

ComEd Facility Assessments Impact Evaluation Report

**Energy Efficiency / Demand Response Plan:
Program Year 2019 (CY2019)
(1/1/2019-12/31/2019)**

**Presented to
ComEd**

FINAL

April 24, 2020

Prepared by:

**Dustin Bailey
Guidehouse**

www.guidehouse.com



ComEd Facility Assessments Impact Evaluation Report

Submitted to:

ComEd
2011 Swift Drive
Oak Brook, IL 60523

Submitted by:

Guidehouse (which acquired Navigant in 2019)
150 N. Riverside Plaza, Suite 2100
Chicago, IL 60606

Contact:

Randy Gunn, Partner
312.583.5714
randy.gunn@guidehouse.com

Jeff Erickson, Director
608.616.4962
jeff.erickson@guidehouse.com

Rob Neumann, Associate Director
312.583.2176
rob.neumann@guidehouse.com

Disclaimer: This report was prepared by Guidehouse for ComEd. The work presented in this report represents Guidehouse's professional judgment based on the information available at the time this report was prepared. Use of this report by any other party for whatever purpose should not, and does not, absolve such party from using due diligence in verifying the report's contents. Neither Guidehouse nor any of its subsidiaries or affiliates assumes any liability or duty of care to such parties, and hereby disclaims any such liability.

TABLE OF CONTENTS

1. Introduction	1
2. Program Description	1
3. Program Savings Detail	5
4. Cumulative Persisting Annual Savings	5
5. Program Savings by Measure	9
6. Impact Analysis Findings and Recommendations	12
6.1 Impact Parameter Estimates	12
6.2 Other Impact Findings and Recommendations	13
6.2.1 Overall Program Results	13
6.2.2 Program Tracking	13
6.2.3 Project Specific Finding	14
7. Appendix 1. Impact Analysis Methodology	14
8. Appendix 2. Impact Analysis Detail	15
9. Appendix 3. Total Resource Cost Detail	16

LIST OF TABLES AND FIGURES

Figure 2-1. Percentage of Measures Installed by Type	3
Figure 2-2. Percentage of Measures Installed by End Use	4
Figure 4-1. Cumulative Persisting Annual Savings	9
Figure 5-1. Verified Net Savings by Measure – Electric	9
Table 2-1. CY2019 Volumetric Findings Detail	2
Table 3-1. CY2019 Total Annual Incremental Electric Savings	5
Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric	6
Table 4-2. Cumulative Persisting Annual Savings (CPAS) – Gas	7
Table 4-3. Cumulative Persisting Annual Savings (CPAS) - Electric	8
Table 5-1. CY2019 Energy Savings by Measure – Electric	10
Table 5-2. CY2019 Energy Savings by Measure - Gas	11
Table 5-3. CY2019 Energy Savings by Measure - Total Combining Electricity and Gas	12
Table 6-1. Savings Parameters Issues	13
Table 7-1. OEP Sample Details	15
Table 9-1. Total Resource Cost Savings Summary	17

1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's Facility Assessments CY2019 (Business Operational Efficiency (OE) Program). It includes a summary of the energy and demand impacts for the total program broken out by relevant measure and program structure details. The appendix provides the impact analysis methodology and details of the Total Resource Cost inputs. CY2019 covers January 1, 2019 through December 31, 2019.

2. PROGRAM DESCRIPTION

The OE Program is made up of low-cost and operational measures identified during ComEd engineering commercial & industrial facility assessments. OE measures are not covered by the Custom or Standard Programs due to their no-cost or low-cost nature, but are identified in the custom and standard audits. These measures focus on existing equipment at the site and apply maintenance and operational best practices to realize energy savings with little or no investment from the customer. Implementation may occur at the time of the audit, or program outreach staff follows up with the customer to check on progress.

Utility staff developed a calculator for each measure to estimate program savings. The measures and operational efficiencies identified through this program include, among others, turning off lights and equipment when not needed, addressing air compressor leaks and high-pressure adjustments, adjusting space temperatures with pre-existing controls, and simple HVAC maintenance.

In CY2019, the OE Program had 154 participants and distributed 219 measures as shown in the following table and graph. However, due to the custom nature of the program, the implementer did not clearly assign measures to defined measure types. Guidehouse evaluators grouped these measures to measure types as show below. Figure 2-1 illustrates the program volume distribution according to the 19 primary measure types; Figure 2-2 illustrates the program distribution according to the measure end use types.

In CY2019, program data was collected over the course of the year into evaluation waves and evaluation tasks were undertaken periodically throughout the year on each wave. Initial evaluation of the initial wave one was completed in October of 2019. The utility provided additional information to support the calculations for Wave One and ex post savings were finalized in November of 2019. The Wave Two evaluation was completed in early in 2020. Eight projects were identified as having insufficient data to justify claimed savings and Guidehouse sent requests for additional backup data in early February 2020. Guidehouse evaluation staff received supporting information for these projects in March 2020.

Table 2-1. CY2019 Volumetric Findings Detail

Participation		OEP Program
Participants		154
Installed Projects		219
Research Measure Types		19
Research End Use Types		6

