Guidehouse

ComEd Single-Family Assessment Impact Evaluation Report

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

Presented to
ComEd

FINAL

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ComEd Single-Family Assessment Impact Evaluation Report

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ComEd Single-Family Assessment Impact Evaluation Report

1. Introduction

This report presents the results of the impact evaluation of ComEd's CY2019 Single-Family Assessment Program, also known as the Home Energy Assessment (HEA) 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 appendices provide the impact analysis methodology and details of the Total Resource Cost inputs. CY2019 covers January 1, 2019 through December 31, 2019. This report focuses solely on the electric savings from the program and the gas savings from Nest thermostats installed as part of an income eligible pilot program. All other natural gas savings will be claimed by the gas utilities and will be included in their evaluation reports.

2. Program Description

The HEA Program is an assessment and direct install program jointly implemented by ComEd, Nicor Gas, and Peoples Gas (PGL) and North Shore Gas (NSG) with Franklin Energy Services (Franklin Energy) implementing the program. The primary objective of this residential direct install program was to secure energy savings through direct installation of low-cost efficiency measures such as: water efficient showerheads and faucet aerators, pipe insulation, programmable thermostats, reprogramming programmable thermostats, co-pay smart thermostats, advanced power strips (APS), and LEDs at eligible single-family residences.

The secondary objective of this program was to function as the "gateway" for homeowners to participate in other residential programs. The HEA Program performs a brief assessment of the major retrofit opportunities (e.g., furnace, boiler, air conditioning, insulation, and air sealing) and brings heightened awareness to the homeowners about efficiency programs offered by ComEd, PGL, NSG and Nicor Gas.

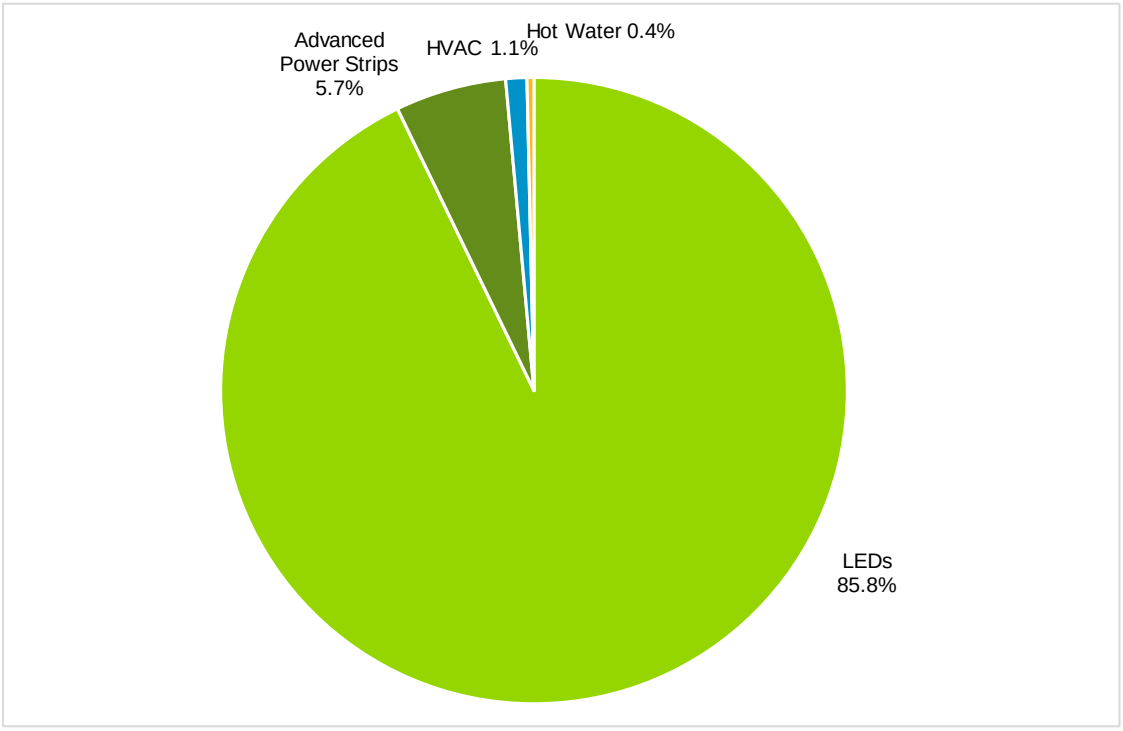
In CY2019, the program had 20,186 participants, implemented 20,692 unique projects, and installed 723,092 measures as shown in the following table and graph. This includes only projects with measures with ComEd-claimed savings. If all projects are included (including those where ComEd could not claim savings), the program had 20,595 participants in CY2019 and 21,138 unique projects.

Table 2-1. CY2019 Volumetric Findings Detail

Participation	Program Overall
Participants*	20,186
Unique Projects†	20,692
Total Measures‡	723,092
Number of Units/Project	34.95
Advanced Power Strip - Tier 1	41,411
Advanced Thermostat	2,506
Advanced Thermostat - IE Pilot	9
HW Pipe Insulation	778
LED Omnidirectional Bulb - Exterior	15,768
LED Omnidirectional Bulb - Interior	256,928
LED Specialty Lamp - Exterior	17,215
LED Specialty Lamp - Interior	381,307
Low Flow Faucet Aerator - Bathroom	574
Low Flow Faucet Aerator - Kitchen	169
Low Flow Showerhead	1,062
Programmable Thermostat	2,238
Programmable Thermostat - Reprogram	3,127

* Participants are defined as unique ComEd account numbers
† Unique Projects are defined as unique Project IDs
‡ Quantity is reported quantity. Guidehouse later adjusted thermostat quantities in its analysis to prevent counting multiple thermostat measures per home.
Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Number of Measures Installed by Type



Source: ComEd tracking data and evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the HEA 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.[1]

