



ComEd Incentives - Standard Program 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

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ComEd Incentives - Standard Impact Evaluation Report

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1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's CY2019 Incentives – Standard Program (Standard 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

As part of the Business Incentives Program,¹ the Standard Program offers prescriptive financial incentives and a streamlined application to facilitate the implementation of energy efficiency improvements for non-residential (commercial and industrial) customers and market segments, with a program network of trade allies and service providers. Eligible measures include energy-efficient indoor and outdoor lighting, HVAC equipment, refrigeration, Energy Management Systems (EMS), commercial kitchen equipment, variable speed drives (VSDs), compressed air equipment and other qualifying products. The program also targets new system installation opportunities (e.g., advanced lighting systems) by offering incentives that “bundle” equipment and controls technologies. The program implementation contractor is ICF International, Inc, in collaboration with DNV-GL for the program’s day-to-day operations.

The program had 2,687 participants in CY2019 and 10,973 measure installations as shown in the following table and graph.

Table 2-1. CY2019 Volumetric Findings Detail by Sector

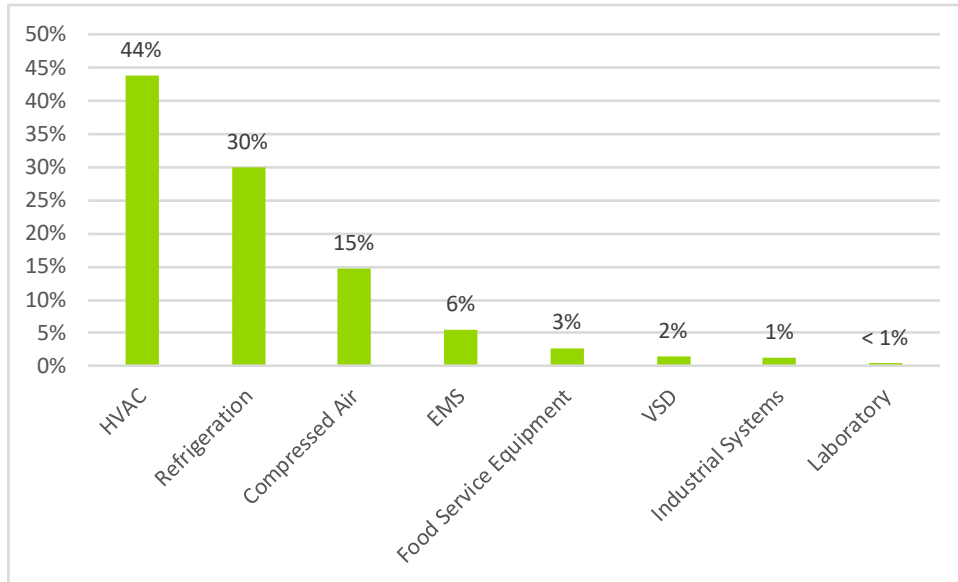
Participation	Private	Public	Total
Participants	2,132	555	2,687
Total Projects	2,407	662	3,069
Total Measure Installations*	8,820	2,153	10,973
Lighting Measures	7,906	2,018	9,924
Non-Lighting Measures	879	112	991
EMS Measures	35	23	58

* Measures installations refers to the number of line items in the tracking data

Source: ComEd tracking data and evaluation team analysis

¹ The Business Incentive Program is comprised of the non-residential Standard, Data Centers, and Custom programs. The incentive structure is based either on a “standard,” per-unit basis, as with most lighting measures, or “custom,” with the incentive based on the calculated annual energy savings for the customer.

Figure 2-1. Distribution of Non-Lighting Measure Installations 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 Standard Program achieved in CY2019. The gas savings are only those that ComEd may be able to claim, which excludes savings the gas utilities claim, either via joint or non-joint programs.² Total verified net savings (without gas savings) are 207,401,858 kWh and the program gross realization rate is 92%. The evaluation sample's precision is 3.2% (for kWh) at a 90/10, two-tailed confidence interval.

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

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	275,020,884	NR	40,626
Program Gross Realization Rate	0.92	NA	0.89
Verified Gross Savings	253,132,456	44,727	35,967
Program Net-to-Gross Ratio (NTG)	Lighting: 0.83 Non-Lighting: 0.78	Lighting: 0.83 Non-Lighting: 0.78	Lighting: 0.83 Non-Lighting: 0.78
Verified Net Savings	207,401,858	36,670	29,649
Converted from Gas†			
Ex Ante Gross Savings	29,183,317	NA	NA
Program Gross Realization Rate	0.74	NA	NA
Verified Gross Savings	21,580,656	NA	NA
Program Net-to-Gross Ratio (NTG)	Non-Lighting: 0.78	NA	NA
Verified Net Savings	16,832,912	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	304,204,202	NR	40,626
Program Gross Realization Rate	0.90	NA	0.89
Verified Gross Savings	274,713,112	44,727	35,966.79
Program Net-to-Gross Ratio (NTG)	Lighting: 0.83 Non-Lighting: 0.78	Lighting: 0.83 Non-Lighting: 0.78	Lighting: 0.83 Non-Lighting: 0.78
Verified Net Savings	224,234,770	36,670	29,649.42

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 Standard Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2019. The electric CPAS across all measures installed in 2019 is 207,401,858 kWh (Table 4-1). The CY2019 gas contribution to CPAS (converted to equivalent electricity) is 16,832,912 kWh (Table 4-2). Adding the gas and electric contributions produces 224,234,770 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 contribution.

Due to the large number of Standard Program measures, the CPAS values presented in the tables of Section 4 are aggregated by research category. The net savings reflect a year-by-year sum of all

measures within a research category. The EUL values reflect averages, weighted by energy savings, of all measures within a research category.

The CPAS Table 4-1 accounts for midlife adjustments to lighting measures with T12 baselines, as required by the TRM (v7.0). Discussion on the T12 adjustment approach are based on guidance from the TRM, detailed in Section 6, Table 8-5, and Table 8-6. The evaluation team estimated that overall, 10% of the savings from affected LED measures involved T12 baselines.



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

End Use Type	Research Category	EUL	CY2019 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	
Lighting	Lighting	11.7	199,170,846	0.83	1,896,445,878		165,311,802	165,311,802	165,106,500	164,868,555	162,684,422	159,152,318	157,894,843	157,614,502	
Non-Lighting	HVAC	17.5	27,377,447	0.78	373,146,833		21,354,409	21,354,409	21,354,409	21,354,409	21,354,409	21,354,409	21,354,409	21,354,409	
Non-Lighting	Refrigeration	9.4	11,711,870	0.78	85,971,252		9,135,259	9,135,259	9,135,259	9,135,259	9,050,208	9,042,983	9,042,983	9,042,983	
Non-Lighting	Compressed Air	12.6	5,946,610	0.78	58,585,703		4,638,356	4,638,356	4,638,356	4,638,356	4,638,356	4,638,356	4,638,356	4,638,356	
Non-Lighting	Industrial Systems	19.5	1,477,428	0.78	22,499,185		1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	
Non-Lighting	VSD	15.0	611,587	0.78	7,155,570		477,038	477,038	477,038	477,038	477,038	477,038	477,038	477,038	
Non-Lighting	Food Service Equipment	13.9	215,699	0.78	2,342,946		168,246	168,246	168,246	168,246	168,246	168,246	168,246	168,246	
Non-Lighting	Laboratory	8.8	63,646	0.78	438,210		49,644	49,644	42,365	42,365	42,365	42,365	42,365	42,365	
EMS	EMS	15.0	6,557,321	0.78	76,720,659		5,114,711	5,114,711	5,114,711	5,114,711	5,114,711	5,114,711	5,114,711	5,114,711	
CY2019 Program Total Electric Contribution to CPAS			253,132,456		2,523,306,236		207,401,858	207,401,858	207,189,277	206,951,332	204,682,148	201,142,819	199,885,344	199,605,003	
Historic Program Total Electric Contribution to CPAS‡						193,038,555	186,054,934	185,951,332	185,951,332	185,686,017	185,118,562	182,919,796	180,725,099	174,470,956	
Program Total Electric CPAS						193,038,555	393,456,792	393,353,190	393,140,609	392,637,349	389,800,710	384,062,615	380,610,443	374,075,958	
CY2019 Program Incremental Expiring Electric Savings§								-	212,581	237,945	2,269,184	3,539,329	1,257,475	280,341	
Historic Program Incremental Expiring Electric Savings‡§							6,983,621	103,602	-	265,315	567,455	2,198,767	2,194,697	6,254,143	
Program Total Incremental Expiring Electric Savings§							6,983,621	103,602	212,581	503,260	2,836,639	5,738,095	3,452,172	6,534,485	

