



ComEd Operational Efficiency Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2018 (CY2018)
(1/1/2018-12/31/2018)

Presented to
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DRAFT

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1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's CY2018 Operational Efficiency Program. It presents a summary of the energy and demand impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. CY2018 covers January 1, 2018 through December 31, 2018.

2. PROGRAM DESCRIPTION

The Operational Efficiency Program (OEP) looks to identify energy efficiency opportunities that are not captured by other traditional programs. The program is a mix of custom and Illinois Technical Reference Manual (IL TRM) measures. The OEP evolved as part of ComEd's Facility Assessment Program offered to customers with a demand of 100 kW and above. The Facility Assessment Program identifies energy efficiency opportunities and the associated energy savings, cost savings, project cost, potential incentives, and simple payback. These energy efficient opportunities may include measures which are part of ComEd's existing program offerings, such as lighting or HVAC, but may also include low- and no-cost and operational measures (OEP measures) outside of ComEd's other programs. These measures focus on taking advantage of equipment already installed at the site or applying maintenance or operational best practices to realize energy savings for little or no investment by the customer. During an assessment, OEP measures are identified and then placed in the OEP tracking system. Implementation may or may not occur at the time of the assessment. If it does not occur during the assessment, program outreach staff follow up with the customer to see if the OEP measures were implemented.

The program had 189 participants in CY2018 and saw 270 measures installed as shown in the following table.

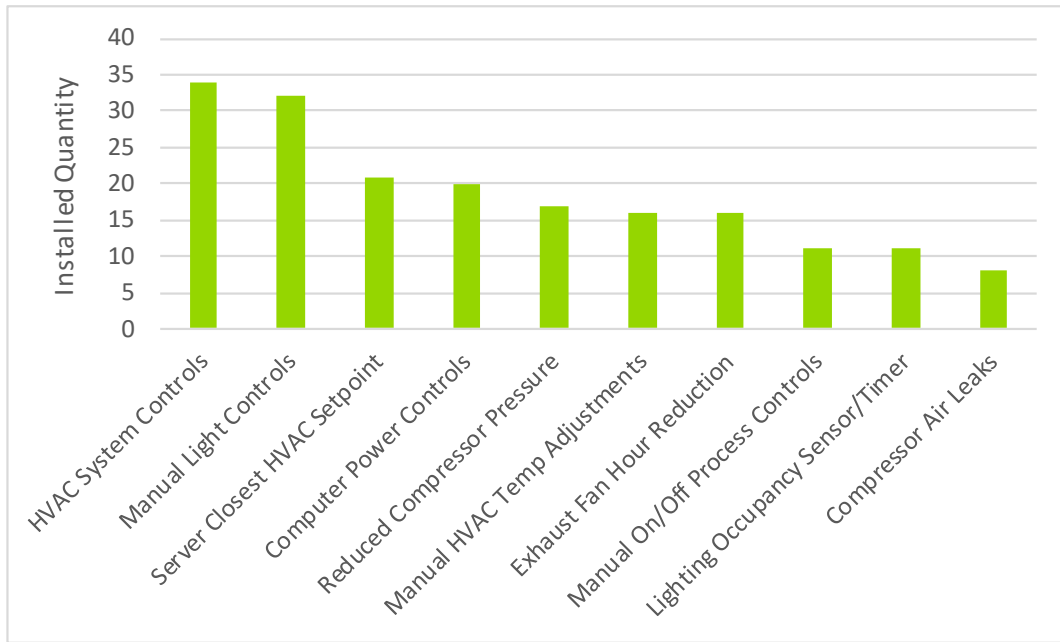
Table 2-1. CY2018 Volumetric Findings Detail

Participation	CY2018
Participants	189
Installed Measures	270
Number of Measures/Participant	1.4
Unique Program Measures	37

Source: ComEd tracking data and Navigant team analysis.

Figure 2-1 identifies the top ten measures by installation for OEP. Due to the large number of measures included in this program, the figure is limited to ten of the 37 CY2018 program measures.

Figure 2-1. Top Ten Measures by Participation



Source: ComEd tracking data and Navigant team analysis.

3. PROGRAM SAVINGS DETAIL

Table 3-1 summarizes the incremental energy savings the OEP Program achieved in CY2018. The gas savings are only those that the gas utilities are not claiming and ComEd can claim.¹ Demand savings was not claimed for this program and since the measure in this program were mostly custom, Navigant was unable to calculate an ex post demand savings.