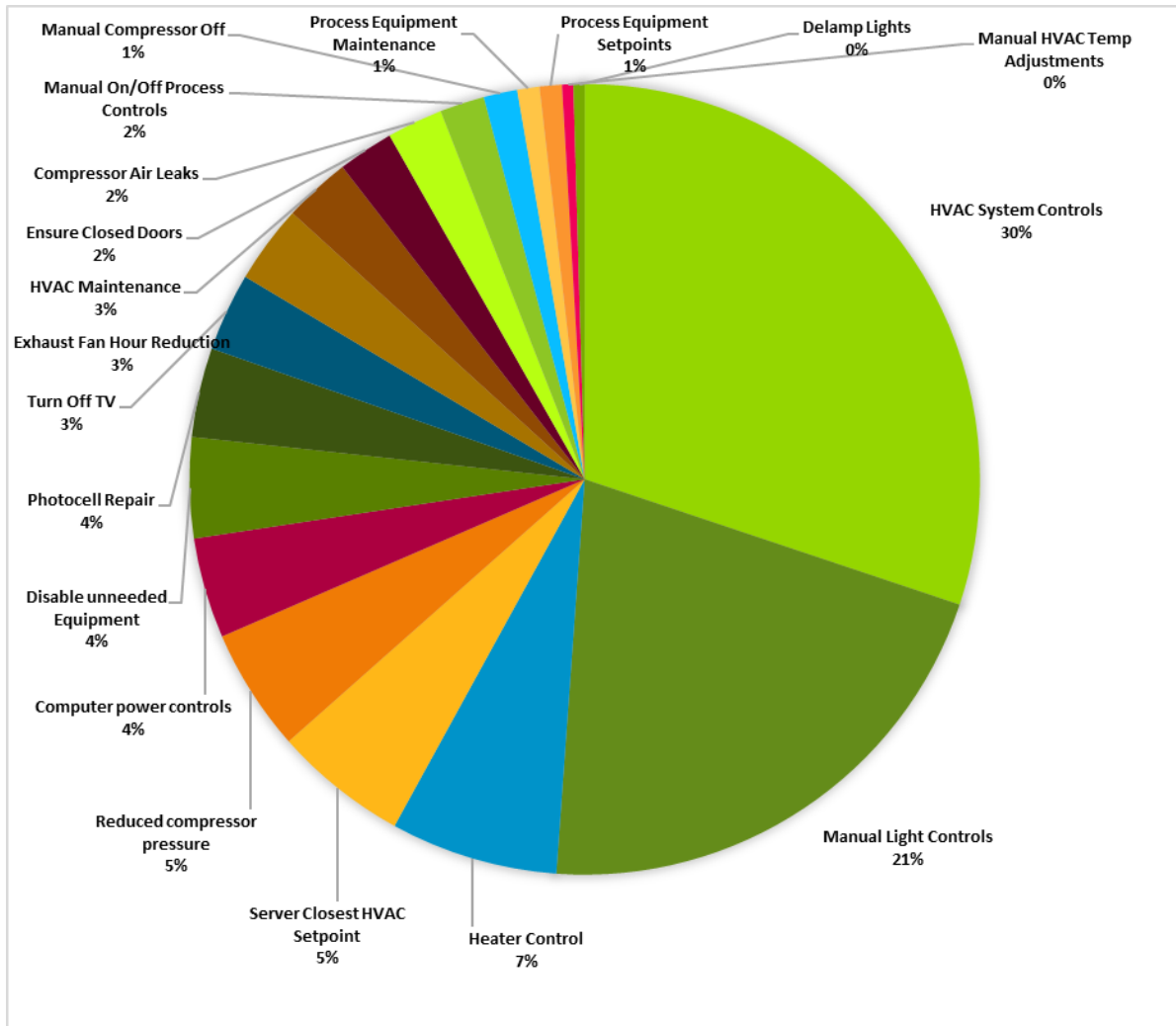
Measure Types	End Use	Count
HVAC System Controls	HVAC	66
Manual Light Controls	Lighting	46
Heater Control	HVAC	15
Server Closest HVAC Setpoint	HVAC	12
Reduced compressor pressure	Air Compressor	11
Computer power controls	Plug Load	9
Disable unneeded Equipment	Process Equipment	9
Photocell Repair	Lighting	8
Turn Off TV	Plug Load	7
Exhaust Fan Hour Reduction	HVAC	7
HVAC Maintenance	HVAC	6
Ensure Closed Doors	HVAC	5
Compressor Air Leaks	Air Compressor	5
Manual On/Off Process Controls	Process Equipment	4
Manual Compressor Off	Air Compressor	3
Process Equipment Maintenance	Process Equipment	2
Process Equipment Setpoints	Process Equipment	2
Manual HVAC Temp Adjustments	HVAC	1
Delamp Lights	Lighting	1

* Participants are defined as unique ComEd account numbers

† Installed projects are defined as unique Project IDS

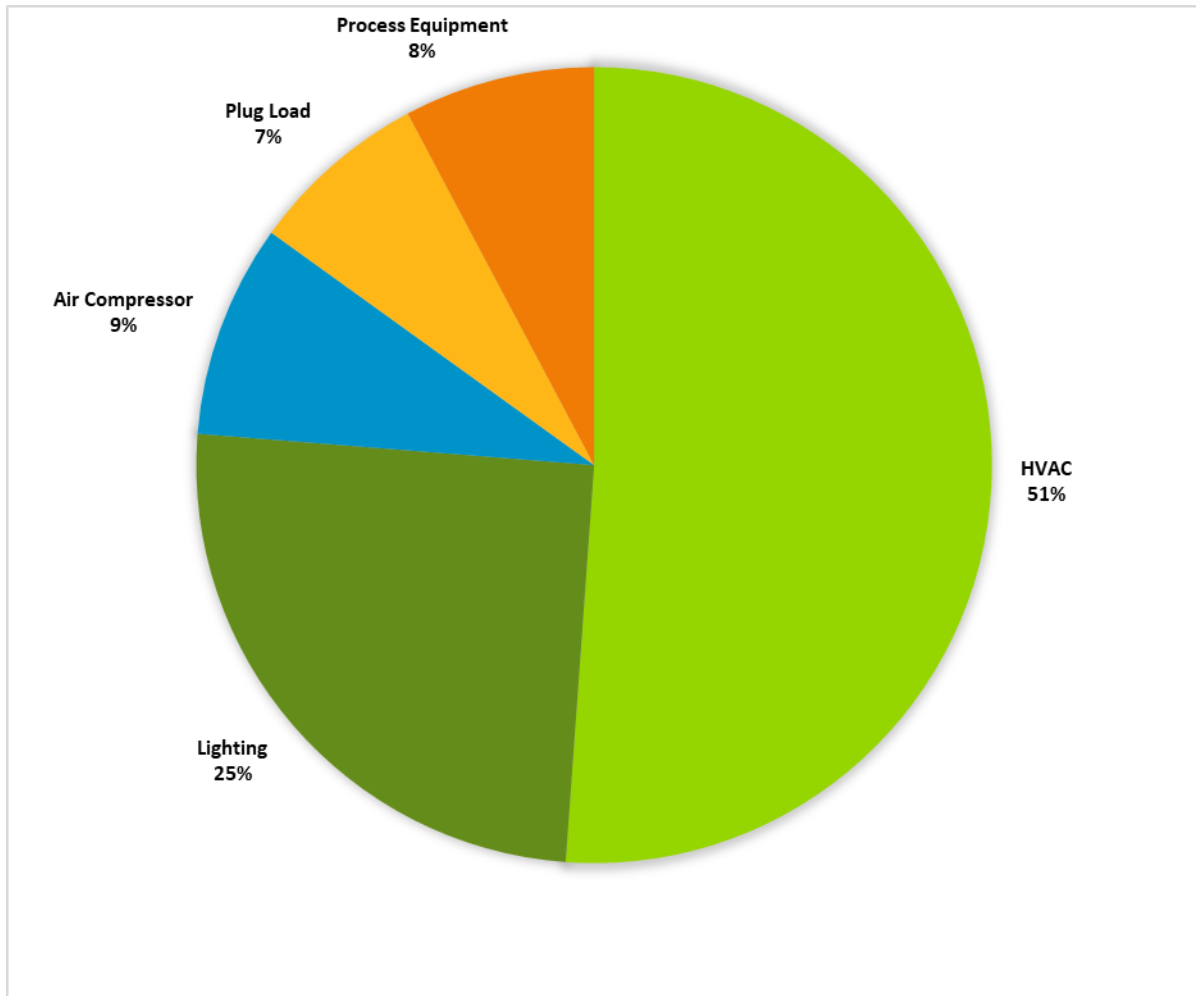
Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Percentage of Measures Installed by Type



