



ComEd Small Business Energy Savings Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Plan Year 9 (PY9)
(6/1/2016-12/31/2017)

Presented to
Commonwealth Edison Company

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1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's PY9 Small Business Energy Savings (SBES) Program. It documents a summary of the energy and demand impacts for the total program by measure and delivery channel. The appendices present the impact analysis methodology and detail. Program Year 9 (PY9) covers dates June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

The SBES Program is designed to assist qualified ComEd non-residential customers¹ to achieve electric energy savings by educating them about energy efficiency (EE) opportunities through no-cost on-site energy assessments conducted by pre-approved, specially-trained Trade Allies (TAs) and installation of no-cost Direct-Install (DI) measures.² Further savings are available to participating customers through incentives of 30 to 75 percent offered for select Contractor-Installed (CI) measures. The program was funded under the Illinois Power Agency (IPA) portfolio. Nexant, Inc. (Nexant) is the implementation contractor for the SBES Program throughout ComEd's service territory.

Notable program changes made from PY8 to PY9 include:

-
- Addition of direct-install Advanced Power Strips
- Decreased incentives for most fluorescent lighting measures
- Increased incentives and promotion for new LED indoor and outdoor lighting features
- Emphasis on optional comprehensive measures, focusing on non-lighting program measures

Additional program changes included: no pre-approval or waitlist project applications in advance of the program year³, and new smart thermostat cards and campaign fact sheets.

The program had 9,024 participants³ in PY9 and implemented 122,844 measures⁴, as shown in Table 2-1.

¹ To qualify, participants must be ComEd commercial or industrial customers with monthly peak demand levels no greater than 100 kW.

² No-cost direct-install measures include low-flow showerheads and faucet aerators, pre-rinse spray valves, vending machine controls, cooling and vending misers, and LED lamps.

³ Participants represent a count of unique ComEd account numbers.

⁴ For evaluation reporting purposes, if a measure quantity is not reported in the tracking system unit (watt reduced, horsepower), Navigant counted the quantity for the data record as one.

Table 2-1. PY9 Volumetric Findings Detail

Channel	Total Participants	Total Measures	Total Projects	Direct Install Projects	Prescriptive Projects
AC Replacement	155	562	158	1	158
Basic SBES	5,404	74,670	5,718	882	5,658
Indoor LED and Controls Promotion	1,619	16,322	1,662	191	1,662
Lighting Retrofit Promotion	72	8,898	74	12	74
Multi-Family Common Area	1	9	1	-	1
Outdoor LED and Controls Promotion	1,378	10,379	1,398	108	1,398
Past Customer + Outdoor LED and Controls Promotion	2	16	2	2	2
Past Customer Promotion	537	4,524	543	96	543
RTU Promotion	54	375	58	-	58
Summer Campaign	191	7,089	194	79	194
Total	9,024*	122,844	9,808*	1,371	9,748

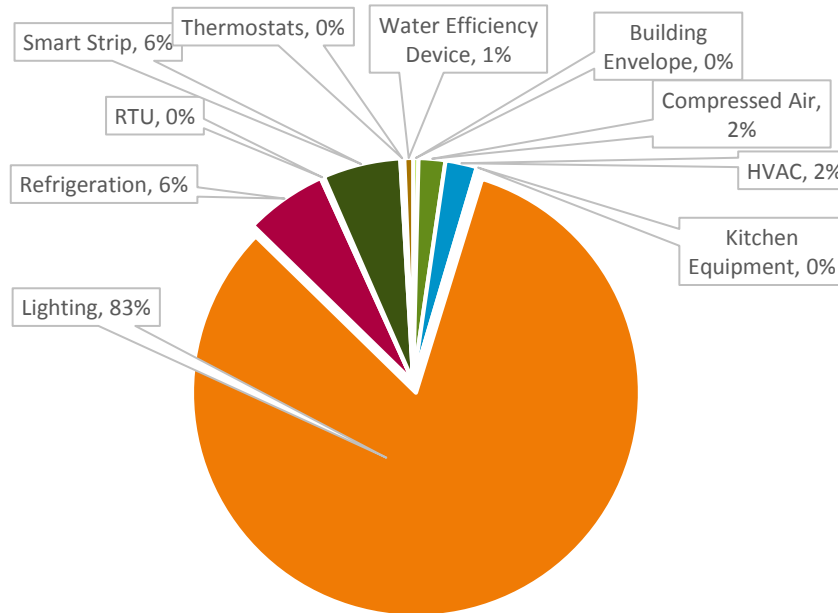
*Unique participants: excludes 696 customers with more than one project.

†Unique projects: 1,311 projects had prescriptive and direct install measures with kWh and kW savings.

Source: ComEd tracking data and Navigant team analysis.

Figure 2-1 shows the PY9 measure mix as the proportion of measures installed by end-use.

Figure 2-1. Proportion of Measures Installed by End-Use



Source: Evaluation Analysis

3. PROGRAM SAVINGS

Table 3-1 summarizes the incremental energy and demand savings the SBES Program achieved in PY9.

Table 3-1. PY9 Total Annual Incremental Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)
Ex Ante Gross Savings	281,515,647	NR*	43,314
Program Gross Realization Rate	100%	NA	90%
Verified Gross Savings	281,829,211	62,804	39,070
Program Net-to-Gross Ratio (NTGR)	0.91	0.91	0.91
Verified Net Savings	256,464,582	57,152	35,554

* NR = Not Reported. Estimates of ex ante demand were not reported in the tracking database provided to the evaluation team.
 Source: ComEd tracking data and Navigant team analysis.

4. PROGRAM SAVINGS BY MEASURE

The following tables show program electric and demand savings by measure end-use. The SBES Program had more than 80 individual measures in PY9; a measure-by-measure breakdown is included in Section 7. The lighting measures contributed the most savings, with 89 percent of the verified gross and net MWh savings. The non-lighting measures contributed 11 percent, of which 8 percent were realized from refrigeration measures, and the remaining 4 percent from other measures.

Table 4-1. PY9 Energy Savings by Measure

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTGR *	Verified Net Savings (kWh)	Technical Measure Life	Persistence	Effective Useful Life (EUL) †
Lighting	Lighting	256,289,297	98%	251,223,181	0.91	228,613,095	NA	NA	8 - 16
	Building Envelope	6,770	100%	6,768	0.91	6,159	NA	NA	15
	Compressed Air	2,834,247	94%	2,661,948	0.91	2,422,373	NA	NA	5 - 15
	HVAC	3,596,569	100%	3,596,586	0.91	3,272,893	NA	NA	5 - 15
	Kitchen Equipment	476,342	100%	476,343	0.91	433,472	NA	NA	5 - 15
Non-lighting	Refrigeration	16,793,207	133%	22,373,915	0.91	20,360,263	NA	NA	5 - 16
	RTU ‡	699,177	101%	707,297	0.91	643,640	NA	NA	15
	Advanced Power Strip	426,146	91%	389,285	0.91	354,249	NA	NA	4
	Thermostats	302,361	100%	302,361	0.91	275,149	NA	NA	8
	Water Efficiency Device	91,529	100%	91,528	0.91	83,290	NA	NA	5 - 10
Total		281,515,647	100%	281,829,211	0.91	256,464,582			

*A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† EUL is a combination of technical measure life and persistence. It is used to calculate CPAS. EUL values in Table 4-1 are expressed as range of the measures that make up the end-use category.

‡ Roof Top Units – Single Package and Split System Unitary Air Conditioners.

Source: ComEd tracking data and Navigant team analysis.