¹ The evaluation will determine which gas savings will be counted toward goal while producing the portfolio-wide Summary Report.

Table 3-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	4,437,413	NR	NR
Program Gross Realization Rate	0.81	NA	NA
Verified Gross Savings	3,607,356	NA	NA
Program Net-to-Gross Ratio (NTG)	0.91	NA	NA
Verified Net Savings	3,282,694	NA	NA
Converted from Gas*			
Ex Ante Gross Savings	1,900,460	NA	NA
Program Gross Realization Rate	0.88	NA	NA
Verified Gross Savings	1,672,837	NA	NA
Program Net-to-Gross Ratio (NTG)	0.91	NA	NA
Verified Net Savings	1,522,282	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	6,337,873	NR	NR
Program Gross Realization Rate	0.83	NA	NA
Verified Gross Savings	5,280,193	NA	NA
Program Net-to-Gross Ratio (NTG)	0.91	NA	NA
Verified Net Savings	4,804,976	NA	NA

* 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 Navigant team analysis.

4. CUMULATIVE PERSISTING ANNUAL SAVINGS

The measure-specific and total ex ante gross savings for the OEP Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following tables and figure. The total electric CPAS across all measures is 3,282,694 kWh. The program achieved 1,522,282 kWh CPAS equivalent of gas savings converted to electricity that might be counted toward ComEd’s goal² (the middle table in the following set of tables). Adding the savings converted from gas savings to the electric savings produces a total of 4,804,976 kWh of total CPAS.

The CPAS tables below combined measure by end use type. For measure level details see Section 70 below.

² The evaluation will determine which gas savings will be counted toward goal while producing the portfolio-wide Summary Report.

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

End Use Type	Research Category	EUL*	CY2018 Verified Gross Savings	NTG**	Lifetime Net Savings†	Verified Net kWh Savings								
						2018	2019	2020	2021	2022	2023	2024	2025	2026
Air Compressor	Air Compressor	4.2	353,495	0.91	1,366,801	321,680	321,680	321,680	200,880	200,880	-	-	-	-
Hot Water	Hot Water	5.0	33,926	0.91	154,365	30,873	30,873	30,873	30,873	30,873	-	-	-	-
HVAC	HVAC	4.5	1,669,879	0.91	6,839,460	1,519,590	1,519,590	1,519,590	1,140,345	1,140,345	-	-	-	-
Lighting	Lighting	4.0	304,999	0.91	1,117,811	277,549	277,549	277,549	142,582	142,582	-	-	-	-
Plug Load	Plug Load	5.0	205,855	0.91	928,651	187,328	187,328	187,328	183,334	183,334	-	-	-	-
Process	Process	4.0	1,039,203	0.91	3,788,171	945,675	945,675	945,675	475,573	475,573	-	-	-	-
CY2018 Program Total Electric CPAS			3,607,356		14,195,258	3,282,694	3,282,694	3,282,694	2,173,588	2,173,588	-	-	-	-
CY2018 Program Expiring Electric Savings‡							-	-	1,109,106	1,109,106	3,282,694	3,282,694	3,282,694	3,282,694

Note: The green highlighted cell shows program total first year electric savings.

* Maintenance and manual measures are given a 3-year EUL, where other measure are given a 5-year EUL based on EUL of behavior-based measure changes. This is based on Navigant experience.

** A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

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

‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

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

End Use Type	Research Category	EUL*	CY2018 Verified Gross Savings (Therms)	NTG**	Lifetime Net Savings†	Verified Net Therms Savings								
						2018	2019	2020	2021	2022	2023	2024	2025	2026
Air Compressor	Air Compressor	NA	0	0.91	-	-	-	-	-	-	-	-	-	-
Hot Water	Hot Water	5.0	4,734	0.91	21,539	4,308	4,308	4,308	4,308	4,308	-	-	-	-
HVAC	HVAC	4.1	52,340	0.91	195,809	47,629	47,629	47,629	26,460	26,460	-	-	-	-
Lighting	Lighting	NA	0	0.91	-	-	-	-	-	-	-	-	-	-
Plug Load	Plug Load	NA	0	0.91	-	-	-	-	-	-	-	-	-	-
Process	Process	NA	0	0.91	-	-	-	-	-	-	-	-	-	-
CY2018 Program Total Gas CPAS (Therms)			57,074		217,348	51,937	51,937	51,937	30,768	30,768	-	-	-	-
CY2018 Program Total Gas CPAS (kWh Equivalent)‡			1,672,837		6,370,481	1,522,282	1,522,282	1,522,282	901,818	901,818	-	-	-	-
CY2018 Program Expiring Gas Savings (Therms)§						-	-	21,169	21,169	51,937	51,937	51,937	51,937	
CY2018 Program Expiring Gas Savings (kWh Equivalent)‡§						-	-	620,464	620,464	1,522,282	1,522,282	1,522,282	1,522,282	

Note: The green highlighted cell shows program total first year gas savings in kWh equivalents.