Source: ComEd tracking data and evaluation team analysis

Figure 2-2. Percentage of Measures Installed by End Use



Source: ComEd tracking data and evaluation team analysis

3. PROGRAM SAVINGS DETAIL

Table 3-1 summarizes the incremental energy and demand savings the OE Program achieved in CY2019. Total verified net energy savings is 4,320,047 kWh.

Table 3-1. CY2019 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Non-Coincident Demand Savings (kW)	Summer Peak* Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	3,955,766	NR	NR
Program Gross Realization Rate	0.90	NA	NA
Verified Gross Savings	3,578,494	NA	NA
Program Net-to-Gross Ratio (NTG)	0.94	NA	NA
Verified Net Savings	3,363,784	NA	NA
Converted from Gas†			
Ex Ante Gross Savings	1,095,285	NA	NA
Program Gross Realization Rate	0.93	NA	NA
Verified Gross Savings	1,017,301	NA	NA
Program Net-to-Gross Ratio (NTG)	0.94	NA	NA
Verified Net Savings	956,263	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	5,051,051	NR	NR
Program Gross Realization Rate	0.91	NA	NA
Verified Gross Savings	4,595,795	NA	NA
Program Net-to-Gross Ratio (NTG)	0.94	NA	NA
Verified Net Savings	4,320,047	NA	NA

NR = Not Reported (refers to a piece of data that was not reported, i.e., non-coincident demand savings)

NA = Not Applicable (refers to a piece of data that cannot be produced or does not apply)

* The coincident summer peak period is defined as 1:00-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

† Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh). The evaluation will determine which gas savings will be converted to kWh and counted toward ComEd's electric savings goal while producing the portfolio-wide Summary Report. According to Section 8-103B(b-25) of the Illinois Public Utilities Act, "In no event shall more than 10% of each year's applicable annual incremental goal as defined in paragraph (7) of subsection (g) of this Section be met through savings of fuels other than electricity."

Source: ComEd tracking data and evaluation team analysis

4. CUMULATIVE PERSISTING ANNUAL SAVINGS

Table 4-1 to Table 4-3 and Figure 4-1 show the measure-specific and total verified gross savings for the OE Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2019. The electric CPAS across all measures installed in 2019 is 3,363,784 kWh (Table 4-1). The CY2019 gas contribution to CPAS (converted to equivalent electricity) is 956,263 kWh (Table 4-2). Adding the gas and electric contributions produces 4,320,047 kWh of total CY2019 contribution to CPAS (Table 4-3). The "historic" rows in each table are the CPAS contribution back to CY2018. The "Program Total Electric CPAS" and the "Program Total Gas CPAS" are the sum of the CY2019 contribution and the historic +36 contribution.

Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric

						Verified Net kWh Savings							
End Use Type	Research Category	EUL	CY2019	NTG*	Lifetime Net	2018	2019	2020	2021	2022	2023	2024	2025
			Verified Gross Savings (kWh)		Savings (kWh)†								
HVAC	HVAC System Controls	5.0	883,871	0.94	4,154,192		830,838	830,838	830,838	830,838	830,838		
Lighting	Manual Light Controls	3.0	481,234	0.94	1,357,079		452,360	452,360	452,360				
HVAC	Heater Control	5.0	68,032	0.94	319,753		63,951	63,951	63,951	63,951	63,951		
HVAC	Server Closest HVAC Setpoint	5.0	73,886	0.94	347,266		69,453	69,453	69,453	69,453	69,453		
Air Compressor	Reduced compressor pressure	5.0	368,480	0.94	1,731,856		346,371	346,371	346,371	346,371	346,371		
Plug Load	Computer power controls	5.0	50,523	0.94	237,460		47,492	47,492	47,492	47,492	47,492		
Process Equipment	Disable unneeded Equipment	5.0	344,774	0.94	1,620,439		324,088	324,088	324,088	324,088	324,088		
Lighting	Photocell Repair	5.0	84,967	0.94	399,345		79,869	79,869	79,869	79,869	79,869		
Plug Load	Turn Off TV	5.0	5,362	0.94	25,200		5,040	5,040	5,040	5,040	5,040		
HVAC	Exhaust Fan Hour Reduction	5.0	377,898	0.94	1,776,121		355,224	355,224	355,224	355,224	355,224		
HVAC	HVAC Maintenance	3.0	133,020	0.94	375,116		125,039	125,039	125,039				
HVAC	Ensure Closed Doors	5.0	84,306	0.94	396,237		79,247	79,247	79,247	79,247	79,247		
Air Compressor	Compressor Air Leaks	5.0	53,374	0.94	250,857		50,171	50,171	50,171	50,171	50,171		
Process Equipment	Manual On/Off Process Controls	3.0	45,498	0.94	128,305		42,768	42,768	42,768				
Air Compressor	Manual Compressor Off	3.0	109,757	0.94	309,514		103,171	103,171	103,171				
Process Equipment	Process Equipment Maintenance	3.0	1,793	0.94	5,056		1,685	1,685	1,685				
Process Equipment	Process Equipment Setpoints	5.0	398,006	0.94	1,870,629		374,126	374,126	374,126	374,126	374,126		
HVAC	Manual HVAC Temp Adjustments	3.0	9,148	0.94	25,796		8,599	8,599	8,599				
Lighting	Delamp Lights	5.0	4,565	0.94	21,454		4,291	4,291	4,291	4,291	4,291		
CY2019 Program Total Electric Contribution to CPAS			3,578,494		15,351,676		3,363,784	3,363,784	3,363,784	2,630,162	2,630,162	-	-
Historic Program Total Electric Contribution to CPAS‡						3,282,694	3,282,694	3,282,694	2,173,588	2,173,588			
Program Total Electric CPAS						3,282,694	6,646,478	6,646,478	5,537,372	4,803,750	2,630,162	-	-
CY2019 Program Incremental Expiring Electric Savings§								-	-	733,622	-	2,630,161.9	-
Historic Program Incremental Expiring Electric Savings‡§							-	-	1,109,106	-	2,173,588	-	-
Program Total Incremental Expiring Electric Savings§							-	-	1,109,106	733,622	2,173,588	2,630,162	-