Table 4-2 PY9 Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTGR*	Verified Net Demand Reduction (kW)
Lighting	Lighting	NR	NA	54,466	0.91	49,564
	Building Envelope	NR†	NA	2	0.91	2
	Compressed Air	NR	NA	3,590	0.91	3,267
	HVAC	NR	NA	594	0.91	541
	Kitchen Equipment	NR	NA	30	0.91	27
Non-lighting	Refrigeration	NR	NA	1,386	0.91	1,261
	RTU	NR	NA	697	0.91	634
	Advanced Power Strip	NR	NA	55	0.91	50
	Thermostats	NR	NA	0	0.91	0
	Water Efficiency Device	NR	NA	1,984	0.91	1,806
Total		NR	NA	62,804	0.91	57,152

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† NR = Not Reported. Estimates of ex ante demand were not reported in the tracking database provided to the evaluation team. Source: ComEd tracking data and Navigant team analysis.

Table 4-3. PY9 Peak Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTGR*	Verified Net Peak Demand Reduction (kW)
Lighting	Lighting	38,709	87%	33,767	0.91	30,728
	Building Envelope	1	100%	1	0.91	1
	Compressed Air	3,410	100%	3,410	0.91	3,104
	HVAC	31	289%	90	0.91	82
	Kitchen Equipment	29	100%	29	0.91	26
Non-lighting	Refrigeration	756	183%	1,386	0.91	1,261
	RTU	333	100%	333	0.91	303
	Advanced Power Strip	35	126%	44	0.91	40
	Thermostats	0	100%	0	0.91	0
	Water Efficiency Device	11	100%	11	0.91	10
Total		43,314	90%	39,070	0.91	35,554

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

Source: ComEd tracking data and Navigant team analysis.

5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

5.1 Impact Parameter Estimates

Navigant estimated verified unit savings for each program measure using impact algorithm sources found in the TRM v5.0 or through secondary research. Table 5-1 presents the key parameters and the references used in the verified gross and net savings calculations.

Table 5-1. Verified Gross Savings Parameters

Measure	Ex Ante Gross Value (kWh/unit)	Verified Gross Value (kWh/unit)	Deemed* or Evaluated?	Source (TRM V5.0)
Building Envelope	Varies	Varies	Evaluated	Research
Compressed Air System	Varies	Custom inputs with TRM adjustment	Partially Deemed/ Evaluated	Section 4.7, Research
HVAC	Varies	Most verified as acceptable with comments. See tracking system review section	Partially Deemed/ Evaluated	Section 4.4, Research
Kitchen Equipment	Varies	Varies	Deemed	Section 4.2
Lighting	Varies	Varies. Adjusted based on hours of use or building type interactive effects	Deemed	Section 4.5
Refrigeration	Varies	Most verified as acceptable with comments. See tracking system review section	Deemed	Section 4.6
RTU	Varies, average of types	Varies, acceptable as is	Partially Deemed/ Evaluated	Section 4.4.15†, Research
APS (Tier 1, 5-plug)	61.84 kWh	56.5 kWh	Deemed	Section 5.2.1
Thermostats	Varies	Acceptable as is with adjustment based on reported building type using TRM	Deemed	Section 4.4
Water Efficiency Device	Varies	Varies	Deemed	Section 4.3

* Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0, available at: <http://www.ilsag.info/technical-reference-manual.html>.

† Illinois Statewide Technical Reference Manual for Energy Efficiency Version 6.0, available at: <http://www.ilsag.info/technical-reference-manual.html>.

5.2 Other Impact Findings and Recommendations

The following describes the key program findings and recommendations. Further detail behind these findings and recommendations is in Section 7. With respect to measure-level recommendations, Nexant has confirmed a number of these findings and plans to update the measure workbook for calendar year 2018.

The PY9 SBES Program involved pre- and post-overlap adjustments with the Instant Discounts (ID) program. The SBES-ID overlap adjustment results in a reduction in the savings for lighting because some lighting products incentivized through the SBES Program are also incentivized through the ID program. Because these measures are tracked under both programs and each cannot claim full savings for these measures, adjustments are made to properly allocate the savings between the two programs. The PY9 overlap resulted in a reduction in the lighting savings by 941 MWh, changing the pre-overlap ex ante savings from 282,457 MWh to the post overlap adjustment ex ante savings of 281,516 MWh.

Verified Gross Impacts and Realization Rate

Finding 1. The PY9 SBES Program achieved 281,829 MWh of verified gross energy savings and 39.07 MW of verified gross peak demand reduction. The overall verified gross program realization rate for energy savings was 100 percent.

Finding 2. The verified savings values presented in Table 3-1 reflect adjustment for overlap with the Instant Discounts (ID) Program. The overlap resulted in a reduction of 941 MWh and less than 1 MW peak demand for both SBES ex ante and verified gross savings due to a 50 percent split in savings for certain LED measures.

Recommendation 1: Adjust the tracking system inputs to adequately track the allowable split or percentage kWh and KW savings for measures due to overlap with the Instant Discount Program. Clearly identify, in the SBES tracking system, measures that receive savings adjustments due to overlap.

Finding 3: Although the overall program realization rate for energy savings was 100 percent, there was variability in the realization rates at the measure level. Navigant made evaluation adjustments to measure-level per-unit savings values for some end-use categories to comply with the TRM. For further detail on these adjustments and associated recommendations, please see the “Tracking System Review” in Section 7.

Recommendation 2: Correct the following values for lighting building type mappings:

- “Warehouse” building type has incorrect “fixture annual operating hours” value in the measure workbook
- “Low-Use Small Business” has an incorrect “Waste Heating Cooling Factor Energy (WHFE)” value in the measure workbook
- In some cases, “Healthcare Clinic” per-unit ex ante savings values in tracking data do not match the measure workbook.

Recommendation 3: Correct the peak demand reduction calculation for the “LED Decorative” measure in the measure workbook to pull the correct savings inputs into the equation.

Recommendation 4: Correct the peak demand savings calculation for the “LED Refrigerated Display Case Lighting” measure in the measure workbook so that the “feet” input is only factored once.

Recommendation 5: Calculate savings for fixtures and occupancy sensors individually then sum the values to calculate total savings when the measures are installed together (“250W MH to 4L 4F T8 Fixture with Fixture Mounted Occupancy Sensor” and “400W MH to 6L 4F T8 Fixture with Fixture Mounted Occupancy Sensor”). The peak demand savings calculation should include peak demand savings from the occupancy sensor.

Recommendation 6: Ensure “Savings Control Factor (SCF)” algorithm inputs for lighting control measures not defined in the TRM match the values assigned in the source document (e.g. PA TRM).

Recommendation 7: Based on the TRM coincidence factor of zero for exterior lighting, the evaluation set the peak demand of “Outdoor: LED Channel Sign LTE 2 Feet” measure to zero. If the program determines that there is evidence of peak savings whether summer or winter peak, it should be brought before the Illinois Technical Advisory Committee (TAC) for review.

Recommendation 8: Use the correct “kW controlled” value of 0.305 per the TRM when calculating savings for the “Wall Mounted Occupancy Sensor” measure. Use the corresponding building type “WHFd” input when calculating peak demand reduction for “Wall Mounted Occupancy Sensor” and “Fixture Mounted Occupancy Sensor” measures.

Recommendation 9: Use the specific deemed savings value of 131 kWh when claiming savings for the “Night Covers-Vertical Open; Remote Condensing; Medium Temperature - 35 F to 55 F” measure per the TRM.

Recommendation 10: Ensure the correct peak demand savings value defined in the measure workbook for the “EC Motor for Reach-in Cooler or Freezer” measure is used in the tracking data.