* Maintenance and manual measures are given a 3 year EUL, where other measure are given a 5 EUL based on EUL of behavior based measure changes. This is based on Navigant experience.

** A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

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

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

§ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

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

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings (Including Those Converted from Gas Savings)								
						2018	2019	2020	2021	2022	2023	2024	2025	2026
Air Compressor	Air Compressor	4.2	353,495	0.91	1,366,801	321,680	321,680	321,680	200,880	200,880	-	-	-	-
Hot Water	Hot Water	5.0	172,676	0.91	785,676	157,135	157,135	157,135	157,135	157,135	-	-	-	-
HVAC	HVAC	4.5	3,203,966	0.91	12,578,631	2,915,609	2,915,609	2,915,609	1,915,901	1,915,901	-	-	-	-
Lighting	Lighting	4.0	304,999	0.91	1,117,811	277,549	277,549	277,549	142,582	142,582	-	-	-	-
Plug Load	Plug Load	5.0	205,855	0.91	928,651	187,328	187,328	187,328	183,334	183,334	-	-	-	-
Process	Process	4.0	1,039,203	0.91	3,788,171	945,675	945,675	945,675	475,573	475,573	-	-	-	-
CY2018 Program Total CPAS			5,280,193		20,565,739	4,804,976	4,804,976	4,804,976	3,075,406	3,075,406	0	0	0	0
CY2018 Program Expiring Savings‡						0	0	0	1,729,570	1,729,570	4,804,976	4,804,976	4,804,976	4,804,976

Note: The green highlighted cell shows program total first year electric savings (including direct electric savings and those converted from gas).

*Maintenance and manual measures are given a 3 year EUL, where other measure are given a 5 EUL based on EUL of behavior based measure changes. This is based on Navigant experience.

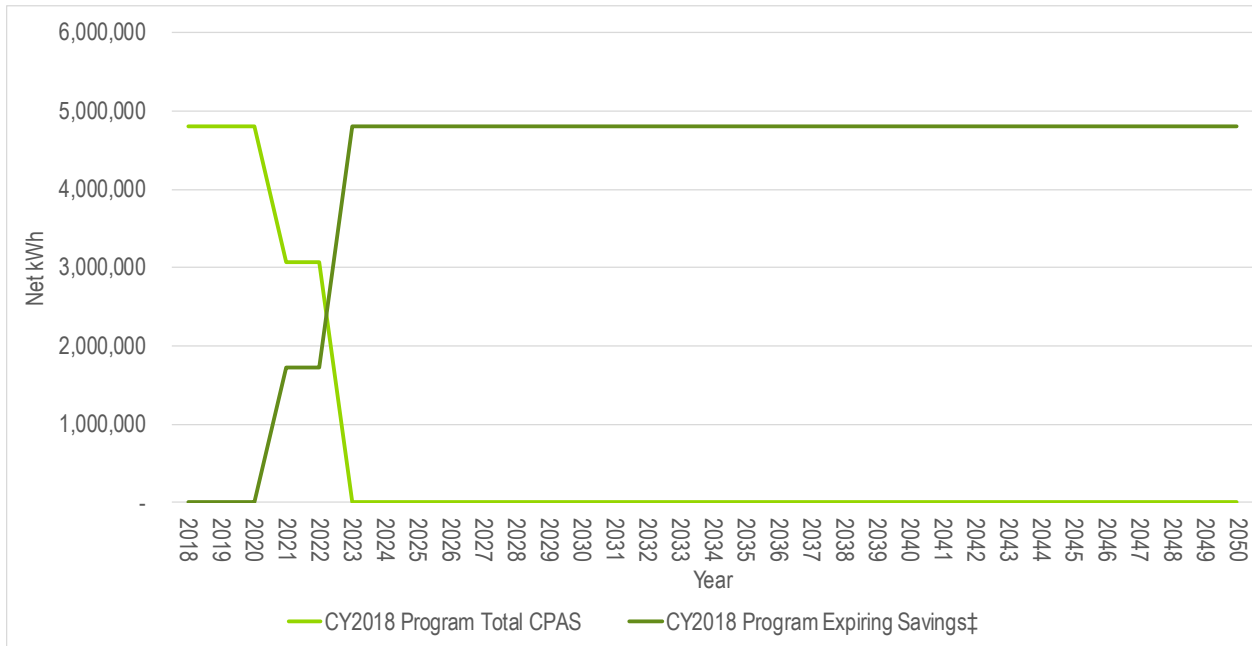
**A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