Note: The green highlighted cell shows program total first year electric savings. The gray cells are blank, indicating values irrelevant to the CY2019 contribution to CPAS.

* A deemed value. Source: is to be found on the SAG web site here: https://www.ilsag.info/ntg_2019.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historical savings go back to CY2018

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n

Source: Evaluation team analysis

Table 4-2. Cumulative Persisting Annual Savings (CPAS) – Gas

		CY2019 Verified Gross Savings (Therms)		Lifetime Net Savings (Therms)†		Verified Net Therms Savings							
End Use Type	Research Category	EUL		NTG*		2018	2019	2020	2021	2022	2023	2024	2025
HVAC	HVAC System Controls	5.0	8,551	0.94	40,192		8,038	8,038	8,038	8,038	8,038		
Lighting	Manual Light Controls	3.0	-	0.94	-								
HVAC	Heater Control	5.0	9,471	0.94	44,514		8,903	8,903	8,903	8,903	8,903		
HVAC	Server Closet HVAC Setpoint	5.0	-	0.94	-								
Air Compressor	Reduced compressor pressure	5.0	-	0.94	-								
Plug Load	Computer power controls	5.0	-	0.94	-								
Process Equipment	Disable unneeded Equipment	5.0	-	0.94	-								
Lighting	Photocell Repair	5.0	-	0.94	-								
Plug Load	Turn Off TV	5.0	-	0.94	-								
HVAC	Exhaust Fan Hour Reduction	5.0	14,343	0.94	67,410		13,482	13,482	13,482	13,482	13,482		
HVAC	HVAC Maintenance	3.0	190	0.94	537		179	179	179				
HVAC	Ensure Closed Doors	5.0	2,153	0.94	10,119		2,024	2,024	2,024	2,024	2,024		
Air Compressor	Compressor Air Leaks	5.0	-	0.94	-								
Process Equipment	Manual On/Off Process Controls	3.0	-	0.94	-								
Air Compressor	Manual Compressor Off	3.0	-	0.94	-								
Process Equipment	Process Equipment Maintenance	3.0	-	0.94	-								
Process Equipment	Process Equipment Setpoints	5.0	-	0.94	-								
HVAC	Manual HVAC Temp Adjustments	3.0	-	0.94	-								
Lighting	Delamp Lights	5.0	-	0.94	-								
CY2019 Program Total Gas Contribution to CPAS (Therms)			34,708		162,771		32,626	32,626	32,626	32,447	32,447	-	
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)‡					9,703,896		956,263	956,263	956,263	951,017	951,017		
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§						1,522,282	1,522,282	1,522,282	901,818	901,818			
Program Total Gas CPAS (kWh Equivalent)‡						1,522,282	2,478,545	2,478,545	1,858,081	1,852,835	951,017		
CY2019 Program Incremental Expiring Gas Savings (Therms)							-	-	-	179	-	32,447	-
CY2019 Program Incremental Expiring Gas Savings (kWh Equivalent)‡							-	-	-	5,246	-	951,017	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§							-	-	620,464	-	901,818	-	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡							-	-	620,464	5,246	901,818	951,017	-

Note: The green highlighted cell shows program total first year gas savings in kWh equivalents. The gray cells are blank, indicating no values or do not contribute to calculating CPAS in CY2019.

* A deemed value. Source: is to be found on the SAG web site here: https://www.ilsag.info/ntg_2019.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ kWh equivalent savings are calculated by multiplying therm savings by 29.31.

§ Historic savings go back to CY2018.

|| Incremental expiring savings are equal to CPAS Yn-1 - CPAS Yn.

