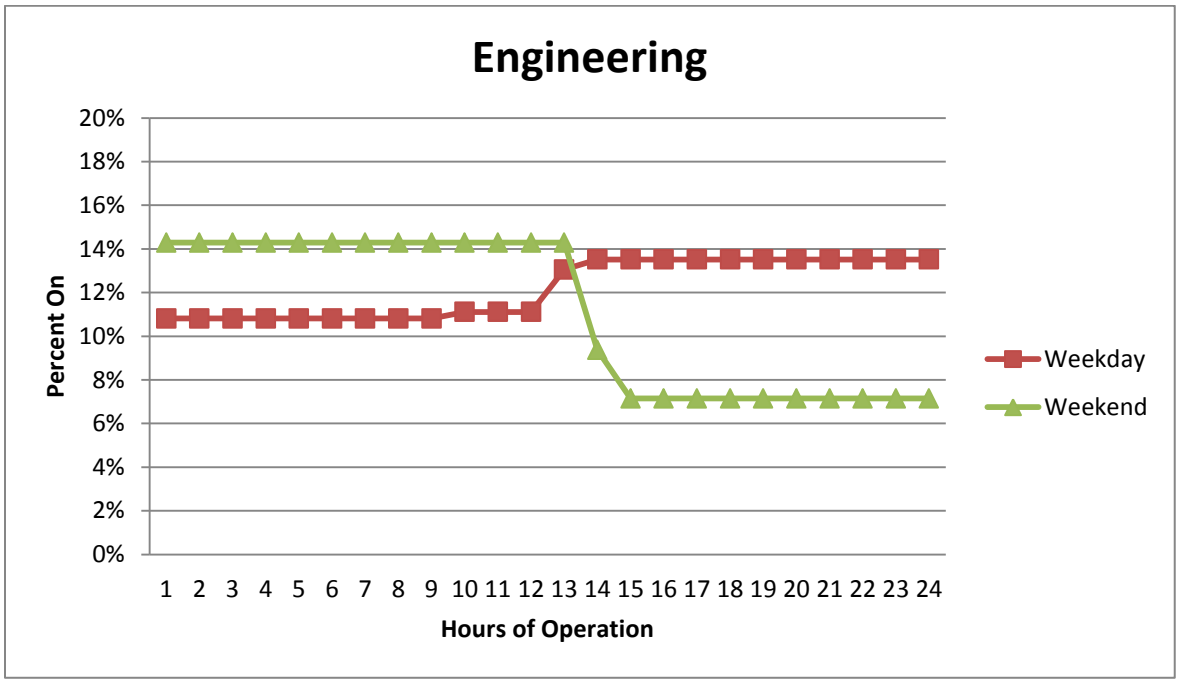
Hours of Use Charts

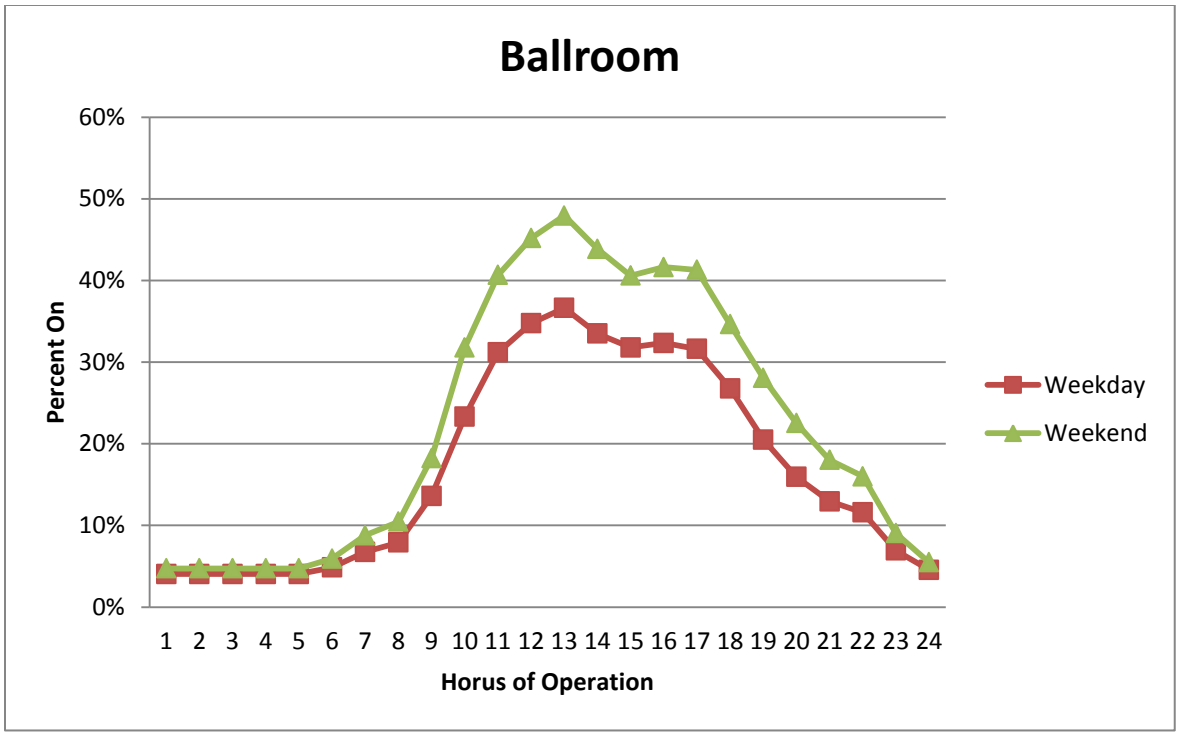



Restaurant
30%
25%
20%
15%
10%
5%
0%
Percent On
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours of Operation
Weekday
Weekend


House Keeping
120%
100%
80%
60%
40%
20%
0%
Percent On
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours of Operation
Weekday
Weekend


Bar and Cocktail Lounge
105%
100%
95%
90%
85%
80%
75%
Percent On
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours of Operation
Weekday
Weekend


Engineering
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Percent On
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours of Operation
Weekday
Weekend


Ballroom
60%
50%
40%
30%
20%
10%
0%
Percent On
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Horus of Operation
Weekday
Weekend

Project Number	PNM-13-01334
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a grocery facility that received incentives from PNM for implementing numerous energy efficiency measures. On-site, the evaluator verified the participants had installed:

- (24) 1/15 HP ECM for walk-in refrigerator, (24) replacing shaded-pole motors;
- (2) 1/15 HP ECM for walk-in freezers, replacing (2) shaded-pole motors; and
- (2) 1/20 HP ECM for walk-in refrigerator, replacing (2) shaded-pole motors.

M&V Methodology

The evaluator used engineering calculation to calculate the savings from electronically commutated motor (ECM) measures as follows,

$$Annual\ kWh\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times 8{,}760 \times CEF$$

Parameters for kWh Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency (70%)
CEF	Cooling Energy Interactive Factor: (1-Eff_{post}) x 1/COP

Following this, the evaluator calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times CEF$$

Parameters for Peak Demand (kW) Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency (70%)
CEF	Cooling Energy Interactive Factor: $(1-Eff_{post}) \times 1/COP$

The table below shows the energy savings calculations for the project.

ECM Savings Calculations

Measures	***Unit Counts***	***kW***	***Eff_{base}***	***Eff_{post}***	***CEF***	***Realized kW***	***Realized kWh Savings***
ECM for Walk-in 1/15HP	24	0.050	0.3	0.7	1.12	3.18	27,882
ECM for Walk-in 1/15HP	2	0.050	0.3	0.7	1.12	0.32	2,766
ECM for Walk-in 1/20HP	2	0.037	0.3	0.7	1.12	0.20	1,743

Results

Verified ECM Savings/Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
ECM for Walk-in 1/15HP	27,882	3.18	98.45%	113.26%
ECM for Walk-in 1/15HP	2,766	0.32	117.20%	134.84%
ECM for Walk-in 1/20HP	1,743	0.20	98.45%	113.26%
ECM Total	**32,391**	**3.70**	**99.81%**	**114.83%**

The realization rate for PNM-13-01334 is 99.8% for kWh and 114.83% for kW.

Project Number	PNM-13-01392
Program	Commercial Comprehensive
Component	Retrofit Rebates

Summary

The participant is a medical clinic building that received incentives from PNM for installing VFDs on its air handlers and the cooling tower fan. The evaluators were able to verify the building characteristics during the M&V site visit and used eQuest building simulation to evaluate the savings. The overall gross kWh realization rate is 116%.

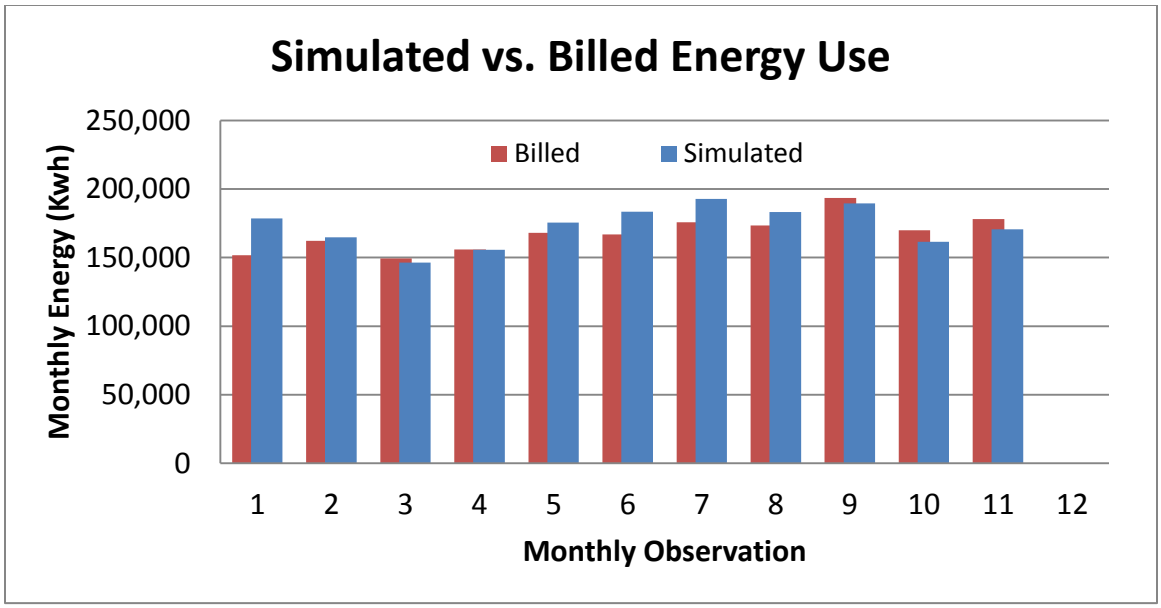
Measurement & Verification Effort

On site, the evaluators verified the installation of:

- VFDs on three air handlers;
- VFD on the return air fan; and
- VFD on the cooling tower fan.

The evaluators used a calibrated eQuest simulation model to calculate the total savings due to the installed energy efficiency measures. eQuest was used to compile two building simulation models, one for the as-built conditions and one for the baseline conditions. The baseline model was created based on the pre-existing equipment explained by the facility manager. The kWh savings for the energy efficiency measures was calculated by subtracting the as-built building energy consumption from that of the baseline building consumption.

eQuest Calibration Result



End Use Results From eQuest

End Use	Baseline (kWh/yr)	As-Built (kWh/yr)	Savings (kWh/yr)
Space Cool	489,620	471,721	17,899
Heat Reject.	14,809	12,841	1,968
Space Heat	147,542	149,343	-1,802
Vent. Fans	607,256	472,232	135,024
Pumps & Aux.	188,232	185,549	2,683
Ext. Usage	48,582	48,582	0
Misc. Equip.	427,246	427,246	0
Area Lights	324,597	324,597	0
Total	**2,247,884**	**2,092,112**	**155,771**

Results

Verified Gross Savings/Realization Rates

Measure	kWh Savings			kW Reduction		
	Expected	Realized	Realization Rate	Expected	Realized	Realization Rate
VFDs	134,096	155,771	116%	6.11	26.07	427%
Total	**134,096**	**155,771**	**116%**	**6.11**	**26.07**	**427%**

This project has a higher realization rate because the VFDs replaced inefficient return inlet guide vanes on the air handlers. The baseline inlet guide vane controls the supply air flow by restricting the return air while the fan motor operates at almost full speed. By removing the inlet guide vane and using VFDs, the digital controller can control the speed of the fan to control the flow instead of using the vacuum created by inlet guide vane. The evaluators noticed the supply fan speed was at average of 80% power, and if

the facility lowers the minimum speed of the fan, the savings from VFDs on air handlers could be greater.

Project Number	PNM-13-01393
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a grocery facility that received incentives from PNM for implementing numerous energy efficiency measures. On-site, the evaluators verified the participants had installed:

- (490) 4' 2-Lamp T8 fixtures, replacing 4' 2-Lamp T12 fixtures;
- (142) LED fixtures, replacing 6' 1-Lamp T12 fixtures;
- (7) LED fixtures, replacing 4' 2-Lamp T12 fixtures;
- (183) 1/50 HP ECM, replacing shaded-pole motors in reach-ins;
- (33) 1/15 HP ECM, replacing shaded-pole motors in walk-ins;
- (2) 16W ECM, replacing shaded-pole motors in walk-ins;
- (92) doors are retrofitted with anti-sweat heater controls; and
- (278) feet of night covers

During the site visit, the evaluators were not able to find (4) CFLs claimed on rebate. The claimed 326 feet of night covers were equal to the total height of night covers, the evaluators verified the total width of night covers to be 278 feet. The evaluators only verified 980 T8 bulbs where 1,079 bulbs were claimed.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. The savings from this project were evaluated via onsite verification and interview with the facility manager. The heating and cooling interaction factors for energy and demand were determined through energy simulation for like buildings in the same climate zone. The table below shows the energy savings calculations for the lighting measure.

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kWpost	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures

CEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kW_{post}	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating
CDF	Heating Cooling Demand Interactive Factor

The table below shows the energy savings calculations for the lighting retrofit portion of the project.

Lighting Retrofit kWh Savings Calculations

Location	Measure	Quantity (Fixtures)		Wattage		Hours		Realized kWh Savings	CEF
		Base	Post	Base	Post	Base	Post		
Retail Floor	4' 2L T12IS to 4' 2L T8	422	422	74	58	7,884	7,884	57,917	1.088
Rear Storage	4' 2L T12IS to 4' 2L T8	28	28	74	58	5,475	5,475	2,669	1.088
Rear Office	4' 2L T12IS to 4' 2L T8	1	1	74	58	5,475	5,475	95	1.088
Break Room	4' 2L T12IS to 4' 2L T8	2	2	74	58	5,475	5,475	191	1.088
Storewide	4' 2L T12IS to Delamp	57	0	74	0	5,475	5,475	25,126	1.088
Liqueur Area	4' 2L T12IS to 4' 2L T8	11	11	74	58	5,475	5,475	1,048	1.088
Deli	4' 2L T12IS to 4' 2L T8	26	26	74	58	5,475	5,475	2,478	1.088
Reach-in Cooler	6' 1L T12HS to LED	46	46	106	7.68	5,475	5,475	32,686	1.320
Reach-in Cooler	6' 1L T12HS to LED	25	25	106	9.7	5,475	5,475	17,399	1.320
Reach-in Cooler	6' 1L T12HS to LED	25	25	106	9.7	5,475	5,475	17,399	1.320
Reach-in Cooler	6' 1L T12HS to LED	46	46	106	7.68	5,475	5,475	32,686	1.320
Walk-in Cooler	4' 2L T12IS to LED	7	7	74	33	5,475	5,475	2,121	1.350
							Total	**191,815**	

Lighting Retrofit kW Savings Calculations

Location	Measure	Quantity (Fixtures)		Wattage		PCF		Realized kW Savings	CDF
		Base	Post	Base	Post	Base	Post		
Retail Floor	4' 2L T12IS to 4' 2L T8	422	422	74	58	0.70	0.70	6.33	1.339
Rear Storage	4' 2L T12IS to 4' 2L T8	28	28	74	58	0.70	0.70	0.42	1.339
Rear Office	4' 2L T12IS to 4' 2L T8	1	1	74	58	0.70	0.70	0.01	1.339
Break Room	4' 2L T12IS to 4' 2L T8	2	2	74	58	0.70	0.70	0.03	1.339
Storewide	4' 2L T12IS to Delamp	57	0	74	0	0.70	0.70	3.95	1.339

Liqueur Area	4' 2L T12IS to 4' 2L T8	11	11	74	58	0.70	0.70	0.16	1.339
Deli	4' 2L T12IS to 4' 2L T8	26	26	74	58	0.70	0.70	0.39	1.339
Reach-in Cooler	6' 1L T12HS to LED	46	46	106	7.68	0.70	0.70	4.43	1.400
Reach-in Cooler	6' 1L T12HS to LED	25	25	106	9.7	0.70	0.70	2.36	1.400
Reach-in Cooler	6' 1L T12HS to LED	25	25	106	9.7	0.70	0.70	2.36	1.400
Reach-in Cooler	6' 1L T12HS to LED	46	46	106	7.68	0.70	0.70	4.43	1.400
Walk-in Cooler	4' 2L T12IS to LED	7	7	74	33	0.50	0.50	0.20	1.400
							Total	**25.07**	

To summarize all lighting measures,

Verified Lighting Savings/Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
Interior Screw-in CFL	0	0.00	0%	0%
Interior Permanent T12 Lamp Removal	25,126	3.95	118%	98%
T8 Retrofit	64,398	7.34	98%	59%
LED lights in Walk-in cooler	2,121	0.20	163%	N/A
LED refrigeration light	100,170	13.58	240%	238%
Lighting Total	**191,815**	**25.07**	**146%**	**112%**

The evaluators used engineering calculation to calculate the savings from electronically commutated motor (ECM) measures as follows,

$$Annual\ kWh\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times 8{,}760 \times CEF$$

Parameters for kWh Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency (70%)
CEF	Cooling Energy Interactive Factor: (1-Eff_{post}) x 1/COP

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times CEF$$

Parameters for Peak Demand (kW) Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency (70%)

CEF	Cooling Energy Interactive Factor: (1-Eff_{post}) x 1/COP

The table below shows the energy savings calculations for the ECM portion of the project.

ECM Savings Calculations

Measures	Unit Counts	kW	Eff_{base}	Eff_{post}	CEF	Realized kW	Realized kWh Savings
ECM reach-in	183	0.015	0.3	0.7	1.12	5.82	51,024.97
ECM for Walk-In 16W	2	0.016	0.3	0.7	1.12	0.07	598.02
ECM for Walk-in 1/15HP	33	0.050	0.3	0.7	1.12	3.50	30,670.75

To summarize the savings,

Verified ECM Savings/Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
ECM reach-in	51,025	5.82	77%	108%
ECM for Walk-In (16W)	598	0.07	52%	62%
ECM for Walk-In (1/15HP)	30,671	3.50	80%	92%
ECM Total	**191,815**	**25.07**	**78%**	**101%**

The evaluators confirmed installation of night covers on coolers. Through on-site verification and interview, the evaluators determined temperature set points, hours of use, and effectiveness of night covers.

Using these collected data, the evaluators calculated night cover savings as follows:

$$Annual\ kWh\ Savings = 0.2 \times \left(Days \times \frac{\Delta Eff}{COP}\right)^{1.08} \times A^{1}$$

Parameters for kWh Savings Calculation of Night Covers

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
A	Surface area of the opening

The Peak kW savings are simply zero because grocery facilities do not use night covers during PNM-defined peak hours.

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

The table below shows the energy savings calculations for the ECM portion of the project.

ECM Savings Calculations

Items Inside	Quantity	DD	Eff	COP	Height (ft)	Width (ft)	Area	kWh Savings
Quick Fixin's	2	487	0.7	2.5	6	6	72	2,907.39
Cakes	2	487	0.7	1.5	6	4	48	3,365.18
Fresh Produce	10	487	0.7	2.5	6	4	240	9,691.30
Fresh Produce	1	487	0.7	2.5	4	4	16	646.09
Fresh Produce	2	487	0.7	2.5	4	5	40	1,615.22
Cheese	6	487	0.7	2.5	6	6	216	8,722.17
Eggs	2	487	0.7	2.5	6	6	72	2,907.39
Dairy	6	487	0.7	2.5	6	6	216	8,722.17
Juice	6	487	0.7	2.5	6	6	216	8,722.17
Juice	2	487	0.7	2.5	4	6	48	1,938.26
Meats	8	487	0.7	2.5	6	4	192	7,753.04
Beers	4	487	0.7	2.5	6	5	120	4,845.65
Beers	4	487	0.7	2.5	4	5	80	3,230.43
							Total	65,066.46

The total savings from night cover is,

Verified Night Cover Savings/Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
Night Covers	65,066	0	142%	100%
Total	**65,066**	**0**	**142%**	**100%**

The evaluators confirmed installation of the 92 doors with anti-sweat heater controls. Savings were then calculated using the calculator developed by the evaluator. In order to determine the savings due to the ASH controller measure, the evaluators relied on power monitoring data from a multitude of participating facilities. ASH controller operation was monitored on both the frame heater and door heater circuits, which was used to obtain an average typical operating profile. This data was correlated to the dew point temperature for the period which monitoring was performed In order to determine the typical annual operation of the ASH controllers, the dew point correlation was used to extrapolate an operating profile based on TMY weather data for the location of the store. The annual savings were calculated by subtracting the as-built energy consumption form the baseline, which assumed a constant operating profile. In order to calculate the interactive effect savings, the kW reduction for each hour was divided by

the COP of the refrigeration system. The ASH controller energy savings were normalized to a per door savings in order to determine overall savings for each location.

Realization rate for ASH controls savings is 123%. The evaluators' calculations show the annual energy savings are 129,786 kWh and a demand energy savings are 9.18.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
ASH Controls	129,786	9.18	123%	463%
Total	**129,786**	**9.18**	**123%**	**463%**

Results

Verified Gross Savings/Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
Interior Screw-in CFL	0	0.00	0%	0%
Interior Permanent T12 Lamp Removal	25,126	3.95	118%	98%
T8 Retrofit	64,398	7.34	98%	59%
LED lights in Walk-in cooler	2,121	0.20	163%	N/A
Night Covers	65,066	0.00	142%	100%
ECM for Reach-Ins	51,025	5.82	77%	108%
Anti Sweat Heater Control	129,786	9.18	123%	463%
LED refrigeration light	100,170	13.58	240%	238%
ECM for Walk-ins (16W)	598	0.07	52%	62%
ECM for Walk-ins (1/15HP)	30,671	3.50	80%	92%
Total	**468,961**	**43.64**	**121%**	**130%**

The project-level kWh realization rate is 121%. This project has a high realization rate mainly because of the refrigeration lighting and the anti-sweat heater controls. The evaluators found the baseline reach-in coolers had T12 fixtures and the new LED fixtures are operating using significantly less wattage. Anti-sweat heater controls showed larger savings historically. The evaluators was not able to identify four CFL bulbs and 99 T8 lamps listed on the rebate application.

Project Number PNM-13-01413
Program Commercial Comprehensive
Component Retrofit Rebates

Project Background

The participant is a garage facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (28) 215W induction high bay fixtures, replacing 400W metal halide high bay fixtures

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed and Custom Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Light Industrial	Comm/Ind Work Area (Unconditioned)	3,744	3,744	1.00	1.00	1.00

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
400W MH to 1L 215W Induction	28	28	453	215	3,744	3,744	25,265	24,950	1.000	98.8%
						Total	**25,265**	**24,950**		**98.8%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
400W MH to 1L 215W Induction	28	28	453	215	1.00	1.00	6.75	6.66	1.000	98.7%
						Total	**6.75**	**6.66**		**98.7%**

Results

The kWh realization rate for PNM-13-01413 is 98.8% and the kW realization rate is 98.7%.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
400W MH to 1L 215W Induction	24,950	6.66	98.8%	98.7%
Total	**24,950**	**6.66**	**98.8%**	**98.7%**

Project Number	PNM-13-01415
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a retail store facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (31) 12W LED lamps, replacing 75W incandescent lamps.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.117	1.335	0.88

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
75W Inc. to 12W LED - Int. Ballast	31	31	53	12	4,013	4,013	6,364	5,697	1.117	89.5%
						Total	**6,364**	**5,697**		**89.5%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
75W Inc. to 12W LED - Int. Ballast	31	31	53	12	0.88	0.88	1.84	1.49	1.335	81.0%
						Total	**1.84**	**1.49**		**81.0%**

Results

The kWh realization rate for PNM-13-01415 is 89.5% and the kW realization rate is 81.0%. The kWh and kW savings are lower due to EISA standards which reduced the 75W incandescent baseline to 53W.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
75W Inc. to 12W LED - Int. Ballast	5,697	1.49	89.5%	81.0%
Total	**5,697**	**1.49**	**89.5%**	**81.0%**

Project Number	PNM-14-01425
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a refrigerated warehouse facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (16) 32W LED fixtures, replacing 2' 4-lamp 24W HO T5 fixtures;
- (126) 153W LED fixtures, replacing 4' 8-lamp HO T5 fixtures;
- (122) 153W LED fixtures, replacing 4' 8-lamp HO T5 fixtures; and
- (40) 153W LED fixtures, replacing 4' 8-lamp HO T5 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. The annual hours of operation were extrapolated from monitoring data of lighting runtime in a representative sample of spaces within the facility collected in 2009. Monitored data was used as follows:

- For fixture retrofits, monitored hours of use were applied to baseline and post conditions in calculating savings

Lighting Retrofit Monitoring Strategy & Results

Space:	***Logger Type***	***Annual Hours***	***HCEF***	***HCDF***	***PCF***
Refrigerated Warehouse – Loading Dock	TOU Lighting Logger	8,760	1.250	1.250	0.84
Refrigerated Warehouse – Cooled Storage	TOU Lighting Logger	6,875	1.250	1.250	0.84
Refrigerated Warehouse – Frozen Storage	TOU Lighting Logger	6,875	1.300	1.300	0.84

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
2' 4L T5HO to 32W LED - Non-Int. Ballast	16	16	104	32	8,760	8,760	9,339	12,614	1.250	135.1%
4' 8L T5HO to 153W LED - Non-Int. Ballast	126	126	468	153	8,760	8,760	321,761	434,606	1.250	135.1%
4' 8L T5HO to 153W LED - Non-Int. Ballast	112	112	468	153	6,875	6,875	286,010	303,188	1.250	106.0%
4' 8L T5HO to 153W LED - Non-Int. Ballast	40	40	468	153	6,875	6,875	102,146	112,613	1.300	110.2%
						Total	**719,257**	**863,021**		**120.0%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
2' 4L T5HO to 32W LED - Non-Int. Ballast	16	16	104	32	0.84	0.84	1.15	1.21	1.250	104.9%
4' 8L T5HO to 153W LED - Non-Int. Ballast	126	126	468	153	0.84	0.84	39.72	41.67	1.250	104.9%
4' 8L T5HO to 153W LED - Non-Int. Ballast	112	112	468	153	0.84	0.84	35.31	37.04	1.250	104.9%
4' 8L T5HO to 153W LED - Non-Int. Ballast	40	40	468	153	0.84	0.84	12.61	13.76	1.300	109.1%
						Total	**88.80**	**93.68**		**105.5%**

Results

The kWh realization rate for PNM-14-01425 is 120.0% and the kW realization rate is 105.5%. The increase in savings is due to the ex post calculations using higher HCIF for the refrigerated space spaces, as per the New Mexico TRM, while the ex ante calculations used an energy and demand factor of one. The ex post calculations verified (152) 153W LED fixtures in areas with occupancy sensors while the ex ante calculations claimed only (70) 153W LED fixtures had occupancy sensors. This lowered the savings since the occupancy sensors were part of a retrofit in 2009.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
2' 4L T5HO to 32W LED - Non-Int. Ballast	12,614	1.21	135.1%	104.9%
4' 8L T5HO to 153W LED - Non-Int. Ballast	434,606	41.67	135.1%	104.9%
4' 8L T5HO to 153W LED - Non-Int. Ballast	303,188	37.04	106.0%	104.9%
4' 8L T5HO to 153W LED - Non-Int. Ballast	112,613	13.76	110.2%	109.1%
Total	**863,021**	**93.68**	**120.0%**	**105.5%**

Project Number PNM-14-01440
Program Commercial Comprehensive
Component Retrofit Rebates

Project Background

The participant is a storage facility that received incentives from PNM for implementing energy efficient lighting and occupancy sensors. On-site, the evaluators verified the participant had installed:

- (14) 4' 4-lamp 28W T8 fixtures, replacing 4' 4-lamp 60W T12 fixtures;
- (4) 4' 4-lamp 28W T8 fixtures, replacing 8' 2-lamp 60W T12 fixtures;
- (2) 4' 2-lamp 28W T8 fixtures, replacing 4' 2-lamp 60W T12 fixtures;
- (28) 4' 4-lamp 28W T8 fixtures with occupancy sensors, replacing 8' 2-lamp 60W T12 fixtures;
- (124) 4' 4-lamp 28W T8 fixtures with occupancy sensors, replacing 8' 2-lamp 60W T12 fixtures;
- (2) 4' 2-lamp 28W T8 fixtures with occupancy sensors, replacing 4' 2-lamp 60W T12 fixtures; and
- (9) (124) 4' 4-lamp 28W T8 fixtures with occupancy sensors, replacing 8' 2-lamp 60W T12 fixtures.