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

‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

Figure 4-1. Cumulative Persisting Annual Savings



‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
 Source: Navigant analysis

5. PROGRAM SAVINGS BY MEASURE

The OEP program includes several custom measures that Navigant has identified as 37 measures categories as shown in the following tables. HVAC measures account for roughly 40% of the programs total savings including; HVAC System Controls, Manual HVAC adjustment and Heater controls. In addition to this, Manual measures such as manual process control, manual lights and manual HVAC account for over 30% of the program savings.

Table 5-1. CY2018 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)	Effective Useful Life
HVAC	HVAC System Controls	837,444	0.81	680,792	0.91	619,521	5.0
Process	Manual On/Off Process Controls	612,653	0.81	498,051	0.91	453,226	3.0
HVAC	Manual HVAC Temp Adjustments	483,687	0.81	393,209	0.91	357,820	3.0
Plug Load	Computer power controls	235,128	0.81	191,145	0.91	173,942	5.0
HVAC	Heater Control	228,952	0.81	186,125	0.91	169,373	5.0
Process	Disable unneeded Equipment	206,520	0.81	167,889	0.91	152,779	5.0
Process	Process VSD	195,464	0.81	158,901	0.91	144,600	5.0
Air Compressor	Reduced compressor pressure	192,243	0.81	156,282	0.91	142,217	5.0
Lighting	Manual Light Controls	182,442	0.81	148,315	0.91	134,966	3.0
Process	Process Equipment Setpoints	148,044	0.81	120,351	0.91	109,519	5.0
HVAC	Server Closest HVAC Setpoint	147,388	0.81	119,818	0.91	109,034	5.0
HVAC	HVAC Economizer	109,774	0.81	89,240	0.91	81,208	5.0
HVAC	Exhaust Fan Hour Reduction	98,504	0.81	80,078	0.91	72,871	5.0
Air Compressor	Manual Compressor Off	91,920	0.81	74,726	0.91	68,000	3.0
Process	Smart Equipment Start Up	86,096	0.81	69,991	0.91	63,692	5.0
Air Compressor	Compressor Air Leaks	79,299	0.81	64,465	0.91	58,664	5.0
Lighting	Lighting Occupancy Sensor/Timer	72,305	0.81	58,780	0.91	53,490	5.0
Air Compressor	Compressor system Maintenance	71,372	0.81	58,021	0.91	52,799	3.0
Lighting	Photocell Repair	54,224	0.81	44,081	0.91	40,114	5.0
HVAC	Mechanical Room HVAC Setpoint	50,649	0.81	41,175	0.91	37,469	5.0
Hot Water	Reduced Domestic Hot Water Temperature	41,733	0.81	33,926	0.91	30,873	5.0
HVAC	Ensure Closed Doors	35,520	0.81	28,876	0.91	26,277	5.0
Lighting	Lighting Occupancy Sensor	33,288	0.81	27,061	0.91	24,626	5.0
HVAC	HVAC Maintenance	28,960	0.81	23,543	0.91	21,424	3.0
Lighting	High Efficiency Lights	26,368	0.81	21,436	0.91	19,506	5.0
HVAC	Window Blinds	25,015	0.81	20,336	0.91	18,506	5.0
Process	Process Equipment Maintenance	22,812	0.81	18,545	0.91	16,876	3.0
HVAC	Building Repair	8,227	0.81	6,688	0.91	6,086	5.0
Process	Equipment relocation	6,736	0.81	5,476	0.91	4,983	5.0
Lighting	Delamp Lights	6,552	0.81	5,326	0.91	4,847	5.0
Plug Load	Manual Shut Off Small Equipment	5,399	0.81	4,389	0.91	3,994	3.0
Plug Load	Turn Off TV	5,388	0.81	4,380	0.91	3,986	5.0
Plug Load	Remove Old Refrigerator	3,504	0.81	2,849	0.91	2,592	5.0
Plug Load	Printer Controls	1,642	0.81	1,335	0.91	1,215	5.0
Plug Load	Small Refrigerator Controls	1,613	0.81	1,311	0.91	1,193	5.0
Plug Load	Timer for Office Water Dispenser	548	0.81	445	0.91	405	5.0
Hot Water	Reduce Pool Temperature	0	0.81	0	0.91	0	5.0
Total		4,437,413	0.81	3,607,356	0.91	3,282,694	NA

* Calculated based on a sampled whole program RR.