[1] 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	34,186,597	NR	4,580
Program Gross Realization Rate	0.95	NA	0.96
Verified Gross Savings	32,385,490	33,910	4,387
Program Net-to-Gross Ratio (NTG)	Varies	Varies	Varies
Verified Net Savings	27,420,368	29,008	3,731
Converted from Gas†			
Ex Ante Gross Savings	18,075	NR	NA
Program Gross Realization Rate	0.95	NR	NA
Verified Gross Savings	17,106	NR	NA
Program Net-to-Gross Ratio (NTG)	NA‡	NR	NA
Verified Net Savings	17,106	NR	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	34,204,672	NR	4,580
Program Gross Realization Rate	0.95	NA	0.96
Verified Gross Savings	32,402,596	33,910	4,387
Program Net-to-Gross Ratio (NTG)	Varies	Varies	Varies
Verified Net Savings	27,437,474	29,008	3,731

NR = Not reported (refers a piece of data that was not reported, i.e., non-coincident demand savings)
NA = Not applicable (refers a piece of data cannnot 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."
‡ The Illinois TRM algorithm calculates net savings for advanced thermostats
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 HEA Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2019. The electric CPAS across all measures installed in 2019 is 27,420,368 kWh (Table 4-1). The CY2019 gas contribution to CPAS (converted to equivalent electricity) is 17,106 kWh (Table 4-2). Adding the gas and electric contributions produces 27,437,474 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.

The evaluation team recently received guidance to include the electric heating penalty in the verified gross and net savings values. All verified kWh savings throughout this report account for the electric

heating penalty incurred by ComEd for lighting measures implemented in building with an electric heating system.

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	LED Specialty Lamp - Interior	10.0	13,902,581	0.84	68,115,568		11,678,168	11,678,168	11,678,168	11,678,168	11,678,168	1,944,946	1,944,946	1,944,946
Lighting	LED Omnidirectional Bulb - Interior	10.0	9,999,201	0.84	40,465,194		8,399,329	8,399,329	2,958,317	2,958,317	2,958,317	2,958,317	2,958,317	2,958,317
Consumer Electronics	Advanced Power Strip - Tier 1	7.0	2,943,080	0.85	17,511,325		2,501,618	2,501,618	2,501,618	2,501,618	2,501,618	2,501,618	2,501,618	
Lighting	LED Specialty Lamp - Exterior	6.1	2,280,330	0.84	9,992,201		1,915,477	1,915,477	1,915,477	1,915,477	1,915,477	377,104	37,710	
Lighting	LED Omnidirectional Bulb - Exterior	6.1	1,790,008	0.84	5,902,179		1,503,606	1,503,606	706,089	706,089	706,089	706,089	70,609	
HVAC	Advanced Thermostat	11.0	632,992	NA**	6,962,917		632,992	632,992	632,992	632,992	632,992	632,992	632,992	632,992
HVAC	Programmable Thermostat - Reprogram	2.0	311,455	0.90	560,620		280,310	280,310						
HVAC	Programmable Thermostat	8.0	253,029	0.90	1,821,806		227,726	227,726	227,726	227,726	227,726	227,726	227,726	227,726
Hot Water	Low Flow Showerhead	10.0	235,115	1.04	2,445,197		244,520	244,520	244,520	244,520	244,520	244,520	244,520	244,520
Hot Water	Low Flow Faucet Aerator - Bathroom	10.0	14,954	1.04	155,524		15,552	15,552	15,552	15,552	15,552	15,552	15,552	15,552
Hot Water	Low Flow Faucet Aerator - Kitchen	10.0	10,487	1.04	109,061		10,906	10,906	10,906	10,906	10,906	10,906	10,906	10,906
Hot Water	HW Pipe Insulation	15.0	10,476	0.80	125,709		8,381	8,381	8,381	8,381	8,381	8,381	8,381	8,381
HVAC	Advanced Thermostat - IE Pilot	11.0	1,782	NA**	19,607		1,782	1,782	1,782	1,782	1,782	1,782	1,782	1,782
CY2019 Program Total Electric Contribution to CPAS			32,385,490		154,186,907		27,420,368	27,420,368	20,901,529	20,901,529	20,901,529	9,629,933	8,655,059	6,045,122
Historic Program Total Electric Contribution to CPAS‡						24,149,880	24,149,880	23,928,139	20,007,644	20,007,644	19,813,957	19,439,261	17,274,032	17,274,032
Program Total Electric CPAS						24,149,880	51,570,248	51,348,507	40,909,172	40,909,172	40,715,486	29,069,194	25,929,091	23,319,154
CY2019 Program Incremental Expiring Electric Savings§								-	6,518,839	-	-	11,271,595	974,874	2,609,937
Historic Program Incremental Expiring Electric Savings‡§							-	221,741	3,920,495	-	193,687	374,696	2,165,229	-
Program Total Incremental Expiring Electric Savings§							-	221,741	10,439,334	-	193,687	11,646,291	3,140,103	2,609,937

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	LED Specialty Lamp - Interior	1,944,946	1,944,946										
Lighting	LED Omnidirectional Bulb - Interior	2,958,317	2,958,317										
Consumer Electronics	Advanced Power Strip - Tier 1												
Lighting	LED Specialty Lamp - Exterior												
Lighting	LED Omnidirectional Bulb - Exterior												
HVAC	Advanced Thermostat	632,992	632,992	632,992									
HVAC	Programmable Thermostat - Reprogram												
HVAC	Programmable Thermostat												
Hot Water	Low Flow Showerhead	244,520	244,520										
Hot Water	Low Flow Faucet Aerator - Bathroom	15,552	15,552										
Hot Water	Low Flow Faucet Aerator - Kitchen	10,906	10,906										
Hot Water	HW Pipe Insulation	8,381	8,381	8,381	8,381	8,381	8,381	8,381					
HVAC	Advanced Thermostat - IE Pilot	1,782	1,782	1,782									
CY2019 Program Total Electric Contribution to CPAS		5,817,397	5,817,397	643,155	8,381	8,381	8,381	8,381	-	-	-	-	-
Historic Program Total Electric Contribution to CPAS‡		17,247,860	563,628	563,628	563,628	563,628	563,628	-	-	-	-	-	-
Program Total Electric CPAS		23,065,256	6,381,025	1,206,784	572,009	572,009	572,009	8,381	-	-	-	-	-
CY2019 Program Incremental Expiring Electric Savings§		227,726	-	5,174,241	634,775	-	-	-	8,381	-	-	-	-
Historic Program Incremental Expiring Electric Savings‡§		26,172	16,684,232	-	-	-	-	563,628	-	-	-	-	-
Program Total Incremental Expiring Electric Savings§		253,898	16,684,232	5,174,241	634,775	-	-	563,628	8,381	-	-	-	-