M&V Methodology

The evaluators found some fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings from this project were evaluated via onsite verification, facility staff interviews, and monitoring of lighting runtime in a representative sample of spaces within the facility. Monitored data was used as follows:

- For fixture retrofits, monitored hours of use were applied to baseline and post conditions in calculating savings.
- For lighting controls, loggers were installed in areas with occupancy sensors and the extrapolated hours of operation were used for post-retrofit hours of operation and the baseline hours of operation.

Lighting Retrofit Monitoring Strategy & Results

Space:	*Logger Type*	*Quantity*	*Baseline Hours*	*Post Hours*	*HCEF*	*HCDF*	*PCF*
Storage	TOU Lighting Logger	1	623	188	1.052	1.540	0.04
Storage	TOU Lighting Logger	1	1,592	1,051	1.052	1.540	0.55
Storage	TOU Lighting Logger	1	1,266	395	1.052	1.540	0.36

Storage	TOU Lighting Logger	1	3,545	1,594	1.052	1.540	0.41
Storage	TOU Lighting Logger	1	882	343	1.052	1.540	0.15

Savings Calculations

Measure 1: T12 to T8 Retrofit, with occupancy sensors

Savings from the T12 – T8 Retrofit were calculated using monitored data of the hours of operation. During the M&V visit, the evaluator staff verified equipment installation, baseline and post-retrofit connected load, and placed five photo-sensor loggers at the site (from 10/1/2014 to 1/4/2014) to monitor lighting operation. This data were used to calculate energy savings. The hours of operation were extrapolated to estimate annual runtime. The rationale behind this is to capture accurate energy savings from the facility since operations did not change after the retrofit and occupancy sensors were installed.

Lighting retrofit energy savings are calculated as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon an PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. The occupancy sensor measure reduces lighting runtime and consequently reduces PCF. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Lamps)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12ES to 4' 4L T8 28W	14	14	144	99	4,368	4,368	4,449	2,896	1.052	65.1%
8' 2L T12ES to 4' 4L T8 28W	4	4	123	99	1,592	1,592	780	161	1.052	20.6%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	1,592	1,592	471	67	1.052	14.2%
8' 2L T12ES to 4' 4L T8 28W	28	28	123	99	623	188	7,281	1,709	1.052	23.5%
8' 2L T12ES to 4' 4L T8 28W	124	124	123	99	1,914	786	36,145	20,568	1.052	56.9%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	1,914	786	314	204	1.052	65.0%
8' 2L T12ES to 4' 4L T8 28W	9	9	123	99	1,914	786	2,340	1,419	1.000	60.6%
						Total	**51,780**	**27,024**		**52.2%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12ES to 4' 4L T8 28W	14	14	144	99	1.00	1.00	1.02	0.97	1.540	95.0%
8' 2L T12ES to 4' 4L T8 28W	4	4	123	99	0.78	0.78	0.18	0.12	1.540	67.0%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	0.78	0.78	0.11	0.05	1.540	46.3%
8' 2L T12ES to 4' 4L T8 28W	28	28	123	99	0.04	0.03	1.67	0.10	1.540	6.0%
8' 2L T12ES to 4' 4L T8 28W	124	124	123	99	0.21	0.14	8.29	2.35	1.540	28.3%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	0.21	0.14	0.07	0.02	1.540	27.8%
8' 2L T12ES to 4' 4L T8 28W	9	9	123	99	0.21	0.14	0.54	0.11	1.000	20.5%
						Total	**11.88**	**3.72**		**31.3%**

Results

The kWh realization rate for PNM-14-01440 is 52.2% and the kW realization rate is 31.3%. The low kWh realization rate can be attributable to ex post calculations using lower verified baseline hours of operation and lower verified post-retrofit hours of operation for the fixtures with occupancy sensors. The ex ante calculations did not

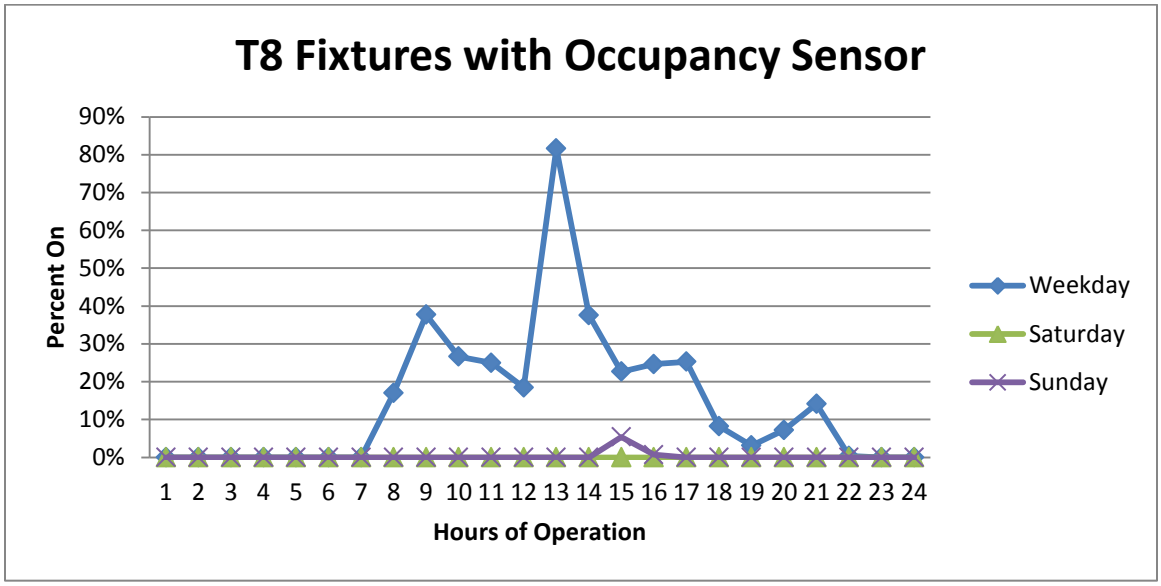
include the occupancy sensors, but the evaluators verified occupancy sensors were installed in four areas. The ex ante calculations used a baseline of 8' 75W T12 lamps, while the evaluators verified the baseline fixtures had 8' 60W T12 lamps. This significantly decreased the savings. The monitored hours of operations were used to determine a PCF, which was lower than the ex ante calculations used.

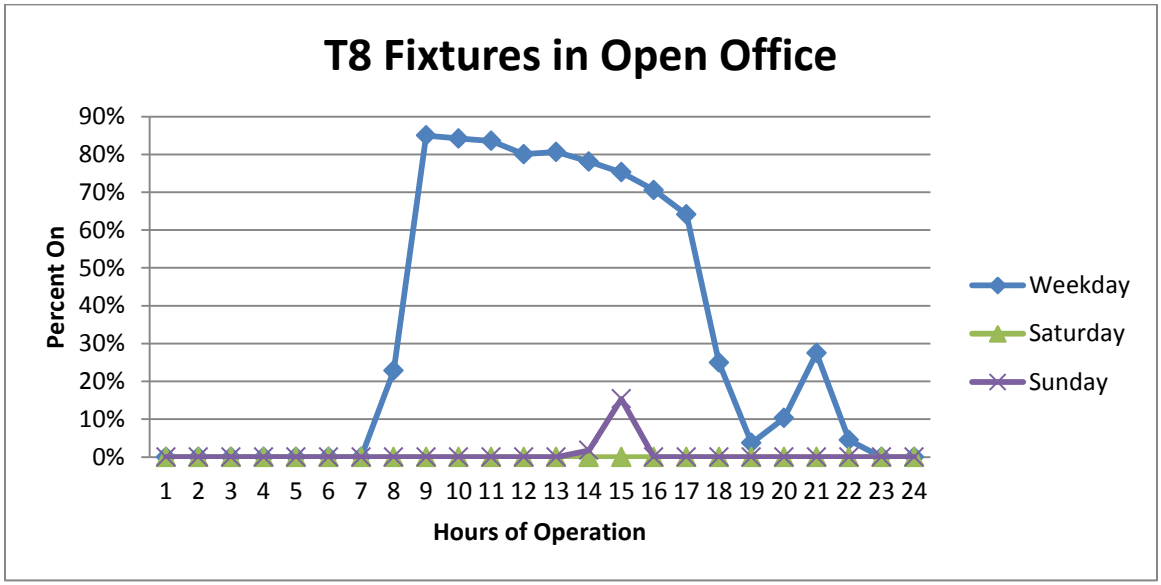
Verified Gross Savings & Realization Rates

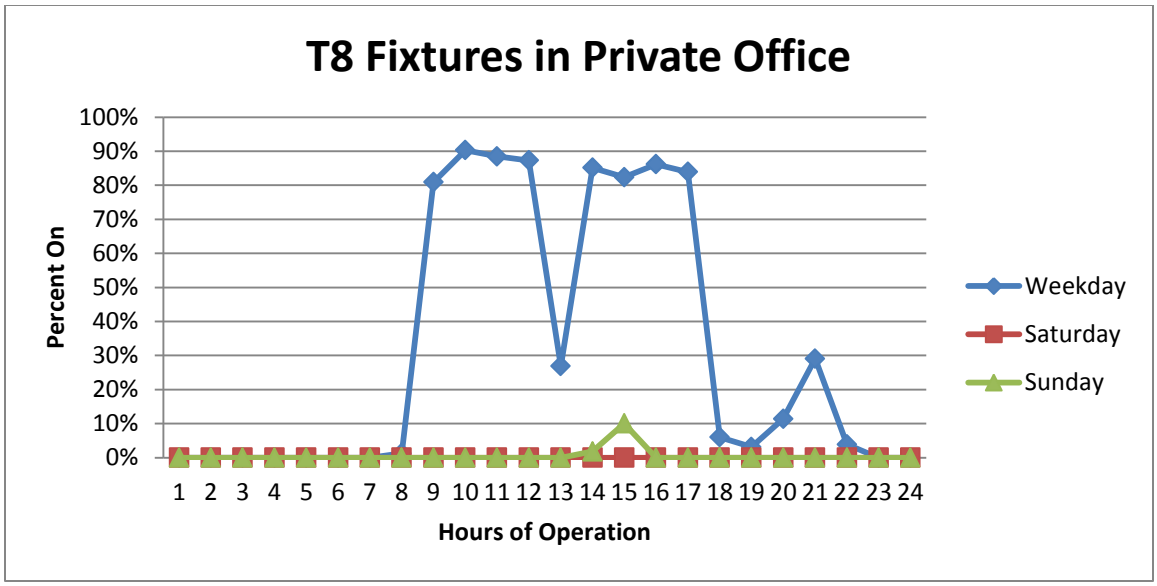
Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 4L T12ES to 4' 4L T8 28W	2,896	0.97	65.1%	95.0%
8' 2L T12ES to 4' 4L T8 28W	161	0.12	20.6%	67.0%
4' 2L T12ES to 4' 2L T8 28W	67	0.05	14.2%	46.3%
8' 2L T12ES to 4' 4L T8 28W	1,709	0.10	23.5%	6.0%
8' 2L T12ES to 4' 4L T8 28W	20,568	2.35	56.9%	28.3%
4' 2L T12ES to 4' 2L T8 28W	204	0.02	65.0%	27.8%
8' 2L T12ES to 4' 4L T8 28W	1,419	0.11	60.6%	20.5%
Total	**27,024**	**3.72**	**52.2%**	**31.3%**

Appendix

Hours of Use Charts






T8 Fixtures in Private Office
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent On
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours of Operation
Weekday
Saturday
Sunday

Project Number	PNM-14-01442
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a large manufacturing facility that received incentives from PNM for implementing energy efficient parking lot lighting. On-site, the evaluators verified the participant had installed:

- (140) 35W LED fixtures, replacing (140) 150W metal halide fixtures;
- (11) 35W LED fixtures, replacing (11) 175W metal halide fixtures;
- (12) 43W LED fixtures, replacing (12) 175W metal halide fixtures;
- (38) 38W LED fixtures, replacing (38) 250W metal halide fixtures;
- (31) 76W LED fixtures, replacing (31) 250W metal halide fixtures;
- (10) 134W LED fixtures, replacing (10) 250W metal halide fixtures; and
- (271) 134W LED fixtures, replacing (262) 400W metal halide fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations.

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x W/$Fixture_{base}$ / 1000 W/kW
kWpost	Total Installed fixtures x W/$Fixture_{post}$ / 1000 W/kW
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor. 1.000 for outdoor lights

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kW_{post}	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating, 0.00 for parking lot light operating after dark.
HCDF	Heating Cooling Demand Interactive Factor, 1.000 for outdoor lights

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
150W MH to 35W LED - Non-Int. Ballast	140	140	163	35	4,313	4,313	N/A	77,284	1.000	N/A
175W MH to 35W LED - Non-Int. Ballast	11	11	196	35	4,313	4,313	N/A	7,638	1.000	N/A
175W MH to 43W LED - Non-Int. Ballast	12	12	196	43	4,313	4,313	N/A	7,918	1.000	N/A
250W MH to 38W LED - Non-Int. Ballast	38	38	275	38	4,313	4,313	N/A	38,840	1.000	N/A
250W MH to 76W LED - Non-Int. Ballast	31	31	275	76	4,313	4,313	N/A	26,605	1.000	N/A
250W MH to 134W LED - Non-Int. Ballast	10	10	275	134	4,313	4,313	N/A	6,081	1.000	N/A
400W MH to 134W LED - Non-Int. Ballast	271	262	429	134	4,313	4,313	N/A	349,980	1.000	N/A
						Total	**503,220**	**514,533**		**102.2%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
150W MH to 35W LED - Non-Int. Ballast	140	140	163	35	0.00	0.00	N/A	0.00	1.000	N/A
175W MH to 35W LED - Non-Int. Ballast	11	11	196	35	0.00	0.00	N/A	0.00	1.000	N/A
175W MH to 43W LED - Non-Int. Ballast	12	12	196	43	0.00	0.00	N/A	0.00	1.000	N/A
250W MH to 38W LED - Non-Int. Ballast	38	38	275	38	0.00	0.00	N/A	0.00	1.000	N/A
250W MH to 76W LED - Non-Int. Ballast	31	31	275	76	0.00	0.00	N/A	0.00	1.000	N/A

250W MH to 134W LED - Non-Int. Ballast	10	10	275	134	0.00	0.00	N/A	0.00	1.000	N/A
400W MH to 134W LED - Non-Int. Ballast	271	262	429	134	0.00	0.00	N/A	0.00	1.000	N/A
						Total	**0.00**	**0.00**		**100.0%**

Results

The kWh realization rate for PNM-14-01442 is 102.2% and the kW realization rate is 100%. The evaluators verified the number of fixtures purchased and installed. The facility purchased more fixtures than number of fixtures claimed on this rebate. The facility plans to purchase additional fixtures to replace more exterior lights in the future.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
150W MH to 35W LED - Non-Int. Ballast	77,284	0.00	N/A	N/A
175W MH to 35W LED - Non-Int. Ballast	7,638	0.00	N/A	N/A
175W MH to 43W LED - Non-Int. Ballast	7,918	0.00	N/A	N/A
250W MH to 38W LED - Non-Int. Ballast	38,840	0.00	N/A	N/A
250W MH to 76W LED - Non-Int. Ballast	26,605	0.00	N/A	N/A
250W MH to 134W LED - Non-Int. Ballast	6,081	0.00	N/A	N/A
400W MH to 134W LED - Non-Int. Ballast	349,980	0.00	N/A	N/A
Total	**514,533**	**0.00**	**102.2%**	**100.0%**

Project Number PNM-14-01458
Program Commercial Comprehensive
Component Retrofit Rebates

Project Background

The participant is a large single-story retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluator verified the participant had installed:

- (96) 4' 6-lamp T8 fixtures, replacing (99) 360W metal halide fixtures;
- (59) 4' 2-lamp T8 fixtures, replacing (59) 4' 2-lamp T8 fixtures;
- (16) 4' 1-lamp T8 fixtures, replacing (16) 4' 1-lamp T8 fixtures;
- (17) 4' 6-lamp T8 fixtures, replacing (17) 360W metal halide fixtures;
- (6) 4' 6-lamp T8 fixtures, replacing (6) 360W metal halide fixtures;
- (7) 4' 4-lamp T8 fixtures, replacing (7) 4' 4-lamp T8 fixtures;
- (14) 4' 2-lamp T8 fixtures, replacing (14) 4' 2-lamp T8 fixtures;
- (2) 4' 4-lamp T8 fixtures, replacing (2) 4' 4-lamp T8 fixtures;
- (9) 4' 4-lamp T8 fixtures, replacing (9) 4' 4-lamp T8 fixtures;
- (4) 4' 4-lamp T8 fixtures, replacing (4) 4' 4-lamp T8 fixtures;
- (1) 4' 4-lamp T8 fixtures, replacing (1) 4' 4-lamp T8 fixtures;
- (2) 4' 4-lamp T8 fixtures, replacing (2) 4' 4-lamp T8 fixtures; and
- (2) 4' 4-lamp T8 fixtures, replacing (2) 4' 4-lamp T8 fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	*CA DEER 2008 Space Type*	*Annual Hours – Non-CFLs*	*Annual Hours – CFLs*	*HCEF*	*HCDF*	*PCF*
Large Single Story Retail	Sales Area	4,454	4,512	1.117	1.348	0.88
	Storage (Conditioned)	2,738	2,633	1.117	1.348	0.88

	Kitchen	3,368	3,947	1.117	1.348	0.88
	Office (General)	2,714	2,737	1.117	1.348	0.88
Small Office	Restroom	2,594	3,957	1.129	1.313	0.81
	Mechanical/Electrical Room	2,594	1,556	1.129	1.313	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
360W MH to 4' 6L T8 28W VHLO	99	96	418	194	4,454	4,454	77,088	113,224	1.117	146.9%

4' 2L T8 to 4' 2L T8 28W	59	59	60	49	4,454	4,454	2,786	3,229	1.117	115.9%
4' 1L T8 to 4' 1L T8 28W	16	16	30	26	4,454	4,454	260	318	1.117	122.4%
360W MH to 4' 6L T8 28W VHLO	17	17	418	194	2,738	2,738	12,363	11,646	1.117	94.2%
360W MH to 4' 6L T8 28W VHLO	6	6	418	194	2,738	2,738	4,363	4,110	1.117	94.2%
4' 4L T8 to 4' 4L T8 28W	7	7	112	99	8,760	8,760	295	900	1.129	304.6%
4' 2L T8 to 4' 2L T8 28W	14	14	60	52	8,760	8,760	364	1,096	1.117	301.4%
4' 4L T8 to 4' 4L T8 28W	2	2	112	99	8,760	8,760	84	254	1.117	300.9%
4' 4L T8 to 4' 4L T8 28W	9	9	112	99	3,368	3,368	380	440	1.117	115.8%
4' 4L T8 to 4' 4L T8 28W	4	4	112	99	4,454	4,454	169	259	1.117	153.4%
4' 4L T8 to 4' 4L T8 28W	1	1	112	99	4,454	4,454	42	65	1.117	154.0%
4' 4L T8 to 4' 4L T8 28W	2	2	112	99	2,714	2,714	84	79	1.117	93.6%
4' 4L T8 to 4' 4L T8 28W	2	2	112	99	2,594	2,594	84	76	1.129	90.0%
						Total	**98,363**	**135,696**		**138.0%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
360W MH to 4' 6L T8 28W VHLO	99	96	418	194	0.88	0.88	22.26	27.00	1.348	121.3%
4' 2L T8 to 4' 2L T8 28W	59	59	60	49	0.88	0.88	0.80	0.77	1.348	95.7%
4' 1L T8 to 4' 1L T8 28W	16	16	30	26	0.88	0.88	0.07	0.08	1.348	106.7%
360W MH to 4' 6L T8 28W VHLO	17	17	418	194	0.88	0.88	3.57	4.52	1.348	126.6%
360W MH to 4' 6L T8 28W VHLO	6	6	418	194	0.88	0.88	1.26	1.59	1.348	126.2%
4' 4L T8 to 4' 4L T8 28W	7	7	112	99	1.00	1.00	0.09	0.12	1.313	140.7%
4' 2L T8 to 4' 2L T8 28W	14	14	60	52	1.00	1.00	0.10	0.15	1.348	142.9%
4' 4L T8 to 4' 4L T8 28W	2	2	112	99	1.00	1.00	0.02	0.04	1.348	164.1%
4' 4L T8 to 4' 4L T8 28W	9	9	112	99	0.88	0.88	0.11	0.14	1.348	127.7%

4' 4L T8 to 4' 4L T8 28W	4	4	112	99	0.88	0.88	0.05	0.06	1.348	123.1%
4' 4L T8 to 4' 4L T8 28W	1	1	112	99	0.88	0.88	0.01	0.02	1.348	164.1%
4' 4L T8 to 4' 4L T8 28W	2	2	112	99	0.88	0.88	0.02	0.03	1.348	123.1%
4' 4L T8 to 4' 4L T8 28W	2	2	112	99	0.81	0.81	0.02	0.03	1.313	123.1%
						Total	**28.40**	**34.55**		**121.7%**

Results

The kWh realization rate for PNM-14-01458 is 138.6% and the kW realization rate is 121.7%. The realization rates increased because the ex post calculations used higher hours of operation than the ex ante calculations. The evaluator was unable to verify (19) 4' 2-lamp T8 fixtures and (4) 4' 1-lamp T8 fixtures.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
360W MH to 4' 6L T8 28W VHLO	113,224	27.00	146.9%	121.3%
4' 2L T8 to 4' 2L T8 28W	3,229	0.77	115.9%	95.7%
4' 1L T8 to 4' 1L T8 28W	318	0.08	122.4%	106.7%
360W MH to 4' 6L T8 28W VHLO	11,646	4.52	94.2%	126.6%
360W MH to 4' 6L T8 28W VHLO	4,110	1.59	94.2%	126.2%
4' 4L T8 to 4' 4L T8 28W	900	0.12	304.6%	140.7%
4' 2L T8 to 4' 2L T8 28W	1,096	0.15	301.4%	142.9%
4' 4L T8 to 4' 4L T8 28W	254	0.04	300.9%	164.1%
4' 4L T8 to 4' 4L T8 28W	440	0.14	115.8%	127.7%
4' 4L T8 to 4' 4L T8 28W	259	0.06	153.4%	123.1%
4' 4L T8 to 4' 4L T8 28W	65	0.02	154.0%	164.1%
4' 4L T8 to 4' 4L T8 28W	79	0.03	93.6%	123.1%
4' 4L T8 to 4' 4L T8 28W	76	0.03	90.0%	123.1%
Total	**135,696**	**34.55**	**138.0%**	**121.7%**

Project Number PNM-14-01479
Program Commercial Comprehensive
Component Retrofit Rebates

Project Background

The participant is a retail store facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (36) 13W Par 30 LED lamps, replacing 75W Incandescent lamps.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.117	1.335	0.88

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kWpost	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW

$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
75W Inc. to 13W LED - Int. Ballast	36	36	53	13	4,013	4,013	9,747	6,455	1.117	66.2%
						Total	**9,747**	**6,455**		**66.2%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
75W Inc. to 13W LED - Int. Ballast	36	36	53	13	0.88	0.88	1.84	1.69	1.335	91.8%
						Total	**1.84**	**1.69**		**91.8%**

Results

The kWh realization rate for PNM-14-01479 is 66.2% and the kW realization rate is 91.8%. The realized kW savings are higher due to the HCDF being higher in the ex post calculations. Further, the evaluators revised the baseline wattage form 75W to 53W in accordance with EISA guidelines.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
75W Inc. to 13W LED - Int. Ballast	6,455	1.69	66.2%	91.8%
Total	**6,455**	**1.69**	**66.2%**	**91.8%**

Project Number PNM-14-01486
Program Commercial Comprehensive
Component Retrofit Rebate

Project Background

The participant is a large office facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (24) 24W LED lamps, replacing 70W metal halide lamps.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Large office	Lobby	2,692	3,860	1.216	1.303	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
70W MH to 24W LED - Non-Int. Ballast	24	24	91	24	3,860	3,860	7,593	7,548	1.216	99.4%
						Total	**7,593**	**7,548**		**99.4%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
70W MH to 24W LED - Non-Int. Ballast	24	24	91	24	0.81	0.81	1.40	1.70	1.303	121.4%
						Total	**1.40**	**1.70**		**121.4%**

Results

The kWh realization rate for PNM-14-01486 is 99.4% and the kW realization rate is 121.4%. The kW savings are higher due to the HCDF being higher in the ex post calculations.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
70W MH to 24W LED - Non-Int. Ballast	7,548	1.70	69.3%	121.4%
Total	**7,548**	**1.70**	**69.3%**	**121.4%**

Project Number	PNM-14-01487
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a grocery store that received incentives from PNM for implementing numerous energy efficiency measures in their multiple grocery stores. On-site, the evaluators verified the participants had installed:

- (1,836) Linear feet of night covers;
- (90) 9W ECMs replacing shaded-pole motors in reach-ins;
- (231) 12W ECMs replacing shaded-pole motors in reach-ins;
- (4) 16W ECMs replacing shaded-pole motors in reach-ins;
- (130) reach-in freezer doors with anti-sweat heater controls;
- (15) reach-in refrigerator doors with anti-sweat heater controls;
- (16) 1/47 HP ECMs replacing shaded-pole motors in walk-ins refrigerators;
- (50) 1/20 HP ECMs replacing shaded-pole motors in walk-in refrigerators;
- (60) 1/20 HP ECMs replacing 1/15 HP shaded-pole motors in walk-in refrigerators;
- (34) 1/20 HP ECMs replacing shaded-pole motors in freezers; and
- (10) 1/20 HP ECMs replacing 1/15 HP shaded-pole motors in freezers.

M&V Methodology

The evaluators confirmed installation of night covers on freezers and coolers. Through on-site verification and interview, the evaluators collected the total width, temperature set point, and hours of use of night covers.

Using these data, the evaluators calculated night cover savings as follows:

$$\text{Annual kWh Savings} = \text{W} \times \text{h} \times \text{SF}$$

Where,

W = Total width of night covers

h = Total night cover hours

SF = Savings factor based on case temperature

The saving factors are based on a test conducted by Southern California Edison (SCE) at Refrigeration Technology and Test Center (RTTC). SCE's workpaper's results were from a high temperature refrigeration case and the evaluators extrapolated the savings to three different case temperatures using the study's average COP.

Savings Factor Based on Case Temperature

Case Temperature	***SF (kW/ft)***
Low (Less than 0F)	0.030
Medium (0F to 32F)	0.020
High (Greater than 32F)	0.012

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are simply zero because grocery does not use night covers during PNM-defined peak hours

The table below shows the energy savings calculations for the ECM portion of the project.

Night Cover Savings Calculations

Type	***Quantity***	***Width (ft)***	***Length (ft)***	***Type***	***SF***	***Hours***	***kWh/ft2***	***kWh***
Vertical	60	4	240	High (32 above)	0.012	2,920	35.402	8,496.52
Vertical	174	6	1,044	High (32 above)	0.012	2,920	35.402	36,959.86
Chest	92	6	552	Low (0 below)	0.030	2,920	88.505	48,854.99
Total Linear Length			**1,836**				**Total Savings**	**94,311.37**

The total savings from the night cover can be found in the table below:

Verified Night Cover Savings/Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
Night Covers	94,311	0	44%	100%
Total	**94,311**	**0**	**44%**	**100%**

The evaluators used engineering calculation to calculate the savings from electronically commutated motor (ECM) measures as follows,

$$Annual\ kWh\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times 8{,}760 \times CEF$$

Parameters for kWh Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency
CEF	Cooling Energy Interactive Factor: (1-Eff_{post}) x 1/COP

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times CEF$$

Parameters for Peak Demand (kW) Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency
CEF	Cooling Energy Interactive Factor: (1-Eff_{post}) x 1/COP

The table below shows the energy savings calculations for the ECM portion of the project.

ECM Savings Calculations

Measures	Unit Count	kW_{base}	kW_{post}	Eff_{base}	Eff_{post}	Type	Realized kW	Realized kWh Savings
9W Reach-in	90	0.009	0.009	30%	66%	Refrigerator	3.44	30,115
12W Reach-In	231	0.012	0.012	30%	66%	Refrigerator	7.06	61,835
16W Reach-In	4	0.016	0.016	30%	66%	Refrigerator	0.16	1,428
1/47 HP Walk-In	16	0.016	0.016	30%	68%	Refrigerator	1.02	8,961
1/20 HP Walk-In	50	0.037	0.037	30%	65%	Refrigerator	7.34	64,257
1/15 HP to 1/20 HP Walk-In	60	0.050	0.037	30%	67%	Refrigerator	5.47	47,910
1/20 HP Walk-In	34	0.037	0.037	30%	65%	Freezer	5.94	52,017
1/15 HP to 1/20HP Walk-In	10	0.050	0.037	30%	67%	Freezer	1.06	9,299
						Total	**31.49**	**275,822**

To summarize the savings,

Verified ECM Savings/Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
ECM reach-in	93,378	10.66	80%	96%
ECM for walk-In	182,444	20.83	93%	93%
ECM Total	275,822	31.49	88%	94%

The evaluators confirmed the installation of anti-sweat heater controls on 130 reach-in freezers doors and 15 reach-in refrigerators doors. Savings were then calculated using the calculator developed by the evaluators, which is based on monitoring data and dew point temperature of Albuquerque TMY3 weather data. In order to determine the savings due to the ASH controller measure, the evaluators relied on power monitoring data from a multitude of participating facilities. ASH controller operation was monitored on both the frame heater and door heater circuits, and was used to obtain an average typical operating profile. This data was correlated to the dew point temperature for the period that monitoring was performed. In order to determine the typical annual operation of the ASH controllers, the dew point correlation was used to extrapolate an operating profile based on TMY weather data for the location of the store. The annual savings were calculated by subtracting the as-built energy consumption from the baseline, which assumed a constant operating profile. In order to calculate the interactive effect savings, the kW reduction for each hour was divided by the COP of the refrigeration system. The ASH controller energy savings were normalized to a per door savings in order to determine overall savings for each location.