† A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.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 5-2. CY2018 Energy Savings by Measure – Gas

End Use Type	Research Category	Ex Ante Gross Savings	Verified Gross Realization Rate*	Verified Gross Savings	NTG†	Verified Net Savings	Effective Useful Life
HVAC	HVAC System Controls	16,535	0.88	14,555	0.91	13,245	5.0
Process	Manual On/Off Process Controls	0	NA	0	0.91	0	NA
HVAC	Manual HVAC Temp Adjustments	24,812	0.88	21,840	0.91	19,875	3.0
Plug Load	Computer power controls	0	NA	0	0.91	0	NA
HVAC	Heater Control	0	NA	0	0.91	0	NA
Process	Disable unneeded Equipment	0	NA	0	0.91	0	NA
Process	Process VSD	0	NA	0	0.91	0	NA
Air Compressor	Reduced compressor pressure	0	NA	0	0.91	0	NA
Lighting	Manual Light Controls	0	NA	0	0.91	0	NA
Process	Process Equipment Setpoints	0	NA	0	0.91	0	NA
HVAC	Server Closest HVAC Setpoint	0	NA	0	0.91	0	NA
HVAC	HVAC Economizer	0	NA	0	0.91	0	NA
HVAC	Exhaust Fan Hour Reduction	11,818	0.88	10,403	0.91	9,466	5.0
Air Compressor	Manual Compressor Off	0	NA	0	0.91	0	NA
Process	Smart Equipment Start Up	0	NA	0	0.91	0	NA
Air Compressor	Compressor Air Leaks	0	NA	0	0.91	0	NA
Lighting	Lighting Occupancy Sensor/Timer	0	NA	0	0.91	0	NA
Air Compressor	Compressor system Maintenance	0	NA	0	0.91	0	NA
Lighting	Photocell Repair	0	NA	0	0.91	0	NA
HVAC	Mechanical Room HVAC Setpoint	0	NA	0	0.91	0	NA
Hot Water	Reduced Domestic Hot Water Temperature	2,433	0.88	2,142	0.91	1,949	5.0
HVAC	Ensure Closed Doors	4,681	0.88	4,120	0.91	3,750	5.0
Lighting	Lighting Occupancy Sensor	0	NA	0	0.91	0	NA
HVAC	HVAC Maintenance	1,616	0.88	1,422	0.91	1,294	3.0
Lighting	High Efficiency Lights	0	NA	0	0.91	0	NA
HVAC	Window Blinds	0	NA	0	0.91	0	NA
Process	Process Equipment Maintenance	0	NA	0	0.91	0	NA
HVAC	Building Repair	0	NA	0	0.91	0	NA
Process	Equipment relocation	0	NA	0	0.91	0	NA
Lighting	Delamp Lights	0	NA	0	0.91	0	NA
Plug Load	Manual Shut Off Small Equipment	0	NA	0	0.91	0	NA
Plug Load	Turn Off TV	0	NA	0	0.91	0	NA
Plug Load	Remove Old Refrigerator	0	NA	0	0.91	0	NA
Plug Load	Printer Controls	0	NA	0	0.91	0	NA
Plug Load	Small Refrigerator Controls	0	NA	0	0.91	0	NA
Plug Load	Timer for Office Water Dispenser	0	NA	0	0.91	0	NA
Hot Water	Reduce Pool Temperature	2,945	0.88	2,592	0.91	2,359	5.0
Total Therms		64,840	0.88	57,074	0.91	51,937	NA
Total kWh Converted From Therms‡		1,900,460	0.88	1,672,837	0.91	1,522,282	NA

* Calculated based on sampled ex ante projects.