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	Lighting	151,923,415	142,960,436	136,782,709	78,438,661	39,230,430	25,438,961	23,726,521	0	-	-	-	-
Non-Lighting	HVAC	21,328,533	21,062,059	20,286,781	20,286,781	20,286,781	20,286,781	20,286,781	7,296,096	7,296,096	7,296,096	7,296,096	7,296,096
Non-Lighting	Refrigeration	3,089,597	3,089,597	3,018,925	3,018,925	344,671	344,671	344,671	0	-	-	-	-
Non-Lighting	Compressed Air	4,638,356	4,638,356	3,998,409	3,998,409	3,998,409	103,459	103,459	-	-	-	-	-
Non-Lighting	Industrial Systems	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,042,655	1,042,655	1,042,655	1,042,655	1,042,655
Non-Lighting	VSD	477,038	477,038	477,038	477,038	477,038	477,038	477,038	-	-	-	-	-
Non-Lighting	Food Service Equipment	168,246	165,316	165,316	165,316	110,929	110,929	110,929	-	-	-	-	-
Non-Lighting	Laboratory	42,365	42,365	-	-	-	-	-	-	-	-	-	-
EMS	EMS	5,114,711	5,114,711	5,114,711	5,114,711	5,114,711	5,114,711	5,114,711	-	-	-	-	-
CY2019 Program Total Electric Contribution to CPAS		187,934,655	178,702,271	170,996,283	112,652,235	70,715,364	53,028,943	51,316,503	8,338,751	8,338,751	8,338,751	8,338,751	8,338,751
Historic Program Total Electric Contribution to CPAS‡		152,906,095	86,174,475	59,543,539	52,756,939	51,770,225	49,634,403	5,495,242	5,423,728	5,423,728	5,423,728	5,423,728	-
Program Total Electric CPAS		340,840,750	264,876,747	230,539,822	165,409,174	122,485,588	102,663,346	56,811,745	13,762,479	13,762,479	13,762,479	13,762,479	8,338,751
CY2019 Program Incremental Expiring Electric Savings§		11,670,348	9,232,383	7,705,988	58,344,049	41,936,871	17,686,420	1,712,440	42,977,752	-	-	-	-
Historic Program Incremental Expiring Electric Savings‡§		21,564,860	66,731,620	26,630,937	6,786,600	986,714	2,135,822	44,139,161	71,514	-	-	-	5,423,728
Program Total Incremental Expiring Electric Savings§		33,235,208	75,964,003	34,336,925	65,130,648	42,923,586	19,822,242	45,851,601	43,049,266	-	-	-	5,423,728



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End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Lighting	Lighting	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	HVAC	7,296,096	7,296,096	7,296,096	59,150	59,150	-	-	-	-	-	-	-
Non-Lighting	Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Compressed Air	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Industrial Systems	0	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	VSD	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Food Service Equipment	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Laboratory	-	-	-	-	-	-	-	-	-	-	-	-
EMS	EMS	-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Total Electric Contribution to CPAS		7,296,096	7,296,096	7,296,096	59,150	59,150	-	-	-	-	-	-	-
Historic Program Total Electric Contribution to CPAS†		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Electric CPAS		7,296,096	7,296,096	7,296,096	59,150	59,150	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Electric Savings§		1,042,655	-	0	7,236,946	0	59,150	-	-	-	-	-	-
Historic Program Incremental Expiring Electric Savings†§		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Incremental Expiring Electric Savings§		1,042,655	-	0	7,236,946	0	59,150	-	-	-	-	-	-

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 Illinois 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*



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

End Use Type	Research Category	EUL	CY2019 Verified Gross Savings (Therms)	NTG*	Lifetime Net Savings (Therms)†	Verified Net Therms Savings									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	
Lighting	Lighting	NA	-	0.83	-		-	-	-	-	-	-	-	-	
Non-Lighting	HVAC	10.8	41,950	0.78	353,174		32,721	32,721	32,721	32,721	32,721	32,721	32,721	32,721	
Non-Lighting	Refrigeration	NA	-	0.78	-		-	-	-	-	-	-	-	-	
Non-Lighting	Compressed Air	NA	-	0.78	-		-	-	-	-	-	-	-	-	
Non-Lighting	Industrial Systems	NA	-	0.78	-		-	-	-	-	-	-	-	-	
Non-Lighting	VSD	NA	-	0.78	-		-	-	-	-	-	-	-	-	
Non-Lighting	Food Service Equipment	NA	-	0.78	-		-	-	-	-	-	-	-	-	
Non-Lighting	Laboratory	NA	-	0.78	-		-	-	-	-	-	-	-	-	
EMS	EMS	15.0	694,340	0.78	8,123,780		541,585	541,585	541,585	541,585	541,585	541,585	541,585	541,585	
CY2019 Program Total Gas Contribution to CPAS (Therms)			736,290		8,476,954		574,306	574,306	574,306	574,306	574,306	574,306	574,306	574,306	
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)‡					9,703,896		16,832,912	16,832,912	16,832,912	16,832,912	16,832,912	16,832,912	16,832,912	16,832,912	
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§						52,270,178	52,270,178	52,270,178	52,270,178	52,270,178	52,270,178	52,270,178	52,270,178	52,270,178	
Program Total Gas CPAS (kWh Equivalent)‡						52,270,178	69,103,090	69,103,090	69,103,090	69,103,090	69,103,090	69,103,090	69,103,090	69,103,090	
CY2019 Program Incremental Expiring Gas Savings (Therms)							-	-	-	-	-	-	-		
CY2019 Program Incremental Expiring Gas Savings (kWh Equivalent)‡							-	-	-	-	-	-	-		
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§							-	-	-	-	-	-	-		
Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡							-	-	-	-	-	-	-		



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End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	Lighting	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	HVAC	32,721	32,721	5,193	5,193	5,193	5,193	5,193	-	-	-	-	-
Non-Lighting	Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Compressed Air	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Industrial Systems	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	VSD	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Food Service Equipment	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Laboratory	-	-	-	-	-	-	-	-	-	-	-	-
EMS	EMS	541,585	541,585	541,585	541,585	541,585	541,585	541,585	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (Therms)		574,306	574,306	546,779	546,779	546,779	546,779	546,779	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)†		16,832,912	16,832,912	16,026,078	16,026,078	16,026,078	16,026,078	16,026,078	-	-	-	-	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)†§		52,270,178	50,800,438	50,800,438	50,800,438	50,800,438	50,800,438	50,800,438	-	-	-	-	-
Program Total Gas CPAS (kWh Equivalent)†		69,103,090	67,633,349	66,826,516	66,826,516	66,826,516	66,826,516	16,026,078	-	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (Therms)		-	-	27,528	-	-	-	0	546,779	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (kWh Equivalent)†		-	-	806,834	-	-	-	0	16,026,078	-	-	-	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)†§		-	1,469,741	-	-	-	-	50,800,438	-	-	-	-	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)†		-	1,469,741	806,834	-	-	-	50,800,438	16,026,078	-	-	-	-