The realization rate for ASH controls savings is 184%. The evaluators' calculations show the annual energy savings are 239,486 kWh and the demand energy savings are 16.93 kW.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
ASH Controls	129,786	9.18	123%	463%
Total	**129,786**	**9.18**	**123%**	**463%**

Results

Verified Gross Savings/Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
Night Covers	94,311	0.00	44%	N/A
ECM for Reach-Ins	93,378	10.66	80%	111%
Anti-Sweat Heater Control	239,486	16.93	184%	688%
ECM for Walk-ins	182,444	20.83	93%	106%
Total	**609,619**	**48.42**	**92%**	**153%**

The project-level kWh realization rate is 92%. There were two measures with notable results—night covers and ASH controls. Night covers have a lower kWh realization rate because the ex ante savings estimation double counts the savings. The evaluators went through ex ante savings calculation and found the demand savings match. However, the annual ex post kWh savings are lower than the ex ante savings because of different equivalent full load hours used in ex ante analysis. The difference in demand occurs because of a difference in duty cycle, and there is no need to apply this to equivalent full load hours. The evaluators suggest that the C&I workpapers on night cover should be updated.

The evaluators calculated higher kWh and kW savings from the ASH controls as the evaluators found the ASH controls are installed on reach-in freezers. Freezers have lower COPs therefore the interactive effect on them is greater.

This report combines projects completed at five different grocery store facilities within the same retail chain. The following table shows savings per facility:

Verified Gross Savings/Realization Rates

Store #	Store Address	Savings	kW
702	Lomas	140,390	11.50
703	Montgomery	131,183	10.86
704	San Mateo	120,624	9.59
705	Zafarano	98,426	7.06
706	Paseo	118,996	9.41
	Total	**609,619**	**48.42**

Project Number	PNM-14-01490
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a grocery facility that received incentives from PNM for implementing numerous energy efficiency measures. On-site, the evaluators verified the participants had installed:

- (292) 4' T8 bulbs replacing 4' T12 bulbs;
- (11) LED exit signs, replacing incandescent exit signs;
- (11) Occupancy sensors controlling T8 fixtures and LED freezer lights;
- (1) High efficiency 3 Ton Packaged AC;
- (1) High efficiency 0.75 Ton Split AC;
- (130) Electronically Commutated Motors;
- (37) Doors are retrofitted with LED lights;
- (37) Doors are retrofitted with anti-sweat heater controls;
- (2) High Efficiency Combination Ovens;
- (1) VSD on 40 HP air handler fan unit;
- (1) VSD on 6 HP condenser fan unit; and
- (1) High Efficiency Ice Maker.

During the site visit, the evaluators found that most of retail floor lights have 8' T8 bulbs while 4' T8 bulbs were installed in office and storage area. The evaluators verified the reach-in units are freezer units.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. The savings from this project were evaluated via onsite verification and interview with the facility manager. The heating and cooling interaction factors for energy and demand were determined through energy simulation for like buildings in the same climate zone. The table below shows the energy savings calculations for the lighting measure.

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kWpost	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures

CEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kW_{post}	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating
CDF	Heating Cooling Demand Interactive Factor

The table below shows the energy savings calculations for the lighting retrofit portion of the project.

Lighting Retrofit kWh Savings Calculations

Location	***Measure***	**Quantity (Fixtures)**		**Wattage**		**Hours**		***Realized kWh Savings***	***CEF***
		Base	**Post**	**Base**	**Post**	**Base**	**Post**		
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	14	14	120	95	6,570	6,570	2,488	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	6	120	95	8,760	8,760	1,422	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	15	15	120	95	6,570	6,570	2,666	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	8	8	120	95	8,760	8,760	1,896	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	9	9	120	95	6,570	6,570	1,599	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	2	2	120	95	8,760	8,760	474	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	6	120	95	6,570	6,570	1,066	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	2	2	120	95	8,760	8,760	474	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	6	120	95	6,570	6,570	1,066	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	11	11	120	95	6,570	6,570	1,955	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	1	1	120	95	6,570	6,570	178	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	23	23	120	95	6,570	6,570	4,088	1.082
Office Area	4' 3L T12IS to 4' 3L T8	4	4	120	95	6,570	6,570	711	1.082

	25W VHLO								
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	2	2	120	95	6,570	6,570	355	1.082
Reach-in Freezer	5' 1L T12HO to 22W LED - Non-Int. Ballast	22	22	69	22	8,760	8,760	12,681	1.400
Reach-in Freezer	5' 1L T12HO to 22W LED - Non-Int. Ballast	26	26	69	22	8,760	8,760	14,987	1.400
Retail Floor	2L 20W Inc. Exit to 2L 2W LED Exit	11	11	40	9	8,760	8,760	3,232	1.082
							Total	**51,338**	

Lighting Retrofit kW Savings Calculations

Location	***Measure***	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Realized kW Savings***	***CDF***
		Base	***Post***	***Base***	***Post***	***Base***	***Post***		
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	14	14	120	95	0.70	0.70	0.33	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	6	120	95	1.00	1.00	0.20	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	15	15	120	95	0.70	0.70	0.35	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	8	8	120	95	1.00	1.00	0.27	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	9	9	120	95	0.70	0.70	0.21	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	2	2	120	95	1.00	1.00	0.07	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	6	120	95	0.70	0.70	0.14	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	2	2	120	95	1.00	1.00	0.07	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	6	120	95	0.70	0.70	0.14	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	11	11	120	95	0.70	0.70	0.26	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	1	1	120	95	0.70	0.70	0.02	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	23	23	120	95	0.70	0.70	0.54	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	4	4	120	95	0.70	0.70	0.09	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	2	2	120	95	0.70	0.70	0.05	1.339
Reach-in Freezer	5' 1L T12HO to 22W LED - Non-Int. Ballast	22	22	69	22	0.70	0.70	1.09	1.500
Reach-in Freezer	5' 1L T12HO to 22W LED - Non-Int. Ballast	26	26	69	22	0.70	0.70	1.28	1.500
Retail Floor	2L 20W Inc. Exit to 2L 2W LED Exit	11	11	40	9	1.00	1.00	0.46	1.339
							Total	**5.57**	

The facility also installed occupancy sensors on T8 lighting fixtures and new LED lights installed inside reach-in freezers.

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

Parameters for kWh Savings of Occupancy Sensor Retrofits

kW_{post}	Total Installed Fixtures x $W/Fixture_{post}$ / 1000 W/kW
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures Including Effects of Occupancy Sensors
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Occupancy Sensor Retrofits

kW_{post}	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW / Sq. Ft.
PCF_{base}	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating w/o Occupancy Sensors
PCF_{post}	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating w/ Occupancy Sensors
HCDF	Heating Cooling Demand Interactive Factor

The table below shows the energy savings calculations for the occupancy control portion of the project.

Occupancy Sensor kWh Savings Calculations

Location	***Measure***	***Quantity (Fixtures)***	***Wattage***	***Hours***		***Realized kWh Savings***	***CEF***
				Base	***Post***		
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	9	95	6,570	4,599	1,823	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	95	6,570	4,599	1,216	1.082
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	4	95	6,570	4,599	810	1.082
Reach-In Freezers	4' 3L T12IS to 4' 3L T8 25W VHLO	26	22	8,760	4,599	3,332	1.400
					Total	**7,182**	

Occupancy Sensor kW Savings Calculations

Location	Measure	Quantity (Fixtures)	Wattage	PCF		Realized kWh Savings	HCDF
				Base	Post		
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	9	95	0.7	0.46	0.27	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	6	95	0.7	0.46	0.18	1.339
Office Area	4' 3L T12IS to 4' 3L T8 25W VHLO	4	95	0.7	0.46	0.12	1.339
Reach-In Freezers	4' 3L T12IS to 4' 3L T8 25W VHLO	26	22	1.0	0.46	0.46	1.500
					Total:	**1.04**	

To summarize all lighting measures,

Verified Lighting Savings/Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
4' T8 Lighting Fixtures	20,438	2.74	94%	67%
LED Reach-in Case Lights	27,668	2.37	161%	101%
LED Exit Signs	3,232	0.46	99%	153%
Occupancy Sensors	7,182	1.04	274%	208%
Lighting Total	**58,520**	**6.61**	**130%**	**91%**

The evaluators used engineering calculation to calculate the savings from electronically commutated motor (ECM) measures as follows,

$$Annual\ kWh\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times 8{,}760 \times CEF$$

Parameters for kWh Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency (70%)
CEF	Cooling Energy Interactive Factor: 1+1/COP

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = kW_{output} \times \left(1/Eff_{base} - 1/Eff_{post}\right) \times CEF$$

Parameters for Peak Demand (kW) Savings Calculation of ECM Measures

kW_{output}	Total Motor Output
Eff_{base}	Baseline Efficiency (Shaded pole motor, 30%)
Eff_{post}	ECM Efficiency (70%)
CEF	Cooling Energy Interactive Factor: 1+1/COP

The table below shows the energy savings calculations for the ECM portion of the project.

ECM Savings Calculations

Measures	***Unit Counts***	***kW***	***Eff_{base}***	***Eff_{post}***	***CEF***	***Realized kW***	***Realized kWh Savings***
ECM for Medium Temp.	21	0.025	0.3	0.7	1.67	1.74	15,484
ECM for Low Temp.	6	0.022	0.3	0.7	2.00	0.50	4,393
ECM for Medium Temp.	8	0.022	0.3	0.7	1.67	0.56	4,881
ECM for Low Temp.	29	0.012	0.3	0.7	2.00	1.33	11,618
ECM for Low Temp.	8	0.012	0.3	0.7	2.00	0.37	3,205
ECM for Medium Temp.	30	0.012	0.3	0.7	1.67	1.14	10,015
ECM for Medium Temp.	31	0.012	0.3	0.7	1.67	1.18	10,349
					Total	**6.82**	**59,946**

To summarize the savings,

Verified ECM Savings/Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
ECM reach-in	59,946	6.82	128%	177%
ECM Total	**59,946**	**6.82**	**128%**	**177%**

The evaluators confirmed installation of the 32 doors on reach-in freezers with anti-sweat heater controls. Savings were then calculated using the calculator developed by the evaluators. In order to determine the savings due to the ASH controller measure, the evaluators relied on power monitoring data from a multitude of participating facilities. ASH controller operation was monitored on both the frame heater and door heater circuits, which was used to obtain an average typical operating profile. This data was correlated to the dew point temperature for the period which monitoring was performed. In order to determine the typical annual operation of the ASH controllers, the dew point correlation was used to extrapolate an operating profile based on TMY weather data for the location of the store. The annual savings were calculated by subtracting the as-built energy consumption form the baseline, which assumed a constant operating profile. In order to calculate the interactive effect savings, the kW reduction for each hour was divided by the COP of the refrigeration system. The ASH controller energy savings were normalized to a per door savings in order to determine overall savings for each location.

The kWh realization rate for the ASH controls savings is 119%. The evaluators' calculations show the annual energy savings are 42,606 kWh and the demand energy savings are 3.80.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
ASH Controls	42,606	3.80	119%	567%
Total	**42,606**	**3.80**	**119%**	**567%**

The facility installed variable speed drive on a rooftop air handler unit and condenser fan unit. The evaluators used a prescriptive method for this part of the measure—VSD installed on a HVAC system for office space. The prescriptive method estimates savings of 851.4 kW/HP and this was derived using the equivalent full load hours of light commercial facilities, according to ASHRAE fundamental.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
VSD on Air Handler	34,056	1.56	100%	101%
VSD on Condenser	5,108	0.23	100%	102%
Total	**39,164**	**1.79**	**100%**	**101%**

The facility installed high efficiency air conditioning units. The evaluators verified the installation of one packaged AC unit and one split AC unit on site. The prescriptive method was used to calculate this portion of the savings.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
3 Ton Packaged Rooftop	651	0.18	99%	643%
0.75 Ton Split AC	239	0.06	99%	439%
Total	**39,164**	**1.79**	**100%**	**101%**

The facility purchased two combination ovens and high efficiency ice maker. The evaluators used the EnergyStar appliance calculator to calculate the savings from these measures.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
Combination Oven	16,942	1.93	46%	27%
Ice Machine	9,389	1.07	974%	1,340%
Total	**39,164**	**1.79**	**100%**	**101%**

Results

Verified Gross Savings/Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
4' T8 Lighting Fixtures	20,438	2.74	94%	67%
LED Exit Signs	3,232	0.46	99%	153%
LED Reach-in Case Lights	27,668	2.37	161%	101%
Occupancy Sensors	7,182	1.04	274%	208%
ECM for Reach-Ins	59,946	6.82	128%	177%
Anti Sweat Heater Control	42,606	3.80	119%	567%
VSD on Air Handler	34,056	1.56	100%	101%
VSD on Condenser	5,108	0.23	100%	102%
Packaged Rooftop AC	239	0.06	99%	643%
Split AC	651	0.18	99%	439%
Combination Oven	16,942	1.93	46%	27%
Ice Machine	9,389	1.07	974%	1,340%
Total	**227,457**	**22.27**	**111%**	**107%**

The project-level kWh realization rate is 111%. This project has a higher realization rate mainly because of the LED freezer lights, ECMs and ASH controls. The facility installed LED fixtures with occupancy control on reach-in freezers. T12 bulbs cannot restart at cold temperatures, so the lamps used to run 24 hours. With the installed LED lights, occupancy sensors can run the lighting based on occupancy. The ECMs and ASH controls measures had high realization rates due to greater savings achieved compared to ex ante estimates.

Project Number	PNM-14-01503
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a small office facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluator verified the participant had installed:

- (96) 8W LED lamps, replacing 50W halogen lamps.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Office	Office (Open)	2,594	3,066	1.216	1.313	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
50W 1L Halogen to 8W LED - Int. Ballast	96	96	50	8	3,066	3,066	21,147	15,032	1.216	71.1%
						Total	**21,147**	**15,032**		**71.1%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
50W 1L Halogen to 8W LED - Int. Ballast	96	96	50	8	0.81	0.81	6.10	4.29	1.313	70.3%
						Total	**6.10**	**4.29**		**70.3%**

Results

The kWh realization rate for PNM-14-01503 is 71.1% and the kW realization rate is 70.3%. The evaluators could not verify seven 8W LED lamps. The rebate claimed 103 lamps were installed, but the evaluators found some 8W LED lamps onsite for spares.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
50W 1L Halogen to 8W LED - Int. Ballast	15,032	4.29	71.1%	70.3%
Total	**15,032**	**4.29**	**71.1%**	**70.3%**

Project Number	PNM-14-01508
Program	Commercial Comprehensive
Component	Retrofit Rebates

Project Background

The participant is a hotel that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (732) 11W LED lamps, replacing (732) 100W Compact Fluorescent lamps;
- (439) 11W LED lamps, replacing (439) 100W incandescent lamps;
- (439) 11W LED lamps, replacing (439) 40W incandescent lamps;
- (24) 7W LED lamps, replacing (24) 26W Compact Fluorescent lamps; and
- (26) 8W LED lamps, replacing (26) 26W Compact Fluorescent lamps.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Hotel	Guest Room	799	799	1.222	1.566	0.11

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
100W Inc. to 11W LED - Int. Ballast	732	732	72	11	799	799	448,097	43,597	1.222	9.7%
100W Inc. to 11W LED - Int. Ballast	439	439	72	11	799	799	266,912	26,146	1.222	9.8%
40W Inc. to 11W LED - Int. Ballast	439	439	29	11	799	799	77,864	7,715	1.222	9.9%
26W CFL to 7W LED - Int. Ballast	24	24	26	7	799	799	4,545	445	1.222	9.8%
26W CFL to 8W LED - Int. Ballast	26	26	26	8	799	799	4,665	457	1.222	9.8%
						Total	**802,083**	**78,360**		**9.8%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
100W Inc. to 11W LED - Int. Ballast	732	732	72	11	0.11	0.11	54.47	7.69	1.566	14.1%
100W Inc. to 11W LED - Int. Ballast	439	439	72	11	0.11	0.11	32.45	4.61	1.566	14.2%

40W Inc. to 11W LED - Int. Ballast	439	439	29	11	0.11	0.11	9.47	1.36	1.566	14.4%
26W CFL to 7W LED - Int. Ballast	24	24	26	7	0.11	0.11	0.55	0.08	1.566	14.5%
26W CFL to 8W LED - Int. Ballast	26	26	26	8	0.11	0.11	0.57	0.08	1.566	14.1%
						Total	**97.50**	**13.82**		**14.2%**

Results

The kWh realization rate for PNM-14-01508 is 12.3% and the kW realization rate is 17.8%. The low kWh and kWh realization rates are due to the ex post calculations using significantly lower hours of operation for the space types than the ex ante calculations, as per the 2008 CA DEER guidelines.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
100W Inc. to 11W LED - Int. Ballast	43,597	7.69	9.7%	14.1%
100W Inc. to 11W LED - Int. Ballast	26,146	4.61	9.8%	14.2%
40W Inc. to 11W LED - Int. Ballast	7,715	1.36	9.9%	14.4%
26W CFL to 7W LED - Int. Ballast	445	0.08	9.8%	14.5%
26W CFL to 8W LED - Int. Ballast	457	0.08	9.8%	14.1%
Total	**78,360**	**13.82**	**9.8%**	**14.2%**

Project Number PNM-14-01515
Program Commercial Comprehensive
Component Retrofit Rebate

Project Background

The participant is a large office facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (38) 43W LED fixtures, replacing (38) 4' 3-lamp T12 fixtures;
- (56) 43W LED fixtures, replacing (56) 4' 3-lamp T12 fixtures;
- (42) 43W LED fixtures, replacing (42) 4' 3-lamp T12 fixtures;
- (4) 43W LED fixtures, replacing (4) 4' 3-lamp T12 fixtures;
- (14) 43W LED fixtures, replacing (14) 4' 3-lamp T12 fixtures; and
- (6) 43W LED fixtures, replacing (6) 4' 3-lamp T12 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Large Office	Office (Open)	2,641	3,100	1.129	1.303	0.81
	Conference Room	2,692	1,647	1.129	1.303	0.81
	Corridor	2,641	3,860	1.129	1.303	0.81
	Mechanical/Electrical Room	2,692	1,647	1.129	1.303	0.81
Community College	Dining	2,471	2,619	1.101	1.479	0.76
	Classroom	2,580	2,620	1.101	1.479	0.87

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

When occupancy sensors and interior daylighting controls are present, post operating hours are derived with the following equation:

$$\mathbf{OperatingHours_{POST} = OperatingHours_{BASE} * (1 - ControlFactor)}$$

Lighting Controls Reduction in Operating Hours

Occupancy Sensor	30%
Daylighting, continuous dimming	30%
Daylighting, multi-step dimming	20%
Daylighting, On/Off	10%

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 3L T12ES to 43W LED - Non-Int. Ballast	38	38	115	43	2,698	1,889	6,920	9,827	1.129	142.0%
4' 3L T12ES to 43W LED - Non-Int. Ballast	56	56	115	43	2,698	1,889	10,198	14,482	1.129	142.0%
4' 3L T12ES to 43W LED - Non-Int. Ballast	42	42	115	43	2,698	1,889	6,556	10,862	1.129	165.7%
4' 3L T12ES to 43W LED - Non-Int. Ballast	4	4	115	43	2,698	1,889	728	1,034	1.129	141.9%
4' 3L T12ES to 43W LED - Non-Int. Ballast	14	14	115	43	2,698	1,889	2,550	3,531	1.101	138.5%
4' 3L T12ES to 43W LED - Non-Int. Ballast	6	6	115	43	2,698	1,889	2,185	1,513	1.101	69.2%
						Total	**29,138**	**41,249**		**141.6%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 3L T12ES to 43W LED - Non-Int. Ballast	38	38	115	43	0.75	0.49	0.00	3.23	1.303	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	56	56	115	43	0.75	0.49	0.00	4.76	1.303	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	42	42	115	43	0.75	0.49	0.00	3.57	1.303	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	4	4	115	43	0.75	0.49	0.00	0.34	1.303	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	14	14	115	43	0.75	0.49	0.00	1.35	1.479	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	6	6	115	43	0.75	0.49	0.00	0.58	1.479	N/A
						Total	**0.00**	**13.83**		**N/A**

Results

The kWh realization rate for PNM-14-01515 is 141.6%. The ex ante calculations did not include the savings from the occupancy sensors that were installed with all rebated fixtures. The ex post calculated the post-retrofit hour of operation using the New Mexico TRM Controls Factor for interior occupancy sensors. In addition, the ex ante calculations did not include peak coincidence savings from the fixtures.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 3L T12ES to 43W LED - Non-Int. Ballast	9,827	3.23	142.0%	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	14,482	4.76	142.0%	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	10,862	3.57	165.7%	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	1,034	0.34	141.9%	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	3,531	1.35	138.5%	N/A
4' 3L T12ES to 43W LED - Non-Int. Ballast	1,513	0.58	69.2%	N/A
Total	**41,249**	**13.83**	**141.6%**	**N/A**

Project Number PNM-14-01536
Program Commercial Comprehensive
Component Retrofit Rebate

Project Background

The participant is a small retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluator verified the participant had installed:

- (2) 12W LED lamps, replacing (2) 100W 1-lamp Halogen lamps;
- (4) 15W LED lamps, replacing (4) 100W 1-lamp Halogen lamps;
- (66) 12W LED lamps, replacing (66) 100W 1-lamp Halogen lamps;
- (1) 8W LED lamps, replacing (1) 100W 1-lamp Halogen lamps;
- (3) 8W LED lamps, replacing (3) 100W 1-lamp Halogen lamps;

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.117	1.335	0.88
Small Office	Office (Executive/Private)	2,594	3,066	1.129	1.313	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
100W 1L Halogen to 15W LED - Int. Ballast	3	3	100	15	8,760	8,760	405	2,495	1.117	615.8%
100W 1L Halogen to 15W LED - Int. Ballast	1	1	100	15	3,378	3,378	780	321	1.117	41.2%
100W 1L Halogen to 12W LED - Int. Ballast	2	2	100	12	8,760	8,760	810	1,722	1.117	212.5%
100W 1L Halogen to 12W LED - Int. Ballast	66	66	100	12	3,378	3,378	13,130	21,915	1.117	166.9%
100W 1L Halogen to 8W LED - Int. Ballast	1	1	100	8	3,378	3,378	212	347	1.117	163.8%
100W 1L Halogen to 8W LED - Int. Ballast	3	3	100	8	2,594	2,594	635	808	1.129	127.2%
						Total	**15,973**	**27,608**		**172.8%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
100W 1L Halogen to 15W LED - Int. Ballast	3	3	100	15	0.88	0.88	0.12	0.30	1.335	255.7%
100W 1L Halogen to 15W LED - Int. Ballast	1	1	100	15	0.88	0.88	0.20	0.10	1.335	48.9%
100W 1L Halogen to 12W LED - Int. Ballast	2	2	100	12	0.88	0.88	0.23	0.21	1.335	89.5%
100W 1L Halogen to 12W LED - Int. Ballast	66	66	100	12	0.88	0.88	3.80	6.82	1.335	179.3%
100W 1L Halogen to 8W LED - Int. Ballast	1	1	100	8	0.88	0.88	0.06	0.11	1.335	179.3%
100W 1L Halogen to 8W LED - Int. Ballast	3	3	100	8	0.81	0.81	0.18	0.29	1.313	157.6%
						Total	**4.60**	**7.83**		**170.1%**

Results

The kWh realization rate for PNM-14-01536 is 172.8% and the kW realization rate is 170.1%. The higher in kWh and kW realization is due 2 additional LED lamps verified for the ex-post calculations.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
100W 1L Halogen to 15W LED - Int. Ballast	2,495	0.30	615.8%	255.7%
100W 1L Halogen to 15W LED - Int. Ballast	321	0.10	41.2%	48.9%
100W 1L Halogen to 12W LED - Int. Ballast	1,722	0.21	212.5%	89.5%
100W 1L Halogen to 12W LED - Int. Ballast	21,915	6.82	166.9%	179.3%
100W 1L Halogen to 8W LED - Int. Ballast	347	0.11	163.8%	179.3%
100W 1L Halogen to 8W LED - Int. Ballast	808	0.29	127.2%	157.6%
Total	**27,608**	**7.83**	**172.8%**	**170.1%**

Project Number PNM-14-01541
Program Commercial Comprehensive
Component Retrofit Rebate

Summary

The participant is a shopping mall that received incentives from PNM for installing a high efficiency chiller, a condenser pump motor, a chilled water pump motor, and VFDs for pumps. The evaluators were able to verify the building characteristics during the M&V site visit and used eQuest building simulation to evaluate the savings. The overall gross kWh realization rate is 99%.

Measurement & Verification Effort

On site, the evaluators verified installation of:

- 500 Ton High Efficiency Centrifugal Chiller
- 75-HP Premium Efficiency Motors
- 50-HP Premium Efficiency Motors
- VFDs on pump motors

The evaluators used eQuest simulation model to calculate the total savings from the installed energy efficiency measures. The as-built model was built based on the building operation and characteristics collected during the site visit, and the baseline models were built by removing energy efficient measures. The original equipment on site was from 1964, which is past expected useful lifetime, therefore, the evaluators used ASHRAE 90.1-2007 minimum requirement as the baseline equipment. The kWh savings for the energy efficiency measures were calculated by subtracting the as-built building energy consumption from that of the baseline building consumption.

End Use Results From eQuest

End Use	Baseline (ASHRAE 90.1-2007)			As-Built (kWh/yr)
	Constant Speed Opeartion (kWh/yr)	Standard Efficiency Pump Motors (kWh/yr)	Code Baseline Chiller (kWh/yr)	
Space Cool	417,643	480,478	480,478	289,862
Heat Reject.	23,422	20,358	20,358	19,139
Space Heat	0	0	0	0
Vent. Fans	221,783	221,783	221,783	221,783
Pumps & Aux.	269,938	112,952	111,818	109,901
Ext. Usage	0	0	0	0

Misc. Equip.	287,055	287,055	287,055	287,055
Area Lights	1,567,934	1,567,934	1,567,934	1,567,934
Total	**2,787,775**	**2,690,559**	**2,689,425**	**2,495,674**

The amount of savings is the difference between total energy consumption. The evaluators removed one energy efficiency measure at a time per model. Energy savings per energy efficiency measures are as follows:

Energy Savings by Measures

Description	***kWh***	***Coin. kW***
High Efficiency Chiller	193,751.20	66.61
VSD on HVAC Motors	97,216.25	16.70
Premium Pump Motors	1,133.50	0.36
TOTAL	**292,100.95**	**83.67**

Results

Verified Gross Savings/Realization Rates

Measure	***kWh Savings***			***kW Reduction***		
	Expected	***Realized***	***Realization Rate***	***Expected***	***Realized***	***Realization Rate***
High Efficiency Chiller	182,899	193,751	106%	32.71	66.61	204%
VSD on HVAC Motors	106,425	97,216	91%	4.85	16.70	344%
Premium Pump Motors	4,837	1,134	23%	0.03	0.36	1203%
Total	294,161	292,101	99%	37.59	83.67	223%

This project has approximately 100% realization rate because the facility is a typical large retail facility with typical energy efficiency measures which operates similar to the operating conditions assumed in the workpapers. The evaluators calculated the savings using eQuest simulation and the result is very similar to the prescriptive method from the workpapers.

Project Number	PNM-14-01734
Program	Commercial Comprehensive
Component	Retrofit Rebate

Summary

The participant is a school building that received incentives from PNM for replacing pneumatic control system to DDC and high efficiency lighting fixtures with controls. The evaluators obtained building drawing and characteristics during M&V site visit and used eQuest building simulation to evaluate the savings. The overall gross kWh realization rate is 102%.