Recommendation 11: Consider using the ComEd Standard Program workpaper-deemed values of 2,209 kWh for energy savings and 0.255 kW for peak demand savings for the “EC Motor with Evaporator Fan Controls for Walk-in Cooler and Freezer” measure.

Recommendation 12: Consider using the deemed peak demand reduction value of 0.0246 kW from the ComEd Standard Program workpaper for the “Restroom Exhaust Fan Occupancy Sensor” measure.

Recommendation 13: Consider using the “heating and cooling run hours” values per the TRM when calculating savings for the “Variable Speed Drive on HVAC Fan or Pump LTE 5 HP” and “Variable Speed Drives for HVAC Supply and Return Fans LTE 5 HP” measures.

Recommendation 14: If Nexant plans to continue calculating savings for the “Compressed Air Leak Repair” measure using lighting annual operating hours, use “screw-based bulb” annual operating hours per the measure workbook. Otherwise, per the TRM, use an hours input based on the number of working shifts at the building. Appropriate documentation of facility shift hours must be provided for verification.

Recommendation 15: Consider collecting the actual installed specs of the Seasonal Energy Efficiency Ratio of the energy efficient equipment (SEER_{ee}) and the Integrated Energy Efficiency Ratio of the energy efficient equipment (IEER_{ee}) inputs to calculate RTU measure savings. This is required by the TRM (v6.0) for CY2018 and beyond. Additionally, use the “EFLH” specific to the climate zone the measure was installed in when possible.

Recommendation 16: Consider providing more information about the type of icemaker installed to use more specific deemed values and algorithms provided in the TRM. Correct the equation used to calculate savings for the “ENERGY STAR Ice Maker 501-1500 lbs per day” to match the regression model in the measure workbook.

Recommendation 17: Consider which Advanced Power Strips (APS) defined in the TRM best represents the APS installed by the SBES Program and use the associated deemed values. Evaluation determined the claimed savings were best fit to the Tier 1, five plug APS type.

Recommendation 18: Recode building types to names where savings are defined by the TRM for smart thermostats.

Program Participation

Finding 4: The program incented 9,808 projects and installed more than 122,844 measures in PY9. Of the 9,808 projects, 58 percent were implemented through the basic SBES Program channel and 31 percent were implemented through the indoor and outdoor LED and control promotion channels. The remaining 11 percent were shared among other program offerings, with the most projects from past customer promotions (6 percent of projects, involving lighting, HVAC, compressed air and other measures).

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

6.1 Verified Gross Program Savings Analysis Approach

Navigant determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the measure workbook for agreement with the TRM or secondary research.
2. Validating that the savings algorithm was applied correctly.
3. Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in Navigant’s calculations if the workbook did not agree with the TRM.
4. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

Additionally, this verification approach was supplemented by an engineering file review of a random sample of 20 SBES project files, and verified the quantity, building types and invoices were adequately tracked.

The ex ante kWh savings for the following measures were split 50 percent due to the SBES overlap with the Instant Discounts Program - the following measures also had relatively similar incentive levels across the two programs:

- Hard wired LED exit retrofit kits
- LED Decorative
- LED Directional MR
- LED Directional PAR 20
- LED Directional PAR 30
- LED Directional PAR 38
- LED Directional R/BR
- LED Exit Signs
- LED Omnidirectional

Navigant reduced the verified deemed kWh savings and peak demand savings for these measures by 50 percent to be consistent with the claimed kWh savings due to the overlap. The peak demand savings were adjusted 50 percent less, in cases where the overlap adjustment was not applied to ex ante demand savings.

6.2 Verified Net Program Savings Analysis Approach

Navigant calculated verified net energy and demand (coincident peak and overall) savings by multiplying the verified gross savings estimates by a net-to-gross ratio (NTGR). In PY9, the NTGR estimates used to calculate the net verified savings were based on past evaluation research and defined by a consensus process through SAG, as documented in a spreadsheet.⁵

7. APPENDIX 2. IMPACT ANALYSIS DETAIL

7.1 Program Savings by Channel and Project Type

Table 7-1 presents program net savings by program channel.

⁵ Source ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

Table 7-1 PY9 Verified Net Savings by Program Channel

Channel	Ex Ante Gross Savings (kWh)	Verified Gross kWh Realization Rate	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	NTGR*	Verified Net Savings (kWh)	Verified Net Peak Demand Reduction (kW)
AC Replacement	2,001,419	101%	2,028,285	324.58	0.91	1,845,739	295.37
Basic SBES	158,974,194	100%	159,667,686	23,998.02	0.91	145,297,595	21,838.20
Indoor LED and Controls Promotion	52,610,210	98%	51,477,386	10,435.94	0.91	46,844,421	9,496.70
Lighting Retrofit Promotion	1,160,586	94%	1,089,260	216.33	0.91	991,226	196.86
Multi-Family Common Area	13,776	99%	13,590	2.24	0.91	12,367	2.04
Outdoor LED and Controls Promotion	55,444,624	101%	55,752,697	2,214.47	0.91	50,734,954	2,015.17
Past Customer + Outdoor LED and Controls Promotion	17,993	97%	17,462	0.44	0.91	15,890	0.40
Past Customer Promotion	4,289,836	115%	4,922,238	680.39	0.91	4,479,236	619.15
RTU Promotion	840,491	100%	843,708	118.61	0.91	767,774	107.93
Summer Campaign	6,162,518	98%	6,016,899	1,079.10	0.91	5,475,378	981.98
Total	281,515,647	100%	281,829,211	39,070.11	0.91	256,464,582	35,553.80

*Source ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here:

<http://ilsag.info/net-to-gross-framework.html>

Source: ComEd tracking data and Navigant team analysis.

Table 7-2 presents program net savings by project type. Direct install measures included APS, kitchen and bath aerators, showerhead, pre-rinse spray valve, reach-in novelty coolers, and beverage and snack machine controls. Adjustment to savings from APS measure reduced the realization of direct install measures to 97 percent. Other adjustments were applied to prescriptive measures, as documented in detail below in the tracking system review section.

Table 7-2 PY9 Verified Net Savings by Project Type

Project Type	Ex Ante Gross Savings (kWh)	Verified Gross kWh Realization Rate	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	NTGR*	Verified Net Savings (kWh)	Verified Net Peak Demand Reduction (kW)
Direct Install	1,206,988	97%	1,170,121	153.03	0.91	1,064,810	139.25
Prescriptive	280,308,658	100%	280,659,089	38,917.08	0.91	255,399,771	35414.54
Total	281,515,647	100%	281,829,211	39,070.11	0.91	256,464,582	35,553.80

Source: ComEd tracking data and Navigant team analysis.

7.2 Tracking System Review

Navigant downloaded the final tracking data and measure workbook for the SBES PY9 impact evaluation from the ComEd Evaluation ShareFile site. We relied on the following documents to verify the per-unit savings for each program measure:

- Final PY9 tracking database file: “SBES_PY9_EOY_Evaluation_Data_Rev0_01122018.xlsx”.
- Measure workbook of default savings: “SBES PY9 Measure Workbook_kWh&Therm_03062017.xlsx”.
- ComEd Standard Program Workpapers “PY9 ComEd Measure Workpapers.pdf”.
- Illinois Technical Reference Manual (TRM v5.0) for deemed input parameters or secondary evaluation research to verify any custom inputs used in the ex ante calculations.

The following sections provide tracking system review findings, associated recommendations, and an outline of the differences between the ex ante and verified savings estimates for each measure by end-use. The findings and recommendations are the same as those presented in Section 5.2.