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 Illinois 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



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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	2026		
Lighting	Lighting	10.0	199,170,846	0.78	1,896,445,878		165,311,802	165,311,802	165,106,500	164,868,555	162,684,422	159,152,318	157,894,843	157,614,502		
Non-Lighting	HVAC	13.0	28,606,993	0.78	383,498,352		22,313,455	22,313,455	22,313,455	22,313,455	22,313,455	22,313,455	22,313,455	22,313,455		
Non-Lighting	Refrigeration	13.0	11,711,870	0.78	85,971,252		9,135,259	9,135,259	9,135,259	9,135,259	9,050,208	9,042,983	9,042,983	9,042,983		
Non-Lighting	Compressed Air	15.0	5,946,610	0.78	58,585,703		4,638,356	4,638,356	4,638,356	4,638,356	4,638,356	4,638,356	4,638,356	4,638,356		
Non-Lighting	Industrial Systems	5.0	1,477,428	0.78	22,499,185		1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394		
Non-Lighting	VSD	12.0	611,587	0.78	7,155,570		477,038	477,038	477,038	477,038	477,038	477,038	477,038	477,038		
Non-Lighting	Food Service Equipment	4.0	215,699	0.78	2,342,946		168,246	168,246	168,246	168,246	168,246	168,246	168,246	168,246		
Non-Lighting	Laboratory	15.0	63,646	0.78	438,210		49,644	49,644	42,365	42,365	42,365	42,365	42,365	42,365		
EMS	EMS	15.0	26,908,431	0.78	314,828,648		20,988,577	20,988,577	20,988,577	20,988,577	20,988,577	20,988,577	20,988,577	20,988,577		
CY2019 Program Total Contribution to CPAS			274,713,112		2,771,765,744		224,234,770	224,234,770	224,022,189	223,784,244	221,515,060	217,975,731	216,718,256	216,437,915		
Historic Program Total Contribution to CPAS‡						193,038,555	202,887,845	202,784,244	202,784,244	202,518,929	201,951,474	199,752,707	197,558,011	191,303,867		
Program Total CPAS						193,038,555	427,122,615	427,019,013	426,806,433	426,303,173	423,466,534	417,728,438	414,276,267	407,741,782		
CY2019 Program Incremental Expiring Savings§								-	212,581	237,945	2,269,184	3,539,329	1,257,475	280,341		
Historic Program Incremental Expiring Savings‡§							(9,849,290)	103,602	-	265,315	567,455	2,198,767	2,194,697	6,254,143		
Program Total Incremental Expiring Savings§							(9,849,290)	103,602	212,581	503,260	2,836,639	5,738,095	3,452,172	6,534,485		

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	
														Lighting
Non-Lighting	HVAC	22,287,579	22,021,105	20,438,993	20,438,993	20,438,993	20,438,993	20,438,993	7,296,096	7,296,096	7,296,096	7,296,096	7,296,096	
Non-Lighting	Refrigeration	3,089,597	3,089,597	3,018,925	3,018,925	344,671	344,671	344,671	0	-	-	-	-	
Non-Lighting	Compressed Air	4,638,356	4,638,356	3,998,409	3,998,409	3,998,409	103,459	103,459	-	-	-	-	-	
Non-Lighting	Industrial Systems	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,152,394	1,042,655	1,042,655	1,042,655	1,042,655	1,042,655	
Non-Lighting	VSD	477,038	477,038	477,038	477,038	477,038	477,038	477,038	-	-	-	-	-	
Non-Lighting	Food Service Equipment	168,246	165,316	165,316	165,316	110,929	110,929	110,929	-	-	-	-	-	
Non-Lighting	Laboratory	42,365	42,365	-	-	-	-	-	-	-	-	-	-	
EMS	EMS	20,988,577	20,988,577	20,988,577	20,988,577	20,988,577	20,988,577	20,988,577	-	-	-	-	-	
CY2019 Program Total Contribution to CPAS			204,767,566	195,535,183	187,022,361	128,678,313	86,741,442	69,055,021	67,342,581	8,338,751	8,338,751	8,338,751	8,338,751	8,338,751
Historic Program Total Contribution to CPAS‡			169,739,007	103,007,387	75,569,617	68,783,017	67,796,303	65,660,481	21,521,320	5,423,728	5,423,728	5,423,728	-	
Program Total CPAS			374,506,574	298,542,570	262,591,978	197,461,330	154,537,744	134,715,502	88,863,901	13,762,479	13,762,479	13,762,479	8,338,751	
CY2019 Program Incremental Expiring Savings§			11,670,348	9,232,383	8,512,822	58,344,049	41,936,871	17,686,420	1,712,440	59,003,830	-	-	-	
Historic Program Incremental Expiring Savings‡§			21,564,860	66,731,620	27,437,771	6,786,600	986,714	2,135,822	44,139,161	16,097,592	-	-	5,423,728	
Program Total Incremental Expiring Savings§			33,235,208	75,964,003	35,950,592	65,130,648	42,923,586	19,822,242	45,851,601	75,101,422	-	-	5,423,728	



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End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Lighting	Lighting	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	HVAC	7,296,096	7,296,096	7,296,096	59,150	59,150	-	-	-	-	-	-	-
Non-Lighting	Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Compressed Air	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Industrial Systems	0	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	VSD	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Food Service Equipment	-	-	-	-	-	-	-	-	-	-	-	-
Non-Lighting	Laboratory	-	-	-	-	-	-	-	-	-	-	-	-
EMS	EMS	-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Total Contribution to CPAS		7,296,096	7,296,096	7,296,096	59,150	59,150	-	-	-	-	-	-	-
Historic Program Total Contribution to CPAS†		-	-	-	-	-	-	-	-	-	-	-	-
Program Total CPAS		7,296,096	7,296,096	7,296,096	59,150	59,150	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Savings§		1,042,655	-	0	7,236,946	0	59,150	-	-	-	-	-	-
Historic Program Incremental Expiring Savings‡§		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Incremental Expiring Savings§		1,042,655	-	0	7,236,946	0	59,150	-	-	-	-	-	-

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.

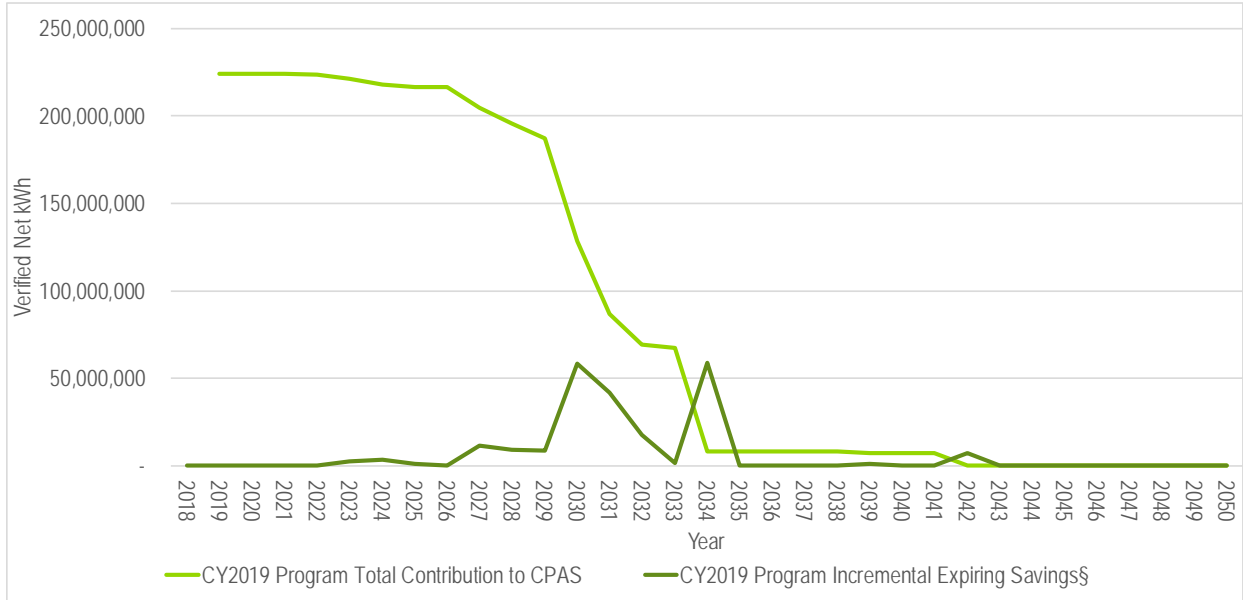
* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.