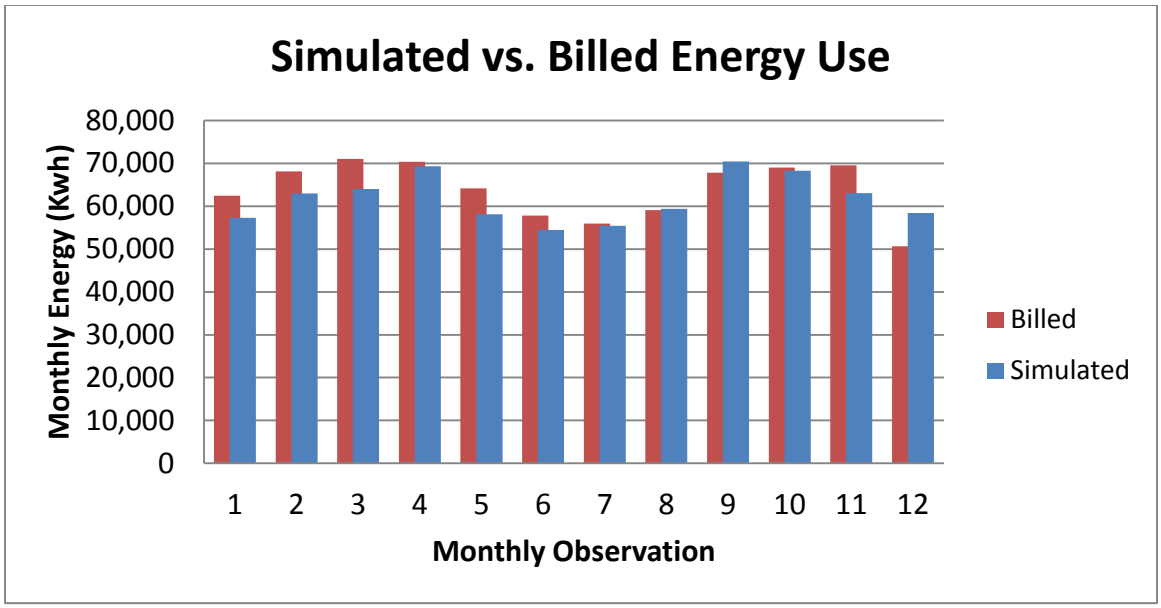
Measurement & Verification Effort

On site, the evaluators verified installation of:

- Energy efficient lighting fixtures (mostly 4' 2-lamp T8 fixtures with 28W bulbs)
- Occupancy sensors with wireless control
- Removed pneumatic system including 25-HP air compressor
- Implementation of Direct Digital Control (DDC)
- Implementation of building operation schedule on HVAC system and lighting system
- Linking exhaust fans to make-up air handler with VFDs
- VFDs and repiping of hot water pumps
- New high efficiency roof top package unit

The evaluators used a calibrated eQuest simulation model to calculate the total savings due to the installed energy efficiency measures. eQuest was used to compile two building simulation models, one for the as-built conditions and one for the baseline conditions. The as-built model was created based on current equipment and operation explained by the facility manager and collected during M&V site visit. Energy efficiency measures were removed from the as-built model to create the baseline model. The kWh savings for the energy efficiency measures was calculated by subtracting the as-built building energy consumption from that of the baseline building consumption.

eQuest Calibration Result



End Use Results From eQuest

End Use	Baseline (kWh/yr)	As-Built (kWh/yr)	Savings (kWh/yr)
Space Cool	3,831.21	2,675.98	1,155.23
Heat Reject.	0.00	0.00	0.00
Vent. Fans	427,735.50	66,357.45	361,378.05
Pumps & Aux.	19,982.98	9,844.06	10,138.92
Misc. Equip.	573,612.60	474,738.29	98,874.31
Area Lights	299,408.19	188,728.02	110,680.17
Total	**1,324,570.47**	**742,343.80**	**582,226.67**

A significant part of the savings comes from the change in HVAC and lighting schedules, which are now linked with occupancy sensors.

The building received chilled water and steam from the central chiller plant. The plant chiller plant efficiency is between 0.55 kW/Ton to 0.6 kW/Ton. In this analysis, the evaluators assumed the plant efficiency is at 0.6 kW/Ton.

The building measure effectively reduced the central plant load and the following additional plant energy savings will be realized.

Central Plant Consumption From eQuest

Central Plant Load	Baseline	As Built	Savings
Chilled Water (kWh)	354,978.48	91,658.98	263,319.50
Steam (Therms)	25,606.74	13,204.43	12,402.30

Results

Verified Gross Savings/Realization Rates

	kWh Savings			***kW Reduction***		
	Expected	***Realized***	***Realization Rate***	***Expected***	***Realized***	***Realization Rate***
DDC and Lighting	825,638	845,546	102%	27.27	104.78	384%
Total	**825,638**	**845,546**	**102%**	**27.27**	**104.78**	**384%**

The eQuest simulation resulted in nearly a 100% realization rate. The ex ante savings estimate came from historical billing analysis and there was a significant drop in energy consumption from billing data during 2013. The evaluators used a different approach to calculate the savings which included using the calibrated building model. The evaluators calibrated the post-installation building model with 2014 billing data and the actual weather data in 2014. The ex post savings via the eQuest method has a 102% realization with appropriate energy savings in all its end-use as predicted.

Project Number	PNM-14-01510
Program	Commercial Comprehensive
Component	Retrofit

Summary

The participant is a school facility that received incentives from PNM for installing VFDs on hot water loop circulation pump motors. The overall gross kWh realization rate is 60%

Measurement & Verification Effort

During the site, the evaluators verified installation of (2) VFDs on hot water loop pump motors. However, the facility mostly runs 1 circulation pump at a time.

The evaluators calculated pump savings as defined in PNM C&I workpaper after verifying similar measure savings found PNM-14-1474. The evaluators used eQuest building simulation to calculate savings from this project and part of that project contained similar measure.

PNM-14-1474 VFDs on hot water pump measure savings is 2,025 kWh. This project had (2) VFDs installed on two hot water loop pump motors rated at 2 HP each. Based on PNM C&I workpaper, this project would save 3,406 kWh. This facility has two pumps, which one pump running most of the time and rarely operating both at the same time. The evaluators estimate that only 20% of the time both pumps are running together and the evaluators applied this rate to the workpaper savings methodology by treating the quantity of pump as 1.2.

PNM C&I Workpaper Prescriptive Savings

VSD Annual Savings (kWh/HP)	851.4
Coin. kW Savings (kW/HP)	0.039

Project Savings

Measure	***Qty***	***HP***	***kWh***	***Coin. kW***
VFD	1.2	5	5,108	0.23

Results

Verified Gross Savings/Realization Rates

Measure	kWh Savings			kW Reduction		
	Expected	Realized	Realization Rate	Expected	Realized	Realization Rate
VFD	8,514	5,108	60%	0.39	0.23	60%
Total	**8,514**	**5,108**	**60%**	**0.39**	**0.23**	**60%**

The kWh realization rate for this project is 60%. The lower realization rate is due to prescriptive method counting savings by measure equipment instead of verifying how much the pumps operated. The evaluators verified the facility heating demand can be met by a single hot water circulation pump without running the second one. The second pump exists as the backup and occasionally requires higher heating demand which is less than 20% of annual heating demand.

Project Number	PNM-14-01474
Program	Commercial Comprehensive
Component	Retrofit Rebates

Summary

The participant is an elementary school that received incentives from PNM for installing variable frequency drives (VFDs) on HVAC related equipment. The evaluators were able to verify building characteristics during M&V site visit and used eQuest building simulation to evaluate the savings. The overall gross kWh realization rate is 125%.

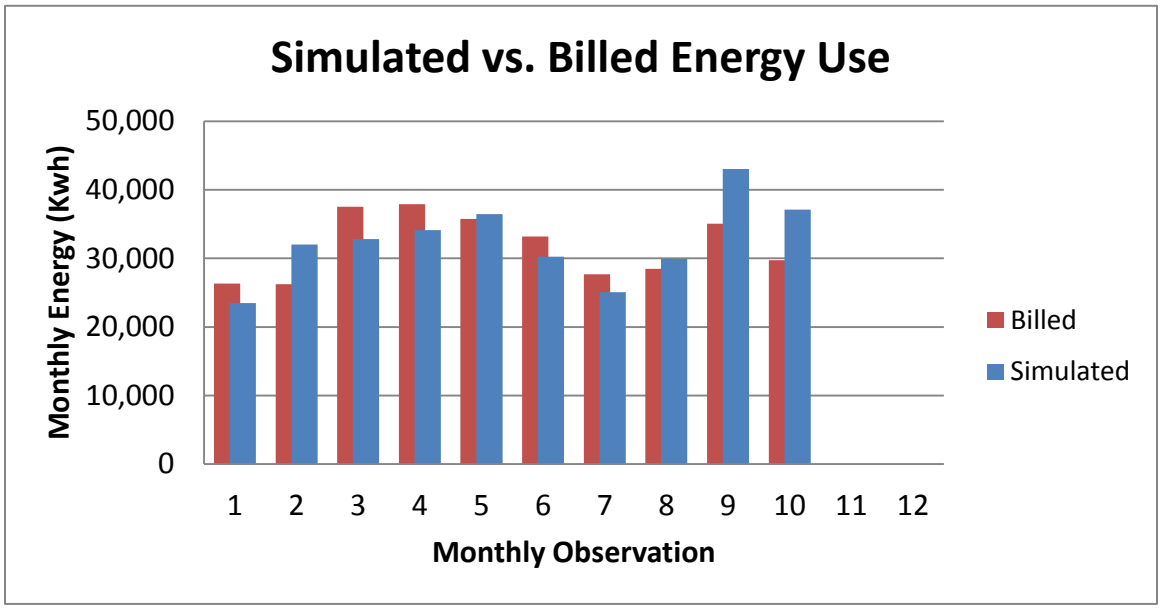
Measurement & Verification Effort

On site, the evaluators verified installation of:

- (2) 20 HP VFDs on AHU-4 and AHU-5 designated for hot air deck supply fans
- (3) 30 HP VFDs on AHU-1, AHU-2, and AHU-3 designated for cold air deck supply fans
- (2) 2 HP VFDs on Hot Water Loop Pump

The evaluators used a calibrated eQuest simulation model to calculate the total savings due to the installed energy efficiency measures. eQuest was used to compile two building simulation models, one for the as-built conditions and one for the baseline conditions. The baseline model was created based on the pre-existing equipment explained by the facility manager. The kWh savings for the energy efficiency measures was calculated by subtracting the as-built building energy consumption from that of the baseline building consumption.

eQuest Calibration Result



End Use Results From eQuest

End Use	Baseline (kWh/yr)	As-Built (kWh/yr)	Savings (kWh/yr)
Space Cool	116,916	95,507	21,409
Space Heat	782	905	-123
Vent. Fans	199,560	79,809	119,751
Pumps & Aux.	4,894	2,869	2,025
Ext. Usage	35,594	35,594	0
Misc. Equip.	107,773	107,773	0
Area Lights	156,836	156,836	0
Total	**622,356**	**479,294**	**143,062**

Results

Verified Gross Savings/Realization Rates

	kWh Savings			kW Reduction		
	Expected	Realized	Realization Rate	Expected	Realized	Realization Rate
VFD	114,088	143,062	125%	5.20	0.00	0%
Total	**114,088**	**143,062**	**125%**	**5.20**	**0.00**	**0%**

This project has higher realization rate because the facility is not fully utilizing the building management system on site. The facility has a building energy management system that can turn the HVAC system on and off using a weekly schedule. The evaluators verified that the facility runs the HVAC system from 6 AM to 4:30 PM every day. They could turn the system off during the weekend which the evaluators verified other schools in the same district do. The project has no peak demand reduction

because the school is closed during summer where PNM's peak demand occurs. A significant portion of the savings come from the VFDs on fans and less from the VFDs on pumps because the facility has two hot water pumps for heating and both are rarely operating at the same time.

Project Number	PNM-14-01473
Program	Commercial Comprehensive
Component	Retrofit

Summary

The participant is a school facility that received incentives from PNM for upgrading pneumatic controls on their HVAC equipment with DDC controller with energy management system. The primary source of energy savings is from shutting down fan at night and on weekends. The overall gross kWh realization rate is 113%

Measurement & Verification Effort

During the site, the evaluators verified installation of DDC controllers on all supply fans on the six rooftop air handler units.

The facility used to have pneumatic controller and they were able to operate HVAC system automatically. Now with the new DDC, they have a scheduled operation and the fan shuts down at night and on weekends.

The evaluators calculated the lighting savings as follows:

$$Annual\ kWh\ Savings = kW \times \left(Hours_{base} - Hours_{post}\right)$$

Parameters for kWh Savings Calculation

kW	Total Fan Power
$Hours_{base}$	Annual Hours of Operation of Baseline
$Hours_{post}$	Annual Hours of Operation after DDC

The baseline operating strategy was to run HVAC system throughout the school year. The HVAC system shuts off only during breaks. Based on Las Vegas School Districts' school year calendar, the number of school days is 266 days per year. The new DDC shuts off the system during the weekends and holidays during the school year. The yearly HVAC operating schedule is 187 days per year. Out of the 187 days, the system operates for 13 hours per day for 134 days and 19 hours per day the other 53 days.

Baseline Operating Hours

Season	Hrs/Day	School Days	Hours
All Year	24	266	6,384

Direct Digital Controlled Operating Hours

Season	Hrs/Day	School Days	Hours
Spring/Fall	13	134	1,742
Winter	19	53	1,007

Supply air fans operate continuously at a constant speed when the HVAC system is on. The following table shows the electrical energy demand by fans:

Supply Air Fan Demand (kW)

Equipment	Device	Qty.	Voltage	3-Phase	Amp	PF	SF	LF	kW
HVAC-1	Fan	1	208	1.732	30	0.85	1.15	0.7	7.395
HVAC-2	Fan	1	208	1.732	30	0.85	1.15	0.7	7.395
HVAC-3	Fan	1	208	1.732	30	0.85	1.15	0.7	7.395
HVAC-4	Fan	1	208	1.732	25.4	0.85	1.15	0.7	6.261
HVAC-5	Fan	1	208	1.732	30	0.85	1.15	0.7	7.395
HVAC-6	Fan	1	208	1.732	36.4	0.85	1.15	0.7	8.973
TOTAL									**44.816**

There is no demand savings for this measure since the energy savings come from shutting the HVAC system at night and on weekends.

Results

Verified Gross Savings/Realization Rates

	kWh Savings			kW Reduction		
	Expected	Realized	Realization Rate	Expected	Realized	Realization Rate
DDC	144,787	162,906	113%	45.80	0.00	N/A
Total	**144,787**	**162,906**	**113%**	**45.80**	**0.00**	**N/A**

The kWh realization rate for this project is 113%. The higher realization rate is mainly due to change in baseline and as-built operating hours. The evaluators analysis used a verified school calendar with instructional days, as well as verifying the operating strategy. There is no peak demand savings because from 3 PM to 6 PM on summer weekdays, these fans operate the same way as the baseline condition.

Project Number	PNM-13-01356
Program	Commercial Comprehensive
Component	Retrofit Rebates

Summary

The participant is a refrigerated storage that received incentives from PNM for implementing fast speed roll up doors between the freezer space and the cold temperature warehouse (CTW) space. On-site, the evaluators verified the participant had replaced a roll up door to a high speed roll up door, as well as measured the time it takes to open and close, the temperature of the freezer, and the temperature of the CTW. The evaluators interviewed the facility manager for average frequency of the use per hour. The gross kWh realization rate for this project is 45%.

M&V Methodology

The evaluators confirmed installation of the fast roll up door on site. The evaluators verified that the facility is open 5 days a week, 12.5 hours per day, and the door is operated about 40 times per hour. The baseline standard roll up door used to operate in 36 inches per second while the fast roll up door opens at 100 inches per second.

Verified Information

Variable	***Baseline***	***As Built***
Door Height (ft)	9	9
Door Width (ft)	6	6
Freezer Temp (F)	-6	-6
CTW Temp (F)	33	33
Cycles/Hr	40	40
Door Speed (Inches/sec.)	100	36
Open time per cycle (sec./cycle)	7.5	9
Door R-Value	0.08	4

The dominant heat transfer is through infiltration, conduction, and natural air convection. Because each side of the door is cooled, infiltration drives the freezer to run more while the CTW runs less.

Infiltration load can be calculated using following equation,

$$Load = \frac{795.6 \times (h_i - h_r) \times \rho_r \times \left(1 - {}^{\rho_i}/_{\rho_r}\right)^{0.5} \times (g \times H)^{0.5} \times F_m \times \left[D_f \times D_t \times \left(1 - E_f\right)\right]}{12{,}000}$$

Where,

A = Doorway area, ft^2

hf = Enthalpy incoming air through doorway from adjacent area, Btu/lb

hr = Enthalpy of room air, Btu/lb

ρ_r = Density of room air, lb/ft^3

ρ_i = Density of incoming air, lb/ft^3

g = Gravitation acceleration, 32.2 ft/s^2

H = Doorway height, ft

F_m = Density factor, $[2/(1+ \rho_r/ \rho_i)^{1/3}]^{1.5}$

D_f = Doorway flow factor

D_t = Percentage time period doorway is open during 1 hour period, average, expressed as a decimal

E_f = Effectiveness factor for open-doorway

The annual energy savings from infiltration is 7,449 kWh.

The annual energy consumption due to infiltration

	Baseline		***As Built***	
	Open	***Closed***	***Open***	***Closed***
H [ft]	9.0	9.0	9.0	9.0
W [ft]	6.0	6.0	6.0	6.0
A [ft2]	54	54	54	54
h_f [BTU/lb]	12.17	12.17	12.17	12.17
h_r [BTU/lb]	-0.84	-0.84	-0.84	-0.84
p_r [lb/ft^3]	0.0874	0.0874	0.0874	0.0874
p_i [lb/ft^3]	0.0801	0.0801	0.0801	0.0801
g [ft/s^2]	32.2	32.2	32.2	32.2
F_m	0.98	0.98	0.98	0.98
D_f	1.1	1.1	1.1	1.1
D_t	3.72%	96.28%	3.10%	96.90%
E_f	0.0%	95.0%	0.0%	97.0%
Load [BTUH]	9,670.21	12,513.25	8,058.51	7,556.30
COP freezer	1.00	1.00	1.00	1.00
COP CTW	2.50	2.50	2.50	2.50
Demand [kW]	**1.70**	**2.20**	**1.42**	**1.33**
Hours/Year	326	8,434	272	8,488
Energy [kWh]	**554.18**	**18,558.87**	**384.85**	**11,279.21**
Total Energy		**19,113.06**		**11,664.06**

In addition to the infiltration, there is heat transfer from the air inside the freezer to the roll up door to the refrigerated air on the other side of the door. The heat is transferred

via natural convection of the air through the door, then conducted to the other side the door, then transferred again via natural convection to the other side of the door.

$$Load = \frac{\Delta T \times A}{\frac{1}{h_{cf}} + R + \frac{1}{h_{cc}}}$$

Where,

ΔT	= Temperature difference
A	= Doorway area, ft^2
h_{cf}	= Natural convection heat transfer coefficient for freezer side
h_{cc}	= Natural convection heat transfer coefficient for CTW side
R	= R-value of the door

The natural convection coefficient is calculated in multiple steps. First, Rayleigh number must be calculated.

$$Ra = Gr \times Pr = \frac{H^3 \times \rho^2 \times g \times \Delta T \times \beta}{\mu^2} \times \frac{\mu \times C_p}{k}$$

Where,

Gr	= Grashof Number
Pr	= Prandtl Number
H	= Height of the door, ft
ρ	= Density of room air, $slug/ft^3$
g	= Gravitation acceleration, 32.2 ft/s^2
ΔT	= Temperature difference
β	= Thermal expansion coefficient of air, 0.002113 $°R^{-1}$
μ	= Viscosity of air, 3.94×10^{-7} lb sec/ft^2
Cp	= Specific heat of air, 7.7 Btu/slug °F
k	= Thermal conductivity of air, 0.0157 Btu/hr ft °F

Rayleigh number tells the convection is either laminar or turbulent. The evaluators calculated Ra of 3.15×10^{11} which is greater than 10^9, so the convection is turbulent. The natural convection equation is,

$$Nu = \left\{0.825 + \frac{0.387 \times Ra^{1/6}}{[1 + (0.492/Pr)^{9/16}]^{8/27}}\right\}^2$$

Finally, the natural convection coefficient is,

$$h_c = \frac{Nu \times k}{H}$$

The evaluators calculated the savings from heat transfer is 1,584 kWh.

The annual energy consumption due to heat transfer

	Baseline	***As Built***
H [ft]	9.0	9.0
ρ_r [slug/ft^3]	2.70E-03	2.70E-03
ρ_i [slug/ft^3]	2.51E-03	2.51E-03
g [ft/s^2]	32.2	32.2
ΔT	39.0	39.0
b [°R^{-1}]	2.11E-03	2.11E-03
u [lb-sec/ft^2]	3.94E-07	3.94E-07
Cp [Btu/slug-°F]	7.72 E+00	7.72E+00
k [Btu/hr-ft-°F]	0.0157	0.0157
h_{cf} [Btu/hr-ft^2-oF]	1.51	1.51
h_{cc} [Btu/hr-ft^2-°F]	1.44	1.44
R [hr-ft^2-°F/Btu]	0.08	4.00
Load [BTUH]	1464.01	393.02
COP freezer	1.0	1.0
COP CTW	2.5	2.5
Demand [kW]	**0.26**	**0.07**
Hours/Year	8,434	8,488
Energy [kWh]	**2,170.70**	**586.48**

The total annual energy savings for fast roll-up door is 9,033 kWh and 1.03 kW peak reduction.

Fast Roll-up Door kWh Savings Calculations

	Infiltration	***Heat Transfer***	***Total kWh***	***Peak kW Reduction***
Baseline	19,113.06	2170.70	21,283.75	2.43
As Built	11,664.06	586.48	12,250.54	1.40
Savings	**7,449.00**	**1,584.21**	**9,033.21**	**1.03**

Results

The evaluators calculated lower savings because they found multiple errors on ex ante savings calculation. The most significant mistake was because the ex ante assumed the baseline was a slow, rigid door. The evaluators interviewed the site contact and found that the baseline door was a standard roll up door. Other errors in the ex ante calculations include using the incorrect hours of operation, operating days, and temperatures, as well as including a defrosting system in the calculations where the evaluators confirmed there is not a defrosting system on site. The realization rate for this project is 45%.

Verified Gross Savings & Realization Rates

Type	Verified			
	kWh Savings	kW Savings	Realization Rate kWh	Realization Rate kW
Fast Roll-up Door Savings	9,033	1.16	45%	116%
Total	**9,033**	**1.16**	**45%**	**116%**

13.2 New Construction

Project Number	PNM-13-01318
Program	Commercial Comprehensive
Component	New Construction

Summary

The participant is an office building that received incentives from PNM for constructing a new building with energy efficient lighting fixtures and HVAC systems. The evaluators was able to verify building characteristics during M&V site visit and used eQuest building simulation to evaluate the savings. The overall gross kWh realization rate is 125%.

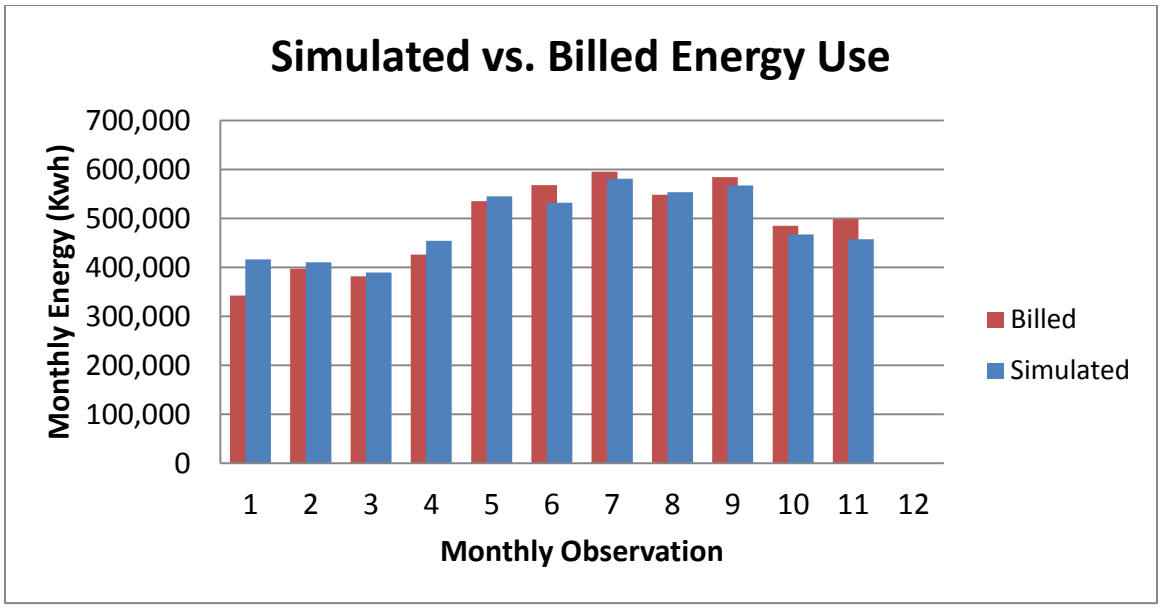
Measurement & Verification Effort

On site, the evaluators verified installation of:

- Energy efficient lighting fixtures (mostly 4’ 2-lamp T8 fixtures with 28W bulbs)
- High Efficiency rooftop packaged unit
- VAV boxes throughout the facility
- Lighting operating hours based on the evaluators’ lighting loggers

The evaluators used a calibrated eQuest simulation model to calculate the total savings due to the installed energy efficiency measures. eQuest was used to compile two building simulation models, one for the as-built conditions and one for the baseline conditions. The baseline model was created based on the pre-existing equipment explained by the facility manager. The kWh savings for the energy efficiency measures was calculated by subtracting the as-built building energy consumption from that of the baseline building consumption.

eQuest Calibration Result



End Use Results From eQuest

End Use	Baseline (kWh/yr)	As-Built (kWh/yr)	Savings (kWh/yr)
Space Cool	1,474,335	1,220,484	253,851
Heat Reject.	0	0	0
Space Heat	0	0	0
Vent. Fans	1,171,206	1,147,842	23,364
Pumps & Aux.	5,467	5,522	-55
Ext. Usage	211,525	211,525	0
Misc. Equip.	1,779,124	1,779,124	0
Area Lights	2,520,280	1,646,547	873,733
Total	7,161,934	6,011,043	1,150,891

Results

Verified Gross Savings/Realization Rates

	kWh Savings			kW Reduction		
	Expected	Realized	Realization Rate	Expected	Realized	Realization Rate
New Construction	923,319	1,150,891	125%	109.33	215.18	155%
Total	923,319	1,150,891	125%	109.33	215.18	155%

This project has higher realization rate because the most of the facility operates for 24/7. Largest savings contribution from lighting because most of the lights operating all day and the evaluators verified this with lighting loggers deployed on site for 144 days (over 20 weeks).

Project Number PNM-13-01366
Program Commercial Comprehensive
Component New Construction

Project Background

The participant is a retail facility that received incentives from PNM for installing energy efficient lighting and HVAC equipment as part of a 25,743 ft.^{2} new construction project.

M&V Methodology

The evaluators found some fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings were calculated for the HVAC measures and lighting measures. Savings from the HVAC measures were calculated using PNM's 2011 C&I Workpapers for ex ante calculations of energy efficient HVAC equipment.

Savings for the lighting measures were calculated using CA DEER 2008 deemed values by building area type for stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters.

The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***HCEF***	***HCDF***	***PCF***
Large Single Story Retail (Non-CFL)	1.109	1.348	0.85
Large Single Story Retail (CFL)	1.109	1.348	0.69

Savings Calculations

Measure 1: HVAC Measures

kWh Savings for HVAC measures are based on the following equation.

$$Annual\ kWh\ Savings = Qty. \times \frac{BtuH}{1000} \times ELFH\ \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{post}}\right)$$

Parameters for kWh Savings Calculation of HVAC Measures

Qty	Quantity of HVAC unit
Btuh	Capacity of HVAC unit
ELFH	Effective full load hours of the HVAC system
EER_{base}	Minimum required HVAC efficiency, per IECC2009
$EERP_{post}$	HVAC efficiency as installed

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = Qty. \times \frac{BtuH}{1000} \times ELFH\ \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{post}}\right) \times PCF$$

Parameters for Peak Demand (kW) Savings Calculation of HVAC Measures

EER_{base}	Minimum required HVAC efficiency, per IECC2009
EER_{post}	HVAC efficiency as installed
PCF	Peak Coincident Factor

HVAC kWh Savings Calculations

Measure	***Quantity***	***Btuh***	***Hours***	***(S)EER***		***Expected kWh Savings***	***Realized kWh Savings***	***Realization Rate***
				Base	***Post***			
HVAC (Lennox LGH 180H4)	4	172,000	1,388	11	12	17,529	**7,234**	**41.27%**
HVAC (Lennox LGH 210H4)	1	198,000	1,388	11	12	4,189	**2,082**	**49.70%**
HVAC (Lennox LGH 060H4)	1	60,000	1,388	13	17	1,846	**1,507**	**81.63%**
HVAC (Lennox LGH 048H4)	1	49,000	1,388	13	17	1,507	**1,231**	**81.70%**
					Total	**25,072**	**12,055**	**48.08%**

HVAC kW Savings Calculations

Measure	Quantity	Btuh	PCF	(S)EER		Expected kW Savings	Realized kW Savings	Realization Rate
				Base	Post			
HVAC (Lennox LGH 180H4)	4	172,000	0.0005	11	12	3.19	3.62	113.39%
HVAC (Lennox LGH 210H4)	1	198,000	0.0005	11	12	0.92	1.04	113.15%
HVAC (Lennox LGH 060H4)	1	60,000	0.0005	13	17	0.24	0.75	314.03%
HVAC (Lennox LGH 048H4)	1	49,000	0.0005	13	17	0.20	0.62	307.75%
					Total	**4.55**	**6.03**	**848.32%**

Measure 2: Lighting Power Density

Using values from the Deemed Savings Parameters table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPD_{post}	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square foot area of the specific lighting area
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon an PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = \left(LPD_{base} - LPD_{post}\right) * sqft * HCDF * PCF$$

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPD_{post}	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square foot area of the specific lighting area
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating

HCDF	Heating Cooling Demand Interactive Factor

Savings from the various energy efficient measures are shown in the tables below.