Each section contains a table that provides the quantity installed⁶, realization rates, and Effective Useful Lifetime (EUL) estimates for each measure that is included in the end-use category.

7.2.1 Lighting

Lighting measures have an overall savings realization rate (RR) of 98 percent and represent 89 percent of total program savings.

⁶ This quantity represents the values provided in the tracking data and are not grouped by unit as shown in Table 2-1.

Table 7-3 Lighting Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
2-Foot T8 Lamp and Ballast	Lamp	657	100%	17,285	100%	3.86	15
250W MH to 4L 4F T8 Fixture with Fixture Mounted Occupancy Sensor	Each	28	90%	13,619	257%	4.12	15
3-Foot T8 Lamp and Ballast	Lamp	75	105%	4,955	100%	1.24	15
4-Foot T8 Lamp and Ballast	Lamp	12,308	97%	618,528	100%	127.28	15
400W MH to 6L 4F T8 Fixture with Fixture Mounted Occupancy Sensor	Each	1,079	95%	793,717	207%	212.07	15
8-Foot T12 Lamp to RW T8 Lamp and Ballast	Lamp	66	101%	6,072	100%	0.82	15
8-Foot T12 Lamp to two 4-Foot T8 Lamps and Ballast	Lamp	13,929	101%	761,594	100%	147.76	15
Daylighting Controls	Watt Controlled	8,724	91%	9,081	100%	1.92	8
Dimming technology	Watt Controlled	122,653	90%	130,628	100%	26.55	8
Fixture Mounted Occupancy Sensor	Each	21,729	96%	3,676,034	86%	2,385.80	8
Hard wired LED exit retrofit kits	Kit	322	100%	29,970	100%	2.47	16
Induction Fixtures	Watt Reduced	3,205	101%	11,861	100%	2.58	15
LED Decorative	Each	776	101%	28,143	84%	6.40	15
LED directional MR	Each	320	100%	19,382	100%	4.91	15
LED directional PAR 20	Each	109	100%	8,097	100%	1.77	15
LED directional PAR 30	Each	873	101%	54,854	100%	12.19	15
LED directional PAR 38	Each	708	100%	92,730	100%	23.12	15

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
LED Directional R/BR	Each	1,866	100%	137,466	100%	31.36	15
LED exit signs	Sign	248	100%	22,872	100%	1.95	16
LED Fixtures	Watt Reduced	28,011,875	98%	107,732,448	100%	21,380.11	15
LED Omnidirectional	Each	4,771	100%	464,976	100%	104.67	15
LED Refrigerated Display Case Lighting	Lamp	10,827	100%	3,362,651	17%	399.90	15
New T8/T5 Fixtures with Electronic Ballasts	Watt Reduced	1,028,150	103%	4,180,744	100%	837.58	15
Occupancy Sensors Plus Daylighting Controls	Watt Controlled	98,000	93%	141,051	100%	27.39	8
Occupancy sensors with dimming technology	Watt Controlled	115,191	91%	162,287	100%	30.91	8
Outdoor: 250-399W Metal Halide Lamp to Ceramic Discharge Metal Halide Lamp	Lamp	10	100%	2,007	100%	-	15
Outdoor: Dimming Technology	Watt Controlled	16,731	92%	23,141	100%	-	8
Outdoor: Induction Fixtures	Watt Reduced	25,771	100%	114,982	100%	-	15
Outdoor: LED Channel Sign LTE 2 Feet	Letter	105	100%	15,694	0%	-	15
Outdoor: LED Fixtures	Watt Reduced	20,026,765	100%	89,354,019	100%	-	15
Outdoor: New T8/T5 Fixtures with Electronic Ballasts	Watt Reduced	67,960	100%	303,218	100%	-	15
Outdoor: Occupancy Sensors Plus Daylighting Controls	Watt Controlled	46,309	91%	78,515	100%	-	8
Outdoor: Occupancy Sensors with Dimming Technology	Watt Controlled	7,592	91%	12,872	100%	-	8
Outdoor: Photocell with Time Clock	Watt Controlled	27,520	100%	36,480	100%	-	8

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Outdoor: Photocells	Watt Controlled	1,431,160	100%	364,660	100%	-	8
Outdoor: Time Clocks for Lighting	Watt Controlled	185,391	116%	231,606	100%	-	8
Outdoor: TLED(Type C)	Watt Reduced	16,552	100%	73,852	100%	-	15
Remove 4-Foot Lamp	Lamp	1,095	102%	142,724	100%	27.96	11
Remove 4-Foot Lamp and Install Reflector	Lamp	3,304	93%	404,715	100%	82.67	11
Remove 8-Foot Lamp	Lamp	1	105%	212	100%	0.05	11
Remove 8-Foot Lamp and Install Reflector	Lamp	1,142	94%	279,808	100%	54.73	11
TLED(Type C)	Watt Reduced	2,944,547	100%	11,738,510	100%	2,324.95	15
Wall Mounted Occupancy Sensor	Each	12,763	57%	2,955,032	52%	2,458.46	8

Source: ComEd tracking data and Navigant team analysis.

Value Mapping for certain Building Types – Input discrepancies for the following building types impacted calculations for all lighting measures:

- **Warehouse “Fixture Annual Operating Hours”:** The measure workbook used 5,087 whereas the TRM (table in section 4.5) shows 5,242.
- **Low-Use Small Business “Waste Heat Cooling Factor Energy” (WHFe):** The measure workbook used 1.24 whereas the TRM (table in section 4.5) shows 1.31.
- **Healthcare Clinic:** Per-unit values typically do not match the measure workbook for this building type. Examples include project IDs SBES9_35787 (LED fixture), SBES9_36441 (Remove 4-Foot Lamp and Install Reflector).

Recommendation 2:⁷ Correct the following values for lighting building type mappings:

- “Warehouse” building type has incorrect “fixture annual operating hours” value in the measure workbook
- “Low-Use Small Business” has an incorrect “Waste Heating Cooling Factor Energy (WHFE)” value in the measure workbook
- In some cases, “Healthcare Clinic” per-unit ex ante savings values in tracking data do not match the measure workbook.

LED Decorative - This measure has a peak demand reduction realization rate of 84 percent because the peak demand savings value was calculated using different baseline and efficient wattages than were used for the energy savings calculation. See PY9 measure workbook⁸ tab “Screw-In LED” cells C16 to AO16, which pull from cells E55 and F55 instead of E54 and F54.

Recommendation 3: Correct the peak demand reduction calculation for the “LED Decorative” measure in the measure workbook to pull the correct inputs into the equation.

⁷ Recommendations are the same as those in “Impact Findings and Conclusions” in section 5.

⁸ SBES PY9 Measure Workbook_kWh&Therm_03062017.xlsx

LED Refrigerated Display Case Lighting – This measure has a peak demand reduction realization rate of 17 percent because the measure workbook value (see “Display Case Lighting” tab) incorrectly factored the “feet” input two times.

Recommendation 4: Correct the peak demand reduction calculation for the “LED Refrigerated Display Case Lighting” measure in the measure workbook so that the “feet” input is only factored once.

“250W MH to 4L 4F T8 Fixture with Fixture Mounted Occupancy Sensor” and “400W MH to 6L 4F T8 Fixture with Fixture Mounted Occupancy Sensor” – The energy savings realization rates for these measures are below 100 percent because Navigant calculated savings from the light fixture and occupancy separately, then summed them. The peak demand reduction realization rate is roughly 200 percent because the calculation in the measure workbook doesn’t include peak demand savings from the occupancy sensor.