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

‡ Historic savings go back to CY2018.

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

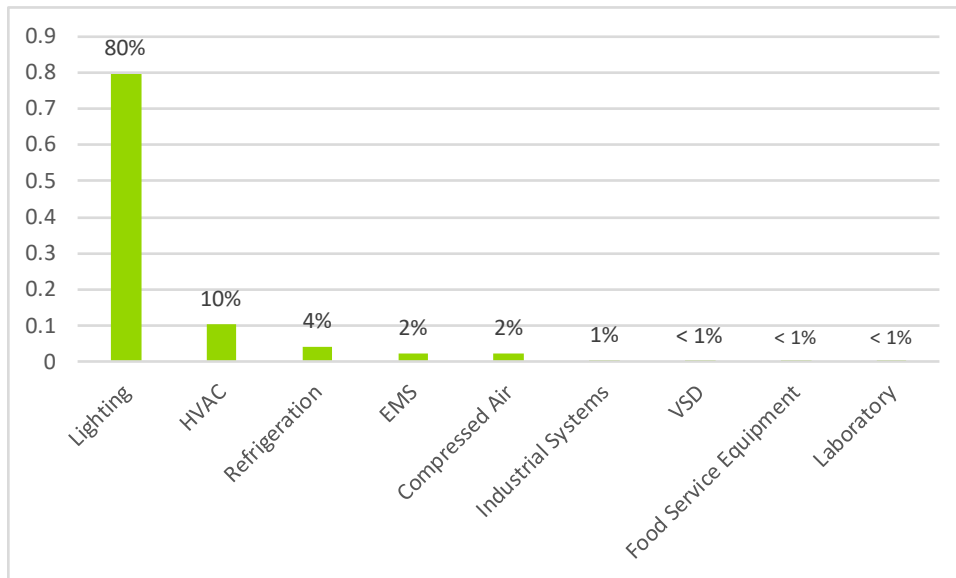
Source: Evaluation team analysis

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 includes measures across nine research categories, as shown in the following tables. Lighting measures contributed the most savings.

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


Source: ComEd tracking data and 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)
Lighting	Lighting	209,721,800	0.95	199,170,846	0.83	165,311,802	11.7
Non-Lighting	HVAC	28,177,460	0.97	27,377,447	0.78	21,354,409	17.5
Non-Lighting	Refrigeration	11,965,429	0.98	11,711,870	0.78	9,135,259	9.4
Non-Lighting	Compressed Air	5,809,994	1.02	5,946,610	0.78	4,638,356	12.6
Non-Lighting	Industrial Systems	1,430,872	1.03	1,477,428	0.78	1,152,394	19.5
Non-Lighting	VSD	601,630	1.02	611,587	0.78	477,038	15.0
Non-Lighting	Food Service Equipment	225,644	0.96	215,699	0.78	168,246	13.9
Non-Lighting	Laboratory	62,610	1.02	63,646	0.78	49,644	8.8
EMS	EMS	17,025,446	0.39	6,557,321	0.78	5,114,711	15.0
Total		275,020,884	0.92	253,132,456	NA	207,401,858	12.4

NA = Not applicable

* A deemed value. Source: https://www.ilsag.info/ntg_2019.

Source: ComEd tracking data and evaluation team analysis

Table 5-2. CY2019 Non-Coincident Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Non-Coincident Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Non-Coincident Demand Reduction (kW)	NTG*	Verified Net Non-Coincident Demand Reduction (kW)
Lighting	Lighting	NR	NA	35,669.94	0.83	29,606.05
Non-Lighting	HVAC	NR	NA	2,240.85	0.78	1,747.86
Non-Lighting	Refrigeration	NR	NA	6,089.20	0.78	4,749.58
Non-Lighting	Compressed Air	NR	NA	471.74	0.78	367.96
Non-Lighting	Industrial Systems	NR	NA	156.29	0.78	121.91
Non-Lighting	VSD	NR	NA	72.72	0.78	56.72
Non-Lighting	Food Service Equipment	NR	NA	22.69	0.78	17.70
Non-Lighting	Laboratory	NR	NA	3.33	0.78	2.60
EMS	EMS	NR	NA	0.00	0.78	0.00
Total		NR	NA	44,726.76	NA	36,670.37

NR = Not reported

NA = Not applicable

* A deemed value. Source: https://www.ilsag.info/ntg_2019.

Source: ComEd tracking data and evaluation team analysis

Table 5-3. CY2019 Summer 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)	NTG*	Verified Net Peak Demand Reduction (kW)
Lighting	Lighting	32,937.94	0.97	31,906.45	0.83	26,482.35
Non-Lighting	HVAC	4,719.72	0.47	2,236.82	0.78	1,744.72
Non-Lighting	Refrigeration	1,636.02	0.73	1,198.67	0.78	934.96
Non-Lighting	Compressed Air	907.84	0.47	423.03	0.78	329.96
Non-Lighting	Industrial Systems	336.40	0.46	156.29	0.78	121.91
Non-Lighting	VSD	52.92	0.47	24.71	0.78	19.28
Non-Lighting	Food Service Equipment	28.49	0.61	17.48	0.78	13.64
Non-Lighting	Laboratory	7.14	0.47	3.33	0.78	2.60
EMS	EMS	0.00	NA	0.00	0.78	0.00
Total		40,626.46	0.89	35,966.79	NA	29,649.42

NA = Not applicable

* A deemed value. Source: https://www.ilsag.info/ntg_2019.

Source: ComEd tracking data and evaluation team analysis

Table 5-4. 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)
Lighting	Lighting	0	NA	0	0.83	0	11.7
Non-Lighting	HVAC	41,043	1.02	41,950	0.78	32,721	17.5
Non-Lighting	Refrigeration	0	NA	0	0.78	0	9.4
Non-Lighting	Compressed Air	0	NA	0	0.78	0	12.6
Non-Lighting	Industrial Systems	0	NA	0	0.78	0	19.5
Non-Lighting	VSD	0	NA	0	0.78	0	15.0
Non-Lighting	Food Service Equipment	0	NA	0	0.78	0	13.9
Non-Lighting	Laboratory	0	NA	0	0.78	0	8.8
EMS	EMS	954,635	0.73	694,340	0.78	541,585	15.0
Total Therms		995,678	0.74	736,290	NA	574,306	NA
Total kWh Converted From Therms†		29,183,317	0.74	21,580,656	NA	16,832,912	NA

NA = Not applicable

* A deemed value. Source: 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 5-5. CY2019 Energy Savings by Measure – Total 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)
Lighting	Lighting	209,721,800	0.95	199,170,846	0.83	165,311,802
Non-Lighting	HVAC	29,380,428	0.97	28,606,993	0.78	22,313,455
Non-Lighting	Refrigeration	11,965,429	0.98	11,711,870	0.78	9,135,259
Non-Lighting	Compressed Air	5,809,994	1.02	5,946,610	0.78	4,638,356
Non-Lighting	Industrial Systems	1,430,872	1.03	1,477,428	0.78	1,152,394
Non-Lighting	VSD	601,630	1.02	611,587	0.78	477,038
Non-Lighting	Food Service Equipm†	225,644	0.96	215,699	0.78	168,246
Non-Lighting	Laboratory	62,610	1.02	63,646	0.78	49,644
EMS	EMS	45,005,795	0.60	26,908,431	0.78	20,988,577
	Total†	304,204,202	0.90	274,713,112	NA	224,234,770

NA = Not applicable

* A deemed value. Source: 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

Verified gross and net savings (energy and coincident peak demand) resulting from the CY2019 Standard Program were calculated using algorithms as defined by the Illinois Technical Reference Manual (TRM) version 7.0 or ComEd CY2019 Workpapers. Table 6-1 presents the key parameters and the references used in the verified gross and net savings calculations and indicate which were examined through CY2019 evaluation research and which were deemed.