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 $Y_{n.}$

** The TRM algorithm calculates net savings for advanced thermostats.

Source: Evaluation team analysis

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	LED Specialty Lamp - Interior	10.0	0	0.84	0									
Lighting	LED Omnidirectional Bulb - Interior	10.0	0	0.84	0									
Consumer Electronics	Advanced Power Strip - Tier 1	7.0	0	0.85	0									
Lighting	LED Specialty Lamp - Exterior	6.1	0	0.84	0									
Lighting	LED Omnidirectional Bulb - Exterior	6.1	0	0.84	0									
HVAC	Advanced Thermostat	11.0	0	NA**	0									
HVAC	Programmable Thermostat - Reprogram	2.0	0	0.90	0									
HVAC	Programmable Thermostat	8.0	0	0.90	0									
Hot Water	Low Flow Showerhead	10.0	0	1.04	0									
Hot Water	Low Flow Faucet Aerator - Bathroom	10.0	0	1.04	0									
Hot Water	Low Flow Faucet Aerator - Kitchen	10.0	0	1.04	0									
Hot Water	HW Pipe Insulation	15.0	0	0.80	0									
HVAC	Advanced Thermostat - IE Pilot	11.0	584	NA**	6,420		584	584	584	584	584	584	584	584
CY2019 Program Total Gas Contribution to CPAS (Therms)			584		6,420		584	584	584	584	584	584	584	584
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)‡					188,163		17,106	17,106	17,106	17,106	17,106	17,106	17,106	17,106
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§						16,496	16,496	16,496	16,496	16,496	16,496	16,496	16,496	16,496
Program Total Gas CPAS (kWh Equivalent)‡						16,496	33,601	33,601	33,601	33,601	33,601	33,601	33,601	33,601
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)‡‖							-	-	-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	LED Specialty Lamp - Interior												
Lighting	LED Omnidirectional Bulb - Interior												
Consumer Electronics	Advanced Power Strip - Tier 1												
Lighting	LED Specialty Lamp - Exterior												
Lighting	LED Omnidirectional Bulb - Exterior												
HVAC	Advanced Thermostat												
HVAC	Programmable Thermostat - Reprogram												
HVAC	Programmable Thermostat												
Hot Water	Low Flow Showerhead												
Hot Water	Low Flow Faucet Aerator - Bathroom												
Hot Water	Low Flow Faucet Aerator - Kitchen												
Hot Water	HW Pipe Insulation												
HVAC	Advanced Thermostat - IE Pilot	584	584	584									
CY2019 Program Total Gas Contribution to CPAS (Therms)		584	584	584	-	-	-	-	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		17,106	17,106	17,106	-	-	-	-	-	-	-	-	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§		16,496	-	-	-	-	-	-	-	-	-	-	-
Program Total Gas CPAS (kWh Equivalent)‡		33,601	17,106	17,106	-	-	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (Therms)||		-	-	-	584	-	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (kWh Equivalent)‡||		-	-	-	17,106	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§||		-	16,496	-	-	-	-	-	-	-	-	-	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡||		-	16,496	-	17,106	-	-	-	-	-	-	-	-

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 Y_n.
** The Illinois TRM algorithm calculates net savings for advanced thermostats.
Source: Evaluation team analysis

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

End Use Type	Research Category	EUL	CY2019 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings (Including Those Converted from Gas Savings) 2018	2019	2020	2021	2022	2023	2024	2025	2026
Lighting	LED Specialty Lamp - Interior	10.0	13,902,581	0.84	68,115,568	-	11,678,168	11,678,168	11,678,168	11,678,168	11,678,168	1,944,946	1,944,946	1,944,946
Lighting	LED Omnidirectional Bulb - Interior	10.0	9,999,201	0.84	40,465,194		8,399,329	8,399,329	2,958,317	2,958,317	2,958,317	2,958,317	2,958,317	2,958,317
Consumer Electronics	Advanced Power Strip - Tier 1	7.0	2,943,080	0.85	17,511,325		2,501,618	2,501,618	2,501,618	2,501,618	2,501,618	2,501,618	2,501,618	-
Lighting	LED Specialty Lamp - Exterior	6.1	2,280,330	0.84	9,992,201		1,915,477	1,915,477	1,915,477	1,915,477	1,915,477	377,104	37,710	-
Lighting	LED Omnidirectional Bulb - Exterior	6.1	1,790,008	0.84	5,902,179		1,503,606	1,503,606	706,089	706,089	706,089	706,089	70,609	-
HVAC	Advanced Thermostat	11.0	632,992	NA**	6,962,917		632,992	632,992	632,992	632,992	632,992	632,992	632,992	632,992
HVAC	Programmable Thermostat - Reprogram	2.0	311,455	0.90	560,620		280,310	280,310	-	-	-	-	-	-
HVAC	Programmable Thermostat	8.0	253,029	0.90	1,821,806		227,726	227,726	227,726	227,726	227,726	227,726	227,726	227,726
Hot Water	Low Flow Showerhead	10.0	235,115	1.04	2,445,197		244,520	244,520	244,520	244,520	244,520	244,520	244,520	244,520
Hot Water	Low Flow Faucet Aerator - Bathroom	10.0	14,954	1.04	155,524		15,552	15,552	15,552	15,552	15,552	15,552	15,552	15,552
Hot Water	Low Flow Faucet Aerator - Kitchen	10.0	10,487	1.04	109,061		10,906	10,906	10,906	10,906	10,906	10,906	10,906	10,906
Hot Water	HW Pipe Insulation	15.0	10,476	0.80	125,709	-	8,381	8,381	8,381	8,381	8,381	8,381	8,381	8,381
HVAC	Advanced Thermostat - IE Pilot	11.0	18,888	NA**	207,771	-	18,888	18,888	18,888	18,888	18,888	18,888	18,888	18,888
CY2019 Program Total Contribution to CPAS			32,402,596		154,375,070		27,437,474	27,437,474	20,918,634	20,918,634	20,918,634	9,647,039	8,672,165	6,062,228
Historic Program Total Contribution to CPAS‡						24,166,376	24,166,376	23,944,635	20,024,140	20,024,140	19,830,453	19,455,757	17,290,527	17,290,527
Program Total CPAS						24,166,376	51,603,850	51,382,108	40,942,774	40,942,774	40,749,087	29,102,796	25,962,692	23,352,755
CY2019 Program Incremental Expiring Savings§								-	6,518,839	-	-	11,271,595	974,874	2,609,937
Historic Program Incremental Expiring Savings‡§							-	221,741	3,920,495	-	193,687	374,696	2,165,229	-
Program Total Incremental Expiring Savings§							-	221,741	10,439,334	-	193,687	11,646,291	3,140,103	2,609,937