† A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.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 5-3. CY2018 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	1,322,084	0.84	1,107,387	0.91	1,007,722
Process	Manual On/Off Process Controls	612,653	0.81	498,051	0.91	453,226
HVAC	Manual HVAC Temp Adjustments	1,210,927	0.85	1,033,345	0.91	940,344
Plug Load	Computer power controls	235,128	0.81	191,145	0.91	173,942
HVAC	Heater Control	228,952	0.81	186,125	0.91	169,373
Process	Disable unneeded Equipment	206,520	0.81	167,889	0.91	152,779
Process	Process VSD	195,464	0.81	158,901	0.91	144,600
Air Compressor	Reduced compressor pressure	192,243	0.81	156,282	0.91	142,217
Lighting	Manual Light Controls	182,442	0.81	148,315	0.91	134,966
Process	Process Equipment Setpoints	148,044	0.81	120,351	0.91	109,519
HVAC	Server Closest HVAC Setpoint	147,388	0.81	119,818	0.91	109,034
HVAC	HVAC Economizer	109,774	0.81	89,240	0.91	81,208
HVAC	Exhaust Fan Hour Reduction	444,890	0.87	384,976	0.91	350,328
Air Compressor	Manual Compressor Off	91,920	0.81	74,726	0.91	68,000
Process	Smart Equipment Start Up	86,096	0.81	69,991	0.91	63,692
Air Compressor	Compressor Air Leaks	79,299	0.81	64,465	0.91	58,664
Lighting	Lighting Occupancy Sensor/Timer	72,305	0.81	58,780	0.91	53,490
Air Compressor	Compressor system Maintenance	71,372	0.81	58,021	0.91	52,799
Lighting	Photocell Repair	54,224	0.81	44,081	0.91	40,114
HVAC	Mechanical Room HVAC Setpoint	50,649	0.81	41,175	0.91	37,469
Hot Water	Reduced Domestic Hot Water Temperature	113,044	0.86	96,697	0.91	87,994
HVAC	Ensure Closed Doors	172,720	0.87	149,643	0.91	136,175
Lighting	Lighting Occupancy Sensor	33,288	0.81	27,061	0.91	24,626
HVAC	HVAC Maintenance	76,325	0.85	65,235	0.91	59,364
Lighting	High Efficiency Lights	26,368	0.81	21,436	0.91	19,506
HVAC	Window Blinds	25,015	0.81	20,336	0.91	18,506
Process	Process Equipment Maintenance	22,812	0.81	18,545	0.91	16,876
HVAC	Building Repair	8,227	0.81	6,688	0.91	6,086
Process	Equipment relocation	6,736	0.81	5,476	0.91	4,983
Lighting	Delamp Lights	6,552	0.81	5,326	0.91	4,847
Plug Load	Manual Shut Off Small Equipment	5,399	0.81	4,389	0.91	3,994
Plug Load	Turn Off TV	5,388	0.81	4,380	0.91	3,986
Plug Load	Remove Old Refrigerator	3,504	0.81	2,849	0.91	2,592
Plug Load	Printer Controls	1,642	0.81	1,335	0.91	1,215
Plug Load	Small Refrigerator Controls	1,613	0.81	1,311	0.91	1,193
Plug Load	Timer for Office Water Dispenser	548	0.81	445	0.91	405
Hot Water	Reduce Pool Temperature	86,318	0.88	75,979	0.91	69,141
Total†		6,337,873	0.83	5,280,193	0.91	4,804,976

*A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† The total includes the electric equivalent of the total therms.
Source: ComEd tracking data and Navigant team analysis.

6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

6.1 Impact Parameter Estimates

The OEP does not have relevant impact parameters.

6.2 Other Impact Findings and Recommendations

The evaluation team has developed several recommendations based on findings from the CY2018 evaluation, as follows:

Finding 1. The "Adjust ST Thermostat" & "Enable ST Thermostat" workbooks in the calculation sheet are too simplified to use to justify the savings for this program. These workbooks use a 1-5 or 1-10 rating system regarding envelope loss type, glazing type, building schedule and system heating and cooling efficiency and Commercial Buildings Energy Consumption Survey (CBECS) data to calculate HVAC energy usage. Savings is then calculated as a percentage, based on the measure installed, and is not well justified. This calculation accounts for approximately 25% of the program savings. This tool is an acceptable assessment tool but may not include enough site-specific input to be used as a calculation tool.

Recommendation 1. Navigant recommends that ComEd identify the major HVAC measures that are completed within this program and develop a number of more specific HVAC calculations. These calculations should use weather data and site-specific HVAC information to create more justifiable savings.