The EM&V team conducted research to validate the parameters that were not specified in the TRM. The results are shown in the following table.

Table 6-1. Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source
Quantity	Varies	Varies	Evaluated	Program tracking database, CY2019 on-site verification
NTG	Varies	NA	Deemed	Illinois SAG Consensus*
Deemed Lighting Measure Savings Parameters: Hours of Use (HOU), Coincidence Factor, Interactive Effects	Varies	NA	Deemed	TRM v7.0*
Lighting Measure Δ Watts (deemed by TRM)	Varies	Watts	Deemed	TRM v7.0*
Lighting Measure Δ Watts (not deemed by TRM)	Varies	Watts	Evaluated	Program documentation and CY2019 M&V
Deemed HVAC, Food Service/Other, and Refrigeration Measures, principally: Electric Chillers, PTAC/PTHP, HVAC VSDs, Air Compressors, EC Motors, and Anti-Sweat Heater Controls	Varies	kWh	Deemed	TRM v7.0*
Non-Deemed Non-Lighting Measures, principally: Industrial VSD, EMS, Refrigeration Cases/Doors, Refrigerated Cycling Dryers, DCV, Laboratory Measures	Varies	kWh	Evaluated	Program documentation and CY2019 M&V
Verified Realization Rate on Ex Ante Gross Savings	Varies	NA	Evaluated	CY2019 Evaluation
Verified Realization Rate on Ex Ante Gross Savings	Varies	NA	Evaluated	CY2019 Evaluation
Effective Useful Life (EUL)	Varies	Years	Deemed	TRM v7.0*

* TRM is the State of Illinois Technical Reference Manual version 7.0 from <http://www.ilsag.info/technical-reference-manual.html>. The NTG values can be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.

6.2 T12 Baseline Adjustment

ComEd provided tracking data detail that enabled the evaluation team to identify T12 baselines in lighting measures. The TRM v7.0 does allow existing baselines to be used for lighting measures that are not a one-for-one replacement. The evaluation team estimated that, overall, 10% of the savings from affected LED measures involved T12 baselines. The affected measures were identified as:

- Indoor LED Fixtures and Retrofits
- Outdoor & Garage - LED Fixtures and Retrofits
- Retrofit of Existing Indoor Fixtures to LED

The evaluation team applied the T12 adjustment by mapping the identified T12 fixtures to equivalent T8 fixtures after one-third of the EUL of that installation had expired. To clarify, this adjustment affects the CPAS and not the first-year savings. The evaluation team calculated the weighted average T12 adjustment factor to be 60%.³ For more details on these adjustments, see Table 8-5 and Table 8-6.

6.3 Other Impact Findings and Recommendations

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

³ This adjustment factor was 56% in the CY2018 evaluation report.

6.3.1 Verified Gross Savings and Realization Rate

Finding 1. Evaluation sampling was done for lighting, non-lighting, and EMS projects separately. The lighting project strata achieved an electric energy savings weighted realization rate (RR_{kWh}) of 95%, non-lighting of 101% and EMS, 41%.⁴ The overall program gross realization rate was 92%. The program sampling achieved relative precision values⁵ of 3.2% and 9.0% for energy and demand, respectively. For additional details on statistical precision, see Table 7-2.

Finding 2. Lighting measures contributed approximately 80% of the total net savings. These include fixture replacements, localized controls (i.e., occupancy sensors), and networked lighting controls.

6.3.2 Tracking Data

Finding 3. The lighting measure baseline information in the tracking data does not use standardized naming conventions which results in a large number of unique fixture names.

Recommendation 1. Guidehouse recommends that the implementer use a standardized or discrete list of fixture names or naming conventions (i.e., a dropdown list of typical names such as “4’ 4LT12, EE ballast”) to identify the lighting baseline types.

6.3.3 Measure-Related Findings

Finding 4. The implementer uses integrated part-load value (IPLV) efficiency values to calculate demand savings for air-cooled and water-cooled chiller measures. The TRM algorithm for electric chiller peak demand savings uses full-load efficiency values. This issue also existed in the PY9 and CY2018 Standard Program Impact Evaluation Reports. The implementer reports that this has been corrected in CY2020.

Recommendation 2. The evaluation team will confirm the implementer update to this measure’s peak demand savings algorithm in CY2020 evaluations activities.

Finding 5. The implementer uses integrated energy efficiency ratio (IEER) or seasonal energy efficiency ratio (SEER) values to calculate demand savings. The TRM algorithm for rooftop unit air conditioners specifies using energy efficiency (EER) efficiency values.

Recommendation 3. The evaluation team recommends the implementer update the peak demand savings algorithm to be consistent with the effective version of the TRM.

Finding 6. The electronically commutated (EC) evaporator measure savings is based on an average of all motor sizes listed in the TRM.⁶ The evaluation team adjusted the sampled projects to reflect the actual motor size. In CY2019, two projects contained this measure and, in both cases, the verified savings decreased.

During the CY2020 workpaper review, Guidehouse reviewed the historical participation of this measure and found that nearly all motors were equal to or less than 1/15th hp in size.

⁴ These figures represent strata-level results, instead of measure-level results. Strata level results are weighted estimate with statistical precision.

⁵ The confidence interval is 90/10, two-tailed.

⁶ TRM (v7.0) measure 4.6.4 Electronically Commutated Motors (ECM) for Walk-in and Reach-in Coolers / Freezer provides deemed savings values for motors ranging from 16 W to 3/4 hp.

Recommendation 4. The evaluation team recommends the implementer update their program workpapers to use the deemed savings associated with the 1/20th – 1/15th range in CY2020.

Finding 7. The evaluation team calculated an energy realization rate of 0.41 for EMSs. The evaluation team adjusted the savings of these measures based on regression analyses. Frequently, the evaluation team found that the new EMS did not add significant functionality, beyond the existing EMS or controls.

The implementer has taken several steps to reduce the frequency of this particular finding (i.e., not adding significant functionality), however many of these projects were pre-approved under the previous program year and were paid for customer service purposes. This finding is likely to be less prevalent in CY2020's evaluation, resulting from more stringent pre-application requirements.

Recommendation 5. While additional checks have been added to the EMS pre-approval process, the evaluation team recommends establishing a savings threshold, over which all projects require a pre-inspection by the implementer. This may help the implementer identify instances where the proposed EMS is not adding significant energy savings strategies.

Finding 8. The evaluation team identified two measures (Measure IDs 3263038 and 3953932) that contained redundant units and adjusted the savings. These two instances were identified using project documentation and not on-site findings.

Recommendation 6. The evaluation team recommends that the implementer update their application review process to further review the project documentation to identify redundant units (pumps, fans, motors, etc.).

Finding 9. Post-inspection photos did not always capture the readouts from the variable speed drive displays. The details of the VSD readouts and other control panel readings are valuable to the evaluation team's ability to conduct desk reviews. This may be due to image resolution settings when the photos are added to the Word documents.