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	LED Specialty Lamp - Interior	1,944,946	1,944,946	-	-	-	-	-	-	-	-	-	-
Lighting	LED Omnidirectional Bulb - Interior	2,958,317	2,958,317	-	-	-	-	-	-	-	-	-	-
Consumer Electronic	Advanced Power Strip - Tier 1	-	-	-	-	-	-	-	-	-	-	-	-
Lighting	LED Specialty Lamp - Exterior	-	-	-	-	-	-	-	-	-	-	-	-
Lighting	LED Omnidirectional Bulb - Exterior	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Advanced Thermostat	632,992	632,992	632,992	-	-	-	-	-	-	-	-	-
HVAC	Programmable Thermostat - Reprogram	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	Low Flow Showerhead	244,520	244,520	-	-	-	-	-	-	-	-	-	-
Hot Water	Low Flow Faucet Aerator - Bathroom	15,552	15,552	-	-	-	-	-	-	-	-	-	-
Hot Water	Low Flow Faucet Aerator - Kitchen	10,906	10,906	-	-	-	-	-	-	-	-	-	-
Hot Water	HW Pipe Insulation	8,381	8,381	8,381	8,381	8,381	8,381	8,381	-	-	-	-	-
HVAC	Advanced Thermostat - IE Pilot	18,888	18,888	18,888	-	-	-	-	-	-	-	-	-
CY2019 Program Total Contribution to CPAS		5,834,502	5,834,502	660,261	8,381	8,381	8,381	8,381	-	-	-	-	-
Historic Program Total Contribution to CPAS‡		17,264,355	563,628	563,628	563,628	563,628	563,628	-	-	-	-	-	-
Program Total CPAS		23,098,858	6,398,130	1,223,889	572,009	572,009	572,009	8,381	-	-	-	-	-
CY2019 Program Incremental Expiring Savings§		227,726	-	5,174,241	651,881	-	-	-	8,381	-	-	-	-
Historic Program Incremental Expiring Savings‡§		26,172	16,700,727	-	-	-	-	563,628	-	-	-	-	-
Program Total Incremental Expiring Savings§		253,898	16,700,727	5,174,241	651,881	-	-	563,628	8,381	-	-	-	-

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.

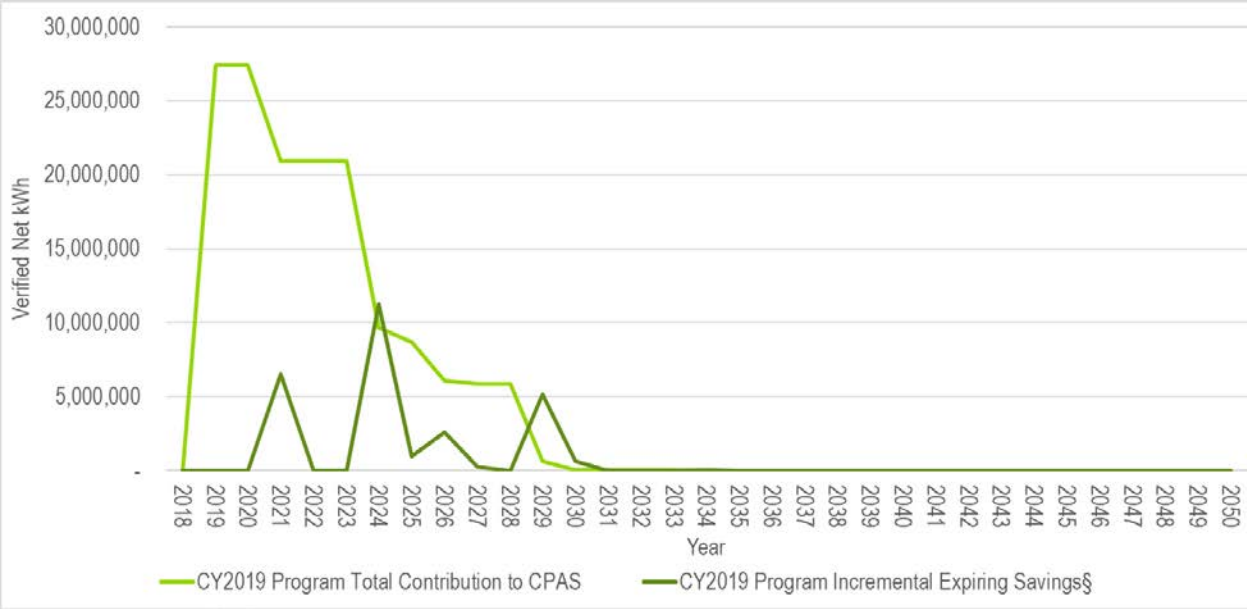
‡ Historic savings go back to CY2018.