Source: Evaluation team analysis

Table 4-3. Cumulative Persisting Annual Savings (CPAS) – Total

End Use Type	Research Category	EUL	CY2019 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings (Including Those Converted from Gas Savings)							
						2018	2019	2020	2021	2022	2023	2024	2025
HVAC	HVAC System Controls	5.0	1,134,514	0.94	5,332,215		1,066,443	1,066,443	1,066,443	1,066,443	1,066,443	-	-
Lighting	Manual Light Controls	3.0	481,234	0.94	1,357,079		452,360	452,360	452,360	-	-	-	-
HVAC	Heater Control	5.0	345,627	0.94	1,624,446		324,889	324,889	324,889	324,889	324,889	-	-
HVAC	Server Closest HVAC Setpoint	5.0	73,886	0.94	347,266		69,453	69,453	69,453	69,453	69,453	-	-
Air Compressor	Reduced compressor pressure	5.0	368,480	0.94	1,731,856		346,371	346,371	346,371	346,371	346,371	-	-
Plug Load	Computer power controls	5.0	50,523	0.94	237,460		47,492	47,492	47,492	47,492	47,492	-	-
Process Equipment	Disable unneeded Equipment	5.0	344,774	0.94	1,620,439		324,088	324,088	324,088	324,088	324,088	-	-
Lighting	Photocell Repair	5.0	84,967	0.94	399,345		79,869	79,869	79,869	79,869	79,869	-	-
Plug Load	Turn Off TV	5.0	5,362	0.94	25,200		5,040	5,040	5,040	5,040	5,040	-	-
HVAC	Exhaust Fan Hour Reduction	5.0	798,278	0.94	3,751,905		750,381	750,381	750,381	750,381	750,381	-	-
HVAC	HVAC Maintenance	3.0	138,601	0.94	390,854		130,285	130,285	130,285	-	-	-	-
HVAC	Ensure Closed Doors	5.0	147,409	0.94	692,822		138,564	138,564	138,564	138,564	138,564	-	-
Air Compressor	Compressor Air Leaks	5.0	53,374	0.94	250,857		50,171	50,171	50,171	50,171	50,171	-	-
Process Equipment	Manual On/Off Process Controls	3.0	45,498	0.94	128,305		42,768	42,768	42,768	-	-	-	-
Air Compressor	Manual Compressor Off	3.0	109,757	0.94	309,514		103,171	103,171	103,171	-	-	-	-
Process Equipment	Process Equipment Maintenance	3.0	1,793	0.94	5,056		1,685	1,685	1,685	-	-	-	-
Process Equipment	Process Equipment Setpoints	5.0	398,006	0.94	1,870,629		374,126	374,126	374,126	374,126	374,126	-	-
HVAC	Manual HVAC Temp Adjustments	3.0	9,148	0.94	25,796		8,599	8,599	8,599	-	-	-	-
Lighting	Delamp Lights	5.0	4,565	0.94	21,454		4,291	4,291	4,291	4,291	4,291	-	-
CY2019 Program Total Contribution to CPAS			4,595,795		20,122,499		4,320,047	4,320,047	4,320,047	3,581,179	3,581,179	-	-
Historic Program Total Contribution to CPAS‡						4,804,976	4,804,976	4,804,976	3,075,406	3,075,406	-	-	-
Program Total CPAS						4,804,976	9,125,023	9,125,023	7,395,453	6,656,585	3,581,179	-	-
CY2019 Program Incremental Expiring Savings§								-	-	738,868	-	3,581,179	-
Historic Program Incremental Expiring Savings‡§							-	-	1,729,570	-	3,075,406	-	-
Program Total Incremental Expiring Savings§							-	-	1,729,570	738,868	3,075,406	3,581,179	-

Note: The green highlighted cell shows program total first year electric savings (including direct electric savings and those converted from gas). The gray cells are blank, indicating no values or do not contribute to calculating CPAS in CY2019.

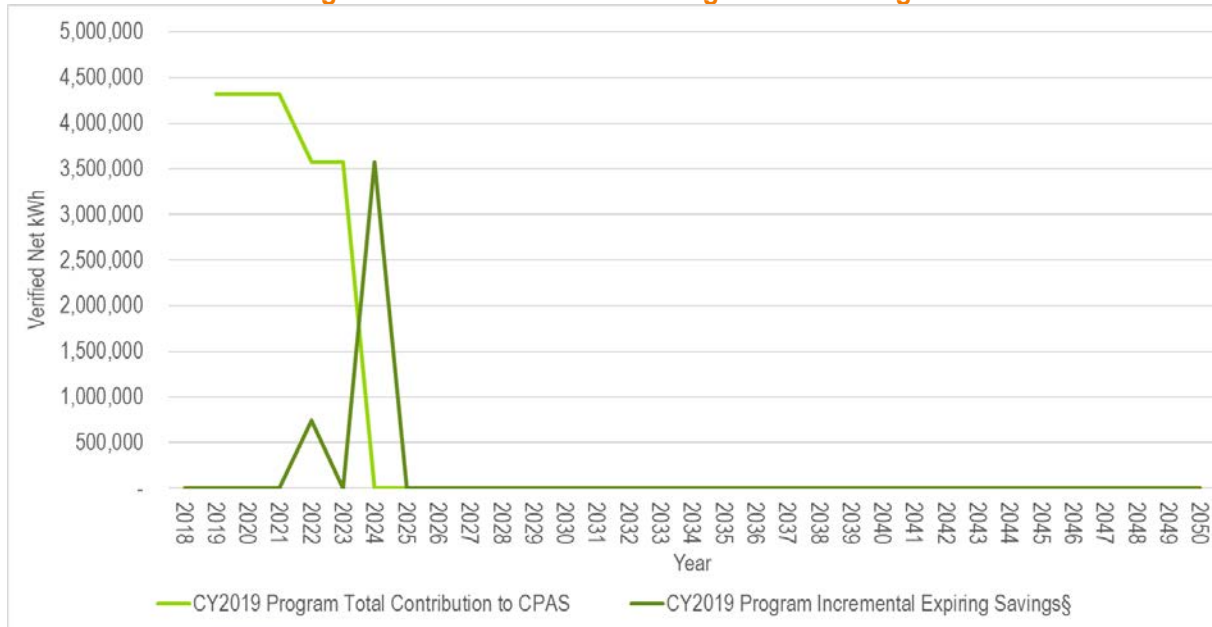
* A deemed value. Source: is to be found on the SAG web site here: https://www.ilsag.info/ntg_2019.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n

Source: Evaluation team analysis

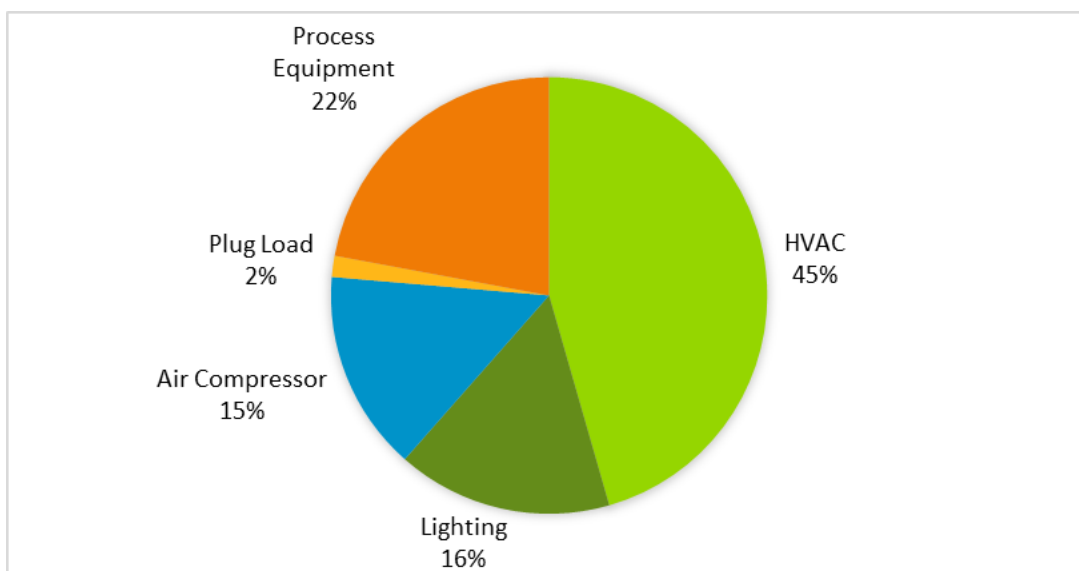
Figure 4-1. Cumulative Persisting Annual Savings


* Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n .