Recommendation 7. The evaluation team will contact the implementer to obtain higher resolution photographs that include intelligible readings of gauges, digital displays, or screenshots during evaluation activities.

Finding 10. Three measures (Measure IDs 2178227, 2894813, 4215910) involved a wattage adjustment based on pre- or post-inspection photos in the documentation.

Recommendation 8. The evaluation team recommends using photos from inspections to inform the wattage assumptions in the savings calculations, whenever possible.

Finding 11. The program's workpaper for the compressed air storage measure⁷ is based on improving the storage from 2 gallons per cfm (rated compressor output), but the incentive worksheet requires only that the new system increase the storage over 2 gal/cfm up to 5 gal/cfm.

The evaluation team sampled two projects with the compressed air storage measure. In both cases (Measure IDs 1415693 and 3032818), the installed storage did not meet the 5 gal/cfm required for the workpaper savings to be accurate.

Recommendation 9. The evaluation team recommends that the incentive worksheet requirements be updated to read "Only eligible to apply for compressed air receivers that increase system storage from 2 gallons / system CFM to at least 5 gallons / system CFM."

⁷ Appears as "Added compressor storage on load/no load systems" and "Added Compressor Storage" in tracking data.

Finding 12. The evaluation team adjusted three projects to reflect a new construction baseline. Two of these projects (Project IDs 63324, 63454) were large-scale renovations and the third project (Project ID 63055) involved a major change to a mechanical system. These particular projects involved scenarios that would be very difficult to identify without additional data gathering or on-site pre-inspections.

Recommendation 10. The evaluation team recommends that the implementer continue to improve efforts to identify these projects in the application process, and redirect them to the Custom Program. One option may be to ask on the application documentation whether the project required a permit. This may help prevent realization rates below 1.00 from appearing in the Standard Program lighting strata.

Finding 13. The compressed air desiccant dryer measure workpaper assumes an inappropriate baseline. The program workpaper assumes the baseline technology is a membrane-type dryer, which is typically limited to low-capacity applications.⁸ Additionally, the workpaper underestimates the energy savings due to the application of a 50% load factor. Desiccant dryers continuously consume air based on the dryers rating, not on the flow that is produced by the compressor at a given time. The implementer reports that this has been corrected in CY2020.

Recommendation 11. The evaluation team will confirm during CY2020 evaluation activities that implementer has updated the the baseline for this measure be a heatless desiccant dryer and that the 50% load factor has been removed.

Finding 14. During the gas savings verification, the evaluation found one of the program's three Advanced Rooftop Controls projects (Project IDs 63656) did not calculate gas savings correctly. The ex ante savings calculation did not include the kBtuh-to-ton conversion factor and when corrected, the realization rate for this project is 12.00. The implementer reports that this was corrected during CY2019. The evaluation team will confirm that the implementer corrected the eTrack savings algorithm in CY2020 evaluation activities.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

7.1 Verified Gross Program Savings Analysis Approach

The evaluation estimates of gross savings and stratified measure-level realization rates are presented in this section of the report. In the savings verification process, the evaluation sought to verify eligibility, quantity, and compliance with claimed per unit savings values defined in the Illinois TRM (v7.0). This process verified that the TRM was applied correctly and consistently by the program, that the measure-level inputs to the algorithm were correct, and that the quantity of measures claimed through the program are correct, in place and operational. Gross impact evaluation of non-deemed measures involved retrospective evaluation adjustments to gross savings on custom variables. For measures with custom variables, ComEd provided work paper documentation of savings, but verified savings were based on engineering review, billing or interval data review, and on-site monitoring and verification (M&V) (including metering) of sampled measures to determine eligibility and savings.

Other evaluation activities to verify gross energy savings involved the following steps.

⁸ "Specify membrane dryers for those parts of the system that require dew points of 35°F to 52°F (2°C to 11°C) and flow rates up to 600 scfm." <http://blog.parker.com/choosing-the-right-compressed-air-dryer-for-your-application>

7.1.1 Sampling Design for Savings Verification

Guidehouse implemented a stratified random sampling design where projects were grouped into three sample strata comprising of lighting, non-lighting, and a special focus on EMS as a third strata. A project was classified as an EMS project if it contained an EMS measure, otherwise it was classified as lighting or non-lighting based on which produced most of the project savings. A project is classified as lighting or non-lighting if savings is greater than 50% from lighting or non-lighting measures.

A total of 129 projects were selected, consisting of 64 lighting projects, 44 non-lighting projects, and 21 EMS projects. The sample draw for CY2019 gross impact evaluation was designed to provide a 90/10 level confidence and relative precision for gross impact realization rate results for lighting measures, non-lighting measures, EMS and the overall program. Strata were defined by project size (separately for lighting, non-lighting and EMS projects) based on ex ante gross energy savings boundaries that placed approximately one-third of program-level savings into each stratum (large, medium, and small) for a total of nine sub-strata.

Overall the sample represented 24 percent (66,037,768 kWh) of the population ex ante savings of 275,020,884 kWh.

Table 7-1. Profile of the CY2019 Population and Gross Savings Verification Sample by Strata

Population Group	Sampling Strata	Population			Sample		
		Number of Projects (N)	Ex Ante Claimed Gross Savings, kWh	kWh Weights	Number of Projects (n)	Ex Ante kWh	Sampled % of Population kWh
Lighting	1	109	81,173,325	0.376	20	26,921,483	33%
	2	254	60,356,718	0.279	19	4,589,681	8%
	3	2234	74,573,302	0.345	25	1,223,906	2%
Sub-total Lighting		2,597	216,103,345	1.000	64	32,735,070	15%
Non-Lighting	1	11	14,368,350	0.360	9	12,451,752	87%
	2	31	10,393,534	0.260	14	4,951,232	48%
	3	374	15,147,935	0.380	21	1,460,987	10%
Sub-total Non-Lighting		416	39,909,819	1.000	44	18,863,971	47%
EMS	1	3	9,286,523	0.489	3	9,286,523	100%
	2	4	4,313,688	0.227	4	4,313,688	100%
	3	49	5,407,510	0.284	14	838,517	16%
Sub-total EMS		56	19,007,720	1.000	21	14,438,727	76%
Program Total		3,069	275,020,884		129	66,037,768	24%

Source: ComEd tracking data and evaluation team analysis

The verified gross realization rate for the stratified sample are extrapolated to the program population using a ratio estimation method to yield ex post evaluation-adjusted gross energy savings for the population end use level. The gross realization rates and relative precision at 90 percent confidence interval for lighting, non-lighting, and EMS sub-strata are summarized in Table 7-2 below.

Table 7-2. Gross kWh Realization Rates and Relative Precision at 90% Confidence Level

Population Group	Sampling Strata	Mean kWh RR	Relative Precision at 90% Level of Confidence \pm %, kWh	Mean kW RR	Relative Precision at 90% Level of Confidence \pm %, kW	Standard Error, kWh
Lighting	1	0.99	2%	1.02	5%	1%
	2	0.92	8%	0.94	6%	4%
	3	0.92	10%	0.95	9%	5%
Sub-total Lighting		0.96	4%	0.98	4%	2%
Non-Lighting	1	0.94	3%	0.47	27%	2%
	2	1.08	22%	0.46	36%	13%
	3	1.02	14%	0.47	70%	9%
Sub-total Non-Lighting		1.01	9%	0.47	39%	5%
EMS	1	0.19	0%	NA	NA	0%
	2	0.40	0%	0.22	0%	0%
	3	0.77	32%	1.06	9%	14%
Sub-total EMS		0.35	12%	0.40	5%	3%
Overall CY2019 Program		0.94	3%	0.89	8%	2%

Source: ComEd tracking data and evaluation team analysis

7.1.2 Engineering Review of Project Files

For each selected project, the evaluation team performed an in-depth application review to assess the engineering methods, parameters and assumptions used to generate all ex ante impact estimates. For each measure in the sampled project, engineers estimated ex post gross savings based on their review of documentation and engineering analysis. We completed desk file reviews on 90 out of the 129 sample projects (44 lighting and 37 non-lighting and 9 EMS projects) to support deemed and non-deemed measure savings verification and program-level research.