Recommendation 5: Calculate savings for fixtures and occupancy sensors individually then sum the values to calculate total savings when the measures are installed together (“250W MH to 4L 4F T8 Fixture with Fixture Mounted Occupancy Sensor” and “400W MH to 6L 4F T8 Fixture with Fixture Mounted Occupancy Sensor”). The peak demand savings calculation should include peak demand savings from the occupancy sensor.

Lighting Controls – For the “Outdoor: Photocell with Time Clock” and “Outdoor: Photocells” measures, Navigant used the values calculated by Nexant as they agreed with the “ComEd Standard Program Year 9” workpaper⁹. For the other lighting control measures that did not have savings defined in the TRM, Navigant verified the calculation method and inputs using the Pennsylvania TRM 2016 section 3.1.3 (PA TRM)¹⁰. The savings equation is defined as:

$$\Delta kWh = kW_{controlled} \times HOU \times (SVG_{ee} - SVG_{base}) \times (1 + IF_{energy})$$

Navigant found that Nexant used an IF_{energy} value of 0.095 for all non-exterior building types. PA TRM table 3-9 in section 3.1.1 dictates that comfort cooled buildings should use a value of 0.031 for non-electric heat, -0.142 for electric heat, and zero for unknown. Because this information was not provided in the tracking data, Navigant used a value of zero for each building type.

The $(SVG_{ee} - SVG_{base})$ portion of the algorithm represents the savings control factor (SCF). Navigant validated the SCF values used in the measure workbook for each measure and used the SCF given by PA TRM Table 3-4 in section 3.1.1. Table 3 compares the SCF values Navigant used (PA TRM SCF) with the values in the measure workbook (Nexant SCF).

⁹ ComEd Standard Program Year 9 Measure Workpapers. Version 2.0 effective June 1, 2016.

¹⁰ Pennsylvania Public Utility Commission Technical Reference Manual, Effective June 2016.

Table 7-4 Lighting Control SCF Input Comparison

Measure	PA TRM SCF	Nexant SCF
Daylighting Controls	28%	30%
Dimming technology	31%	30%
Occupancy Sensors Plus Daylighting Controls	38%	38%
Occupancy sensors with dimming technology	38%	38%
Outdoor: Dimming Technology	31%	30%
Outdoor: Occupancy Sensors Plus Daylighting Controls	38%	38%
Outdoor: Occupancy Sensors with Dimming Technology	38%	38%
Outdoor: Time Clocks for Lighting	28%	24%

Source: Navigant analysis of tracking data, PA TRM

Recommendation 6: Ensure “Savings Control Factor (SCF)” algorithm inputs for lighting control measures not defined in the TRM match the values assigned in the source document (e.g. PA TRM).

Outdoor: LED Channel Sign LTE 2 Feet – This measure appears to have been installed outside but the tracking data reported peak demand savings. When a lighting measure is installed outside, “exterior” building type algorithm inputs are used and peak demand savings are zero.

Recommendation 7: Based on the TRM coincidence factor of zero for exterior lighting, the evaluation set the peak demand of “Outdoor: LED Channel Sign LTE 2 Feet” measure to zero. If the program determines that there is evidence of peak savings whether summer or winter peak, it should be brought before the Illinois Technical Advisory Committee (TAC) for review.

Wall and Fixture Mounted Occupancy Sensors – The wall mounted occupancy fixture measure has a realization rate of 57 percent because the measure workbook used a “kW controlled” algorithm input value of 0.517 for remote mounted occupancy sensors instead of the correct value of 0.305 for wall mounted occupancy sensors, per IL TRM section 4.5.10. Both the wall and fixture mounted occupancy sensors have peak demand realization rates below 100 percent due to using the same “WHFd” savings algorithm input for every building type.

Recommendation 8: Use the correct “kW controlled” value of 0.305 per the TRM when calculating savings for the “Wall Mounted Occupancy Sensor” measure. Use the corresponding building type “WHFd” input when calculating peak demand reduction for “Wall Mounted Occupancy Sensor” and “Fixture Mounted Occupancy Sensor” measures.

7.2.2 Refrigeration

Refrigeration measures have an overall savings RR of 133 percent and represent eight percent of total program savings.

Table 7-5 Refrigeration Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Anti-Sweat Heater Controls for Glass Door Cooler or Refrigerator	Linear Foot	18,723	100%	10,176,424	100%	-	12
Auto Closer for Walk-in Cooler	Each	590	100%	506,297	100%	165.90	8
Auto Closer for Walk-in Freezer	Each	81	100%	170,049	100%	10.10	8
Direct Install: Reach-in (Novelty) Cooler Controls	Each	67	100%	73,756	100%	-	5
EC Motor for Reach-in Cooler or Freezer	Motor	58	100%	18,188	80%	1.77	15
EC Motor for Walk-in Cooler or Freezer	Motor	607	100%	221,722	100%	23.27	15
EC Motor with Evaporator Fan Controls for Walk-in Cooler and Freezer	Motor	4,127	259%	8,296,054	250%	957.67	15
ENERGY STAR Glass Door Freezer	Each	1	100%	1,836	100%	0.20	12
ENERGY STAR Solid Door Freezer	Each	13	100%	10,284	100%	1.10	12
ENERGY STAR Solid or Glass Door Refrigerator	Each	12	100%	6,392	100%	0.68	12
Evaporator Fan Controls for walk-in coolers	Motor	83	100%	36,330	100%	4.53	16
Night Covers-Vertical Open; Remote Condensing; Medium Temperature - 35 F to 55 F	Linear Foot	120	58%	14,305	100%	-	5
Strip Curtains for Cooler	Door	854	100%	327,953	100%	38.86	6
Strip Curtains for Freezer	Door	185	100%	500,673	100%	57.24	6

Source: ComEd tracking data and Navigant team analysis.

Night Covers-Vertical Open; Remote Condensing; Medium Temperature - 35 F to 55 F - This measure has a realization rate of 58 percent because Navigant used the deemed savings value from TRM section 4.6.9 for this specific measure. The measure workbook uses an average energy savings value for all night cover types. However, the measure name provides all necessary information to choose the specific deemed value of 131 kWh from the IL TRM.

Recommendation 9: Use the specific deemed savings value of 131 kWh when claiming savings for the “Night Covers-Vertical Open; Remote Condensing; Medium Temperature - 35 F to 55 F” measure per the TRM.

EC Motor for Reach-in Cooler or Freezer – This measure has a peak demand savings realization rate of 80 percent because the value for “EC Motor for Walk-in Cooler or Freezer” was used instead of the correct value for “EC Motor for Reach-in Cooler or Freezer” in the tracking data. This value is correct in the measure workbook.

Recommendation 10: Ensure the correct peak demand savings value defined in the measure workbook for the “EC Motor for Reach-in Cooler or Freezer” measure is used in the tracking data.

EC Motor with Evaporator Fan Controls for Walk-in Cooler and Freezer - Navigant found that the measure workbook calculated ex ante savings by adding savings for the “Evaporator Fan Controls for Walk-In Coolers” measure to an average of the savings values for the “EC Motor for Walk-in Cooler or Freezer” and “EC Motor for Reach-in Cooler or Freezer” measures. The IL TRM does not define savings for these measures installed together. The ComEd Standard Program workpaper defines a savings algorithm and deemed savings values for this measure, taken from the Wisconsin TRM¹¹. Navigant reviewed the Wisconsin TRM and determined that the deemed savings values were reasonable. Navigant used the deemed savings values defined in the ComEd Standard Program workpaper and Wisconsin TRM as verified savings values for this measure in the analysis, resulting in a realization rate of 259 percent.