Source: Evaluation team analysis

5. PROGRAM SAVINGS BY MEASURE

The program effects 5 end uses as shown in the following tables. The HVAC measures contributed the greatest savings at 45% (see Figure 5-1). Energy savings are summarized in Table 5-1. No demand savings or water reduction was claimed for this program.

Figure 5-1. Verified Net Savings by Measure – Electric


Source: Evaluation team analysis

Table 5-1. CY2019 Energy Savings by Measure – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	EUL (years)
HVAC	HVAC System Controls	977,055	0.90	883,871	0.94	830,838	5.0
Lighting	Manual Light Controls	531,969	0.90	481,234	0.94	452,360	3.0
HVAC	Heater Control	75,205	0.90	68,032	0.94	63,951	5.0
HVAC	Server Closest HVAC Setpoint	81,676	0.90	73,886	0.94	69,453	5.0
Air Compressor	Reduced compressor pressure	407,328	0.90	368,480	0.94	346,371	5.0
Plug Load	Computer power controls	55,850	0.90	50,523	0.94	47,492	5.0
Process Equipment	Disable unneeded Equipment	381,123	0.90	344,774	0.94	324,088	5.0
Lighting	Photocell Repair	93,925	0.90	84,967	0.94	79,869	5.0
Plug Load	Turn Off TV	5,927	0.90	5,362	0.94	5,040	5.0
HVAC	Exhaust Fan Hour Reduction	417,739	0.90	377,898	0.94	355,224	5.0
HVAC	HVAC Maintenance	147,044	0.90	133,020	0.94	125,039	3.0
HVAC	Ensure Closed Doors	93,194	0.90	84,306	0.94	79,247	5.0
Air Compressor	Compressor Air Leaks	59,001	0.90	53,374	0.94	50,171	5.0
Process Equipment	Manual On/Off Process Controls	50,295	0.90	45,498	0.94	42,768	3.0
Air Compressor	Manual Compressor Off	121,328	0.90	109,757	0.94	103,171	3.0
Process Equipment	Process Equipment Maintenance	1,982	0.90	1,793	0.94	1,685	3.0
Process Equipment	Process Equipment Setpoints	439,967	0.90	398,006	0.94	374,126	5.0
HVAC	Manual HVAC Temp Adjustments	10,112	0.90	9,148	0.94	8,599	3.0
Lighting	Delamp Lights	5,046	0.90	4,565	0.94	4,291	5.0
Total		3,955,766	0.90	3,578,494	0.94	3,363,784	4.6

* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.

Source: ComEd tracking data and evaluation team analysis

Table 5-2. CY2019 Energy Savings by Measure – Gas


End Use Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTG*	Verified Net Savings (Therms)	EUL (years)
HVAC	HVAC System Controls	9,207	0.93	8,551	0.94	8,038	5.0
Lighting	Manual Light Controls	0	0.93	0	0.94	0	3.0
HVAC	Heater Control	10,197	0.93	9,471	0.94	8,903	5.0
HVAC	Server Closest HVAC Setpoint	0	0.93	0	0.94	0	5.0
Air Compressor	Reduced compressor pressure	0	0.93	0	0.94	0	5.0
Plug Load	Computer power controls	0	0.93	0	0.94	0	5.0
Process Equipment	Disable unneeded Equipment	0	0.93	0	0.94	0	5.0
Lighting	Photocell Repair	0	0.93	0	0.94	0	5.0
Plug Load	Turn Off TV	0	0.93	0	0.94	0	5.0
HVAC	Exhaust Fan Hour Reduction	15,442	0.93	14,343	0.94	13,482	5.0
HVAC	HVAC Maintenance	205	0.93	190	0.94	179	3.0
HVAC	Ensure Closed Doors	2,318	0.93	2,153	0.94	2,024	5.0
Air Compressor	Compressor Air Leaks	0	0.93	0	0.94	0	5.0
Process Equipment	Manual On/Off Process Controls	0	0.93	0	0.94	0	3.0
Air Compressor	Manual Compressor Off	0	0.93	0	0.94	0	3.0
Process Equipment	Process Equipment Maintenance	0	0.93	0	0.94	0	3.0
Process Equipment	Process Equipment Setpoints	0	0.93	0	0.94	0	5.0
HVAC	Manual HVAC Temp Adjustments	0	0.93	0	0.94	0	3.0
Lighting	Delamp Lights	0	0.93	0	0.94	0	5.0
Total Therms		37,369	0.93	34,708	NA	32,626	NA

* A deemed value. Source: is to be found on the SAG web site here: https://www.ilsag.info/ntg_2019.

† Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).

Source: ComEd tracking data and evaluation team analysis

Table 5-3. CY2019 Energy Savings by Measure - Total Combining Electricity and Gas

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
HVAC	HVAC System Controls	1,246,912	0.91	1,134,514	0.94	1,066,443
Lighting	Manual Light Controls	531,969	0.90	481,234	0.94	452,360
HVAC	Heater Control	374,079	0.92	345,627	0.94	324,889
HVAC	Server Closest HVAC Setpoint	81,676	0.90	73,886	0.94	69,453
Air Compressor	Reduced compressor pressure	407,328	0.90	368,480	0.94	346,371
Plug Load	Computer power controls	55,850	0.90	50,523	0.94	47,492
Process Equipment	Disable unneeded Equipment	381,123	0.90	344,774	0.94	324,088
Lighting	Photocell Repair	93,925	0.90	84,967	0.94	79,869
Plug Load	Turn Off TV	5,927	0.90	5,362	0.94	5,040
HVAC	Exhaust Fan Hour Reduction	870,344	0.92	798,278	0.94	750,381
HVAC	HVAC Maintenance	153,053	0.91	138,601	0.94	130,285
HVAC	Ensure Closed Doors	161,135	0.91	147,409	0.94	138,564
Air Compressor	Compressor Air Leaks	59,001	0.90	53,374	0.94	50,171
Process Equipment	Manual On/Off Process Controls	50,295	0.90	45,498	0.94	42,768
Air Compressor	Manual Compressor Off	121,328	0.90	109,757	0.94	103,171
Process Equipment	Process Equipment Maintenance	1,982	0.90	1,793	0.94	1,685
Process Equipment	Process Equipment Setpoints	439,967	0.90	398,006	0.94	374,126
HVAC	Manual HVAC Temp Adjustments	10,112	0.90	9,148	0.94	8,599
Lighting	Delamp Lights	5,046	0.90	4,565	0.94	4,291
Total†		5,051,051	0.91	4,595,795 	0.94	4,320,047