To support this review, ComEd provided project documentation in electronic format for each sampled project. Documentation included some or all scanned files of hardcopy application forms and supporting documentation from the applicant (invoices, measure specification sheets, and vendor proposals), pre-inspection reports and photos (when required), post inspection reports and photos (when conducted), calculation spreadsheets, a project summary report, and important email and memoranda.

7.1.3 On-Site Data Collection

The evaluation team completed on-site surveys for 39 of the 129 customer applications sampled, including 14 lighting, 13 non-lighting and 12 EMS projects. For most projects, on-site sources include interviews that are completed at the time of the on-site, visual inspection of the systems and equipment, EMS data downloads, spot measurements, and short-term monitoring (e.g., less than four weeks). Our approach typically follows the International Performance Measurement and Verification Protocol (IPMVP) Option A or Option B.

The evaluation team developed an analysis plan for each project selected for on-site data collection. Each plan explains the general gross impact approach used (including monitoring plans), provides an analysis of the current inputs (based on the application and other available sources at that time), and

identifies sources that will be used to verify data or obtain newly identified inputs for the ex post gross impact approach.

The engineer assigned to each project first calls to set up an appointment with the customer. During the on-site audit, the engineer collects data identified in the analysis plan, including monitoring records (such as instantaneous spot watt measurements for relevant equipment, measured temperatures, data from equipment logs and EMS/SCADA system downloads), equipment nameplate data, system operation sequences and operating schedules, and a careful description of site conditions that might contribute to baseline selection.

7.1.4 Site-Specific Impact Estimates

After all the field data is collected, including any monitoring data, the evaluation team develops annual energy and demand impacts based on the on-site data, monitoring data, application information, and, in some cases, billing or interval data. Each program engineering analysis is based on calibrated engineering models that make use of hard copy application review and on-site gathered information surrounding the equipment installed through the program (and the operation of those systems).

Energy and demand savings calculations are accomplished using methods that include short-term monitoring-based assessments, bin models, application of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) methods and algorithms, analysis of pre- and post-installation billing and interval data, and other specialized algorithms and models.

For this study, summer peak hours are defined as non-holiday weekdays between 1:00 P.M. and 5:00 P.M. Central Prevailing Time (CPT) from June 1 to August 31. Winter peak hours are defined as non-holiday weekdays between 6:00 A.M. and 8:00 A.M. CPT, and between 5:00 P.M. and 7:00 P.M. CPT, from January 1 to February 28. This is in accordance with the PJM manual 18, *PJM Capacity Market*, effective October 16, 2015.⁹

Peak demand savings for both baseline and post retrofit conditions are the average demand kW savings for the 1:00 P.M. to 5:00 P.M. CPT weekday time period for summer, and 6:00 A.M. to 8:00 A.M. CPT and 5:00 P.M. to 7:00 P.M. CPT weekday time period for winter.¹⁰ If this energy savings measure is determined to have weather dependency, then the summer peak kW savings are based on the zonal weighted temperature humidity index (WTHI) standard, and the winter peak kW savings are based on the zonal wind speed-adjusted temperature (WWP) standards posted by PJM (there is also PJM Zonal Winter Weather Standards similar to summer WTHI). The zonal WTHI and WWP are the mean of the zonal WTHI values or WWP values on the days in which PJM peak load occurred in the past sixteen years (1998-2014). This means ComEd WTHI value is 81.7 for summer and the WWP value is 12.9 for winter.¹¹

7.1.5 Gas Savings Verification

The primary gas-saving measure in the Standard Program is EMS, accounting for 96% of the program's total gas savings. The evaluation team evaluates the EMS measure's electric energy savings using a billing analysis approach that generally uses all the available post-installation usage data. However, in most circumstances there is not enough heating season gas usage data to use the same approach to

⁹ Manual 18b, page 65-67: (<https://www.pjm.com/~media/documents/manuals/m18.ashx>)

¹⁰ The Winter Weather Standard is the dry bulb temperature adjusted (by 0.5 °F) for wind speed above 10 mph. The measurements were for Hour Ending 19:00 on RTO peak days."

¹¹ <https://www.pjm.com/~media/planning/res-adeq/zonal-weather-standards-weather-sensitive-ee-demand-reductions.ashx?la=en>

verify therms. Generally, the file reviews did not provide insight to the gas savings, with two exceptions: when the area (ft²) of the project was adjusted, and when the building type was adjusted. Additionally, the electric regression analyses were only used to adjust the gas savings if they showed non-positive electric energy savings. For these projects, the gas savings was set to zero using the evaluator’s judgment that if the EMS installation was producing no electric savings that it was unlikely to produce gas savings. To otherwise verify the EMS gas savings, the evaluation team reviewed the tracking data for compliance with program workpapers and the Illinois TRM. The implementation team has stated disagreement with the evaluation team’s approach to evaluating the gas savings of EMS projects.¹²

For all other gas-saving measures, rather than draw a sample, the evaluation team reviewed the program (population) tracking data for compliance with program workpapers and the Illinois TRM.

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

In Table 8-1, Table 8-2, and Table 8-3 we present the program performance from the private and public sector participation and the overall population-level savings summary.

Table 8-1. Population Level Savings Summary

End Use Type	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	RR _{kWh}	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Peak Demand Reduction (kW)	RR _{kW}	Ex Ante Gross Gas Savings (therms)	Verified Gross Gas Savings (therms)	RR _{therm}
Private-Lighting	190,935,862	181,900,070	0.95	28,806	28,056	0.97	-	-	NA
Public-Lighting	25,167,483	23,395,309	0.93	4,846	4,612	0.95	386	386	NA
Sub-total Lighting	216,103,345	205,295,379	0.95	33,651	32,668	0.97	386	386	NA
Private-Non-Lighting	36,609,974	36,740,057	1.00	6,164	2,873	0.47	40,130	41,037	1.02
Public-Non-Lighting	3,299,846	3,397,994	1.03	598	277	0.46	527	527	NA
Sub-total Non-Lighting	39,909,819	40,138,051	1.01	6,762	3,150	0.47	40,657	41,564	1.02
Private-EMS	13,873,859	5,837,597	0.42	139	70	0.51	591,492	470,059	0.79
Public-EMS	5,133,861	1,861,428	0.36	74	78	1.06	363,143	224,282	0.62
Sub-total EMS	19,007,720	7,699,026	0.41	213	149	0.70	954,635	694,340	0.73
Total	275,020,884	253,132,456	0.92	40,626	35,967	0.89	995,678	736,290	0.74

Note: The realization rates presented in this table reflect the statistical sample realization rates extrapolated at the population level.

Source: ComEd tracking data and evaluation team analysis

¹² From the implementation team (DNV GL): Due to timeline limitations imposed by legislation some EMS projects were evaluated utilizing limited data sets. Increasing data points to include post project implementation cooling months not currently available may lead to an increase or decrease in ex-post savings. As evaluators are unable to verify those savings, a conservative approach was taken and only verifiable kWh reductions are included in the ex-post energy reduction values.