Finding 2. The program data provided by ComEd was inconsistent. The provided on-site form and supporting calculations did not align with the tracking database in terms of measures installed, inputs for these measures and savings claimed. Navigant noted that final savings for some measures seemed to be influenced by the tracking data. Navigant was able to replicate savings by updating the provided calculation sheets with tracking data inputs. The final savings of other measures seemed to be independent of the tracking data. In these cases, inputs in the calculations were not updated and therefor miss represented what was completed at the sites

Recommendation 2. Measure tracking practices for this program need to improve in order to clearly record, update and track measure identified and completed through the OEP . Any information that would result in changes to the calculation sheets should be recorded and an updated version of the calculation sheet should be created. Measures not installed should also be recorded as they represent opportunities for future activities. All changes, updates and confirmation of installation should be recorded in a simple transparent manner.

Finding 3. ComEd's calculation sheets were inconsistently formatted and difficult to navigate.

Recommendation 3. The calculation sheets should only include the measures identified through the OEP and not include blank calculation sheets. Sheet formatting should be consistent to reduce confusion while reviewing these workbooks. Links, live cells, source summaries and other improvements to these workbooks should be identified and implemented over time.

Finding 4. The ComEd calculation sheets used a number of non-standard calculations. These calculations include any calculation that have not been formally reviewed and approved through previous evaluations, such as the use of the "other opportunity" tab. These calculations are often custom in nature but do not include sufficient supporting data to be considered acceptable.

Navigant noted that many of these calculations were missing key inputs such as load factor, and resulted in ex post savings that was lower than estimated ex ante. In addition, measures that seemed to be same were estimated using different calculation methodologies.

Recommendation 4. If non-standard calculations are required, they should be more thoroughly vetted to ensure that they are accurate, consistent, and include all required inputs. Common required inputs that should be vetted and include waste heat factor, power factor, load factor, motor efficiency, heating and cooling hours, lighting hours, conversion factors, and measured equipment power.

Finding 5. Over 30% of the claimed ex ante program savings were due to manual operational measures such as manual lighting controls, manual HVAC controls and manual process controls. These measures represent a high level of uncertainty in terms of realized savings.

Recommendation 5. As much as possible, controls such as timers and sensors should be used in place of manual operation to ensure energy savings. Additional data collection may be required to justify the savings associated with these projects.

Finding 6. Of the 270 measures installed through this program, the top 10 measures represented nearly half of the claimed savings in this program. Each of these measures were above 100,000 kWh each and in total represented 1,500,000 kWh.

Recommendation 6. For measures above a certain size, Navigant recommends that they are completed through the more traditional custom program which includes a higher level of rigor for savings claimed.

Finding 7. Navigant identified several common measures that were installed through this program. HVAC controls, lighting controls and computer server room temperature adjustment were all installed 20 to 30 times during this program year.

Recommendation 7. Navigant recommends that ComEd identify these commonly installed measures and consider steps to convert these measures from custom calculations to TRM type calculations. Site level data collection may be required initially, but after standard values can be agreed on, the calculation of the savings for these measures could be simplified greatly.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant developed a sample of projects based on the provided tracking data to calculate verified savings to 10% precision at 90% confidence. Due to the timing of the development of the sample, Navigant was only able to review sites that were included in the first three quarters of the program. This sample was developed 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)
Large (> 130,000 kWh)	7	5	172,514
Medium (40,000 – 130,000 kWh)	16	10	66,836
Small (3,000 – 39,999 kWh)	81	15	15,111
Bottom 2% (< 2,999 kWh)	46	0	1,411

Source: ComEd tracking data and Navigant team analysis.

Once a sample of projects was identified, Navigant requested the documentation associated with these projects in order to develop a realization rate for each stratum. This realization rate was then applied to all projects within each stratum in order to develop a program level realization rate. Navigant did not specifically sample gas projects and only calculated ex post savings for the projects sampled. All gas projects not sampled were assumed to have a realization rate of 1.0.

Navigant was provided with a number of key program documents to estimate ex post savings 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 OEP 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.

In many cases, the tracking data and supporting calculations did not align. The calculations used to produce ex ante estimates were updated based on customer tracker information, but these updated calculations were not provided to Navigant for review.

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

Project included in the sample were reviewed 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 tracking data did not align. Examples of this include partial installations of measure, as identified in the tracking data, that were claimed as fully installed in the calculation sheets and changes in key inputs that were not updated in the calculation sheets.
- The use of custom calculations that were not well built resulted in inaccurate savings. These calculations were often overly simplified and did not include load factors and other important inputs.
- Several measures included, had very weak justification within the tracking data. These measures were often manual changes and were not directly controlled by the site contact. Examples of this include property managers asking tenants to turn off lights when not in use.
- Several measures seemed to be using calculation that didn't seem appropriate to the measure. HVAC control measure had this issue the most due to the use of the "Adjust ST Thermostat" & "Enable ST Thermostat" calculation methodologies. These methodologies were used for a huge variety of measure including setpoint changes, VAV upgrades and the use of economizers and in some cases these calculations seemed inappropriate and not well justified.