* A deemed value. Source: is to be found on the SAG web site here: https://www.ilsag.info/ntg_2019.

† The total includes the electric equivalent of the total therms.

Source: ComEd tracking data and evaluation team analysis

6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

6.1 Impact Parameter Estimates

The ex ante and ex post savings calculations for this program include many custom calculations. Utility staff developed a calculator for each measure to estimate program savings. The evaluation team reviewed those calculations. Many of the calculations used sources such as the Illinois Technical Reference Manual (TRM). Other calculations were completely custom and based purely on onsite staff estimates and calculation methodologies. There were issues the evaluation found with some of the input parameter are shown in Table 6-1.

Table 6-1. Savings Parameters Issues

Gross Savings Input Parameters	Notes
Equipment Load Factors	Load factors for similar pieces of equipment (HVAC fans, pump and process motors) were inconsistent across measures
Hours	For many measures, hours were often estimated to be 8,760 without the collection of operational data
Process specific Input	The implementer estimated process specific inputs (such as power per flow) using limited pre-operational data
Equipment Quantity	No invoices were provided to verify quantity of affected equipment
Post equipment operation (kWh)	The implementer did not monitor energy usage of equipment after measures were installed. Instead pre-operational data with low load (such as weekend or night operation) was used.
Post equipment operation (Hours or other key inputs)	Impacts of measure were estimated by the implementation contractor (IC) with little verification of changes. For example, manual lights off would be estimated at 1 hours per day of impact but no monitoring would occur to verify this estimate.
Energy Savings Factors (ESFs)	The evaluator noted that one project used an ESF of 10% of total equipment operation without providing justification. This project was over 100,000 kWh and had a significant impact on program total savings.
Measure Methodologies	Many measures were similar but used different custom calculations. Measure labeling was not clear in the provided tracker.
Effective Useful Life (EUL)	Guidehouse staff used an EUL for maintenance and manual measures of 3 years, and a EUL of 5 years for behavior-based measure changes.
NTG	A deemed value based on Operational Savings NTG. Source: is to be found on the SAG web site here: https://www.ilsag.info/ntg_2019

Source: ComEd tracking data and evaluation team analysis

6.2 Other Impact Findings and Recommendations

The evaluation team developed recommendations based on findings from the CY2019 evaluation.

6.2.1 Overall Program Results

Finding 1. The program received an overall realization rate of 91% and the electric-only realization rate is 90%. The main driver behind this realization rate was a lower realization rate for one large refrigerated warehouse project. This project savings was more than 10% of the overall program savings and a lower realization rate significantly effected the program as a whole. Details regarding this project is included in section 6.2.3..

6.2.2 Program Tracking

Finding 2. Measure identification is limited in the OE Program tracking system. Currently, all measures are labeled as Operational Savings. The notes in the tracker provide some additional measure details but they are inconsistent and difficult to categorize. Furthermore, measures with the similar names in the notes used different calculation methodologies and it is not clear which measures are using approved deemed methodologies, and which are using custom calculations.

Recommendation 1. As the program moves forward, additional measure details should be provided in the tracker to more accurately identify and categorize measures. In addition, as

standard calculations are approved for the program, measures that use these methods should be marked so that well informed samples can be created.

Finding 3. Based on finding from CY2018 the program is developing deemed measure calculations for many of the OE program projects. The current tracker does not include rows for standard calculations inputs such as building type, equipment wattage or system hours.

Recommendation 2. As the program adds standard calculation methodologies, the tracker should be updated to include rows for standard input recording.

6.2.3 Project Specific Finding

Finding 4. A small number of measures accounts for the majority of the program savings. Of the 219 installed measures, six claimed over 100,000 kWh and accounted for 50% of the overall program savings. These measures were often custom with low levels of justification and parameter documentation.

Recommendation 3. Guidehouse recommends that the IC identify projects with very large savings. These projects should be reviewed early by Guidehouse staff so that any potential issues are identified before final savings is claimed.

Finding 5. Project FACA-41015 had a realization rate of 50%. In addition, this project was one of the very large projects with savings over 10% of the overall program savings. This main driver for the lower realization rate was a lack of accounting for the seasonal impact on this project. This project was a refrigeration system upgrade and the system was assumed to be consistently loaded throughout the year, Guidehouse staff made adjustments to account for the much lower outdoor air conditions experienced by the system during the winter.

Recommendation 4. As discussed in recommendation 4, Guidehouse staff should be consulted early for very large projects so that any final calculations are carefully vetted.

Finding 6. As stated in Table 6-1, several calculations used input parameters from non-documented sources such as evaluator estimates and standard practices. These estimates were used as justification for savings and the only backup information provided were usually brief phone logs with site contacts. These estimates included examples such as:

- manual lighting reducing operation by 1 hour a day,
- manual closing doors resulting in 5 minutes of each hour of the door being closed,
- Standard impacts such as 10 psi reduction of compressor pressure or 5 degrees of HVAC temperature reduction
- Energy savings factors with limited justification

Recommendation 5. Guidehouse recommends that the IC collect and provide justification for these inputs such as screenshots of controls, and the installation of on/off sensors when savings justifies the additional effort.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Guidehouse developed a sample of projects based on the tracking data to calculate verified savings with an overall 9.9% precision at 90% confidence. Guidehouse developed the sample using strata associated with the size of energy efficiency projects installed as shown in the table below.