Recommendation 11: Consider using the ComEd Standard Program workpaper-deemed values of 2,209 kWh for energy savings and 0.255 kW for peak demand savings for the “EC Motor with Evaporator Fan Controls for Walk-in Cooler and Freezer” measure.

7.2.3 HVAC

HVAC measures have an overall savings RR of 100 percent and represent one percent of program savings.

¹¹ Wisconsin Focus on Energy Technical Reference Manual, Effective October 22, 2014.

Table 7-6 HVAC Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Economizer with DCV	Ton	7,308	100%	2,622,436	100%	-	15
Restroom Exhaust Fan Occupancy Sensor	Fan	2,393	100%	348,421	0%	53.57	8
Room Air Conditioner	Ton	1	100%	37	100%	0.07	9
Tankless Water Heater 5gpm	Each	4	100%	10,891	100%	1.24	5
Variable Speed Drive on HVAC Fan or Pump LTE 5 HP	Horsepower	145	100%	108,433	100%	12.79	15
Variable Speed Drives for HVAC Supply and Return Fans LTE 5 HP	Horsepower	162	100%	182,675	100%	14.17	15

Source: ComEd tracking data and Navigant team analysis.

Restroom Exhaust Fan Occupancy Sensor – No ex ante peak demand reduction was reported for this measure. Because this measure is not defined in the TRM, Navigant used the deemed peak demand savings value for miscellaneous buildings type from the ComEd Standard Program workpaper.

Recommendation 12: Consider using the deemed peak demand reduction value of 0.0246 kW from the ComEd Standard Program workpaper for the “Restroom Exhaust Fan Occupancy Sensor” measure.

“Variable Speed Drive on HVAC Fan or Pump LTE 5 HP” and “Variable Speed Drives for HVAC Supply and Return Fans LTE 5 HP” – These measures use “hours of use” values for lighting fixtures instead of the “heating and cooling run hours” values, per TRM sections 4.4.17 and 4.4.26.

Recommendation 13: Consider using the “heating and cooling run hours” values per the TRM when calculating savings for the “Variable Speed Drive on HVAC Fan or Pump LTE 5 HP” and “Variable Speed Drives for HVAC Supply and Return Fans LTE 5 HP” measures.

7.2.4 Compressed Air

Compressed air measures have an overall savings RR of 94 percent and represent one percent of total program savings.

Table 7-7 Compressed Air Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Air Compressors with Integrated VSD LTE 40 HP	Horsepower	1,915	100%	857,107	100%	275.65	10
Compressed Air Leak Repair	Horsepower	5,857	83%	758,522	100%	2,568.13	5
Compressed Air Pressure Reduction	Compressor	18	100%	18,873	100%	6.39	5
Direct Install: High-Efficiency Air Nozzles	Each	1,233	100%	278,416	100%	89.53	15
Efficient Refrigerated CA Dryer	CFM	2,355	100%	5,525	100%	1.77	10
No-Loss Condensate Drains	Each	584	100%	503,930	100%	162.06	10

Source: ComEd tracking data and Navigant team analysis.

Hours Based on Work Shifts – Each of the compressed air measures (except “Compressed Air Leak Repair”) uses the TRM lighting “hours of use” value of 2,954 hours for Low-use Small Business buildings to calculate savings for compressed air systems, instead of TRM v5.0 values based on the number of work shifts at the building the measure was installed in. TRM section 4.7.5 provides the opportunity to determine the project hours based on the shifts of operation. These would be reasonable values to use for the following measures:

- Air Compressors with Integrated VSD LTE 40 HP
- Direct Install: High-Efficiency Air Nozzles
- Efficient Refrigerated CA Dryer

TRM section 4.7.3 provides a deemed hours of use value of 6,136 for the “No-Loss Condensate Drains” measure.

Compressed Air Leak Repair – This measure has a savings realization rate of 83 percent due to some records with incorrect hours of use values. Project IDs SBES9_35834 and SBES9_36242 are examples of records that used TRM lighting “fixture annual operating hours” instead of “screw-based bulb annual operating hours.” The measure workbook calculates savings using the “screw-based bulb annual operating hours.” It is appropriate to use the Industrial Systems’ calculation for compressed-air hours.

Recommendation 14: If Nexant plans to continue calculating savings for the “Compressed Air Leak Repair” measure using lighting annual operating hours, use “screw-based bulb” annual operating hours per the measure workbook. Otherwise, per the TRM, use an hours input based on the number of working shifts at the building. Appropriate documentation of facility shift hours must be provided for verification.

7.2.5 RTU

RTU measures have an overall RR savings of 101 percent and represent less than one percent of total program savings.

Table 7-8 RTU Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Early Replacement for Air Cooled AC (GT 5 ton and LTE 10 ton)	Ton	1,793	101%	330,096	100%	152.46	15
Early Replacement for Air Cooled AC (GT 10 ton and LTE 20 ton)	Ton	1,176	101%	182,239	100%	83.04	15
Early Replacement for Air Cooled AC (LTE 5 ton)	Ton	824	102%	119,293	100%	62.03	15
End of life Replacement for Air Cooled AC (GT 10 ton to LTE 20 ton)	Ton	125	101%	7,406	100%	3.19	15
End of life Replacement for Air Cooled AC (GT 5 ton and LTE 10 ton)	Ton	54	101%	3,817	100%	1.87	15
End of life Replacement for Air Cooled AC (LTE 5 ton)	Ton	8	103%	788	100%	0.37	15

Source: ComEd tracking data and Navigant team analysis.

Navigant found that the measure workbook calculates savings for “early replacement” and “end of useful lifetime” RTUs based on averages of TRM (v6.0) deemed SEER and EER values. To correctly choose these deemed values, more information would need to be provided on the equipment type and subcategory (split system, single package) for the measure.

The realization rates above 100 percent for RTU measures are caused by ex ante savings calculations using an average of the “EFLH” vales for climate zones one and two. Navigant used the EFLH specific to the climate zone the measure was installed in.

Recommendation 15: Consider collecting the actual installed specs of the Seasonal Energy Efficiency Ratio of the energy efficient equipment (SEER_{ee}) and the Integrated Energy Efficiency Ratio of the energy efficient equipment (IEER_{ee}) inputs to calculate RTU measure savings. This is required by the TRM (v6.0) for CY2018 and beyond. Additionally, use the “EFLH” specific to the climate zone the measure was installed in when possible.

7.2.6 Kitchen Equipment

Kitchen equipment measures have an overall savings RR of 100 percent and represent less than one percent of program savings.

Table 7-9 Kitchen Equipment Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Direct Install: Beverage Machine Controls	Each	187	100%	274,475	100%	-	5
Direct Install: Snack Machine Controls	Each	2	100%	624	100%	-	5
ENERGY STAR Hot Food Holding Cabinet Full Size	Each	1	100%	8,470	100%	0.63	12
ENERGY STAR Ice Maker 501-1500 lbs per day	Each	3	100%	2,942	100%	0.56	10
Kitchen Fan with DCV	Each	36	100%	146,961	100%	24.90	15

Source: ComEd tracking data and Navigant team analysis.

ENERGY STAR Ice Maker 501-1500 lbs per day – Savings for this measure were calculated using a regression model that was trained with data points from the different types of icemakers and Harvest Rate (pounds of ice made per day) (H) values in the TRM. Navigant found that in implementing the equation of the model to calculate savings, Nexant used the incorrect coefficient value for “H” as shown in the graphic (see cell N82 and associated graphic on the “Ice Maker” tab of the measure workbook).