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

** The TRM algorithm calculates net savings for advanced thermostats.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings

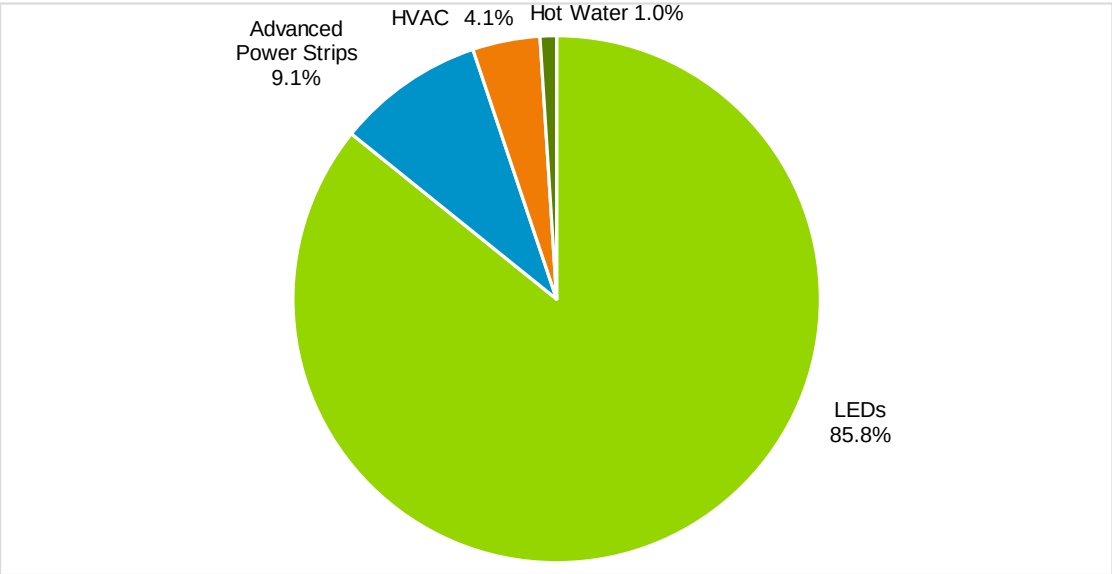


* Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n
Source: Evaluation team analysis

5. Program Savings by Measure

The program includes 13 measures as shown in the following tables. The LED measures collectively represented 85.8 percent of net kWh savings; the next most significant measure was the Advanced Power Strip – Tier 1, representing 9.1 percent of net kWh savings. The advanced thermostat is the only measure with gas savings. ComEd is eligible to claim the gas savings of nine Nest E thermostat installations as part of an income eligible pilot program.

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	LED Specialty Lamp - Interior	14,771,804	0.94	13,902,581	0.84	11,678,168	10.0
Lighting	LED Omnidirectional Bulb - Interior	10,633,654	0.94	9,999,201	0.84	8,399,329	10.0
Consumer Electronics	Advanced Power Strip - Tier 1	2,943,121	1.00	2,943,080	0.85	2,501,618	7.0
Lighting	LED Specialty Lamp - Exterior	2,394,339	0.95	2,280,330	0.84	1,915,477	6.1
Lighting	LED Omnidirectional Bulb - Exterior	1,879,498	0.95	1,790,008	0.84	1,503,606	6.1
HVAC	Advanced Thermostat	650,072	0.97	632,992	NA†	632,992	11.0
HVAC	Programmable Thermostat - Reprogram	328,745	0.95	311,455	0.90	280,310	2.0
HVAC	Programmable Thermostat	266,208	0.95	253,029	0.90	227,726	8.0
Hot Water	Low Flow Showerhead	277,523	0.85	235,115	1.04	244,520	10.0
Hot Water	Low Flow Faucet Aerator - Bathroom	15,929	0.94	14,954	1.04	15,552	10.0
Hot Water	Low Flow Faucet Aerator - Kitchen	13,288	0.79	10,487	1.04	10,906	10.0
Hot Water	HW Pipe Insulation	10,519	1.00	10,476	0.80	8,381	15.0
HVAC	Advanced Thermostat - IE Pilot	1,896	0.94	1,782	NA†	1,782	11.0
	Total	34,186,597	0.95	32,385,490		27,420,368	

* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
† The TRM algorithm calculates net savings for advanced thermostats.
Note: The savings in this table includes secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd.
NA = Not applicable
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	LED Specialty Lamp - Interior	NR	NA	19,322.86	0.84	16,231.20
Lighting	LED Omnidirectional Bulb - Interior	NR	NA	9,751.78	0.84	8,191.50
Consumer Electronics	Advanced Power Strip - Tier 1	NR	NA	412.83	0.85	350.91
Lighting	LED Specialty Lamp - Exterior	NR	NA	923.52	0.84	775.76
Lighting	LED Omnidirectional Bulb - Exterior	NR	NA	723.93	0.84	608.10
HVAC	Advanced Thermostat	NR	NA	872.78	NA†	872.78
HVAC	Programmable Thermostat - Reprogram	NR	NA	0.00	0.90	0.00
HVAC	Programmable Thermostat	NR	NA	0.00	0.90	0.00
Hot Water	Low Flow Showerhead	NR	NA	970.81	1.04	1,009.64
Hot Water	Low Flow Faucet Aerator - Bathroom	NR	NA	821.14	1.04	853.99
Hot Water	Low Flow Faucet Aerator - Kitchen	NR	NA	105.92	1.04	110.15
Hot Water	HW Pipe Insulation	NR	NA	1.20	0.80	0.96
HVAC	Advanced Thermostat - IE Pilot	NR	NA	2.93	NA†	2.93
	Total	NR	NA	33,909.69		29,007.91