Based on the review of the Navigant staff the final realization rate for this program was 81% for kWh and 88% for therm.

9. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 9-1, below, shows the Total Resource Cost (TRC) table. It includes only the 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 evaluation later.

Table 9-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)
HVAC	HVAC System Controls	Each	34	5.0	837,444	0.00	680,792	0.00
Process	Manual On/Off Process Controls	Each	11	3.0	612,653	0.00	498,051	0.00
HVAC	Manual HVAC Temp Adjustments	Each	16	3.0	483,687	0.00	393,209	0.00
Plug Load	Computer power controls	Each	20	5.0	235,128	0.00	191,145	0.00
HVAC	Heater Control	Each	6	5.0	228,952	0.00	186,125	0.00
Process	Disable unneeded Equipment	Each	6	5.0	206,520	0.00	167,889	0.00
Process	Process VSD	Each	4	5.0	195,464	0.00	158,901	0.00
Air Compressor	Reduced compressor pressure	Each	17	5.0	192,243	0.00	156,282	0.00
Lighting	Manual Light Controls	Each	31	3.0	182,442	0.00	148,315	0.00
Process	Process Equipment Setpoints	Each	1	5.0	148,044	0.00	120,351	0.00
HVAC	Server Closest HVAC Setpoint	Each	20	5.0	147,388	0.00	119,818	0.00
HVAC	HVAC Economizer	Each	3	5.0	109,774	0.00	89,240	0.00
HVAC	Exhaust Fan Hour Reduction	Each	15	5.0	98,504	0.00	80,078	0.00
Air Compressor	Manual Compressor Off	Each	3	3.0	91,920	0.00	74,726	0.00
Process	Smart Equipment Start Up	Each	2	5.0	86,096	0.00	69,991	0.00
Air Compressor	Compressor Air Leaks	Each	8	5.0	79,299	0.00	64,465	0.00
Lighting	Lighting Occupancy Sensor/Timer	Each	10	5.0	72,305	0.00	58,780	0.00
Air Compressor	Compressor system Maintenance	Each	4	3.0	71,372	0.00	58,021	0.00
Lighting	Photocell Repair	Each	7	5.0	54,224	0.00	44,081	0.00
HVAC	Mechanical Room HVAC Setpoint	Each	6	5.0	50,649	0.00	41,175	0.00
Hot Water	Reduced Domestic Hot Water Temperature	Each	6	5.0	41,733	0.00	33,926	0.00
HVAC	Ensure Closed Doors	Each	4	5.0	35,520	0.00	28,876	0.00
Lighting	Lighting Occupancy Sensor	Each	1	5.0	33,288	0.00	27,061	0.00
HVAC	HVAC Maintenance	Each	4	3.0	28,960	0.00	23,543	0.00
Lighting	High Efficiency Lights	Each	1	5.0	26,368	0.00	21,436	0.00
HVAC	Window Blinds	Each	3	5.0	25,015	0.00	20,336	0.00
Process	Process Equipment Maintenance	Each	0	3.0	22,812	0.00	18,545	0.00
HVAC	Building Repair	Each	0	5.0	8,227	0.00	6,688	0.00
Process	Equipment relocation	Each	1	5.0	6,736	0.00	5,476	0.00
Lighting	Delamp Lights	Each	1	5.0	6,552	0.00	5,326	0.00
Plug Load	Manual Shut Off Small Equipment	Each	4	3.0	5,399	0.00	4,389	0.00
Plug Load	Turn Off TV	Each	3	5.0	5,388	0.00	4,380	0.00
Plug Load	Remove Old Refrigerator	Each	1	5.0	3,504	0.00	2,849	0.00
Plug Load	Printer Controls	Each	3	5.0	1,642	0.00	1,335	0.00
Plug Load	Small Refrigerator Controls	Each	1	5.0	1,613	0.00	1,311	0.00
Plug Load	Timer for Office Water Dispenser	Each	1	5.0	548	0.00	445	0.00
Hot Water	Reduce Pool Temperature	Each	1	5.0	0.0	0.0	0.0	0.0

Source: ComEd tracking data and Navigant team analysis.