Recommendation 16: Consider providing more information about the type of icemaker installed to use more specific deemed values and algorithms provided in the TRM. Correct the equation used to calculate savings for the “ENERGY STAR Ice Maker 501-1500 lbs per day” to match the regression model in the measure workbook.

7.2.7 Advanced Power Strip

Advanced Power Strips (Tier 1, 5-plug) have an overall savings RR of 91 percent and represent less than one percent of total program savings.

Table 7-10 Advanced Power Strips Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Direct Install: Advanced Power Strip	Each	6,890	91%	354,249	126%	39.75	4

Source: ComEd tracking data and Navigant team analysis.

The ex ante savings estimate for the APS measure was calculated using an algorithm from the Pennsylvania TRM but included an extra input not outlined in the algorithm. Navigant believes the estimated ex ante savings value and description of the measure correspond to the “Advanced Power Strip – Tier 1” (5-plug) measure defined by IL TRM section 5.2.1 and used the TRM-deemed values for energy and peak demand reduction instead. As a result, the realization was for this measure is 91 percent for energy savings and 126 percent for peak demand reduction.

Recommendation 17: Consider which Advanced Power Strips (APS) defined in the TRM best represents the APS installed by the SBES Program and use the associated deemed values. Evaluation determined the claimed savings were best fit to the Tier 1, five plug APS type.

7.2.8 Smart Thermostats

Smart thermostats have an overall savings RR of 100 percent and represent less than one percent of total program savings.

Table 7-11 Smart Thermostats Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Programmable Thermostat - Continuous Fan Mode During Occupied Period	Each	94	100%	259,216	100%	-	4
Programmable Thermostat - Intermittent Fan Mode During Occupied Period	Each	258	100%	15,932	100%	-	4

Source: ComEd tracking data and Navigant team analysis.

Navigant found that Nexant calculated savings for smart thermostats installed in buildings that the TRM does not define savings for. For these buildings, Nexant used default values for the “restaurant” building type, which was an average of the savings for “fast food” and “full service” restaurant types.

Recommendation 18: Recode building types to names where savings are defined by the TRM for smart thermostats.

7.2.9 Water Efficiency

Direct install water efficiency measures have an overall savings RR of 100 percent and represent less than one percent of total program savings.

Table 7-12 Water Efficiency Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Direct Install: Aerator (Bathroom) - Low Flow	Each	662	100%	55,185	100%	8.24	9
Direct Install: Aerator (Kitchen) - Low Flow	Each	103	100%	10,470	100%	1.57	9
Direct Install: High Efficiency Pre-Rinse Spray Valve	Each	13	100%	16,387	100%	-	5
Direct Install: Showerhead - Low Flow	Each	4	100%	1,249	100%	0.15	10

Source: ComEd tracking data and Navigant team analysis.

7.2.10 Building Envelope

Building envelope measures have an overall savings RR of 100 percent and represent less than one percent of total program savings.

Table 7-13 Building Envelope Measures Impact Detail

Measure	Unit Basis	Quantity Installed	Verified Gross kWh Realization Rate	Verified Net Savings (kWh)	Verified Gross Peak Demand Reduction Realization Rate	Verified Net Peak Demand Reduction (kW)	EUL
Cool Roof - A.C. Equipment NOT on Roof	Square Foot	4,588	100%	334	100%	0.79	15
Weather Stripping	Door	463	100%	5,825	100%	-	15

Source: ComEd tracking data and Navigant team analysis.

8. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 8-1, the Total Resource Cost (TRC) variable table, only includes cost-effectiveness analysis inputs available at the time of finalizing this PY9 impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation at a later date. Detail in this table (e.g., EULs), other than final PY9 savings and program data, are subject to change and are not final.

Table 8-1. TRC Detail

Program	Measure	Units	Quantity	EUL	Ex Ante Savings (kWh)	Ex Ante Peak Demand Savings (kW)	Verified Savings (kWh)	Verified Peak Demand Savings (kW)
SBES	2-Foot T8 Lamp and Ballast	Lamp	657	15	18,917	4	18,994	8
SBES	250W MH to 4L 4F T8 Fixture with Fixture Mounted Occupancy Sensor	Each	28	15	16,640	2	14,966	12
SBES	3-Foot T8 Lamp and Ballast	Lamp	75	15	5,203	1	5,445	2
SBES	4-Foot T8 Lamp and Ballast	Lamp	12,308	15	703,708	140	679,701	226
SBES	400W MH to 6L 4F T8 Fixture with Fixture Mounted Occupancy Sensor	Each	1,079	15	922,442	112	872,216	671
SBES	8-Foot T12 Lamp to RW T8 Lamp and Ballast	Lamp	66	15	6,595	1	6,673	2
SBES	8-Foot T12 Lamp to two 4-Foot T8 Lamps and Ballast	Lamp	13,929	15	831,030	162	836,917	243
SBES	Air Compressors with Integrated VSD LTE 40 HP	Horsepower	1,915	10	941,874	303	941,876	319
SBES	Anti-Sweat Heater Controls for Glass Door Cooler or Refrigerator	Linear Foot	18,723	12	11,182,822	-	11,182,884	-
SBES	Auto Closer for Walk-in Cooler	Each	590	8	556,370	182	556,370	182
SBES	Auto Closer for Walk-in Freezer	Each	81	8	186,867	11	186,867	11
SBES	Compressed Air Leak Repair	Horsepower	5,857	5	1,005,834	2,822	833,541	2,971
SBES	Compressed Air Pressure Reduction	Compressor	18	5	20,740	7	20,740	7
SBES	Cool Roof - A.C. Equipment NOT on Roof	Square Foot	4,588	15	367	1	367	2
SBES	Daylighting Controls	Watt Controlled	8,724	8	10,932	2	9,979	3
SBES	Dimming technology	Watt Controlled	122,653	8	159,064	29	143,547	45

Program	Measure	Units	Quantity	EUL	Ex Ante Savings (kWh)	Ex Ante Peak Demand Savings (kW)	Verified Savings (kWh)	Verified Peak Demand Savings (kW)
SBES	Direct Install: Aerator (Bathroom) - Low Flow	Each	662	9	60,646	9	60,643	1,663
SBES	Direct Install: Aerator (Kitchen) - Low Flow	Each	103	9	11,506	2	11,506	315
SBES	Direct Install: Beverage Machine Controls	Each	187	5	301,620	-	301,621	-
SBES	Direct Install: High Efficiency Pre-Rinse Spray Valve	Each	13	5	18,008	-	18,008	-
SBES	Direct Install: High-Efficiency Air Nozzles	Each	1,233	15	305,957	98	305,952	104
SBES	Direct Install: Reach-in (Novelty) Cooler Controls	Each	67	5	81,051	-	81,050	-
SBES	Direct Install: Showerhead - Low Flow	Each	4	10	1,370	0	1,372	6
SBES	Direct Install: Smart Strip	Each	6,890	4	426,146	35	389,285	55
SBES	Direct Install: Snack Machine Controls	Each	2	5	686	-	686	-
SBES	Early Replacement for Air Cooled AC (GT 5 ton and LTE 10 ton)	Ton	1,793	15	359,076	168	362,743	351
SBES	Early Replacement for Air Cooled AC (GT 10 ton and LTE 20 ton)	Ton	1,176	15	198,413	91	200,263	191
SBES	Early Replacement for Air Cooled AC (LTE 5 ton)	Ton	824	15	128,680	68	131,091	143
SBES	EC Motor for Reach-in Cooler or Freezer	Motor	58	15	19,987	2	19,987	2
SBES	EC Motor for Walk-in Cooler or Freezer	Motor	607	15	243,650	26	243,650	26
SBES	EC Motor with Evaporator Fan Controls for Walk-in Cooler and Freezer	Motor	4,127	15	3,524,458	421	9,116,543	1,052
SBES	Economizer with DCV	Ton	7,308	15	2,881,781	-	2,881,798	-