* A deemed value. Source: Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
† The TRM algorithm calculates net savings for advanced thermostats.
NR = Not reported
NA = Not applicable
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	LED Specialty Lamp - Interior	2,209.57	0.95	2,106.19	0.84	1,769.20
Lighting	LED Omnidirectional Bulb - Interior	1,308.83	0.95	1,248.23	0.84	1,048.51
Consumer Electronics	Advanced Power Strip - Tier 1	330.25	1.00	330.27	0.85	280.73
Lighting	LED Specialty Lamp - Exterior	264.09	0.95	252.12	0.84	211.78
Lighting	LED Omnidirectional Bulb - Exterior	207.31	0.95	197.63	0.84	166.01
HVAC	Advanced Thermostat	202.08	1.01	203.36	NA†	203.36
HVAC	Programmable Thermostat - Reprogram	0.00	NA	0.00	0.90	0.00
HVAC	Programmable Thermostat	0.00	NA	0.00	0.90	0.00
Hot Water	Low Flow Showerhead	31.37	0.86	26.99	1.04	28.07
Hot Water	Low Flow Faucet Aerator - Bathroom	21.62	0.84	18.07	1.04	18.79
Hot Water	Low Flow Faucet Aerator - Kitchen	2.94	0.79	2.33	1.04	2.42
Hot Water	HW Pipe Insulation	1.20	1.00	1.20	0.80	0.96
HVAC	Advanced Thermostat - IE Pilot	0.70	0.97	0.68	NA†	0.68
	Total	4,579.97	0.96	4,387.06		3,730.51

* A deemed value. Source: Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
† The TRM algorithm calculates net savings for advanced thermostats.
NR = Not reported
NA = Not applicable
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	LED Specialty Lamp - Interior	0	NA	0	0.84	0	10.0
Lighting	LED Omnidirectional Bulb - Interior	0	NA	0	0.84	0	10.0
Consumer Electronics	Advanced Power Strip - Tier 1	0	NA	0	0.85	0	7.0
Lighting	LED Specialty Lamp - Exterior	0	NA	0	0.84	0	6.1
Lighting	LED Omnidirectional Bulb - Exterior	0	NA	0	0.84	0	6.1
HVAC	Advanced Thermostat	0	NA	0	NA†	0	10.0
HVAC	Programmable Thermostat - Reprogram	0	NA	0	0.90	0	2.0
HVAC	Programmable Thermostat	0	NA	0	0.90	0	8.0
Hot Water	Low Flow Showerhead	0	NA	0	1.04	0	10.0
Hot Water	Low Flow Faucet Aerator - Bathroom	0	NA	0	1.04	0	10.0
Hot Water	Low Flow Faucet Aerator - Kitchen	0	NA	0	1.04	0	10.0
Hot Water	HW Pipe Insulation	0	NA	0	0.80	0	15.0
HVAC	Advanced Thermostat - IE Pilot	617	0.95	584	NA†	584	10.0
	Total Therms	617	0.95	584		584	
	Total kWh Converted from Therms‡	18,075	27.74	17,106		17,106	

* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
† The TRM algorithm calculates net savings for advanced thermostats.
‡ Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).
NR = Not reported
NA = Not applicable
Source: ComEd tracking data and evaluation team analysis

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

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Lighting	LED Specialty Lamp - Interior	14,771,804	0.94	13,902,581	0.84	11,678,168
Lighting	LED Omnidirectional Bulb - Interior	10,633,654	0.94	9,999,201	0.84	8,399,329
Consumer Electronics	Advanced Power Strip - Tier 1	2,943,121	1.00	2,943,080	0.85	2,501,618
Lighting	LED Specialty Lamp - Exterior	2,394,339	0.95	2,280,330	0.84	1,915,477
Lighting	LED Omnidirectional Bulb - Exterior	1,879,498	0.95	1,790,008	0.84	1,503,606
HVAC	Advanced Thermostat	650,072	0.97	632,992	NA†	632,992
HVAC	Programmable Thermostat - Reprogram	328,745	0.95	311,455	0.90	280,310
HVAC	Programmable Thermostat	266,208	0.95	253,029	0.90	227,726
Hot Water	Low Flow Showerhead	277,523	0.85	235,115	1.04	244,520
Hot Water	Low Flow Faucet Aerator - Bathroom	15,929	0.94	14,954	1.04	15,552
Hot Water	Low Flow Faucet Aerator - Kitchen	13,288	0.79	10,487	1.04	10,906
Hot Water	HW Pipe Insulation	10,519	1.00	10,476	0.80	8,381
HVAC	Advanced Thermostat - IE Pilot	19,970	0.95	18,888	NA†	18,888
	Total‡	34,204,672	0.95	32,402,596		27,437,474

* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
† The TRM algorithm calculates net savings for advanced thermostats.
‡ The total includes the electric equivalent of the total therms.
NR = Not reported
NA = Not applicable
Source: ComEd tracking data and evaluation team analysis

The HEA Program includes measures that save water. That reduction in water produces secondary kWh savings from water supply and wastewater treatment. Table 5-6 shows the secondary measure level savings. The savings in this table are included within the electricity savings in the previous tables in this section.

Table 5-6. Secondary Energy Savings from Water Reduction by Measure – Electric

End Use Type	Research Category	Ex Ante Annual Water Savings (gallons)	Ex Ante Gross Savings (kWh)*	Verified Gross Realization Rate (RR_{water})	Verified Gross Savings (kWh)	NTG†	Verified Net Savings (kWh)
Lighting	LED Specialty Lamp - Interior	NA	NA	NA	NA	NA	NA
Lighting	LED Omnidirectional Bulb - Interior	NA	NA	NA	NA	NA	NA
Consumer Electronics	Advanced Power Strip - Tier 1	NA	NA	NA	NA	NA	NA
Lighting	LED Specialty Lamp - Exterior	NA	NA	NA	NA	NA	NA
Lighting	LED Omnidirectional Bulb - Exterior	NA	NA	NA	NA	NA	NA
HVAC	Advanced Thermostat	NA	NA	NA	NA	NA	NA
HVAC	Programmable Thermostat - Reprogram	NA	NA	NA	NA	NA	NA
HVAC	Programmable Thermostat	NA	NA	NA	NA	NA	NA
Hot Water	Low Flow Showerhead	1,916	7.16	1,015.18	7,266	1.04	7,556
Hot Water	Low Flow Faucet Aerator - Bathroom	168	0.62	1,067.97	667	1.04	694
Hot Water	Low Flow Faucet Aerator - Kitchen	110	0.42	946.86	395	1.04	411
Hot Water	HW Pipe Insulation	NA	NA	NA	NA	NA	NA
HVAC	Advanced Thermostat - IE Pilot	NA	NA	NA	NA	NA	NA
	Total	2,194	8.20	1,015.72	8,328		8,662