Table 8-2. Private Sector Savings Summary

End Use Type	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	RR _{kWh}	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Peak Demand Reduction (kW)	RR _{kW}	Ex Ante Gross Gas Savings (therms)	Verified Gross Gas Savings (therms)	RR _{therm}
Lighting	190,935,862	181,900,070	0.95	28,806	28,056	0.97	0	0	NA
Non-Lighting	36,609,974	36,740,057	1.00	6,164	2,873	0.47	40,130	33,600	0.84
EMS	13,873,859	5,837,597	0.42	139	70	0.51	591,492	470,059	0.79
Total	241,419,695	224,477,724	0.93	35,108	30,999	0.88	631,622	503,658	0.80

Note: The electric realization rates presented in this table reflect the statistical sample realization rates extrapolated at the population level.
 Source: ComEd tracking data and evaluation team analysis

Table 8-3. Public Sector Savings Summary

End Use Type	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	RR _{kWh}	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Peak Demand Reduction (kW)	RR _{kW}	Ex Ante Gross Gas Savings (therms)	Verified Gross Gas Savings (therms)	RR _{therm}
Lighting	25,167,483	23,395,309	0.93	4,846	4,612	0.95	386	386	1.00
Non-Lighting	3,299,846	3,397,994	1.03	598	277	0.46	527	527	1.00
EMS	5,133,861	1,861,428	0.36	74	78	1.06	363,143	224,282	0.62
Total	33,601,190	28,654,732	0.85	5,518	4,967	0.90	364,056	225,194	0.62

Note: The electric realization rates presented in this table reflect the statistical sample realization rates extrapolated at the population level.
 Source: ComEd tracking data and evaluation team analysis

Table 8-4. Program Savings by Building Type

Space Type	Ex Ante Gross Savings (kWh)	Verified Gross Savings (kWh)	RR _{kWh}	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Peak Demand Reduction (kW)	RR _{kW}	Ex Ante Gross Gas Savings (therms)	Verified Gross Gas Savings (therms)	RR _{therm}
College / University	1,438,009	1,348,326	0.94	351	316	0.90	10,965	6,772	0.62
Exterior	50,410,415	47,579,442	0.94	23	22	0.95	-	-	NA
Garage	1,809,842	1,671,487	0.92	503	476	0.95	-	-	NA
Garage/24/7	5,224,306	4,905,806	0.94	647	621	0.96	-	-	NA
Grocery/Convenience Store	14,350,311	13,719,186	0.96	2,621	2,523	0.96	511	511	1.00
Healthcare Clinic/Office	831,086	799,581	0.96	107	80	0.75	69,949	43,201	0.62
Hospital (24/7)	4,088,753	4,105,551	1.00	655	346	0.53	-	-	NA
Hotel/Motel - Common	831,517	825,636	0.99	131	85	0.65	-	-	NA
Hotel/Motel - Guest	1,166,876	1,094,212	0.94	290	142	0.49	-	-	NA
K-12 School	14,731,107	13,692,559	0.93	4,335	3,934	0.91	308,512	190,890	0.62
Manufacturing	27,225,640	25,763,907	0.95	5,150	4,981	0.97	-	-	NA
Miscellaneous	9,549,409	8,927,477	0.93	2,025	1,855	0.92	50,338	31,089	0.62
Miscellaneous (24/7)	43,398,676	42,415,538	0.98	4,911	4,758	0.97	-	-	NA
MultiFamily - Common	3,679,169	3,594,249	0.98	813	446	0.55	52,570	32,468	0.62
Office	30,346,514	19,055,767	0.63	2,978	2,040	0.68	445,348	379,798	0.85
Restaurant	895,700	809,508	0.90	115	106	0.92	17,866	11,035	0.62
Retail	1,265	1,286	1.02	20	9	0.47	85	85	1.00
Retail - Department Store	104,777	106,511	1.02	20	9	0.47	1,836	2,958	1.61
Retail/Service - Indoor Mall/Department Store	8,590,073	8,105,933	0.94	1,934	1,718	0.89	9,387	9,172	0.98
Retail/Service - Strip Mall	11,492,163	11,159,794	0.97	2,619	2,607	1.00	-	-	NA
Warehouse	20,621,612	19,390,266	0.94	7,108	6,807	0.96	5,155	5,155	1.00
Unknown	24,233,665	24,060,432	0.99	3,270	2,086	0.64	23,155	23,155	1.00
Total	275,020,884	253,132,456	0.92	40,626	35,967	0.89	995,678	736,290	0.74

Source: ComEd tracking data and evaluation team analysis

Table 8-5. Energy Savings Affected by T12 Baseline Shift

Measure Name	No T12 Baseline Ex Ante Gross Savings (kWh)	T12 Baseline Ex Ante Gross Savings (kWh)	Total Ex Ante Gross Savings (kWh)	Percentage of Savings Involving T12 Baseline
Indoor LED Fixtures and Retrofits	118,175,424	18,667,593	136,843,017	13.6%
Outdoor & Garage - LED Fixtures and Retrofits	51,530,489	997,780	52,528,269	1.9%
Retrofit of Existing Indoor Fixtures to LED	236,037	162,663	398,700	40.8%
Grand Total	169,941,950	19,828,036	189,769,986	10.4%

Source: ComEd tracking data and evaluation team analysis

Table 8-6. T12 Savings Adjustment Factor Details

Measure Name	Verified Gross Savings (kWh/year)	Midlife Adjusted Verified Gross Savings (kWh/year)	Average Midlife Adjustment Factor
Indoor LED Fixtures and Retrofits	17,381,177	10,568,640	61%
Outdoor & Garage - LED Fixtures and Retrofits	921,815	483,087	52%
Retrofit of Existing Indoor Fixtures to LED	154,621	74,178	48%
Total	18,457,613	11,125,905	60%

Source: ComEd tracking data and evaluation team analysis

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. Due to the large number of Standard Program measures, the values presented in the Table 9-1 are aggregated by research category.

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)
Lighting	Lighting	Varies	28,792	11.7	Yes	199,170,846	31,906.45	0	0	2,354,866	0.83	0.83	0.83	165,311,802	26,482.35	0	0	1,954,539
Non-Lighting	HVAC	Varies	246,563	17.5	No	27,377,447	2,236.82	41,950	0	0	0.78	0.78	0.78	21,354,409	1,744.72	32,721	0	0
Non-Lighting	Refrigeration	Varies	315	9.4	No	11,711,870	1,198.67	0	0	0	0.78	0.78	0.78	9,135,259	934.96	0	0	0
Non-Lighting	Compressed Air	Varies	10,022	12.6	No	5,946,610	423.03	0	0	0	0.78	0.78	0.78	4,638,356	329.96	0	0	0
Non-Lighting	Industrial Systems	Varies	14	19.5	No	1,477,428	156.29	0	0	0	0.78	0.78	0.78	1,152,394	121.91	0	0	0
Non-Lighting	VSD	Varies	16	15.0	No	611,587	24.71	0	0	0	0.78	0.78	0.78	477,038	19.28	0	0	0
Non-Lighting	Food Service Equipment	Varies	29	13.9	No	215,699	17.48	0	0	0	0.78	0.78	0.78	168,246	13.64	0	0	0
Non-Lighting	Laboratory	Varies	4	8.8	No	63,646	3.33	0	0	0	0.78	0.78	0.78	49,644	2.60	0	0	0
EMS	EMS	ft ²	58	15.0	No	6,557,321	0.00	694,340	0	0	0.78	0.78	0.78	5,114,711	0.00	541,585	0	0
Total				12.4		253,132,456	35,967	736,290	0	2,354,866	NA	NA	NA	207,401,858	29,649	574,306	0	1,954,539

Note: To avoid double counting, the verified gross kWh and net kWh used in the TRC analysis excludes secondary energy savings from water reduction measures. Table 9-1 represents the kWh savings from Table 5-1 minus those shown in Table 5-5

* 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 (there is baseline adjustment). See the CPAS Table 4-1 to Table 4-3.

Source: ComEd tracking data and evaluation team analysis