LPD_{post} Calculations

New Fixture	***Quantity***	***Total Wattage***	***Building Square Footage***	***Total Facility LPD_{base}***	***Total Facility LPD_{post}***
16' fixture (4 x 4' T8 lamps) HO	133	19,551	25,743	1.500	1.159
12' fixture (3 x 4' T8 lamps) HO	37	4,070			
8' fixture (2 x 4' T8 lamps) HO	7	518			
4' T8 lamp HO	16	592			
4' T8 lamp HO	20	740			
8' fixture (2 x 4' T8 lamps)	10	500			
4' T8 lamp	4	100			
4' 4 lamp T8 fixture	4	592			
39W Metal Halide	15	630			
42W CFL Task Light	3	126			
26W CFL Downlight	4	104			
Wall Scone CFL	4	56			
Task Light Halogen (35W)	14	490			
Pendant Halogen (35 W)	2	70			
4' 2 lamp T8 fixture	2	100			
4' 2 lamp T8 fixture	6	300			
4' 4 lamp T8 fixture	10	990			
4' 2 lamp T8 wall mount fixture	4	200			
3' 1 lamp T8 (25W)	5	100			

Total Facility Hours

Space Type	***Weight***	***Hours***
Retail Overhead lights	0.874	4,536
Retail Floor	0.106	4,171
Security Lights	0.020	8,760
	Total Facility Hours	**4,582**

LPD kWh Savings Calculations

Space	*LPD*		*Sq. Ft.*	*Hours*		*Expected kWh Savings*	*Realized kWh Savings*	***HCEF***	***Realization Rate***
	Base	*Post*		*Base*	*Post*				
Retail Space	1.500	1.159	29,829	4,582	4,582	19,565	44,626	1.109	228.09%

Total	**19,565**	**44,626**	**1.109**	**228.09%**

LPD kW Savings Calculations

Space	LPD		Sq. Ft.	PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post		Base	Post				
Retail Space	1.500	1.159	29,829	0.85	0.85	4.89	34.11	1.348	761.47%
					Total	**4.89**	**34.11**	**1.348**	**761.47%**

Results

The overall kWh realization rate for PNM-13-01366 is 125% and the kW realization rate is 439%. The kWh savings are higher for the LPD improvement because the evaluators verified 35W halogen lamps for spot lights rather than 50W which is listed on the compliance check. The reduce fixture wattage reduced the overall LPD from 1.307 to 1.159. In addition, the ex post calculations used the operating hours collected during the evaluators site visit, which is higher than PNM's 2011 C&I Workpapers and CA DEER 2008.

The kWh realization rate is low for the HVAC measure because of miscalculations in the ex ante expected kWh savings. The evaluators suspect that the ex ante savings were calculated using the post retrofit efficiency in SEER and the baseline efficiency in EER, generating larger difference in savings. Both efficiency units must be the same, and using EER is preferred. The evaluators calculated ex post savings based on AHRI certificates supplied in project documentation and used the algorithm found in PNM's 2011 C&I Workpapers.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
HVAC Measures	10,978	5.49	44%	121%
LPD Improvement	44,626	34.11	228%	761%
Total	**55,604**	**39.60**	**125%**	**439%**

Project Number PNM-15-01411
Program Commercial Comprehensive
Component New Construction

Project Background

The participant is an assembly building that received incentives from PNM for installing energy efficient lighting as part of a 468,189 ft.^{2} exterior lighting new construction project. On-site, the evaluators verified the participant had installed:

- (88) 241W LED fixtures; and
- (15) 55W LED fixtures.

M&V Methodology

Savings from the lighting measures were calculated using New Mexico Technical Resource Manual for lighting power density.

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and EPE peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Measure	*IECC 2009 Building Type*	*Annual Hours*	*Lighting Power Density (w/ft2)*	*HCEF*	*HCDF*	*PCF*
1	Uncovered parking areas	4,312	0.15	1.00	1.00	0.00
2	Building grounds – Walkways greater than 10 ft wide	4,312	0.20	1.00	1.00	0.00

Savings Calculations

Measure 1: Lighting Power Density Reduction

Using values from the Deemed Savings Parameters table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPDpost	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square footage of the specific lighting area
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = \left(LPD_{base} - LPD_{post}\right) * sqft * HCDF * PCF$$

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPD_{post}	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square foot area of the specific lighting area
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating
HCDF	Heating Cooling Demand Interactive Factor

Savings from the various energy efficient measures are shown in the tables below.

LPD_{post} Calculations

Measure 1

Space Type	*New Fixture*	*Quantity*	*Wattage*	*Building Square Footage*	*Total Facility LPDbase*	*Total Facility LPDpost*
Assembly	LED241-FIXT	88	241	437,977	0.15	0.05
	Total	**88**	**21,208**	**437,977**	**0.15**	**0.05**

Measure 2

Space Type	*New Fixture*	*Quantity*	*Wattage*	*Building Square Footage*	*Total Facility LPDbase*	*Total Facility LPDpost*
Assembly	LED055-FIXT	15	55	30,212	0.20	0.03
	Total	**15**	**825**	**30,212**	**0.20**	**0.03**

LPD kWh Savings Calculations

Measure	Total Wattage	LPD		Sq. Ft.	Hours	Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
		Base	Base						
1	21,208	0.15	0.05	437,977	4,312	194,860	188,856	1.00	96.9%
2	825	0.20	0.03	30,212	4,312	19,239	22,147	1.00	115.1%
Total	22,033	N/A	N/A	4,68,189	4,312	214,099	211,003	-	98.6%

LPD kW Savings Calculations

Measure	LPD		Sq. Ft.	PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post		Base	Post				
1	0.15	0.05	437,977	0.00	0.00	44.49	0.00	1.00	0.0%
2	0.20	0.03	30,212	0.00	0.00	4.39	0.00	1.00	0.0%
Total	N/A	N/A	4,68,189	0.00	0.00	**44.88**	**0.00**	-	**0.0%**

Results

The overall kWh realization rate for PNM-15-01411 is 98.6% and the kW realization rate is 0.0%. The kW realization rate is low because project was entirely exterior fixtures and the ex ante calculations did not account for the peak coincidence factor of zero for exterior fixtures. In addition, the evaluators could not verify (15) 55W LED fixtures, which increased the kWh savings for Measure 2.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
LPD Improvement	211,003	0.00	98.6%	0.0%
Total	**211,003**	**0.00**	**98.6%**	**0.0%**

Project Number PNM-14-01297
Program Commercial Comprehensive
Component New Construction

Project Background

The participant is a grocery store facility that received incentives from PNM for installing LED refrigerated case lighting as part of a new construction project.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***HCEF***	***HCDF***	***PCF***
Grocery	Reach-in Cooler	4,964	1.320	1.400	0.70
Grocery	Reach-in Freezer	4,964	1.400	1.400	0.70

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 1L T8 HLO to 22W LED - Non-Int. Ballast	9	9	36	22	8,760	4,964	3,039	2,449	1.320	80.6%
4' 1L T8 HLO to 18W LED - Non-Int. Ballast	6	6	36	18	8,760	4,964	2,605	1,790	1.320	68.7%
4' 1L T8 HLO to 22W LED - Non-Int. Ballast	7	7	36	22	8,760	4,964	2,364	2,020	1.400	85.5%
4' 1L T8 HLO to 18W LED - Non-Int. Ballast	4	4	36	18	8,760	4,964	1,737	1,266	1.400	72.9%
						Total	**9,744**	**7,525**		**77.2%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 1L T8 HLO to 22W LED - Non-Int. Ballast	9	9	36	22	0.70	0.70	0.41	0.12	1.400	28.9%
4' 1L T8 HLO to 18W LED - Non-Int. Ballast	6	6	36	18	0.70	0.70	0.36	0.11	1.400	30.9%
4' 1L T8 HLO to 22W LED - Non-Int. Ballast	7	7	36	22	0.70	0.70	0.32	0.10	1.500	31.0%
4' 1L T8 HLO to 18W LED - Non-Int. Ballast	4	4	36	18	0.70	0.70	0.24	0.08	1.500	33.8%
						Total	**1.33**	**0.41**		**30.8%**

Results

The overall kWh realization rate for PNM-14-01297 is 77.2% and kW realization rate is 30.8%. The kWh savings are lower due to the ex post calculations using lower post-retrofit operating hours for this space type (4,964), as per CA DEER 2008 guidelines, than the ex ante calculations (6,205). In addition, the ex post calculations used a lower PCF than the ex ante calculations. The evaluators verified the site had one additional LED strip per case than claimed—26 LED strips were verified rather than 21.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
LED Case Lighting	7,525	0.41	77.2%	30.8%
Total	**7,525**	**0.41**	**77.2%**	**30.8%**

Project Number PNM-14-01443
Program Commercial Comprehensive
Component New Construction

Project Background

The participant is a retail facility that received incentives from PNM for installing energy efficient lighting and HVAC equipment as part of a 48,463 ft.^{2} new construction project.

M&V Methodology

The evaluators found some fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings were calculated for the HVAC measures and lighting measures. Savings from the HVAC measures were calculated using KEMA's work papers for ex ante calculations of energy efficient HVAC equipment.

Savings for the lighting measures were calculated using CA DEER 2008 deemed values by building area type for stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters.

The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***HCEF***	***HCDF***	***PCF***
Large Single Story Retail (Non-CFL)	1.109	1.348	.85

Savings Calculations

Measure 1: HVAC Measures

kWh Savings for HVAC measures are based on the following equation.

$$Annual\ kWh\ Savings = Qty. \times \frac{BtuH}{1000} \times ELFH\ \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{post}}\right)$$

Parameters for kWh Savings Calculation of HVAC Measures

Qty	Quantity of HVAC unit
Btuh	Capacity of HVAC unit
ELFH	Effective full load hours of the HVAC system
EER_{base}	Minimum required HVAC efficiency, per IECC2009
EER_{post}	HVAC efficiency as installed

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = Qty. \times \frac{BtuH}{1000} \times ELFH\ \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{post}}\right) \times PCF$$

Parameters for Peak Demand (kW) Savings Calculation of HVAC Measures

EER_{base}	Minimum required HVAC efficiency, per IECC2009
EER_{post}	HVAC efficiency as installed
PCF	Peak Coincident Factor

HVAC kWh Savings Calculations

Measure	***Quantity***	***Btuh***	***Hours***	***(S)EER***		***Expected kWh Savings***	***Realized kWh Savings***	***Realization Rate***
				Base	***Post***			
HVAC (York YHD180F)	8	172,000	1,388	11	12		**14,469**	
HVAC (York YSC120F4)	2	113,000	1,388	11	11.3		**757**	
					Total	**36,862**	**15,226**	**41.31%**

HVAC kW Savings Calculations

Measure	***Quantity***	***Btuh***	***PCF***	***(S)EER***		***Expected kW Savings***	***Realized kW Savings***	***Realization Rate***
				Base	***Post***			
HVAC (York YHD180F)	8	172,000	0.0005	11	13.3		7.23	
HVAC (York YSC120F4)	2	113,000	0.0005	11	11.3		0.38	
					Total	**7.3**	**7.61**	**104.29%**

Measure 2: Lighting Power Density

Using values from the Deemed Savings Parameters table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPDpost	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square foot area of the specific lighting area
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon an PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = \left(LPD_{base} - LPD_{post}\right) * sqft * HCDF * PCF$$

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPD_{post}	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square foot area of the specific lighting area
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating
HCDF	Heating Cooling Demand Interactive Factor

Savings from the various energy efficient measures are shown in the tables below.

LPD_{post} Calculations

New Fixture	Quantity	Total Wattage	Building Square Footage	Total Facility LPD_{base}	Total Facility LPD_{post}
4' 2L T8 Shelf	131	7,598	48,463	1.500	1.395
35W Halogen	9	315			
35W Halogen	2	70			
50W MH	42	2,226			
400W MH	127	57,404			
Total	**311**	**67,613**	**48,463**	**1.500**	**1.395**

Results

The overall kWh realization rate for PNM-13-01443 is 78.6% and the kW realization rate is 189.9%. The increase in kWh savings for the LPD improvement is due the evaluators verifying a lower LPD in this facility, using the IECC 2009 code for LPD calculations.

The HVAC units were smaller than indicated in the application, resulting in significantly reduced savings due to lower cooling load and a change in baseline.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
HVAC Measures	14,702	7.35	39.9%	100.7%
LPD Improvement	26,486	13.24	170.8%	373.0%
Total	**41,188**	**20.59**	**78.6%**	**189.8%**

Project Number	PNM-14-01500
Program	Commercial Comprehensive
Component	New Construction

Project Background

The participant is a high school that received incentives from PNM for installing energy efficient lighting and HVAC equipment as part of an 112,538 ft.^{2} new construction project.

M&V Methodology

The evaluators found some fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings were calculated for the HVAC measures and lighting measures. Savings from the HVAC measures were calculated using PNM's work papers for ex ante calculations of energy efficient HVAC equipment.

Savings for the lighting measures were calculated using CA DEER 2008 deemed values by building area type for stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters.

The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***HCEF***	***HCDF***	***PCF***
Secondary School (Non-CFL)	1.067	1.344	0.71

Savings Calculations

Measure 1: HVAC Measures

kWh Savings for HVAC measures are based on the following equation.

$$Annual\ kWh\ Savings = Qty. \times \frac{BtuH}{1000} \times ELFH\ \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{post}}\right)$$

Parameters for kWh Savings Calculation of HVAC Measures

Qty	Quantity of HVAC unit
Btuh	Capacity of HVAC unit
ELFH	Effective full load hours of the HVAC system
EER_{base}	Minimum required HVAC efficiency, per IECC2009
EER_{post}	HVAC efficiency as installed

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = Qty. \times \frac{BtuH}{1000} \times ELFH\ \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{post}}\right) \times PCF$$

Parameters for Peak Demand (kW) Savings Calculation of HVAC Measures

EER_{base}	Minimum required HVAC efficiency, per IECC2009
EER_{post}	HVAC efficiency as installed
PCF	Peak Coincident Factor

HVAC kWh Savings Calculations

Measure	***Quantity***	***Btuh***	***Hours***	***(S)EER***		***Expected kWh Savings***	***Realized kWh Savings***	***Realization Rate***
				Base	***Post***			
HVAC (Trane YFD151)	1	138,480	811	11.0	12.0	1,011	**851**	**84.12%**
HVAC (Trane YHC036)	1	31,680	811	11.2	15.0	295	**581**	**196.68%**
HVAC (Mitsubishi PUHY-P96)	1	96,000	811	11.2	11.4	2,319	**123**	**5.30%**
HVAC (Mitsubishi PUHY-P72)	1	72,000	811	11.2	13.7	2,067	**940**	**45.45%**
HVAC (Mitsubishi PUHY-P72)	1	72,000	811	11.2	13.7	552	**940**	**170.37%**
					Total	**6,245**	**3,434**	**54.99%**

HVAC kW Savings Calculations

Measure	Quantity	Btuh	PCF	(S)EER		Expected kW Savings	Realized kW Savings	Realization Rate
				Base	Post			
HVAC (Trane YFD151)	0	138,480	0.0004	11.0	12.0	0.17	0.34	200.19%
HVAC (Trane YHC036)	1	31,680	0.0004	11.2	15.0	0.06	0.23	387.43%
HVAC (Mitsubishi PUHY-P96)	1	96,000	0.0004	11.2	11.4	0.18	0.05	27.29%
HVAC (Mitsubishi PUHY-P72)	1	72,000	0.0004	11.2	13.7	0.13	0.38	289.11%
HVAC (Mitsubishi PUHY-P72)	1	72,000	0.0004	11.2	13.7	0.90	0.38	41.76%
					Total	**1.44**	**1.37**	**95.39%**

Measure 2: Lighting Power Density

Using values from the Deemed Savings Parameters table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPDpost	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square foot area of the specific lighting area
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon an PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

$$Peak\ kW\ Savings = \left(LPD_{base} - LPD_{post}\right) * sqft * HCDF * PCF$$

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

LPD_{base}	Allowed ASHRAE 90.1 LPD (w/ft^2)
LPD_{post}	Total Wattage for fixtures / square footage / 1000 W/kW
Sqft	Square foot area of the specific lighting area
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating
HCDF	Heating Cooling Demand Interactive Factor

Savings from the various energy efficient measures are shown in the tables below.

LPD_{post} Calculations

New Fixture	***Quantity***	***Total Wattage***	***Building Square Footage***	***Total Facility LPD_{base}***	***Total Facility LPD_{post}***
4' 2L T8 (25W, BF 1.14)	23	1,311.0	112,538	1.200	0.735
4' 1L T5 (54W HO, BF 1.21)	66	4,312.4			
4' 1L T5 (54W HO, BF 1.21)	5	326.7			
4' 1L T5 (54W HO, BF 1.21)	11	718.7			
4' 2L T8 (25W, BF 0.94)	124	5,828.0			
4' 3L T8 (25W, BF 0.94)	20	1,485.0			
4' 3L T8 (25W, BF 1.14)	7	633.5			
4' 2L T8 (25W, BF 1.14)	150	8,550.0			
22W T8-size LED	37	814.0			
4' 2L T8 (25W, BF 1.14)	14	798.0			
22W T8-size LED	6	132.0			
4' 2L T8 (25W, BF 1.14)	3	171.0			
4' 2L T8 (25W, BF 1.14)	14	798.0			
6" Downlight 22W LED	273	6,006.0			
4' 1L T5 (54W HO, BF 1.11)	86	5,154.8			
4' 2L T8 (25W, BF 0.94)	17	765.0			
2-lamp 32W CF	8	512.0			
4' 3L T8 (25W, BF 0.95)	1	71.3			
8' fix 4' 6L T8 (25W, BF 0.95)	139	19,807.5			
12' fix 4' 9L T8 (25W, BF 0.95)	112	23,940.0			
30W LED Pendant Fixture	20	600.0			

Total Facility Hours

Space Type	***Weight***	***Hours***
Classroom	0.976	2,445
Dining Area	0.011	2,365
Kitchen	0.013	1,168
	Total Facility Hours	**2,400**

LPD kWh Savings Calculations

Space	*LPD*		*Sq. Ft.*	*Hours*		*Expected kWh Savings*	*Realized kWh Savings*	***HCEF***	***Realization Rate***
	Base	*Post*		*Base*	*Post*				
Secondary School	1.200	0.735	112,538	2,400	2,400	234,079	133,992	1.067	53%
Total						**234,079**	**133,992**	**1.067**	**53%**

LPD kW Savings Calculations

Space	LPD		Sq. Ft.	PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post		Base	Post				
Secondary School	1.200	0.735	112,538	0.42	0.42	53.60	46.69	1.344	87%
Total						**53.60**	**46.69**	**1.344**	**87%**

Results

The overall kWh realization rate for PNM-14-01500 is 57% and the kW realization rate is 89%. The overall realization is low because of an error in the ex ante lighting savings calculation. The evaluators reverse engineered the ex ante savings claim and discovered that the annual hours of operation used was 4,000 hours. For a K-12 school facility, the annual operating hour is 2,245, as per PNM's 2011 C&I Workpapers. The evaluators used the annual operating hours from CA DEER 2008 by area type for this facility, which averages to 2,399 hours per year. In addition to the difference in annual operating hours, the evaluators verified installed lighting fixtures and calculated a higher lighting power density (LPD) than the ex ante claimed. The ex post calculations found a LPD of 0.735 W/sqft and the ex ante claimed 0.68 W/sqft. The ex post LPD is higher because the evaluators found verified fixture counts varied from what was used in the ex ante calculations. In addition, the ballast factors the evaluators verified for linear fluorescent fixtures increased the wattage per fixture and resulted in a higher overall LPD.

The lower realization rate for the HVAC equipment is because the ex ante calculations used the EER for baseline efficiency but SEER for the new efficiency. It's important to use the same efficiency unit. The evaluators suggest using SEER for HVAC equipment smaller than 5 tons but EER for units over 5.4 tons.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
HVAC Measures	3,434	1.72	55%	273%
LPD Improvement	133,992	46.69	57%	87%
Total	**137,426**	**48.41**	**57%**	**89%**

13.3 QuickSaver

Project Number QS-3654
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a small office facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluator verified the participant had installed:

- (4) 4' 3-lamp RW T8 fixtures, replacing (4) 4' 3-lamp T8 fixtures;
- (21) 4' 3-lamp RW T8 fixtures, replacing (21) 4' 3-lamp T8 fixtures;
- (3) 4' 3-lamp RW T8 fixtures, replacing (3) 4' 3-lamp T8 fixtures;
- (18) 4' 3-lamp RW T8 fixtures, replacing (18) 4' 3-lamp T8 fixtures;
- (1) 4' 2-lamp RW T8 fixture, replacing (1) 4' 2-lamp T12 fixture;
- (4) 4' 2-lamp RW T8 fixtures, replacing (2) 4' 2-lamp T8 fixtures;
- (4) 4' 2-lamp RW T8 fixtures, replacing (2) 4' 2-lamp T8 fixtures;
- (4) 4' 2-lamp RW T8 fixture, replacing (4) 4' 2-lamp T12 fixture;
- (32) 4' 4-lamp HO T5 fixtures, replacing (32) 400W metal halide fixtures;
- (5) 2' 2-lamp HO T5 fixtures, replacing (5) 150W metal halide fixtures;
- (5) 2' 2-lamp HO T5 fixtures; replacing (5) 100W incandescent fixtures; and
- (5) 2-lamp 26W multi 4-pin CFL, replacing 70W metal halide fixtures.

The evaluator also verified the participant had removed:

- (5) 100W incandescent fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Office	Lobby	2,594	3,957	1.216	1.232	0.81
	Office (Open)	2,594	3,066	1.216	1.232	0.81
	Office (Executive/Private)	2,594	3,066	1.216	1.232	0.81

	Mechanical/Electrical Room	2,594	1,556	1.216	1.232	0.81
	Restroom	2,594	3,957	1.216	1.232	0.81
Storage	Storage (Conditioned)	3,441	2,780	1.052	1.540	0.70

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 3L T8 to 4' 3L T8 28W	4	4	85	76	2,594	2,594	171	114	1.216	66.8%
4' 3L T8 to 4' 3L T8 28W	21	21	85	76	2,594	2,594	896	596	1.216	66.5%
4' 3L T8 to 4' 3L T8 28W	3	3	85	76	2,594	2,594	128	85	1.216	66.4%
4' 3L T8 to 4' 3L T8 28W	18	18	85	76	2,594	2,594	768	511	1.216	66.6%
4' 2L T12ES to 4' 2L T8 28W	1	1	72	52	2,594	2,594	95	63	1.216	66.5%
4' 2L T8 to 4' 2L T8 28W	4	4	58	52	2,594	2,594	114	76	1.216	66.8%
4' 2L T8 to 4' 2L T8 28W	4	4	58	52	2,594	2,594	114	76	1.216	66.8%
4' 2L T12ES to 4' 2L T8 28W	4	4	72	52	3,441	3,441	379	290	1.052	76.5%
400W MH to 4' 4L T5HO	32	32	453	211	2,594	2,594	36,698	24,427	1.216	66.6%
150W MH to 2' 2L T5HO	4	4	183	52	4,313	4,313	3,104	2,260	1.000	72.8%
150W MH to 4' 4L T5HO	1	1	183	211	4,313	4,313	-133	-121	1.000	91.2%
100W Inc. to Delamp	5	0	100	0	4,313	0	1,706	2,156	1.000	126.4%
100W Inc. to 2' 2L T5HO	5	5	100	52	4,313	4,313	474	1,035	1.000	218.4%
70W MH to 2L 26W CFL Multi 4-Pin	2	2	91	51	4,313	4,313	379	345	1.000	91.0%
						Total	**44,892**	**31,913**		**71.1%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 3L T8 to 4' 3L T8 28W	4	4	85	76	0.81	0.81	0.04	0.04	1.313	96.4%
4' 3L T8 to 4' 3L T8 28W	21	21	85	76	0.81	0.81	0.22	0.20	1.313	91.8%
4' 3L T8 to 4' 3L T8 28W	3	3	85	76	0.81	0.81	0.03	0.03	1.313	96.4%
4' 3L T8 to 4' 3L T8 28W	18	18	85	76	0.81	0.81	0.19	0.17	1.313	91.0%
4' 2L T12ES to 4' 2L T8 28W	1	1	72	52	0.81	0.81	0.02	0.02	1.313	86.7%
4' 2L T8 to 4' 2L T8 28W	4	4	58	52	0.81	0.81	0.03	0.03	1.313	108.4%

4' 2L T8 to 4' 2L T8 28W	4	4	58	52	0.81	0.81	0.03	0.03	1.313	108.4%
4' 2L T12ES to 4' 2L T8 28W	4	4	72	52	0.70	0.70	0.09	0.09	1.540	97.6%
400W MH to 4' 4L T5HO	32	32	453	211	0.81	0.81	8.93	8.24	1.313	92.3%
150W MH to 2' 2L T5HO	4	4	183	52	0.00	0.00	0.76	0.00	1.000	0.0%
150W MH to 4' 4L T5HO	1	1	183	211	0.00	0.00	-0.03	0.00	1.000	0.0%
100W Inc. to Delamp	5	0	100	0	0.00	0.00	0.41	0.00	1.000	0.0%
100W Inc. to 2' 2L T5HO	5	5	100	52	0.00	0.00	0.12	0.00	1.000	0.0%
70W MH to 2L 26W CFL Multi 4-Pin	2	2	91	51	0.00	0.00	0.09	0.00	1.000	0.0%
						Total	**10.92**	**8.85**		**81.0%**

Results

The kWh realization rate for QS-3654 is 71.2% and the kW realization rate is 81.0%. The decrease in savings is because the ex post calculations used lower hours of operation than the ex ante, as per the CA DEER 2008 guidelines. In addition, the ex post calculations used coincidence factor of zero for exterior fixtures and a higher coincidence factor the interior fixtures than the ex ante calculations.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 3L T8 to 4' 3L T8 28W	114	0.04	66.8%	96.4%
4' 3L T8 to 4' 3L T8 28W	596	0.20	66.5%	91.8%
4' 3L T8 to 4' 3L T8 28W	85	0.03	66.4%	96.4%
4' 3L T8 to 4' 3L T8 28W	511	0.17	66.6%	91.0%
4' 2L T12ES to 4' 2L T8 28W	63	0.02	66.5%	86.7%
4' 2L T8 to 4' 2L T8 28W	76	0.03	66.8%	108.4%
4' 2L T8 to 4' 2L T8 28W	76	0.03	66.8%	108.4%
4' 2L T12ES to 4' 2L T8 28W	290	0.09	76.5%	97.6%
400W MH to 4' 4L T5HO	24,427	8.24	66.6%	92.3%
150W MH to 2' 2L T5HO	2,260	0.00	72.8%	0.0%
150W MH to 4' 4L T5HO	-121	0.00	91.2%	0.0%
100W Inc. to Delamp	2,156	0.00	126.4%	0.0%
100W Inc. to 2' 2L T5HO	1,035	0.00	218.4%	0.0%
70W MH to 2L 26W CFL Multi 4-Pin	345	0.00	91.0%	0.0%
Total	**31,913**	**8.85**	**71.1%**	**81.0%**

Project Number QS-4500
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is an office facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (94) 4' 2-lamp RW T8 fixtures, replacing (94) 4' 4-lamp T12 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Office	Office (Executive/Private)	2,594	3,066	1.216	1.232	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8 28W	94	94	188	52	2,594	2,594	36,073	40,325	1.216	111.8%
						Total	**36,073**	**40,325**		**111.8%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8 28W	94	94	188	52	0.81	0.81	11.56	13.60	1.313	117.6%
						Total	**11.56**	**13.60**		**117.6%**

Results

The kWh realization rate for QS-4500 is 111.8% and the kW realization rate is 117.6%. The ex ante incorrectly classified this facility as Small Retail and the evaluators verified onsite that the facility is a Small Office. This reduced the hours of operation, increased the HCEF, and decreased the HCDF.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
4' 4L T12 to 4' 2L T8 28W	40,325	13.60	111.8%	117.6%
Total	**40,325**	**13.60**	**111.8%**	**117.6%**

Project Number QS-4300
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a fast food restaurant facility that received incentives from PNM for implementing energy efficient lighting. On-site, ADM verified the participant had installed:

- (33) 4' 2-lamp 32W T8 fixtures, replacing 4' 4-lamp 40W T12 fixtures
- (4) 4' 2-lamp 25W T8 fixtures, replacing 4' 2-lamp 40W T12 fixtures
- (3) 1-lamp 2W LED exit signs, replacing 1-lamp 25W incandescent exit signs

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Sit Down Restaurant	Dining Area	4,850	4,850	1.207	1.274	0.81
	Lobby	4,850	4,850	1.207	1.274	0.81
	Kitchen	4,812	4,812	1.207	1.274	0.81
	Restrooms	4,677	4,677	1.207	1.274	0.81

Savings Calculations

Using deemed values from the table above, ADM calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, ADM calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8	1	1	172	54	4,850	4,850	572	667	1.207	116.7%
4' 4L T12 to 4' 2L T8	12	12	172	54	4,850	4,850	6,862	8,008	1.207	116.7%
4' 4L T12 to 4' 2L T8	5	5	172	54	4,850	4,850	2,859	3,337	1.207	116.7%
4' 4L T12 to 4' 2L T8	1	1	172	54	4,850	4,850	572	667	1.207	116.7%
4' 4L T12 to 4' 2L T8	1	1	172	54	4,812	4,812	572	662	1.207	115.8%
4' 4L T12 to 4' 2L T8	3	3	172	54	4,812	4,812	1,715	1,986	1.207	115.8%
4' 4L T12 to 4' 2L T8	8	8	172	54	4,812	4,812	4,574	5,297	1.207	115.8%
4' 4L T12 to 4' 2L T8	1	1	172	54	4,420	4,420	572	608	1.207	106.3%
4' 4L T12 to 4' 2L T8	1	1	172	54	4,420	4,420	572	608	1.207	106.3%
1L 25W Inc. Exit to 1L 2W LED Exit	3	3	25	6	8,760	8,760	286	603	1.207	210.9%