Table 7-1. OEP Sample Details

Strata	Population Quantity	Sample Quantity	Average Savings of Installed Measures (kWh)
Small (0-10,000 kWh)	145	8	2,622
Medium (10,001-25,000 kWh)	32	8	14,982
Large (25,001+ kWh)	42	24	73,716

Source: ComEd tracking data and Guidehouse team analysis.

Guidehouse requested the documentation associated with the sampled projects in order to develop a realization rate for each stratum. Guidehouse applied this realization rate to all projects within each stratum in order to develop a program-level realization rate.

ComEd provided several key program documents for this program. These include:

- Tracking data - This information provided claimed ex ante savings, and a detailed customer log that tracked the customer interaction between the utility regarding each measure claimed.
- Facility Assessment Report and supporting calculations - This documentation included the measure identified during the site visit as well as the estimated savings for each recommended measure. These calculations were not updated based on the subsequent communication with the customer and included measures that were identified but not installed by the customer.

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

The evaluation team reviewed the projects in the sample in order to calculate ex post savings. These measures were custom and final ex post savings were affected by a variety of issues:

- The calculation sheets and the facility assessment report data did not align. Examples of this include unreported measures in the facility assessment sheets, that were included in the calculation sheets. Since this information did not align it was unclear if the inputs in the calculations were correct.
- The IC used fully custom calculations based on SME inputs. Although this program has a calculation sheet with reviewed and approved measure methodologies, around half of the provided calculations were completely custom built by the IC. These calculations were often overly simplified, inconsistent with other calculations that were similar and did not include justification for inputs such as equipment cut sheets or control screenshots.
- Several measures included, had very weak justification within the tracking data. These measures relied on SME estimates for key inputs such as hour reduction and change in equipment setpoints. No post operational data was collected by the implementer to confirm the initial estimates for these measures making these measures very difficult to evaluate.
- Several measures utilized calculations that were not well explained by the IC. Some of these calculations utilized preoperational information to estimate the impacts of HVAC controls (such as comparing weekend operation to weekday operation) but it is not clear if the operational changes of the installed measure would be similar to what is seen in the pre installation case. Without the collection of actual post-measure operational data evaluation of these measures is difficult.

Based on the review of the Guidehouse staff the final realization rate for this program was 90% for kWh and 93% for therms.

9. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 9-1 shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of finalizing this 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 the evaluation team later.

Table 9-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Verified Gross Electric Energy Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	Verified Gross Gas Savings (Therms)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Verified Net Electric Energy Savings (kWh)	Verified Net Peak Demand Reduction (kW)	Verified Net Gas Savings (Therms)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
HVAC	HVAC System Controls	Measures	66	5.0	No	883,871	0.00	8,551	0	0	0.94	0.94	0.94	830,838	0.00	8,038	0	0
Lighting	Manual Light Controls	Measures	46	3.0	No	481,234	0.00	0	0	0	0.94	0.94	0.94	452,360	0.00	0	0	0
HVAC	Heater Control	Measures	15	5.0	No	68,032	0.00	9,471	0	0	0.94	0.94	0.94	63,951	0.00	8,903	0	0
HVAC	Server Closest HVAC Setpoint	Measures	12	5.0	No	73,886	0.00	0	0	0	0.94	0.94	0.94	69,453	0.00	0	0	0
Air Compressor	Reduced compressor pressure	Measures	11	5.0	No	368,480	0.00	0	0	0	0.94	0.94	0.94	346,371	0.00	0	0	0
Plug Load	Computer power controls	Measures	9	5.0	No	50,523	0.00	0	0	0	0.94	0.94	0.94	47,492	0.00	0	0	0
Process Equipment	Disable unneeded Equipment	Measures	9	5.0	No	344,774	0.00	0	0	0	0.94	0.94	0.94	324,088	0.00	0	0	0
Lighting	Photocell Repair	Measures	8	5.0	No	84,967	0.00	0	0	0	0.94	0.94	0.94	79,869	0.00	0	0	0
Plug Load	Turn Off TV	Measures	7	5.0	No	5,362	0.00	0	0	0	0.94	0.94	0.94	5,040	0.00	0	0	0
HVAC	Exhaust Fan Hour Reduction	Measures	7	5.0	No	377,898	0.00	14,343	0	0	0.94	0.94	0.94	355,224	0.00	13,482	0	0
HVAC	HVAC Maintenance	Measures	6	3.0	No	133,020	0.00	190	0	0	0.94	0.94	0.94	125,039	0.00	179	0	0
HVAC	Ensure Closed Doors	Measures	5	5.0	No	84,306	0.00	2,153	0	0	0.94	0.94	0.94	79,247	0.00	2,024	0	0
Air Compressor	Compressor Air Leaks	Measures	5	5.0	No	53,374	0.00	0	0	0	0.94	0.94	0.94	50,171	0.00	0	0	0
Process Equipment	Manual On/Off Process Controls	Measures	4	3.0	No	45,498	0.00	0	0	0	0.94	0.94	0.94	42,768	0.00	0	0	0
Air Compressor	Manual Compressor Off	Measures	3	3.0	No	109,757	0.00	0	0	0	0.94	0.94	0.94	103,171	0.00	0	0	0
Process Equipment	Process Equipment Maintenance	Measures	2	3.0	No	1,793	0.00	0	0	0	0.94	0.94	0.94	1,685	0.00	0	0	0
Process Equipment	Process Equipment Setpoints	Measures	2	5.0	No	398,006	0.00	0	0	0	0.94	0.94	0.94	374,126	0.00	0	0	0
HVAC	Manual HVAC Temp Adjustments	Measures	1	3.0	No	9,148	0.00	0	0	0	0.94	0.94	0.94	8,599	0.00	0	0	0
Lighting	Delamp Lights	Measures	1	5.0	No	4,565	0.00	0	0	0	0.94	0.94	0.94	4,291	0.00	0	0	0
Total				4.6		3,578,494	0.00	34,708	0	0	0.94	0.94	0.94	3,363,784	0.00	32,626	0	0

Note: No secondary energy savings from water reduction measures are included in the verified gross kWh and net kWh in this table. There were no water reduction measures in this program.

* The total of the EUL column is the weighted average measure life (WAML) and is calculated as the sum product of EUL and measure savings divided by total program savings.

† Early Replacement (ER) measures are flagged as YES, otherwise a NO is indicated in the column.

Source: ComEd tracking data and evaluation team analysis