Program	Measure	Units	Quantity	EUL	Ex Ante Savings (kWh)	Ex Ante Peak Demand Savings (kW)	Verified Savings (kWh)	Verified Peak Demand Savings (kW)
SBES	Efficient Refrigerated CA Dryer	CFM	2,355	10	6,076	2	6,071	2
SBES	End of life Replacement for Air Cooled AC (GT 10 ton to LTE 20 ton)	Ton	125	15	8,031	4	8,139	7
SBES	End of life Replacement for Air Cooled AC (GT 5 ton and LTE 10 ton)	Ton	54	15	4,138	2	4,195	4
SBES	End of life Replacement for Air Cooled AC (LTE 5 ton)	Ton	8	15	840	0	866	1
SBES	ENERGY STAR Glass Door Freezer	Each	1	12	2,018	0	2,018	0
SBES	ENERGY STAR Hot Food Holding Cabinet Full Size	Each	1	12	9,308	1	9,308	2
SBES	ENERGY STAR Ice Maker 501-1500 lbs per day	Each	3	10	3,233	1	3,233	1
SBES	ENERGY STAR Solid Door Freezer	Each	13	12	11,301	1	11,301	1
SBES	ENERGY STAR Solid or Glass Door Refrigerator	Each	12	12	7,024	1	7,024	1
SBES	Evaporator Fan Controls for walk-in coolers	Mobtr	83	16	39,923	5	39,923	5
SBES	Fixture Mounted Occupancy Sensor	Each	21,729	8	4,216,876	3,052	4,039,598	5,141
SBES	Hard wired LED exit retrofit kits	Kit	322	16	32,915	3	32,934	4
SBES	Induction Fixtures	Watt Reduced	3,205	15	12,856	3	13,034	3
SBES	Kitchen Fan with DCV	Each	36	15	161,496	27	161,496	27
SBES	LED Decorative	Each	776	15	30,644	8	30,926	12
SBES	LED directional MR	Each	320	15	21,290	5	21,299	9
SBES	LED directional PAR 20	Each	109	15	8,898	2	8,898	3
SBES	LED directional PAR 30	Each	873	15	59,928	13	60,279	23
SBES	LED directional PAR 38	Each	708	15	101,470	25	101,901	42

Program	Measure	Units	Quantity	EUL	Ex Ante Savings (kWh)	Ex Ante Peak Demand Savings (kW)	Verified Savings (kWh)	Verified Peak Demand Savings (kW)
SBES	LED Directional R/BR	Each	1,866	15	150,875	35	151,062	59
SBES	LED exit signs	Sign	248	16	25,050	2	25,134	3
SBES	LED Fixtures	Watt Reduced	28,011,875	15	120,809,440	23,481	118,387,305	36,326
SBES	LED Omnidirectional	Each	4,771	15	509,587	115	510,963	203
SBES	LED Refrigerated Display Case Lighting	Lamp	10,827	15	3,695,255	2,637	3,695,221	637
SBES	New T8/T5 Fixtures with Electronic Ballasts	Watt Reduced	1,028,150	15	4,475,293	920	4,594,224	1,351
SBES	Night Covers-Vertical Open; Remote Condensing; Medium Temperature - 35 F to 55 F	Linear Foot	120	5	27,160	-	15,720	-
SBES	No-Loss Condensate Drains	Each	584	10	553,766	178	553,769	187
SBES	Occupancy Sensors Plus Daylighting Controls	Watt Controlled	98,000	8	167,413	30	155,001	44
SBES	Occupancy sensors with dimming technology	Watt Controlled	115,191	8	195,109	34	178,337	52
SBES	Outdoor: 250-399W Metal Halide Lamp to Ceramic Discharge Metal Halide Lamp	Lamp	10	15	2,206	-	2,206	-
SBES	Outdoor: Dimming Technology	Watt Controlled	16,731	8	27,773	-	25,430	-
SBES	Outdoor: Induction Fixtures	Watt Reduced	25,771	15	126,276	-	126,354	-
SBES	Outdoor: LED Channel Sign LTE 2 Feet	Letter	105	15	17,246	4	17,246	-

Program	Measure	Units	Quantity	EUL	Ex Ante Savings (kWh)	Ex Ante Peak Demand Savings (kW)	Verified Savings (kWh)	Verified Peak Demand Savings (kW)
SBES	Outdoor: LED Fixtures	Watt Reduced	20,026,765	15	98,131,150	-	98,191,230	-
SBES	Outdoor: New T8/T5 Fixtures with Electronic Ballasts	Watt Reduced	67,960	15	333,003	-	333,207	-
SBES	Outdoor: Occupancy Sensors Plus Daylighting Controls	Watt Controlled	46,309	8	94,470	-	86,280	-
SBES	Outdoor: Occupancy Sensors with Dimming Technology	Watt Controlled	7,592	8	15,488	-	14,145	-
SBES	Outdoor: Photocell with Time Clock	Watt Controlled	27,520	8	40,179	-	40,088	-
SBES	Outdoor: Photocells	Watt Controlled	1,431,160	8	400,725	-	400,725	-
SBES	Outdoor: Time Clocks for Lighting	Watt Controlled	185,391	8	218,761	-	254,512	-
SBES	Outdoor: TLED(Type C)	Watt Reduced	16,552	15	81,107	-	81,156	-
SBES	Programmable Thermostat - Continuous Fan Mode During Occupied Period	Each	94	4	284,853	-	284,853	-
SBES	Programmable Thermostat - Intermittent Fan Mode During Occupied Period	Each	258	4	17,508	-	17,508	-
SBES	Remove 4-Foot Lamp	Lamp	1,095	11	154,122	31	156,840	47
SBES	Remove 4-Foot Lamp and Install Reflector	Lamp	3,304	11	476,485	91	444,742	148

Program	Measure	Units	Quantity	EUL	Ex Ante Savings (kWh)	Ex Ante Peak Demand Savings (kW)	Verified Savings (kWh)	Verified Peak Demand Savings (kW)
SBES	Remove 8-Foot Lamp	Lamp	1	11	221	0	233	0
SBES	Remove 8-Foot Lamp and Install Reflector	Lamp	1,142	11	328,744	60	307,481	89
SBES	Restroom Exhaust Fan Occupancy Sensor	Fan	2,393	8	382,880	-	382,880	392
SBES	Room Air Conditioner	Ton	1	9	41	0	41	0
SBES	Strip Curtains for Cooler	Door	854	6	360,388	43	360,388	43
SBES	Strip Curtains for Freezer	Door	185	6	550,190	63	550,190	63
SBES	Tankless Water Heater 5gpm	Each	4	5	11,968	1	11,968	1
SBES	TLED(Type C)	Watt Reduced	2,944,547	15	12,938,174	2,555	12,899,461	3,759
SBES	Variable Speed Drive on HVAC Fan or Pump LTE 5 HP	Horsepower	145	15	119,157	14	119,157	101
SBES	Variable Speed Drives for HVAC Supply and Return Fans LTE 5 HP	Horsepower	162	15	200,743	16	200,742	99
SBES	Wall Mounted Occupancy Sensor	Each	12,763	8	5,715,736	5,149	3,247,288	5,297
SBES	Weather Stripping	Door	463	15	6,403	-	6,401	-