4' 4L T12 to 4' 2L T8 25W	4	4	172	43	4,850	4,850	2,528	2,950	1.207	116.7%
						Total	**21,683**	**25,393**		**117.1%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
4' 4L T12 to 4' 2L T8	1	1	172	54	0.81	0.81	0.10	0.12	1.277	117.6%
4' 4L T12 to 4' 2L T8	12	12	172	54	0.81	0.81	1.22	1.42	1.277	116.0%
4' 4L T12 to 4' 2L T8	5	5	172	54	0.81	0.81	0.51	0.59	1.277	115.6%
4' 4L T12 to 4' 2L T8	1	1	172	54	0.81	0.81	0.10	0.12	1.277	117.6%
4' 4L T12 to 4' 2L T8	1	1	172	54	0.81	0.81	0.10	0.12	1.277	117.6%
4' 4L T12 to 4' 2L T8	3	3	172	54	0.81	0.81	0.31	0.35	1.277	114.3%
4' 4L T12 to 4' 2L T8	8	8	172	54	0.81	0.81	0.82	0.94	1.277	115.1%
4' 4L T12 to 4' 2L T8	1	1	172	54	0.81	0.81	0.10	0.12	1.277	117.6%
4' 4L T12 to 4' 2L T8	1	1	172	54	0.81	0.81	0.10	0.12	1.277	117.6%
1L 25W Inc. Exit to 1L 2W LED Exit	3	3	25	6	1.00	1.00	0.05	0.07	1.277	137.2%
4' 4L T12 to 4' 2L T8 25W	4	4	172	43	0.81	0.81	0.45	0.52	1.277	115.3%
						Total	**3.87**	**4.49**		**116.0%**

Results

The kWh realization rate for PNM-13-01170 is 120.7% and the kW realization rate is 117.8%. The kWh savings increased due to a higher Heating Cooling Energy Factor used in the ex-post calculations. The kW savings were increased because the ex-post calculations used a higher Heating Cooling Demand Factor. The kWh and kW savings increased due to one additional verified 4’ 2-lamp 32W T8 fixture in the kitchen.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
4' 4L T12 to 4' 2L T8	667	0.12	116.7%	117.6%
4' 4L T12 to 4' 2L T8	8,008	1.42	116.7%	116.0%
4' 4L T12 to 4' 2L T8	3,337	0.59	116.7%	115.6%
4' 4L T12 to 4' 2L T8	667	0.12	116.7%	117.6%
4' 4L T12 to 4' 2L T8	662	0.12	115.8%	117.6%
4' 4L T12 to 4' 2L T8	1,986	0.35	115.8%	114.3%
4' 4L T12 to 4' 2L T8	5,297	0.94	115.8%	115.1%
4' 4L T12 to 4' 2L T8	608	0.12	106.3%	117.6%
4' 4L T12 to 4' 2L T8	608	0.12	106.3%	117.6%
1L 25W Inc. Exit to 1L 2W LED Exit	603	0.07	210.9%	137.2%
4' 4L T12 to 4' 2L T8 25W	2,950	0.52	116.7%	115.3%
Total	**25,393**	**4.49**	**117.1%**	**116.0%**

Project Number QS-5408
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is an large retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (167) 4' 2-lamp 32W T8 fixtures, replacing 8' 2-lamp 60W T12 fixtures;
- (21) 4' 1-lamp 32W T8 fixture, replacing 4' 2-lamp 34W T12 fixtures;
- (1) 4' 2-lamp 32W T8 fixture, replacing 4' 2-lamp 34W T12 fixture;
- (1) 4' 2-lamp 25W T8 fixture, replacing 4' 2-lamp 40W T12 fixture;
- (3) 4' 2-lamp 25W T8 fixtures, replacing 4' 2-lamp 34W T12 fixtures;
- (1) 42W CF Hardwire fixture, replacing 100W metal halide fixture;
- (25) 4' 2-lamp 32W T8 fixtures, replacing 4' 4-lamp 34W T12 fixtures;
- (44) 4' 2-lamp 32W T8 fixtures, replacing 8' 2-lamp 75W T12 fixtures; and
- (53) 4' 2-lamp 32W T8 HP fixtures, replacing 8' 2-lamp 60W T12 fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Large Single Story Retail	Auto Repair Workshop	3,429	4,022	1.196	1.348	0.88
	Sales Area	4,454	4,512	1.196	1.348	0.88
	Office (General)	2,714	2,737	1.196	1.348	0.88
Storage	Storage (Conditioned)	3,441	2,780	1.052	1.540	0.70
Small Office	Restrooms	2,594	3,957	1.216	1.313	0.81
	Mechanical/Electrical Room	2,594	1,556	1.216	1.313	0.81
Small Retail	Sales Area	3,378	4,013	1.196	1.335	0.88

Exterior	Exterior	4313	4313	1.00	1.00	0.00

Savings Calculations

Using deemed values from the table above, the evaluator calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluator calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES to 4' 2L T8	1	1	123	58	4,454	4,454	235	346	1.196	147.4%
8' 2L T12ES to 4' 2L T8	20	20	123	58	4,454	4,454	4,695	6,925	1.196	147.5%
4' 2L T12ES to 4' 1L T8	7	7	72	31	4,454	4,454	1,037	1,529	1.196	147.5%
8' 2L T12ES to 4' 2L T8	1	1	123	58	4,454	4,454	235	346	1.196	147.4%
8' 2L T12ES to 4' 2L T8	47	47	123	58	4,454	4,454	11,033	16,274	1.196	147.5%
8' 2L T12ES to 4' 2L T8	97	97	123	58	4,454	4,454	22,771	33,587	1.196	147.5%
4' 2L T12ES to 4' 2L T8	1	1	72	58	4,454	4,454	51	75	1.196	148.3%
8' 2L T12ES to 4' 2L T8	1	1	123	58	4,454	4,454	235	346	1.196	147.4%
4' 2L T12 to 4' 2L T12 25W RLO	1	1	94	39	2,594	2,594	199	173	1.216	87.1%
4' 2L T12ES to 4' 2L T12 25W RLO	1	1	72	39	2,714	2,714	119	107	1.196	89.8%
8' 2L T12ES to 4' 2L T8	53	53	123	54	3,441	3,441	13,207	13,241	1.052	100.3%
100W MH to 1L 42W CFL Multi 4-Pin	1	1	124	46	4,313	4,313	282	336	1.000	119.3%
4' 2L T12ES to 4' 2L T12 25W RLO	1	1	72	39	2,594	2,594	119	104	1.216	87.3%
4' 2L T12ES to 4' 2L T12 25W RLO	1	1	72	39	2,594	2,594	119	104	1.216	87.3%
4' 3L T12ES to 4' 2L T8	14	14	144	58	3,378	3,378	4,348	4,864	1.196	111.9%
4' 3L T12ES to 4' 2L T8	11	11	144	58	3,429	3,429	3,416	3,880	1.196	113.6%
8' 2L T12 to 4' 2L T8	34	34	173	58	3,429	3,429	14,121	16,035	1.196	113.6%
8' 2L T12 to 4' 2L T8	10	10	173	58	3,429	3,429	4,153	4,716	1.196	113.5%
4' 2L T12ES to 4' 1L T8	14	14	72	31	4,454	4,454	2,073	3,058	1.196	147.5%
						Total	**82,447**	**106,046**		**128.6%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES to 4' 2L T8	1	1	123	58	0.88	0.88	0.07	0.08	1.348	118.4%
8' 2L T12ES to 4' 2L T8	20	20	123	58	0.88	0.88	1.35	1.54	1.348	113.9%
4' 2L T12ES to 4' 1L T8	7	7	72	31	0.88	0.88	0.30	0.34	1.348	113.9%
8' 2L T12ES to 4' 2L T8	1	1	123	58	0.88	0.88	0.07	0.08	1.348	118.4%
8' 2L T12ES to 4' 2L T8	47	47	123	58	0.88	0.88	3.18	3.62	1.348	113.9%
8' 2L T12ES to 4' 2L T8	97	97	123	58	0.88	0.88	6.56	7.48	1.348	114.1%
4' 2L T12ES to 4' 2L T8	1	1	72	58	0.88	0.88	0.01	0.02	1.348	137.4%
8' 2L T12ES to 4' 2L T8	1	1	123	58	0.88	0.88	0.07	0.08	1.348	118.4%
4' 2L T12 to 4' 2L T12 25W RLO	1	1	94	39	0.81	0.81	0.06	0.06	1.313	104.9%
4' 2L T12ES to 4' 2L T12 25W RLO	1	1	72	39	0.88	0.88	0.03	0.04	1.348	116.6%
8' 2L T12ES to 4' 2L T8	53	53	123	54	0.70	0.70	3.80	3.94	1.540	103.6%
100W MH to 1L 42W CFL Multi 4-Pin	1	1	124	46	0.00	0.00	0.08	0.00	1.000	0.0%
4' 2L T12ES to 4' 2L T12 25W RLO	1	1	72	39	0.81	0.81	0.03	0.04	1.313	116.6%
4' 2L T12ES to 4' 2L T12 25W RLO	1	1	72	39	0.81	0.81	0.03	0.04	1.313	116.6%
4' 3L T12ES to 4' 2L T8	14	14	144	58	0.88	0.88	1.25	1.41	1.335	112.6%
4' 3L T12ES to 4' 2L T8	11	11	144	58	0.88	0.88	0.98	1.12	1.348	113.9%
8' 2L T12 to 4' 2L T8	34	34	173	58	0.88	0.88	4.07	4.64	1.348	114.1%
8' 2L T12 to 4' 2L T8	10	10	173	58	0.88	0.88	1.20	1.36	1.348	113.7%
4' 2L T12ES to 4' 1L T8	14	14	72	31	0.88	0.88	0.60	0.68	1.348	113.9%
						Total	**23.74**	**26.57**		**111.9%**

Results

The kWh realization rate for QS-5408 is 128.6% and the kW realization rate is 111.9%. The increase in kWh and kW savings is due to the evaluators verifying additional fixtures—(17) 4’ 2-lamp T8 fixtures and seven 4’ 1-lamp T8 fixtures.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
8' 2L T12ES to 4' 2L T8	346	0.08	147.4%	118.4%
8' 2L T12ES to 4' 2L T8	6,925	1.54	147.5%	113.9%
4' 2L T12ES to 4' 1L T8	1,529	0.34	147.5%	113.9%
8' 2L T12ES to 4' 2L T8	346	0.08	147.4%	118.4%
8' 2L T12ES to 4' 2L T8	16,274	3.62	147.5%	113.9%
8' 2L T12ES to 4' 2L T8	33,587	7.48	147.5%	114.1%
4' 2L T12ES to 4' 2L T8	75	0.02	148.3%	137.4%
8' 2L T12ES to 4' 2L T8	346	0.08	147.4%	118.4%
4' 2L T12 to 4' 2L T12 25W RLO	173	0.06	87.1%	104.9%
4' 2L T12ES to 4' 2L T12 25W RLO	107	0.04	89.8%	116.6%
8' 2L T12ES to 4' 2L T8	13,241	3.94	100.3%	103.6%
100W MH to 1L 42W CFL Multi 4-Pin	336	0.00	119.3%	0.0%
4' 2L T12ES to 4' 2L T12 25W RLO	104	0.04	87.3%	116.6%
4' 2L T12ES to 4' 2L T12 25W RLO	104	0.04	87.3%	116.6%
4' 3L T12ES to 4' 2L T8	4,864	1.41	111.9%	112.6%
4' 3L T12ES to 4' 2L T8	3,880	1.12	113.6%	113.9%
8' 2L T12 to 4' 2L T8	16,035	4.64	113.6%	114.1%
8' 2L T12 to 4' 2L T8	4,716	1.36	113.5%	113.7%
4' 2L T12ES to 4' 1L T8	3,058	0.68	147.5%	113.9%
Total	**106,046**	**26.57**	**128.6%**	**111.9%**

Project Number QS 5516
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is an upholstery shop that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (3) 4' 2-lamp 32W T8 HP fixtures, replacing 8' 2-lamp 110W T12 HO fixtures;
- (6) 4' 2-lamp 32W T8 fixtures, replacing 8' 2-lamp110W T12 fixtures;
- (4) 4' 2-lamp 32W T8 HP fixtures, replacing 4' 4-lamp 40W T12 fixtures;
- (1) 42W CF wallpack, replacing 150W metal halide wallpack; and
- (1) 42W CF wallpack, replacing 100W metal halide wallpack.

On-site, ADM verified the participant had removed:

- (1) 100W metal halide wallpack; and
- (1) 150W metal halide wallpack.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.196	1.355	0.88
Large Single Story Retail	Auto Repair Workshop	3,429	4,022	1.196	1.348	0.88
Exterior	Exterior	4,313	4,313	1.00	1.00	0.00

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12HO to 4' 2L T8	2	2	207	58	3,378	3,378	1,480	1,204	1.196	81.3%
8' 2L T12HO to 4' 2L T8	1	1	207	58	3,378	3,378	740	602	1.196	81.3%
8' 2L T12 to 4' 2L T8	6	6	173	58	3,429	3,429	3,428	2,830	1.196	82.6%
4' 4L T12 to 4' 2L T8	4	4	188	58	3,429	3,429	2,583	2,133	1.196	82.6%
Delamp 100W MH	1	0	124	0	3,429	0	616	509	1.196	82.6%
150W MH to 1L 42W CFL Multi 4-Pin	3	3	183	46	4,313	4,313	2,042	1,773	1.000	86.8%
100W MH to 1L 42W CFL Multi 4-Pin	2	2	124	46	4,313	4,313	775	673	1.000	86.8%
Delamp 150W MH	1	0	183	0	4,313	0	909	789	1.000	86.8%
						Total	**12,573**	**10,513**		**83.6%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12HO to 4' 2L T8	2	2	207	58	0.88	0.88	0.31	0.35	1.335	113.0%
8' 2L T12HO to 4' 2L T8	1	1	207	58	0.88	0.88	0.15	0.18	1.335	116.3%
8' 2L T12 to 4' 2L T8	6	6	173	58	0.88	0.88	0.72	0.82	1.348	114.4%
4' 4L T12 to 4' 2L T8	4	4	188	58	0.88	0.88	0.54	0.62	1.348	114.7%
Delamp 100W MH	1	0	124	0	0.88	0.88	0.13	0.15	1.348	116.4%
150W MH to 1L 42W CFL Multi 4-Pin	3	3	183	46	0.00	0.00	0.43	0.00	1.000	0.0%
100W MH to 1L 42W CFL Multi 4-Pin	2	2	124	46	0.00	0.00	0.16	0.00	1.000	0.0%
Delamp 150W MH	1	0	183	0	0.00	0.00	0.19	0.00	1.000	0.0%
Total							**2.63**	**2.12**		**80.6%**

Results

The kWh realization rate for QS-5516 is 83.6% and the kW realization rate is 80.6%. The kWh realization rate is low due to the ex post calculations using lower hours of operation for the space types listed, as per the CA DEER 2008 guidelines. The low kW realization rate is due to the exterior wallpacks, which have a PCF of zero. This was not accounted for in ex ante calculations.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
8' 2L T12HO to 4' 2L T8	1,204	0.35	81.3%	113.0%
8' 2L T12HO to 4' 2L T8	602	0.18	81.3%	116.3%
8' 2L T12 to 4' 2L T8	2,830	0.82	82.6%	114.4%
4' 4L T12 to 4' 2L T8	2,133	0.62	82.6%	114.7%
Delamp 100W MH	509	0.15	82.6%	116.4%
150W MH to 1L 42W CFL Multi 4-Pin	1,773	0.00	86.8%	0.0%
100W MH to 1L 42W CFL Multi 4-Pin	673	0.00	86.8%	0.0%
Delamp 150W MH	789	0.00	86.8%	0.0%
Total	**10,513**	**2.12**	**83.6%**	**80.6%**

Project Number QS-5612
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a medical facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (1) 3' 2-lamp 28W T8 fixture, replacing 4' 4-lamp 34W T12 fixture;
- (9) 4' 2-lamp 28W T8 fixture, replacing 4' 4-lamp 40W T12 fixture;
- (3) 4' 3-lamp 28W T8 fixture, replacing 4' 4-lamp 40W T12 fixture;
- (3) 4' 2-lamp 32W T8 fixture, replacing 4' 4-lamp 40W T12 fixture; and
- (2) 2-Lamp 2W LED exit signs, replacing 2-lamp 25W incandescent exit signs.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Office	Lobby	2,594	3,957	1.216	1.313	0.81
	Office (Open)	2,594	3,066	1.216	1.313	0.81
	Office (Executive/Private)	2,594	3,066	1.216	1.313	0.81
	Corridor	2,594	3,360	1.216	1.313	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 3L T12ES to 4' 2L T8 28W	2	2	144	52	2,594	2,594	501	580	1.216	115.8%
4' 4L T12 to 4' 2L T8 28W	2	2	188	52	2,594	2,594	740	858	1.216	115.9%
4' 4L T12 to 4' 2L T8 28W	2	2	188	52	2,594	2,594	740	858	1.216	115.9%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	2,594	2,594	370	429	1.216	115.9%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	2,594	2,594	370	429	1.216	115.9%
4' 4L T12 to 4' 3L T8 28W	1	1	188	76	2,594	2,594	305	353	1.216	115.8%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	2,594	2,594	370	429	1.216	115.9%

4' 4L T12 to 4' 3L T8 28W	1	1	188	76	2,594	2,594	305	353	1.216	115.8%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	2,594	2,594	370	429	1.216	115.9%
4' 4L T12 to 4' 2L T8	1	1	188	58	2,594	2,594	354	410	1.216	115.9%
4' 4L T12 to 4' 4L T8 28W	2	2	188	99	2,594	2,594	484	561	1.216	115.8%
4' 4L T12 to 4' 2L T8	2	2	188	58	2,594	2,594	707	820	1.216	115.9%
4' 4L T12 to 4' 3L T8 28W	1	1	188	76	2,594	2,594	305	353	1.216	115.8%
2L 25W Inc. Exit to 2L 2W LED Exit	2	2	50	9	8,760	8,760	223	873	1.216	391.2%
						Total	**6,144**	**7,735**		**125.9%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
4' 3L T12ES to 4' 2L T8 28W	2	2	144	52	0.81	0.81	0.13	0.20	1.313	157.3%
4' 4L T12 to 4' 2L T8 28W	2	2	188	52	0.81	0.81	0.19	0.29	1.313	154.3%
4' 4L T12 to 4' 2L T8 28W	2	2	188	52	0.81	0.81	0.19	0.29	1.313	154.3%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	0.81	0.81	0.09	0.14	1.313	149.0%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	0.81	0.81	0.09	0.14	1.313	149.0%
4' 4L T12 to 4' 3L T8 28W	1	1	188	76	0.81	0.81	0.08	0.12	1.313	155.1%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	0.81	0.81	0.09	0.14	1.313	149.0%
4' 4L T12 to 4' 3L T8 28W	1	1	188	76	0.81	0.81	0.08	0.12	1.313	155.1%
4' 4L T12 to 4' 2L T8 28W	1	1	188	52	0.81	0.81	0.09	0.14	1.313	149.0%
4' 4L T12 to 4' 2L T8	1	1	188	58	0.81	0.81	0.09	0.14	1.313	155.9%
4' 4L T12 to 4' 4L T8 28W	2	2	188	99	0.81	0.81	0.12	0.19	1.313	154.5%
4' 4L T12 to 4' 2L T8	2	2	188	58	0.81	0.81	0.18	0.28	1.313	155.9%
4' 4L T12 to 4' 3L T8 28W	1	1	188	76	0.81	0.81	0.08	0.12	1.313	155.1%
2L 25W Inc. Exit to 2L 2W LED Exit	2	2	50	9	1.00	1.00	0.06	0.11	1.313	194.2%
						Total	**1.56**	**2.42**		**155.1%**

Results

The kWh realization rate for QS-5612 is 125.9% and the kW realization rate is 155.1%. The higher in realization rate is due to the six additional fixtures the evaluator verified onsite. These fixtures were not included in the ex ante calculations.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 3L T12ES to 4' 2L T8 28W	580	0.20	115.8%	157.3%
4' 4L T12 to 4' 2L T8 28W	858	0.29	115.9%	154.3%
4' 4L T12 to 4' 2L T8 28W	858	0.29	115.9%	154.3%
4' 4L T12 to 4' 2L T8 28W	429	0.14	115.9%	149.0%
4' 4L T12 to 4' 2L T8 28W	429	0.14	115.9%	149.0%
4' 4L T12 to 4' 3L T8 28W	353	0.12	115.8%	155.1%
4' 4L T12 to 4' 2L T8 28W	429	0.14	115.9%	149.0%
4' 4L T12 to 4' 3L T8 28W	353	0.12	115.8%	155.1%
4' 4L T12 to 4' 2L T8 28W	429	0.14	115.9%	149.0%
4' 4L T12 to 4' 2L T8	410	0.14	115.9%	155.9%
4' 4L T12 to 4' 4L T8 28W	561	0.19	115.8%	154.5%
4' 4L T12 to 4' 2L T8	820	0.28	115.9%	155.9%
4' 4L T12 to 4' 3L T8 28W	353	0.12	115.8%	155.1%
2L 25W Inc. Exit to 2L 2W LED Exit	873	0.11	391.2%	194.2%
Total	**7,735**	**2.42**	**125.9%**	**155.1%**

Project Number QS-5850
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (5) 4' 2-lamp 32W T8 fixtures, replacing 8' 2-lamp 75W T12 fixtures;
- (16) 4' 2-lamp 32W T8 fixtures, replacing 8' 2-lamp 75W T12 fixtures;
- (3) 4' 2-lamp 32W T8 HP fixtures, replacing 8' 2-lamp 110W T12 fixtures;
- (2) 4' 2-lamp 32W T8 fixtures, replacing 4' 2-lamp 40W T12 fixtures;
- (13) 4' 2-lamp 32W T8 fixtures, replacing 8' 1-lamp 110W T12 fixtures; and
- (2) 65W hardwired CFL lamps, replacing 500W halogen lamps.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.196	1.335	0.88
Exterior	Exterior	4313	4313	1.00	1.00	0.00

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES to 4' 2L T8	5	5	123	58	3,378	3,378	1,503	1,313	1.196	87.4%
8' 2L T12 to 4' 2L T8	16	16	173	58	3,378	3,378	8,509	7,434	1.196	87.4%
8' 2L T12HO to 4' 2L T8	3	3	207	54	4,313	4,313	2,123	1,980	1.000	93.3%
4' 2L T12 to 4' 2L T8	2	2	94	58	3,378	3,378	333	291	1.196	87.4%
8' 1L T12HO to 4' 2L T8	13	13	121	54	4,313	4,313	4,028	3,756	1.000	93.3%
500W 1L Halogen to 65W CFL	2	2	500	65	4,313	4,313	4,023	3,752	1.000	93.3%
						Total	**20,518**	**18,526**		**90.3%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES to 4' 2L T8	5	5	123	58	0.88	0.88	0.36	0.38	1.335	106.1%
8' 2L T12 to 4' 2L T8	16	16	173	58	0.88	0.88	2.03	2.16	1.335	106.5%
8' 2L T12HO to 4' 2L T8	3	3	207	54	0.00	0.00	0.51	0.00	1.000	0.0%
4' 2L T12 to 4' 2L T8	2	2	94	58	0.88	0.88	0.08	0.08	1.335	100.8%
8' 1L T12HO to 4' 2L T8	13	13	121	54	0.00	0.00	0.96	0.00	1.000	0.0%
500W 1L Halogen to 65W CFL	2	2	500	65	0.00	0.00	0.96	0.00	1.000	0.0%
						Total	**4.89**	**2.62**		**53.6%**

Results

The kWh realization rate for QS-5850 is 90.3% and the kW realization rate is 53.6%. The kW realization rate is low because 16 4' 2-lamp T8 fixtures were verified on the exterior rather than interior space. The ex post calculations used a peak coincidence factor of zero and a HCIF of one for these exterior fixtures. In addition, the kWh and kW realization rate is low due to two 4' 2-lamp T8 fixtures failing verification.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
8' 2L T12ES to 4' 2L T8	1,313	0.38	87.4%	106.1%
8' 2L T12 to 4' 2L T8	7,434	2.16	87.4%	106.5%
8' 2L T12HO to 4' 2L T8	1,980	0.00	93.3%	0.0%
4' 2L T12 to 4' 2L T8	291	0.08	87.4%	100.8%
8' 1L T12HO to 4' 2L T8	3,756	0.00	93.3%	0.0%
500W 1L Halogen to 65W CFL	3,752	0.00	93.3%	0.0%
Total	**18,526**	**2.62**	**90.3%**	**53.6%**

Project Number QS-5933
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a small retail store facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (65) 4' 2-lamp 28W T8 fixtures, replacing 4' 2-lamp 40W T12 fixtures;
- (15) 4' 2-lamp 32W T8 fixtures, replacing 8' 2-lamp 60W T12 fixtures;
- (30) 4' 2-lamp 32W T8 fixtures, replacing 4' 4-lamp 40W T12 fixtures; and
- (8) 2' 2-lamp 17W T8 fixtures, replacing 2' 2-lamp 20W T12 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.196	1.335	0.88

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 2L T12 to 4' 2L T8 28W	28	28	94	52	3,378	3,378	5,981	4,751	1.196	79.4%
8' 2L T12ES to 4' 2L T8	5	5	123	58	3,378	3,378	1,653	1,313	1.196	79.4%
4' 4L T12 to 4' 2L T8	4	4	188	58	3,378	3,378	2,645	2,101	1.196	79.4%
4' 4L T12 to 4' 2L T8	12	12	188	58	3,378	3,378	7,935	6,303	1.196	79.4%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	3,378	3,378	427	339	1.196	79.3%
8' 2L T12ES to 4' 2L T8	1	1	123	58	3,378	3,378	331	263	1.196	79.6%
4' 2L T12 to 4' 2L T8 28W	24	24	94	52	3,378	3,378	5,127	4,072	1.196	79.4%
2' 2L T12 20W to 2' 2L T8	8	8	50	33	3,378	3,378	692	549	1.196	79.4%
8' 2L T12ES to 4' 2L T8	1	1	123	58	3,378	3,378	331	263	1.196	79.6%
4' 4L T12 to 4' 2L T8	2	2	188	58	3,378	3,378	1,322	1,050	1.196	79.4%
8' 2L T12ES to 4' 2L T8	7	7	123	58	3,378	3,378	2,314	1,838	1.196	79.4%

4' 2L T12 to 4' 2L T8 28W	10	10	94	52	3,378	3,378	2,136	1,697	1.196	79.4%
8' 2L T12ES to 4' 2L T8	1	1	123	58	3,378	3,378	331	263	1.196	79.6%
4' 2L T12 to 4' 2L T8 28W	1	1	94	52	3,378	3,378	214	170	1.196	79.6%
4' 4L T12 to 4' 2L T8	12	12	188	58	3,378	3,378	7,935	6,303	1.196	79.4%
						Total	**39,373**	**31,275**		**79.4%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
4' 2L T12 to 4' 2L T8 28W	28	28	94	52	0.88	0.88	1.28	1.38	1.335	108.0%
8' 2L T12ES to 4' 2L T8	5	5	123	58	0.88	0.88	0.35	0.38	1.335	107.6%
4' 4L T12 to 4' 2L T8	4	4	188	58	0.88	0.88	0.56	0.61	1.335	108.0%
4' 4L T12 to 4' 2L T8	12	12	188	58	0.88	0.88	1.69	1.83	1.335	108.0%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	0.88	0.88	0.09	0.10	1.335	109.6%
8' 2L T12ES to 4' 2L T8	1	1	123	58	0.88	0.88	0.07	0.08	1.335	113.3%
4' 2L T12 to 4' 2L T8 28W	24	24	94	52	0.88	0.88	1.10	1.18	1.335	107.8%
2' 2L T12 20W to 2' 2L T8	8	8	50	33	0.88	0.88	0.15	0.16	1.335	108.3%
8' 2L T12ES to 4' 2L T8	1	1	123	58	0.88	0.88	0.07	0.08	1.335	113.3%
4' 4L T12 to 4' 2L T8	2	2	188	58	0.88	0.88	0.28	0.31	1.335	109.7%
8' 2L T12ES to 4' 2L T8	7	7	123	58	0.88	0.88	0.49	0.53	1.335	107.2%
4' 2L T12 to 4' 2L T8 28W	10	10	94	52	0.88	0.88	0.46	0.49	1.335	107.4%
8' 2L T12ES to 4' 2L T8	1	1	123	58	0.88	0.88	0.07	0.08	1.335	113.3%
4' 2L T12 to 4' 2L T8 28W	1	1	94	52	0.88	0.88	0.05	0.05	1.335	109.6%
4' 4L T12 to 4' 2L T8	12	12	188	58	0.88	0.88	1.69	1.83	1.335	108.0%
						Total	**8.41**	**9.09**		**108.1%**