Note: The savings in this table reflects only secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd, not those claimed by gas utilities.
* Ex ante gross savings (kWh) were not directly reported in the tracking data. These values were produced by multiplying the reported ex ante annual water savings by the appropriate ΔE_{water} value (2,937 kWh/Million Gallons in Cook County, 5,010 kWh/Million Gallons in other counties).
† A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
NR = Not reported
NA = Not applicable
Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

6.1 Impact Parameter Estimates

Table 6-1 summarizes the parameters and references used in the verified gross and net savings calculations. Guidehouse calculated savings for each measure following algorithms defined by the Illinois Technical Reference Manual (TRM) version 7.0 and TRM v7.0 Errata, where applicable, which can be found in Section 7(Appendix 1).

The lifetime energy and demand savings are estimated by multiplying the verified savings by the effective useful life for each measure.

Table 6-1. Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	# measures	Evaluated	Program Tracking Data
NTG	Varies		Deemed	SAG Consensus
Advanced Power Strip – Tier 1	71.1	kWh		TRM v7.0 – Section 5.2.1
HW Pipe Insulation	Varies	kWh		TRM v7.0 – Section 5.4.1
Low Flow Faucet Aerator - Bathroom	Varies	kWh		TRM v7.0 Errata – Section 5.4.4
Low Flow Faucet Aerator - Kitchen	Varies	kWh		TRM v7.0 Errata – Section 5.4.4
Low Flow Showerhead	Varies	kWh		TRM v7.0 Errata – Section 5.4.5
Advanced Thermostat	Varies	kWh and/or therms		TRM v7.0 – Section 5.3.16
Programmable Thermostat	Varies	kWh		TRM v7.0 – Section 5.3.11
Programmable Thermostat – Reprogram	Varies	kWh		TRM v7.0 – Section 5.3.11
LED Omnidirectional Bulb – Exterior	Varies	kWh		TRM v7.0 – Section 5.5.8
LED Omnidirectional Bulb – Interior	Varies	kWh		TRM v7.0 – Section 5.5.8
LED Specialty Lamp	Varies	kWh		TRM v7.0 – Section 5.5.6
LED Specialty Lamp – Recessed/Track	Varies	kWh		TRM v7.0 – Section 5.5.6

* 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 Other Impact Findings and Recommendations

6.2.1 All Measures: Master Measure Database (MMDB[2]) and Ex Ante Mismatch

The differences between the ex ante and verified per unit gross savings estimates by research category are discussed below.

Finding 1: The ex ante savings in the tracking data were often inconsistent with those in the Master Measure Database (MMDB). The MMDB values tended to agree with, or were close to, the verified savings values, while the ex ante savings values reported in the tracking data were not. Examples are included in Table 6-2.

This may be due to the use of a universal NTG value (0.8) when converting ex ante net savings to ex ante gross savings, rather than measure-specific NTG values.

Recommendation 1: Guidehouse recommends that Franklin Energy correct the tracking data ex ante savings to align with the savings calculated in the MMDB. Franklin should use measure-specific NTG values (see Table 4-3).

[2] 'CY2019 HEA DI Savings Values v9.0,' Tab: 'Option 1 (FES).'

Table 6-2. MMDB Tracking Data Savings Discrepancies

Research Category	Sample Project ID	Tracking Data Gross Unit kWh Savings	MMDB Gross Unit kWh Savings
Low Flow Showerhead	4097181	269	207
Low Flow Aerator	3688723	26.5	21.2
LED Omnidirectional Bulb - Interior	3750162	27.0	25.7

Source: Guidehouse Analysis of CY2019 Tracking Data and "CY2019 HEA DI Savings Values v9.0"

6.2.2 All Measures: Building Type

For CY2019, ComEd has indicated that they are defining Multi Family (MF) as a building with four or more units.[3] Guidehouse used this working definition to determine its mapping for CY2019. Guidehouse used the following building type mapping as shown in the table below:

Table 6-3. Home Type Definition

Tracking Data Residential_Building_Type	Guidehouse Assigned Building Type
One Unit	Single Family
Two Unit	Single Family
Three Unit	Single Family
Four Unit	Multi Family
Five Unit	Multi Family
Condo (6 or More)	Multi Family
Mobile Home	Mobile Home

Source: Guidehouse Analysis of CY2019 Tracking Data

Finding 2: Not all multifamily aerator, showerhead, and thermostat projects had "CONDO" in the MeasureName.

There are several project IDs with a multifamily building type (defined in Table 6-3) that do not have "CONDO" in the MeasureName.

Guidehouse searched the address of several projects in which there was a multifamily building type (e.g., "Condo (6 or More)"), but "CONDO" was not in the MeasureName (e.g., "Gas Tstat – Nest ($150) Baseline Manual)"). Guidehouse found that most of the addresses it searched appeared to be multifamily units.

For these projects Guidehouse used multifamily inputs, and the ex ante savings incorrectly used single family inputs.

[3] Gutierrez, Vincent. "Re: HEA - Res Building Type." Message to Nishant Mehta. October 01, 2018. E-mail.