Results

The kWh realization rate for QS-5933 is 79.4% and the kW realization rate is 108.1%. The kWh realization rate is low due to the ex post calculations using lower hours of operation for the space types listed, as per the CA DEER 2008 guidelines. The kW savings were increased because the ex-post calculations used a higher Heating Cooling Demand Factor, as per the 2011 Workpapers.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 2L T12 to 4' 2L T8 28W	4,751	1.38	79.4%	108.0%
8' 2L T12ES to 4' 2L T8	1,313	0.38	79.4%	107.6%
4' 4L T12 to 4' 2L T8	2,101	0.61	79.4%	108.0%
4' 4L T12 to 4' 2L T8	6,303	1.83	79.4%	108.0%
4' 2L T12 to 4' 2L T8 28W	339	0.10	79.3%	109.6%
8' 2L T12ES to 4' 2L T8	263	0.08	79.6%	113.3%
4' 2L T12 to 4' 2L T8 28W	4,072	1.18	79.4%	107.8%
2' 2L T12 20W to 2' 2L T8	549	0.16	79.4%	108.3%
8' 2L T12ES to 4' 2L T8	263	0.08	79.6%	113.3%
4' 4L T12 to 4' 2L T8	1,050	0.31	79.4%	109.7%
8' 2L T12ES to 4' 2L T8	1,838	0.53	79.4%	107.2%
4' 2L T12 to 4' 2L T8 28W	1,697	0.49	79.4%	107.4%
8' 2L T12ES to 4' 2L T8	263	0.08	79.6%	113.3%
4' 2L T12 to 4' 2L T8 28W	170	0.05	79.6%	109.6%
4' 4L T12 to 4' 2L T8	6,303	1.83	79.4%	108.0%
Total	**31,275**	**5.56**	**79.4%**	**108.1%**

Project Number QS-6005
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a storage facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (16) 4' 2-lamp 32W T8 fixtures, replacing 8' 2-lamp 60W T12 fixtures; and
- Delamp (9) 8' 2-lamp 60W T12 fixtures

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Storage	Storage (unconditioned)	3,441	2,780	1.00	1.00	0.70

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kWpost	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures

$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
Delamp 8' 2L T12ES	9	0	123	0	3,441	0	5,375	3,809	1.000	70.9%
8' 2L T12ES to 4' 2L T8	16	16	123	58	3,441	3,441	5,050	3,579	1.000	70.9%
						Total	**10,425**	**7,388**		**70.9%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
Delamp 8' 2L T12ES	9	0	123	0	0.70	0.70	1.29	0.77	1.000	59.5%
8' 2L T12ES to 4' 2L T8	16	16	123	58	0.70	0.70	1.22	0.73	1.000	60.0%
						Total	**2.51**	**1.50**		**59.8%**

Results

The kWh realization rate for QS-6005 is 70.9% and the kW realization rate is 59.8%. %. The kWh and kW realization rates are low due to the ex post calculations using lower

hours of operation for the space types listed, as per the CA DEER 2008 guidelines. The ex post calculations used lower HCIF than the ex ante because the space is not conditioned, which lowered the kWh and kW savings.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
Delamp 8' 2L T12ES	3,809	0.77	70.9%	59.5%
8' 2L T12ES to 4' 2L T8	3,579	0.73	70.9%	60.0%
Total	**7,388**	**1.50**	**70.9%**	**59.8%**

Project Number	QS-6006
Program	Commercial Comprehensive
Component	QuickSaver

Project Background

The participant is a light industrial facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (1) 4’ 2-lamp 28W T8 fixture, replacing 4’ 2-lamp T12 fixtures;
- (6) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (17) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 4-lamp T12 fixtures;
- (2) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (1) LED Exit sign, replacing a 2-lamp 40W Incandescent Exit sign;
- (2) 4’ 2-lamp 28W T8 fixtures, 4’ 4-lamp 40W T12 fixtures;
- (1) 4’ 4-lamp T8 fixture, replacing a 8’ 2-lamp T12 fixture;
- (8) 4' 2-lamp T8 28W, replacing 4' 4-lamp 32W T8 fixtures;
- (2) 4’ 4-lamp T8 fixtures, replacing a 8’ 2-lamp T12 fixtures;
- (15) 4’ 2-lamp T8 fixtures, replacing a 8’ 2-lamp T12 fixtures;
- (8) 4’ 4-lamp T8 fixtures, replacing a 8’ 2-lamp T12 fixtures;
- Delamp (19) 8’ 2-lamp T12 fixtures;
- (1) LED Exit sign, replacing a 2-lamp 40W Incandescent Exit sign;
- (3) 4' 2-lamp 28W T8, replacing, 4' 2-lamp T12 fixtures;
- (4) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 2-lamp T12 fixtures;
- (2) 4’ 2-lamp 28W T8 fixtures, replacing 4’ 4-lamp T12 fixtures;
- (23) 4’ 2-lamp 28W T8 fixtures, replacing 8’ 2-lamp T12 fixtures;
- (5) 2-lamp 40W CFL fixture, replacing 400W Metal Halide fixtures;
- (1) 2-lamp 40W CFL fixture, replacing 400W Mercury Vapor fixtures;
- (2) 2-lamp 40W CFL fixture, replacing 400W Metal Halide fixtures;
- (3) 2-lamp 40W CFL fixture, replacing 400W Metal Halide fixtures;
- (2) 2-lamp 40W CFL fixture, replacing 400W Mercury Vapor fixtures;
- (2) 2-lamp 40W CFL fixture, replacing 400W Metal Halide fixtures;
- Delamp (1) 400W Mercury Vapor fixture; and
- Delamp (1) 400W Metal Halide fixture.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values

by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Office	Lobby	2,594	3,957	1.216	1.313	0.81
	Corridor	2,594	3,360	1.216	1.313	0.81
	Conference Room	2,594	1,556	1.216	1.313	0.81
	Office (Open)	2,594	3,066	1.216	1.313	0.81
Light Industrial	Comm/Ind Work Area (Unconditioned)	3,068	2,613	1.000	1.000	0.83

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 2L T12ES to 4' 2L T8 28W	1	1	72	52	2,594	2,594	91	63	1.216	69.1%
4' 2L T12ES to 4' 2L T8 28W	6	6	72	52	2,594	2,594	456	379	1.216	83.1%
4' 4L T12ES to 4' 2L T8 28W	4	4	144	52	2,594	2,594	1,679	1,161	1.216	69.2%
4' 4L T12ES to 4' 2L T8 28W	3	3	144	52	2,594	2,594	1,259	871	1.216	69.2%
4' 4L T12ES to 4' 2L T8 28W	2	2	144	52	2,594	2,594	839	580	1.216	69.1%
4' 4L T12ES to 4' 2L T8 28W	2	2	144	52	2,594	2,594	839	580	1.216	69.1%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	2,594	2,594	182	126	1.216	69.1%
2L 40W Inc. Exit to 2L 2W LED Exit	1	1	80	9	8,760	8,760	324	756	1.216	233.4%
4' 4L T12 to 4' 2L T8 28W	2	2	188	52	2,594	2,594	1,241	858	1.216	69.2%
8' 2L T8 to 4' 4L T8 28W	1	1	110	99	2,594	2,594	50	35	1.216	69.8%
4' 4L T12ES to 4' 2L T8 28W	4	4	144	52	2,594	2,594	2,518	1,161	1.216	46.1%
4' 4L T8 to 4' 2L T8 28W	8	8	112	52	2,594	2,594	1,916	1,514	1.216	79.0%
4' 4L T12ES to 4' 2L T8 28W	9	9	144	52	2,594	2,594	3,777	2,612	1.216	69.2%
8' 2L T8 to 4' 4L T8 28W	2	2	110	99	2,594	2,594	100	69	1.216	68.8%
8' 2L T12ES to 4' 2L T8 28W	15	15	123	52	3,068	3,068	4,858	3,267	1.000	67.2%
8' 2L T12ES to 4' 4L T8	8	8	123	112	3,068	3,068	401	270	1.000	67.3%
8' 2L T12ES to Delamp	19	0	123	0	3,068	0	10,661	7,170	1.000	67.3%
2L 40W Inc. Exit to 2L 2W LED Exit	1	1	80	9	8,760	8,760	324	622	1.000	192.0%
4' 2L T12ES to 4' 2L T8 28W	3	3	72	52	3,068	3,068	274	184	1.000	67.2%
4' 2L T12ES to 4' 2L T8 28W	4	4	72	52	3,068	3,068	365	245	1.000	67.1%

4' 4L T12ES to 4' 2L T8 28W	2	2	144	52	3,068	3,068	839	565	1.000	67.3%
400W MH to 4' 4L T8	1	1	453	112	3,068	3,068	1,556	1,046	1.000	67.2%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	3,068	2,148	383	353	1.000	92.1%
8' 2L T12ES to 4' 2L T8 28W	23	23	123	52	3,068	3,068	7,773	5,010	1.000	64.5%
400W MH to 2L 42W CFL Multi 4-Pin	5	5	453	93	4,313	4,313	8,211	7,763	1.000	94.5%
400W MV to 2L 42W CFL Multi 4-Pin	1	1	455	93	4,313	4,313	1,651	1,561	1.000	94.5%
400W MH to 2L 42W CFL Multi 4-Pin	2	2	453	93	4,313	4,313	3,284	3,105	1.000	94.5%
400W MH to 2L 42W CFL Multi 4-Pin	3	3	453	93	4,313	4,313	4,927	4,658	1.000	94.5%
400W MV to 2L 42W CFL Multi 4-Pin	2	2	455	93	4,313	4,313	3,303	3,122	1.000	94.5%
400W MH to 2L 42W CFL Multi 4-Pin	2	2	453	93	4,313	4,313	3,284	3,105	1.000	94.5%
400W MV to Delamp	1	0	455	0	3,068	3,068	2,076	1,396	1.000	67.3%
400W MH to Delamp	1	0	453	0	4,313	4,313	2,066	1,954	1.000	94.6%
4' 4L T12ES to 4' 4L T8 28W RLO	0	0	144	85	3,068	3,068	269	0	1.000	0.0%
						Total	**71,777**	**56,161**		**78.2%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
4' 2L T12ES to 4' 2L T8 28W	1	1	72	52	0.81	0.81	0.02	0.02	1.313	90.8%
4' 2L T12ES to 4' 2L T8 28W	6	6	72	52	0.81	0.81	0.11	0.13	1.313	118.0%
4' 4L T12ES to 4' 2L T8 28W	4	4	144	52	0.81	0.81	0.41	0.39	1.313	96.2%
4' 4L T12ES to 4' 2L T8 28W	3	3	144	52	0.81	0.81	0.30	0.29	1.313	95.4%
4' 4L T12ES to 4' 2L T8 28W	2	2	144	52	0.81	0.81	0.20	0.20	1.313	98.7%
4' 4L T12ES to 4' 2L T8 28W	2	2	144	52	0.81	0.81	0.20	0.20	1.313	98.7%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	0.81	0.81	0.04	0.04	1.313	90.8%
2L 40W Inc. Exit to 2L 2W LED Exit	1	1	80	9	1.00	1.00	0.08	0.09	1.313	115.1%

4' 4L T12 to 4' 2L T8 28W	2	2	188	52	0.81	0.81	0.30	0.29	1.313	96.8%
8' 2L T8 to 4' 4L T8 28W	1	1	110	99	0.81	0.81	0.01	0.01	1.313	82.5%
4' 4L T12ES to 4' 2L T8 28W	4	4	144	52	0.81	0.81	0.61	0.39	1.313	64.1%
4' 4L T8 to 4' 2L T8 28W	8	8	112	52	0.81	0.81	0.46	0.51	1.313	110.3%
4' 4L T12ES to 4' 2L T8 28W	9	9	144	52	0.81	0.81	0.91	0.88	1.313	96.5%
8' 2L T8 to 4' 4L T8 28W	2	2	110	99	0.81	0.81	0.02	0.02	1.313	82.5%
8' 2L T12ES to 4' 2L T8 28W	15	15	123	52	0.83	0.83	1.17	0.88	1.000	75.0%
8' 2L T12ES to 4' 4L T8	8	8	123	112	0.83	0.83	0.10	0.07	1.000	72.2%
8' 2L T12ES to Delamp	19	0	123	0	0.83	0.83	2.57	1.93	1.000	75.0%
2L 40W Inc. Exit to 2L 2W LED Exit	1	1	80	9	1.00	1.00	0.08	0.07	1.000	89.5%
4' 2L T12ES to 4' 2L T8 28W	3	3	72	52	0.83	0.83	0.07	0.05	1.000	75.7%
4' 2L T12ES to 4' 2L T8 28W	4	4	72	52	0.83	0.83	0.09	0.07	1.000	79.4%
4' 4L T12ES to 4' 2L T8 28W	2	2	144	52	0.83	0.83	0.20	0.15	1.000	74.0%
400W MH to 4' 4L T8	1	1	453	112	0.83	0.83	0.38	0.28	1.000	74.6%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	0.83	0.54	0.09	0.10	1.000	108.1%
8' 2L T12ES to 4' 2L T8 28W	23	23	123	52	0.83	0.83	1.88	1.35	1.000	71.9%
400W MH to 2L 42W CFL Multi 4-Pin	5	5	453	93	0.00	0.00	1.98	0.00	1.000	0.0%
400W MV to 2L 42W CFL Multi 4-Pin	1	1	455	93	0.00	0.00	0.40	0.00	1.000	0.0%
400W MH to 2L 42W CFL Multi 4-Pin	2	2	453	93	0.00	0.00	0.79	0.00	1.000	0.0%
400W MH to 2L 42W CFL Multi 4-Pin	3	3	453	93	0.00	0.00	1.19	0.00	1.000	0.0%
400W MV to 2L 42W CFL Multi 4-Pin	2	2	455	93	0.00	0.00	0.80	0.00	1.000	0.0%
400W MH to 2L 42W CFL Multi 4-Pin	2	2	453	93	0.00	0.00	0.79	0.00	1.000	0.0%
400W MV to Delamp	1	0	455	0	0.83	0.83	0.50	0.38	1.000	75.8%
400W MH to Delamp	1	0	453	0	0.00	0.00	0.50	0.00	1.000	0.0%

4' 4L T12ES to 4' 4L T8 28W RLO	0	0	144	85	0.83	0.83	0.06	0.00	1.000	0.0%
						Total	**17.33**	**8.79**		**50.7%**

Results

The kWh realization rate for QS-6006 is 78.2% and the kW realization rate is 50.7%. The kWh realization rate is low due to the ex post calculations using lower hours of operation for the space types listed, as per the CA DEER 2008 guidelines. The kW realization rate is low because the ex ante did not use a PCF of zero for the exterior fixtures. The evaluators could not verify one 4' 4-lamp 28W T8 fixture.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 2L T12ES to 4' 2L T8 28W	63	0.02	69.1%	90.8%
4' 2L T12ES to 4' 2L T8 28W	379	0.13	83.1%	118.0%
4' 4L T12ES to 4' 2L T8 28W	1,161	0.39	69.2%	96.2%
4' 4L T12ES to 4' 2L T8 28W	871	0.29	69.2%	95.4%
4' 4L T12ES to 4' 2L T8 28W	580	0.20	69.1%	98.7%
4' 4L T12ES to 4' 2L T8 28W	580	0.20	69.1%	98.7%
4' 2L T12ES to 4' 2L T8 28W	126	0.04	69.1%	90.8%
2L 40W Inc. Exit to 2L 2W LED Exit	756	0.09	233.4%	115.1%
4' 4L T12 to 4' 2L T8 28W	858	0.29	69.2%	96.8%
8' 2L T8 to 4' 4L T8 28W	35	0.01	69.8%	82.5%
4' 4L T12ES to 4' 2L T8 28W	1,161	0.39	46.1%	64.1%
4' 4L T8 to 4' 2L T8 28W	1,514	0.51	79.0%	110.3%
4' 4L T12ES to 4' 2L T8 28W	2,612	0.88	69.2%	96.5%
8' 2L T8 to 4' 4L T8 28W	69	0.02	68.8%	82.5%
8' 2L T12ES to 4' 2L T8 28W	3,267	0.88	67.2%	75.0%
8' 2L T12ES to 4' 4L T8	270	0.07	67.3%	72.2%
8' 2L T12ES to Delamp	7,170	1.93	67.3%	75.0%
2L 40W Inc. Exit to 2L 2W LED Exit	622	0.07	192.0%	89.5%
4' 2L T12ES to 4' 2L T8 28W	184	0.05	67.2%	75.7%
4' 2L T12ES to 4' 2L T8 28W	245	0.07	67.1%	79.4%
4' 4L T12ES to 4' 2L T8 28W	565	0.15	67.3%	74.0%
400W MH to 4' 4L T8	1,046	0.28	67.2%	74.6%
4' 2L T12 to 4' 2L T8 28W	353	0.10	92.1%	108.1%
8' 2L T12ES to 4' 2L T8 28W	5,010	1.35	64.5%	71.9%
400W MH to 2L 42W CFL Multi 4-Pin	7,763	0.00	94.5%	0.0%
400W MV to 2L 42W CFL Multi 4-Pin	1,561	0.00	94.5%	0.0%
400W MH to 2L 42W CFL Multi 4-Pin	3,105	0.00	94.5%	0.0%

400W MH to 2L 42W CFL Multi 4-Pin	4,658	0.00	94.5%	0.0%
400W MV to 2L 42W CFL Multi 4-Pin	3,122	0.00	94.5%	0.0%
400W MH to 2L 42W CFL Multi 4-Pin	3,105	0.00	94.5%	0.0%
400W MV to Delamp	1,396	0.38	67.3%	75.8%
400W MH to Delamp	1,954	0.00	94.6%	0.0%
4' 4L T12ES to 4' 4L T8 28W RLO	0	0.00	0.0%	0.0%
Total	**56,161**	**8.79**	**78.2%**	**50.7%**

Project Number QS-6019
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a small office facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (13) 4' 2-lamp T8 fixtures, replacing (13) 8' 2-lamp T12 fixtures;
- (2) 4' 2-lamp T8 fixtures, replacing (2) 4' 4-lamp T12 fixtures;
- (6) 4' 2-lamp T8 fixtures, replacing (6) 4' 4-lamp T12 fixtures; and
- (2) 4' 1-lamp T8 fixtures, replacing (2) 4' 2-lamp T12 fixtures.

The evaluators verified the participant had removed

- (1) 8' 2-lamp T12 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	CA DEER 2008 Space Type	Annual Hours – Non-CFLs	Annual Hours – CFLs	HCEF	HCDF	PCF
Small Office	Office (Open)	2,594	3,066	1.216	1.313	0.81
	Office (Executive/Private)	2,594	3,066	1.216	1.313	0.81
	Corridor	2,594	3,360	1.216	1.313	0.81
	Lobby	2,594	3,957	1.216	1.313	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12 to 4' 2L T8	13	13	173	58	2,594	2,594	4,626	4,716	1.216	101.9%
4' 4L T12 to 4' 2L T8	2	2	188	58	2,594	2,594	805	820	1.216	101.9%
4' 4L T12 to 4' 2L T8	6	6	188	58	2,594	2,594	2,414	2,460	1.216	101.9%
4' 2L T12 to 4' 1L T8	2	2	94	31	2,594	2,594	390	397	1.216	101.8%
Delamped 8' 1L T12	1	0	173	0	2,594	2,594	535	546	1.216	102.0%
						Total	**8,770**	**8,939**		**101.9%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12 to 4' 2L T8	13	13	173	58	0.81	0.81	1.48	1.59	1.313	107.3%
4' 4L T12 to 4' 2L T8	2	2	188	58	0.81	0.81	0.26	0.28	1.313	108.6%
4' 4L T12 to 4' 2L T8	6	6	188	58	0.81	0.81	0.77	0.83	1.313	107.3%
4' 2L T12 to 4' 1L T8	2	2	94	31	0.81	0.81	0.12	0.13	1.313	104.1%
Delamped 8' 1L T12	1	0	173	0	0.81	0.81	0.17	0.18	1.313	104.9%
						Total	**2.81**	**3.01**		**107.1%**

Results

The kWh realization rate for QS-6019 is 101.9% and the kW realization rate is 107.1%.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
8' 2L T12 to 4' 2L T8	4,716	1.59	101.9%	107.3%
4' 4L T12 to 4' 2L T8	820	0.28	101.9%	108.6%
4' 4L T12 to 4' 2L T8	2,460	0.83	101.9%	107.3%
4' 2L T12 to 4' 1L T8	397	0.13	101.8%	104.1%
Delamped 8' 1L T12	546	0.18	102.0%	104.9%
Total	**8,939**	**3.01**	**101.9%**	**107.1%**

Project Number QS-6024
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (12) 4' 4-lamp T8 fixtures, replacing (15) 8' 2-lamp HO T12 fixtures;
- (1) 4' 2-lamp T8 fixtures, replacing 8' 2-lamp HO T12 fixtures;
- (1) 4' 4-lamp T8 fixtures, replacing 8' 2-lamp T12 fixtures;
- (1) 4' 4-lamp RW T8 fixtures, replacing 4' 2-lamp T12 fixtures;
- (2) 18W CFL, replacing 100W incandescent lamps;
- (4) 4' 2-lamp T8 fixtures, replacing 4' 4-lamp T12 fixtures;
- (2) 4' 2-lamp T8 fixtures, replacing 8' 2-lamp HO T12 fixtures;
- (16) 4' 2-lamp T8 fixtures, replacing 8' 2-lamp HO T12 fixtures;
- (2) 4' 4-lamp T8 fixtures, replacing 8' 2-lamp HO T12 fixtures; and
- (4) 4' 2-lamp T8 fixtures, replacing 8' 2-lamp HO T12 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.196	1.335	0.88
Small Office	Restroom	2,594	3,957	1.216	1.313	0.81
	Office (Executive/Private)	2,594	3,066	1.216	1.313	0.81
Large Single Story Retail	Auto Repair Workshop	3,429	4,022	1.000	1.000	0.88
Exterior	Exterior	4,313	4,313	1.000	1.000	0.00

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x W/Fixture$_{base}$ / 1000 W/kW
kWpost	Total Installed fixtures x W/Fixture$_{post}$ / 1000 W/kW
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures
HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x W/Fixture$_{base}$ / 1000 W/kW
kW_{post}	Total Installed fixtures x W/Fixture$_{post}$ / 1000 W/kW
PCF	Peak Coincident Factor, % Time During the Peak Period in Which Lighting is Operating
HCDF	Heating Cooling Demand Interactive Factor

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12HO to 4' 4L T8	15	12	207	112	3,378	3,378	9,843	7,115	1.196	72.3%
8' 2L T12HO to 4' 2L T8	1	1	207	58	3,378	3,378	656	602	1.196	91.7%
8' 2L T12ES to 4' 2L T8	1	1	123	58	3,378	3,378	390	263	1.196	67.4%
4' 2L T12 to 4' 2L T8 28W	1	1	94	52	3,378	3,378	298	170	1.196	57.0%
100W Inc. to 18W CFL	2	2	72	18	3,957	3,957	457	520	1.216	113.9%

4' 4L T12 to 4' 2L T8 28W	4	4	188	52	2,594	2,594	2,384	1,716	1.216	72.0%
8' 2L T12HO to 4' 4L T8	2	2	207	112	2,594	2,594	1,312	599	1.216	45.6%
8' 2L T12HO to 4' 2L T8	16	16	207	58	3,429	3,429	10,500	8,175	1.000	77.9%
8' 2L T12HO to 4' 4L T8	2	2	207	112	3,429	3,429	1,312	652	1.000	49.7%
8' 2L T12HO to 4' 2L T8	4	4	207	58	4,313	4,313	2,625	2,570	1.000	97.9%
						Total	**29,778**	**22,382**		**75.2%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
8' 2L T12HO to 4' 4L T8	15	12	207	112	0.88	0.88	2.56	2.07	1.335	80.8%
8' 2L T12HO to 4' 2L T8	1	1	207	58	0.88	0.88	0.17	0.18	1.335	105.4%
8' 2L T12ES to 4' 2L T8	1	1	123	58	0.88	0.88	0.10	0.08	1.335	78.8%
4' 2L T12 to 4' 2L T8 28W	1	1	94	52	0.88	0.88	0.08	0.05	1.335	64.5%
100W Inc. to 18W CFL	2	2	72	18	0.81	0.81	0.12	0.11	1.313	92.6%
4' 4L T12 to 4' 2L T8 28W	4	4	188	52	0.81	0.81	0.62	0.58	1.313	93.5%
8' 2L T12HO to 4' 4L T8	2	2	207	112	0.81	0.81	0.34	0.20	1.313	58.6%
8' 2L T12HO to 4' 2L T8	16	16	207	58	0.88	0.88	2.73	2.10	1.000	76.8%
8' 2L T12HO to 4' 4L T8	2	2	207	112	0.88	0.88	0.34	0.17	1.000	49.8%
8' 2L T12HO to 4' 2L T8	4	4	207	58	0.00	0.00	0.68	0.00	1.000	0.0%
						Total	**7.75**	**5.54**		**71.5%**

Results

The kWh realization rate for is 75.2% and the kW realization rate is 71.5%. The low kWh and kW realization rates are due to the ex post calculations using lower hours of operation, as per the CA DEER 2008 guidelines. In addition, the savings were reduced because the ex post calculations used lower heating cooling interactive factors. The ex ante classified this facility as a Warehouse, and the evaluators confirmed onsite this is a Small Retail facility with an Auto Repair Workshop.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
8' 2L T12HO to 4' 4L T8	7,115	2.07	72.3%	80.8%
8' 2L T12HO to 4' 2L T8	602	0.18	91.7%	105.4%
8' 2L T12ES to 4' 2L T8	263	0.08	67.4%	78.8%
4' 2L T12 to 4' 2L T8 28W	170	0.05	57.0%	64.5%
100W Inc. to 18W CFL	520	0.11	113.9%	92.6%
4' 4L T12 to 4' 2L T8 28W	1,716	0.58	72.0%	93.5%
8' 2L T12HO to 4' 4L T8	599	0.20	45.6%	58.6%
8' 2L T12HO to 4' 2L T8	8,175	2.10	77.9%	76.8%
8' 2L T12HO to 4' 4L T8	652	0.17	49.7%	49.8%
8' 2L T12HO to 4' 2L T8	2,570	0.00	97.9%	0.0%
Total	**22,382**	**5.54**	**75.2%**	**71.5%**

Project Number QS 6064
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a sit down restaurant that received incentives from PNM for implementing energy efficient lighting. On-site, ADM verified the participant had installed:

- (7) 26W compact fluorescent hardwired fixtures, replacing 175W mercury vapor fixtures
- (22) 4' 2-lamp 28W T8 fixtures, replacing 4' 2-lamp 32W T8 fixtures
- (6) 13W compact florescent screw-in lamps, replacing 6 75W incandescent lamps

On-site, ADM verified the participant had removed:

- (1) 400W metal halide fixture

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Sit Down Restaurant	Dining Area	4,836	4,836	1.207	1.274	0.80
	Lobby	4,836	4,836	1.207	1.274	0.80
	Restrooms	4,606	4,606	1.207	1.274	0.80
	Kitchen	4,804	4,804	1.207	1.274	0.80
Exterior	Exterior	4,313	4,313	1.000	1.000	0.00

Savings Calculations

Using deemed values from the table above, ADM calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, ADM calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
175W MV to 1L 26W CFL Multi 4-Pin	7	7	205	29	4,313	4,313	4,890	5,313	1.000	108.6%
4' 2L T8 to 4' 2L T8 28W	3	3	58	52	4,836	4,836	71	105	1.207	147.0%
4' 2L T8 to 4' 2L T8 28W	1	1	58	52	4,836	4,836	24	35	1.207	147.0%
75W Inc. to 13W Cold Cathode	6	6	75	13	4,606	4,606	1,477	2,068	1.207	140.0%
4' 2L T8 to 4' 2L T8 28W	13	13	58	52	4,804	4,804	310	452	1.207	146.0%
400W MH to Delamp	1	0	429	0	4,313	0	1,703	1,850	1.000	108.6%
						Total	**8,475**	**9,823**		**115.9%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
175W MV to 1L 26W CFL Multi 4-Pin	7	7	205	29	0.00	0.00	1.31	0.00	1.000	0.0%
4' 2L T8 to 4' 2L T8 28W	3	3	58	52	0.80	0.80	0.02	0.02	1.274	104.5%
4' 2L T8 to 4' 2L T8 28W	1	1	58	52	0.80	0.80	0.01	0.01	1.274	156.8%
75W Inc. to 13W Cold Cathode	6	6	75	13	0.80	0.80	0.40	0.38	1.274	96.1%
4' 2L T8 to 4' 2L T8 28W	13	13	58	52	0.80	0.80	0.08	0.08	1.274	96.5%
400W MH to Delamp	1	0	429	0	0.00	0.00	0.46	0.00	1.000	0.0%
						Total	**2.27**	**0.49**		**21.6%**

Results

The kWh realization rate for QS 6064 is 115.9% and the kW realization rate is 21.6%. The realized kWh is higher because the hours for a sit down restaurant as per the CA DEER 2008 guidelines, are higher than the specified hours of operation. The increase in specified hours of operation for the exterior light also contributes to the higher kWh realization rate. The low kW realization rate is due to the exterior fixtures with a PCF of 0.00. This was not accounted for in ex ante calculations.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
175W MV to 1L 26W CFL Multi 4-Pin	5,313	0.00	108.6%	0.0%
4' 2L T8 to 4' 2L T8 28W	105	0.02	147.0%	104.5%
4' 2L T8 to 4' 2L T8 28W	35	0.01	147.0%	156.8%
75W Inc. to 13W Cold Cathode	2,068	0.38	140.0%	96.1%
4' 2L T8 to 4' 2L T8 28W	452	0.08	146.0%	96.5%
400W MH to Delamp	1,850	0.00	108.6%	0.0%
Total	**9,823**	**0.49**	**115.9%**	**21.6%**

Project Number QS-6073
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a small retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluator verified the participant had installed:

- (295) 4' 1-lamp T8 fixtures, replacing (150) 8' 2-lamp T12 fixtures;
- (1) 4' 2-lamp RW T8 fixture, replacing (1) 4' 2-lamp T12 fixture;
- (8) 4' 1-lamp T8 fixtures, replacing (5) 8' 2-lamp T12 fixtures;
- (2) 4' 1-lamp T8 fixtures, replacing (3) 4' 4-lamp T12 fixtures; and
- (3) 4' 1-lamp T8 fixtures, replacing (3) 4' 2-lamp T12 fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.196	1.335	0.88
	Storage (Conditioned)	2,753	2,550	1.196	1.335	0.88
Small Office	Restrooms	2,594	3,957	1.216	1.313	0.81
	Office (Executive/Private)	2,594	3,066	1.216	1.313	0.81

Savings Calculations

Using deemed values from the table above, ADM calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, ADM calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES to 4' 1L T8	150	295	123	31	3,378	3,378	55,334	37,593	1.196	67.9%
4' 2L T12ES to 4' 2L T8 25W	1	1	72	46	2,594	2,594	620	82	1.216	13.2%
8' 2L T12ES to 4' 1L T8	5	8	123	31	2,753	2,753	1,844	1,208	1.196	65.5%
4' 4L T12ES to 4' 1L T8	3	2	144	31	2,594	2,594	1,444	1,167	1.216	80.8%
4' 2L T12ES to 4' 1L T8	3	3	72	31	3,378	3,378	465	497	1.196	106.9%
						Total	**59,707**	**40,547**		**67.9%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES to 4' 1L T8	150	295	123	31	0.88	0.88	11.90	10.93	1.335	91.9%
4' 2L T12ES to 4' 2L T8 25W	1	1	72	46	0.81	0.81	0.13	0.03	1.313	22.5%
8' 2L T12ES to 4' 1L T8	5	8	123	31	0.88	0.88	0.40	0.43	1.335	108.4%
4' 4L T12ES to 4' 1L T8	3	2	144	31	0.81	0.81	0.31	0.39	1.313	125.6%
4' 2L T12ES to 4' 1L T8	3	3	72	31	0.88	0.88	0.10	0.14	1.335	140.0%
						Total	**12.84**	**11.92**		**92.8%**

Results

The kWh realization rate for QS-6073 is 67.9% and the kWh realization rate is 92.8% overall kW savings. The low kWh and kW realization rate is due to a discrepancy in the fixture listed on the application and the fixtures installed at the facility. The evaluators verified (308) 4’ 1-lamp T8 fixtures were installed instead of (161) 4’ 2-lamp fixtures as claimed in the ex-ante calculations. In addition, there was one 4’ 2-lamp T8 installed rather than four 4’ 2-lamp T8 as claimed in the ex-ante calculations. Furthermore, the ex post calculations used lower hours of operation than the ex ante, as per the CA DEER 2008 guidelines.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
8' 2L T12ES to 4' 1L T8	37,593	10.93	67.9%	91.9%
4' 2L T12ES to 4' 2L T8 25W	82	0.03	13.2%	22.5%
8' 2L T12ES to 4' 1L T8	1,208	0.43	65.5%	108.4%
4' 4L T12ES to 4' 1L T8	1,167	0.39	80.8%	125.6%
4' 2L T12ES to 4' 1L T8	497	0.14	106.9%	140.0%
Total	**40,547**	**11.92**	**67.9%**	**92.8%**

Project Number QS-6075
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a fitness center that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (23) 4' 2-lamp 28W T8 fixtures, replacing 4' 2-lamp T12 fixtures;
- (4) 4' 2-lamp 28W T8 fixtures, replacing 4' 3-lamp T12 fixtures;
- (7) 26W CFL fixtures, replacing 250W Mercury Vapor fixtures;
- (17) 4' 4-lamp T8 fixtures, replacing 400W Metal Halide fixtures; and
- (8) 2-lamp 42W CFL fixtures, replacing 400W Metal Halide fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings were then calculated using annual hours of operation based on a facility schedule from facility staff interviews, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	CA DEER 2008 Space Type	Annual Hours	HCEF	HCDF	PCF
Large Single Story Retail	Sales Area	7,332	1.196	1.348	0.88
Small Office	Office (Open)	2,594	1.216	1.313	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 2L T8 to 4' 2L T8 28W	23	23	58	52	7,332	7,332	922	1,210	1.196	131.2%
4' 3L T8 to 4' 2L T8 28W	5	5	85	52	2,594	2,594	1,152	520	1.216	45.1%
250W MV to 1L 26W CFL Multi 4-Pin	7	7	290	29	4,313	4,313	12,760	7,879	1.000	61.7%
400W MH to 4' 4L T8	17	17	453	112	7,332	7,332	40,488	50,834	1.196	125.6%
400W MH to 2L 40W CFL Long Twin	8	8	453	72	4,313	4,313	21,288	13,145	1.000	61.7%
						Total	**76,611**	**73,588**		**96.1%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 2L T8 to 4' 2L T8 28W	23	23	58	52	1.00	1.00	0.13	0.19	1.348	141.3%
4' 3L T8 to 4' 2L T8 28W	5	5	85	52	1.00	1.00	0.17	0.22	1.313	130.9%
250W MV to 1L 26W CFL Multi 4-Pin	7	7	290	29	0.00	0.00	1.86	0.00	1.000	0.0%
400W MH to 4' 4L T8	17	17	453	112	1.00	1.00	5.90	7.81	1.348	132.3%
400W MH to 2L 40W CFL Long Twin	8	8	453	72	0.00	0.00	3.10	0.00	1.000	0.0%
						Total	**11.17**	**8.22**		**73.6%**

Results

The kWh realization rate for QS-6975 is 96.1% and the kW realization rate is 73.6%. The ex ante calculations classified this facility's space type as Miscellaneous, and the hours of operations are an average across all building types in the 2011 Workpapers rather than specific to the space type. ADM used the facility's actual hours of operation which more accurately represented the facility kWh and kW savings. In addition, the evaluators verified one additional 4' 2-lamp T8 fixture.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
4' 2L T8 to 4' 2L T8 28W	1,210	0.19	131.2%	141.3%
4' 3L T8 to 4' 2L T8 28W	520	0.22	45.1%	130.9%
250W MV to 1L 26W CFL Multi 4-Pin	7,879	0.00	61.7%	0.0%
400W MH to 4' 4L T8	50,834	7.81	125.6%	132.3%
400W MH to 2L 40W CFL Long Twin	13,145	0.00	61.7%	0.0%
Total	**73,588**	**8.22**	**96.1%**	**73.6%**

Project Number QS-6196
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a fast food facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (24) 4' 2-lamp T8 fixtures, replacing 8' 2-lamp HO T12 fixtures;
- (1) 4' 2-lamp T8 fixture, replacing 4' 2-lamp T12 fixture; and
- (13) 4' 4-lamp RW T8 fixtures, replacing 4' 4-lamp T12 fixtures.
-

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Fast Food	Kitchen	7,413	7,413	1.207	1.277	0.81
	Dining Area	7,413	7,413	1.207	1.277	0.81

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

kW_{base}	Total Baseline fixtures x $W/Fixture_{base}$ / 1000 W/kW
kWpost	Total Installed fixtures x $W/Fixture_{post}$ / 1000 W/kW
$Hours_{base}$	Annual Hours of Operation of Baseline Fixtures
$Hours_{post}$	Annual Hours of Operation of Installed Fixtures

HCEF	Heating/Cooling Energy Interactive Factor

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES HO to 4' 2L T8	24	24	207	58	7,413	7,413	25,474	26,509	1.000	104.1%
4' 2L T12 to 4' 2L T8	1	1	94	58	7,413	7,413	256	267	1.000	104.1%
4' 4L T12 to 4' 4L T8 28W	13	13	188	99	7,413	7,413	7,608	10,352	1.207	136.1%
						Total	**33,339**	**37,128**		**111.4%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
8' 2L T12ES HO to 4' 2L T8	24	24	207	58	0.81	0.81	3.87	2.90	1.000	75.0%
4' 2L T12 to 4' 2L T8	1	1	94	58	0.81	0.81	0.04	0.03	1.000	77.1%
4' 4L T12 to 4' 4L T8 28W	13	13	188	99	0.81	0.81	1.15	1.20	1.277	103.9%
						Total	**5.06**	**4.13**		**81.6%**

Results

The kWh realization rate for QS-6196 is 128.0% and the kW realization rate is 97.6%. The decrease in kW savings is due to the location of the dining fixtures are in an exterior space. One additional 4' 4-lamp T8 was verified onsite.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
8' 2L T12ES HO to 4' 2L T8	26,509	2.90	104.1%	0.0%
4' 2L T12 to 4' 2L T8	267	0.03	104.1%	0.0%
4' 4L T12 to 4' 4L T8 28W	10,352	1.20	136.1%	103.9%
Total	**37,128**	**4.13**	**111.4%**	**81.6%**

Project Number QS-6203
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (8) 4' 2-lamp 25W T8 fixtures, replacing 4' 4-lamp 40W T12 fixtures;
- (2) 4' 4-lamp 25W T8 fixtures, replacing 4' 4-lamp 32W T8 fixtures;
- (2) 4' 3-lamp 25W T8 fixtures, replacing 4' 3-lamp 32W T8 fixtures; and
- (2) 4' 2-lamp 25W T8 fixtures, replacing 4' 3-lamp 32W T8 fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4013	1.196	1.335	0.88

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8 25W	8	8	188	46	3,378	3,378	3,761	4,590	1.196	122.0%
4' 4L T8 to 4' 4L T8 25W	2	2	112	86	3,378	3,378	172	210	1.196	122.0%
4' 3L T8 to 4' 3L T8 25W	2	2	85	66	3,378	3,378	126	154	1.196	122.4%
4' 3L T8 to 4' 2L T8 25W	2	2	85	46	3,378	3,378	258	315	1.196	122.0%
						Total	**4,317**	**5,269**		**122.1%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8 25W	8	8	188	46	0.88	0.88	1.04	1.33	1.335	128.3%
4' 4L T8 to 4' 4L T8 25W	2	2	112	86	0.88	0.88	0.05	0.06	1.335	126.4%
4' 3L T8 to 4' 3L T8 25W	2	2	85	66	0.88	0.88	0.03	0.04	1.335	115.3%
4' 3L T8 to 4' 2L T8 25W	2	2	85	46	0.88	0.88	0.07	0.09	1.335	126.4%
						Total	**1.19**	**1.52**		**127.7%**

Results

The kWh realization rate for QS-6203 is 122.1% and the kW realization rate is 127.7%. The ex post calculations used lower operating hours than the ex ante, as per CA DEER 2008 guidelines. The evaluators verified two 4’ 2-lamp T8 fixtures instead of 4’ 3-lamp T8 fixtures, which increased the savings.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 4L T12 to 4' 2L T8 25W	4,590	1.33	122.0%	128.3%
4' 4L T8 to 4' 4L T8 25W	210	0.06	122.0%	126.4%
4' 3L T8 to 4' 3L T8 25W	154	0.04	122.4%	115.3%
4' 3L T8 to 4' 2L T8 25W	315	0.09	122.0%	126.4%
Total	**5,269**	**1.52**	**122.1%**	**127.7%**

Project Number QS-6234
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a retail store facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (19) 4' 2-lamp 32W T8 fixtures, replacing 4' 4-lamp 40W T12 fixtures; and
- (2) 2' 2-lamp 17W T8 fixtures, replacing 2' 2-lamp 40W U-tube T12 fixtures.

M&V Methodology

The evaluators confirmed the installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	3,378	4,013	1.196	1.335	0.88

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8	19	19	188	58	3,378	3,378	10,392	9,979	1.196	96.0%
2L T12 U-Tube to 2' 2L T8	2	2	72	33	3,378	3,378	328	315	1.196	96.0%
						Total	**10,720**	**10,294**		**96.0%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8	19	19	188	58	0.88	0.88	2.50	2.90	1.335	116.0%
2L T12 U-Tube to 2' 2L T8	2	2	72	33	0.88	0.88	0.08	0.09	1.335	114.0%
						Total	**2.58**	**2.99**		**115.9%**

Results

The kWh realization rate for QS-6234 is 96.0% and the kW realization rate is 115.9%. The decrease in kWh realization rate is due to the ex post calculations using reduced hours of operation in the space type, as per the CA DEER 2008 guidelines.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 4L T12 to 4' 2L T8	9,979	2.90	96.0%	116.0%
2L T12 U-Tube to 2' 2L T8	315	0.09	96.0%	114.0%
Total	**10,294**	**2.99**	**96.0%**	**115.9%**

Project Number QS-6396
Program Commercial Comprehensive
Component Quick Saver

Project Background

The participant is a small retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluator verified the participant had installed:

- (46) 4' 2-lamp RW T8 fixtures, replacing, 4' 2-lamp T8 fixtures.

The evaluator could not verify the participant had installed:

- (6) 4' 2-lamp RW T8 fixtures;
- (2) 4' 2-lamp RW T8 fixtures; and
- (1) 4' 2-lamp RW T8 fixture.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings were then calculated using annual hours of operation based on a facility schedule from facility staff interviews, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	CA DEER 2008 Space Type	Annual Hours	HCEF	HCDF	PCF
Grocery	Retail Sales Area	8,760	1.082	1.339	0.70

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***Hours***		***Expected kWh Savings***	***Realized kWh Savings***	***HCEF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
4' 2L T8 to 4' 2L T8 25W	46	46	58	46	8,760	8,760	7,600	5,232	1.082	68.8%
						Total	**7,600**	**5,232**		**68.8%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
4' 2L T8 to 4' 2L T8 25W	46	46	58	46	0.70	0.70	0.87	0.52	1.339	59.8%
						Total	**0.87**	**0.52**		**59.8%**

Results

The kWh realization rate for QS-6396 is 68.8% and the kW realization rate is 59.8%. The evaluators were unable to verify nine 4’ 2-lamp T8 fixtures. The ex post used higher hours of operation, as per the CA 2008 DEER guidelines.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 2L T8 to 4' 2L T8 25W	5,232	0.52	68.8%	59.8%
Total	**5,232**	**0.52**	**68.8%**	**59.8%**

Project Number QS-6546
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a large retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (141) 4' 2-lamp 25W T8 fixtures, replacing 4' 4-lamp T12 fixtures;
- (8) 4' 2-lamp 25W T8 fixtures, replacing 4' 4-lamp T12 fixtures;
- (4) 4' 2-lamp 25W T8 fixtures, replacing 4' 4-lamp T12 fixtures;
- (11) 4' 6-lamp T8 fixtures, replacing 8' 2-lamp T12 fixtures;
- (4) 1-lamp 3W LED exit signs, replacing 1-lamp 25W incandescent exit sign;
- (13) 12W LED lamps, replacing 100W incandescent lamps; and
- (3) 53W LED wall packs, replacing 250W metal halide wall packs.

The evaluator also verified the participant had removed:

- (8) 4' 2-lamp T12 fixtures; and
- (3) 8' 2-lamp T12 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
Small Retail	Sales Area	4,454	4,512	1.196	1.335	0.88
	Storage (Conditioned)	2,753	2,550	1.196	1.335	0.88
Large Single Story Retail	Office (General)	2,714	2,737	1.196	1.348	0.88
	Kitchen	3,368	3,947	1.196	1.348	0.88

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 4L T12 to 4' 2L T8 25W	141	141	188	46	3,378	3,378	90,121	80,891	1.196	89.8%
4' 4L T12 to 4' 2L T8 25W	8	8	188	46	2,714	2,714	5,113	3,687	1.196	72.1%
4' 4L T12 to 4' 2L T8 25W	4	4	188	46	3,368	3,368	2,557	2,288	1.196	89.5%
8' 2L T12ES to 4' 6L T8	11	11	123	170	2,753	2,753	-2,327	-1,702	1.196	73.1%
1L 25W Inc. Exit to 1L 3W LED Exit	4	4	25	3	8,760	8,760	396	922	1.196	232.8%

100W Inc. to 12W LED - Int. Ballast	13	13	72	12	4,313	4,313	3,511	3,364	1.000	95.8%
250W MH to 53W LED - Non-Int. Ballast	3	3	288	53	4,313	4,313	3,173	3,040	1.000	95.8%
Delamped 4' 4L T12	8	8	188	0	2,753	0	2,539	4,952	1.196	195.1%
Delamped 8' 2L T12	3	3	173	0	2,753	0	6,230	1,709	1.196	27.4%
Total							**111,312**	**99,151**		**89.1%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
4' 4L T12 to 4' 2L T8 25W	141	141	188	46	0.88	0.88	18.92	23.52	1.335	124.3%
4' 4L T12 to 4' 2L T8 25W	8	8	188	46	0.88	0.88	1.07	1.35	1.348	125.8%
4' 4L T12 to 4' 2L T8 25W	4	4	188	46	0.88	0.88	0.54	0.67	1.348	124.8%
8' 2L T12ES to 4' 6L T8	11	11	123	170	0.88	0.88	-0.49	-0.61	1.335	124.9%
1L 25W Inc. Exit to 1L 3W LED Exit	4	4	25	3	1.00	1.00	0.08	0.12	1.335	144.3%
100W Inc. to 12W LED - Int. Ballast	13	13	72	12	0.00	0.00	0.74	0.00	1.000	0.0%
250W MH to 53W LED - Non-Int. Ballast	3	3	288	53	0.00	0.00	0.67	0.00	1.000	0.0%
Delamped 4' 4L T12	8	8	188	0	0.88	0.88	0.53	1.77	1.335	332.1%
Delamped 8' 2L T12	3	3	173	0	0.88	0.88	1.31	0.61	1.335	46.6%
Total							**23.37**	**27.43**		**117.4%**

Results

The kWh realization rate for QS-6546 is 89.1% and the kW realization rate is 117.4%. The ex post calculations used lower operating hours than the ex ante, as per CA DEER 2008 guidelines.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
4' 4L T12 to 4' 2L T8 25W	80,891	23.52	89.8%	124.3%
4' 4L T12 to 4' 2L T8 25W	3,687	1.35	72.1%	125.8%
4' 4L T12 to 4' 2L T8 25W	2,288	0.67	89.5%	124.8%
8' 2L T12ES to 4' 6L T8	-1,702	-0.61	73.1%	124.9%
1L 25W Inc. Exit to 1L 3W LED Exit	922	0.12	232.8%	144.3%
100W Inc. to 12W LED - Int. Ballast	3,364	0.00	95.8%	0.0%
250W MH to 53W LED - Non-Int. Ballast	3,040	0.00	95.8%	0.0%
Delamped 4' 4L T12	4,952	1.77	195.1%	332.1%
Delamped 8' 2L T12	1,709	0.61	27.4%	46.6%
Total	**99,151**	**27.43**	**89.1%**	**117.4%**

Project Number QS-6584
Program Commercial Comprehensive
Component QuickSaver

Project Background

The participant is a large retail facility that received incentives from PNM for implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (49) 4' 4-lamp T8 fixtures, replacing 400W mercury vapor fixtures;
- (91) 8W LED lamps, replacing 65W incandescent lamps;
- (17) 4' 3-lamp 28W T8 fixtures, replacing 4' 3-lamp T8 fixtures;
- (19) 4' 3-lamp 28W T8 fixtures, replacing 4' 3-lamp T12 fixtures;
- (2) 4' 2-lamp 28W T8 fixtures, replacing 4' 2-lamp T12 fixtures;
- (18) 4' 4-lmap T8 fixtures, replacing 400W mercury vapor fixtures;
- (2) 4' 2-lamp 28W T8 fixtures, replacing 4' 2-lamp T12 fixtures;
- (2) 4' 1-lamp 28W T8 fixtures, replacing 4' 1-lamp T12 fixtures; and
- (4) 2-lamp 2W LED exit signs, replacing 2-lamp 40W incandescent exit signs.

The evaluator also verified the participant had removed:

- (8) 400W mercury vapor fixtures.

M&V Methodology

The evaluators found some lighting fixture counts deviated from those listed in the project application. Verified fixture counts were used in ex post savings calculations. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	*CA DEER 2008 Space Type*	*Annual Hours – Non-CFLs*	*Annual Hours – CFLs*	*HCEF*	*HCDF*	*PCF*
Small Retail	Sales Area	3,378	4,013	1.196	1.335	0.88
	Storage (Conditioned)	2,753	2,550	1.196	1.335	0.88
Large Single	Office (General)	2,714	2,737	1.196	1.348	0.88

Story Retail	Kitchen	3,368	3,947	1.196	1.348	0.88

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
400W MV to 4' 4L T8	49	49	455	112	3,378	3,378	66,453	67,902	1.196	102.2%
65W Inc. to 8W LED - Int. Ballast	91	91	65	8	4,013	4,013	19,833	24,895	1.196	125.5%
4' 3L T8 to 4' 3L T8 28W	17	17	110	76	3,378	3,378	605	2,335	1.196	386.0%

4' 3L T12ES to 4' 3L T8 28W	19	19	115	76	3,378	3,378	2,930	2,994	1.196	102.2%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	2,714	2,714	332	273	1.196	82.2%
400W MV to 4' 4L T8	18	18	455	112	2,753	2,753	21,699	20,328	1.196	93.7%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	3,368	3,368	237	161	1.196	67.9%
4' 1L T12ES to 4' 1L T8 28W	2	2	43	27	3,378	3,378	127	129	1.196	102.0%
2L 40W Inc. Exit to 2L 2W LED Exit	4	4	80	9	8,760	8,760	775	2,975	1.196	383.9%
Delamped 400W MV	8	0	455	0	3,378	0	14,392	14,706	1.196	102.2%
						Total	**127,382**	**136,698**		**107.3%**

Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***PCF***		***Expected kW Savings***	***Realized kW Savings***	***HCDF***	***Realization Rate***
	Base	***Post***	***Base***	***Post***	***Base***	***Post***				
400W MV to 4' 4L T8	49	49	455	112	0.88	0.88	17.63	19.74	1.335	112.0%
65W Inc. to 8W LED - Int. Ballast	91	91	65	8	0.88	0.88	5.26	6.09	1.335	115.7%
4' 3L T8 to 4' 3L T8 28W	17	17	110	76	0.88	0.88	0.16	0.68	1.335	423.6%
4' 3L T12ES to 4' 3L T8 28W	19	19	115	76	0.88	0.88	0.78	0.87	1.335	111.9%
4' 2L T12 to 4' 2L T8 28W	2	2	94	52	0.88	0.88	0.09	0.10	1.348	113.5%
400W MV to 4' 4L T8	18	18	455	112	0.88	0.88	5.76	7.25	1.335	125.9%
4' 2L T12ES to 4' 2L T8 28W	2	2	72	52	0.88	0.88	0.06	0.05	1.348	79.4%
4' 1L T12ES to 4' 1L T8 28W	2	2	43	27	0.88	0.88	0.03	0.04	1.335	119.1%
2L 40W Inc. Exit to 2L 2W LED Exit	4	4	80	9	1.00	1.00	0.21	0.38	1.335	184.8%
Delamped 400W MV	8	0	455	0	0.88	0.88	3.82	4.28	1.335	112.1%
						Total	**33.80**	**39.48**		**116.8%**

Results

The kWh realization rate for QS-6584 is 107.3% and the kW realization rate is 116.8%. The realization rate is higher due to three additional verified 8W LED lamps and two additional verified 4’ 4-lamp 28W T8 fixtures.

Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
400W MV to 4' 4L T8	67,902	19.74	102.2%	112.0%
65W Inc. to 8W LED - Int. Ballast	24,895	6.09	125.5%	115.7%
4' 3L T8 to 4' 3L T8 28W	2,335	0.68	386.0%	423.6%
4' 3L T12ES to 4' 3L T8 28W	2,994	0.87	102.2%	111.9%
4' 2L T12 to 4' 2L T8 28W	273	0.10	82.2%	113.5%
400W MV to 4' 4L T8	20,328	7.25	93.7%	125.9%
4' 2L T12ES to 4' 2L T8 28W	161	0.05	67.9%	79.4%
4' 1L T12ES to 4' 1L T8 28W	129	0.04	102.0%	119.1%
2L 40W Inc. Exit to 2L 2W LED Exit	2,975	0.38	383.9%	184.8%
Delamped 400W MV	14,706	4.28	102.2%	112.1%
Total	**136,698**	**39.48**	**107.3%**	**116.8%**

13.4 Self Direct

Project Number PNM2014-SD1
Program Self-Direct Energy Efficiency Program

Project Background

The participant is a university facility that completed a PNM Self-Direct Energy Efficiency project by implementing energy efficient lighting. On-site, the evaluators verified the participant had installed:

- (101) 4' 1-lamp 25W T8 fixtures, replacing 4' 1-lamp 40W T12 fixtures.

M&V Methodology

The evaluators confirmed installation of all fixtures listed in the project application. Savings for the lighting measures were calculated using CA DEER 2008 deemed values by space type for hours of use, facility staff interviews to determine hours of use, along with a stipulated Peak Coincident Factor (PCF), Heating Cooling Energy Factor (HCEF) and Heating Cooling Demand Factor (HCDF) determined using local weather data and PNM peak parameters. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

CA DEER 2008 Building Type	***CA DEER 2008 Space Type***	***Annual Hours – Non-CFLs***	***Annual Hours – CFLs***	***HCEF***	***HCDF***	***PCF***
University	Corridor	8,760	8,760	1.169	1.479	0.96

Savings Calculations

Using deemed values from the table above, the evaluators calculated lighting savings as follows:

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

Parameters for kWh Savings Calculation of Lighting Retrofit Measures

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

Following this, the evaluators calculated peak kW savings. This is based upon a PNM-defined peak of 3:00 – 6:00 PM during summer weekdays. Peak kW savings are calculated as:

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

Parameters for Peak Demand (kW) Savings Calculation of Lighting Retrofit Measures

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

Lighting Retrofit kWh Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours		Expected kWh Savings	Realized kWh Savings	HCEF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 1L T12 to 4' 1L T8 25W	101	101	43	24	8,760	8,760	11,944	19,651	1.169	164.5%
						Total	**11,944**	**19,651**		**164.5%**

Lighting Retrofit kW Savings Calculations

Measure	Quantity (Fixtures)		Wattage		PCF		Expected kW Savings	Realized kW Savings	HCDF	Realization Rate
	Base	Post	Base	Post	Base	Post				
4' 1L T12 to 4' 1L T8 25W	101	101	43	24	1.00	1.00	0.00	2.84	1.479	N/A
						Total	**0.00**	**2.84**		**N/A**

Results

The kWh realization rate for PNM2014-SD1 is 164.5%. The ex post analysis used higher hours of operation than the ex ante because evaluators verified the lighting schedule is 8,760. In addition, the evaluators verified the fixtures were in a conditioned space rather than installed on the exterior of the facility.

Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
4' 1L T12 to 4' 1L T8 25W	19,651	2.84	164.5%	N/A
Total	**19,651**	**2.84**	**164.5%**	**N/A**

Project Number PNM2014-SD2
Program Self-Direct Energy Efficiency Program

Summary

The participant is a school building that completed a PNM Self-Direct Energy Efficiency project replacing an oversized chilled water pump with a smaller pump. The evaluators obtained the operating characteristics during M&V site visit and used an engineering calculation to validate the savings. The overall gross kWh realization rate is 100%.

Measurement & Verification Effort

On site, the evaluators verified installation of:

- 30-HP Chilled Water Pump Motor
- Butterfly Valve open 100%

The evaluators used an engineering calculation to calculate the total savings due to the installed energy efficiency measure. The baseline 100-HP pump was running at its full speed and the flow was controlled by a butterfly valve only open for 25%. The new 30-HP is running at its full speed with butterfly valve open 100%. The savings is the difference in demand multiplied with its operating time.

$$Energy\ Savings\ kWh = (kW_{baseline} - kW_{new}) \times Operating\ Hours$$

The old pump energy was measured by the participant, it was 86 kW. The evaluator verified that value is reasonable based on its operating characteristics. The new pump draws 22 kW based on its specification.

The pump is installed on the chilled water pump at the Central Utility Plant. This pump runs at full speed when the campus requires cooling. The facility manager explained that these pump do not run in winter: January, February, November, and December. In March and October the plant runs from Noon to 8 PM, every day. In summer, June, July, and August, the plant runs from 9 AM to 8 PM, every day. In March, the plant shuts down for maintenance. The resulting annual operating hours based on the schedule is 3,364 hours/year.

Chilled Water Pump Annual Consumptions and Savings

	Demand (kW)	*Operating Hours*	*Annual kWh*
Baseline	86.00	3,364	289,304
As Built	22.00	3,364	74,008
		Total Savings	**215,296**

Results

Verified Gross Savings/Realization Rates

	kWh Savings			*kW Reduction*		
	Expected	*Realized*	*Realization Rate*	*Expected*	*Realized*	*Realization Rate*
Pump Motor Size Reduction	215,296	215,296	100%	64.00	64.00	100%
Total	**215,296**	**215,296**	**100%**	**64.00**	**64.00**	**100%**

The overall realization rate for PNM2014-SD2 is 100% realization rate because the evaluator confirmed the claims made by the participant are accurate.