Table 6-4. Multifamily Projects without "CONDO" in the MeasureName

Research Category	Example Project IDs
Advanced Thermostat	3738571, 3834043, 359159
Programmable Thermostat - Reprogram	4094422, 3767599, 3722056
Programmable Thermostat	3703484, 3735787, 3858556
Low Flow Showerhead	3725952, 3723480, 3736067
Low Flow Faucet Aerator - Bathroom	3778982, 3758869, 3761986
Low Flow Faucet Aerator - Kitchen	3858556, 3728868, 3699251

Source: Guidehouse Analysis of CY2019 Tracking Data

Recommendation 2: Guidehouse recommends that Franklin Energy search through these projects and correct the MeasureName to include "CONDO" when appropriate and recalculate savings using the proper inputs according to each project's corrected building type.

6.2.3 Hot Water

The table below shows realization rate details for hot water measures.

Table 6-5. Verified Measure Total Savings – Hot Water

End Use Type	Research Category	Unit	Ex Ante Gross kWh Savings	Ex Ante Gross Peak kW Savings	Verified Gross kWh Savings	Verified Gross kWh Savings (Water)	Verified Gross Peak kW Savings	kWh Savings RR	Peak kW Savings RR
Hot Water	Electric Showerhead	each	145,950	16	118,443	3,733	13	0.81	0.83
Hot Water	Electric Showerhead - Handheld	each	86,439	9	70,176	2,233	8	0.81	0.83
Hot Water	Electric Showerhead - CONDO	each	27,216	4	28,055	801	4	1.03	1.01
Hot Water	Electric Showerhead - Handheld - CONDO	each	17,917	2	18,441	499	2	1.03	1.01
Hot Water	Electric Pipe Insulation - (DHW) Outlet	linear foot	10,519	1	10,476	0	1	1.00	1.00
Hot Water	Electric Aerator - Bathroom	each	11,269	17	10,137	468	13	0.90	0.79
Hot Water	Electric Aerator - Kitchen	each	11,249	2	8,420	323	2	0.75	0.75
Hot Water	Electric Aerator - Bathroom - CONDO	each	4,661	5	4,817	200	5	1.03	1.01
Hot Water	Electric Aerator - Kitchen - CONDO	each	2,040	1	2,067	72	1	1.01	0.98

Source: Guidehouse Analysis of CY2019 Tracking Data

Finding 3: Water supply and treatment kWh savings were not separately reported in the tracking data. In addition to energy savings from the water heater for showerheads and aerators, TRM v7.0 includes kWh savings from water supply and wastewater treatment for water savings measures. Secondary savings are excluded from ex ante gross savings. Guidehouse and ComEd agreed that ComEd would provide gallon savings and Guidehouse would convert to kWh. Gallon savings were included in the tracking data.

Recommendation 3: Guidehouse recommends that Franklin Energy report, in a separate field, the secondary water supply and treatment kWh savings in the tracking data for showerhead and aerator measures.

Finding 4: The ex ante water savings reported in the 'Calculated_Total_Gross_Gallon' field are off by a factor of 1,000. For example, the highest reported faucet aerator annual water savings are 2.06 gallons. It should be approximately 2,006 gallons (see example in TRM v7.0 5.4.4). ComEd clarified that reported water savings are in kilogallons.

Recommendation 4: Guidehouse recommends that Franklin Energy change the 'Calculated_Total_Gross_Gallon' data from kilogallons to gallons or rename the field to 'Calculated_Total_Gross_kiloGallon.'

Finding 5: Aerator inputs do not appear to match TRM v7.0. Due to the inconsistencies between the ex ante and MMDB savings (see Table 6-2), Guidehouse was unable to definitively determine the GPM_base and GPM_low values Franklin Energy used to calculate savings for aerators. Given the differences in verified and MMDB inputs (see Table 6-5), Guidehouse believes there may be differences between the sets of GPM inputs used for verified and ex ante savings.

In order to ensure consistency of inputs across the joint programs, Guidehouse used the custom values used by the Home Energy Jumpstart (HEJ) program run by PGL and NSG, specified in the table below.

Table 6-6. Hot Water Measure Inputs

Measure	Input	PGL and NSG HEJ Inputs (Verified)	HEA MMDB Inputs (Ex Ante)
Aerator - Bathroom	GPM_base	1.530	1.5355
Aerator - Bathroom	GPM_low	0.969	0.969
Aerator - Kitchen	GPM_base	1.630	1.6351
Aerator - Kitchen	GPM_low	1.406	1.406

Source: Peoples Gas-North Shore Gas. "RESIDENTIAL MMDB PY8 – Verification.xlsx"

Recommendation 5: Guidehouse recommends Franklin Energy clarify which GPM_base and GPM_low values they used to calculate ex ante savings.

Finding 6: Showerhead gross savings do not appear to match TRM v7.0. Given the differences in ex ante and verified savings (see Table 6-7), Guidehouse believes that the differences in savings are due to misuse of a global NTG value when converting ex ante net saving to ex ante gross savings (Finding 1), and the use of single family inputs for measures without CONDO in the MeasureName installed in mutltifamily buildings (Finding 2).

Recommendation 6: Guidehouse recommends that the implementer implement Recommendations 1 and 2 and, if discrepancies persist, review the inputs Guidehouse used (see Table 6-7 below) and correct the inputs used to calculate ex ante savings.

Table 6-7. Showerhead Measure Inputs

Measure	Residential Building Type	Sample project id	GPM_base	GPM_low	Household	SPH	ISR	Ex Ante Gross kWh/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings RR
Low Flow Showerhead	Single Family	4097181	2.24	1.5	2.56	1.79	0.98	269.3	216.3	80.3%
Low Flow Showerhead	Multi Family	3918743	2.24	1.5	2.10	1.30	0.95	226.8	236.8	104%
Low Flow Showerhead	Multi Family	4068945	2.24	1.5	2.10	1.30	0.95	269.3	236.8	88.0%

Source: Guidehouse Analysis of CY2019 Tracking Data

6.2.4 Electric Pipe Insulation

Finding 7: Water inputs' columns are missing data. Guidehouse found the following inputs, which may be used for pipe insulation and aerator measures, were blank for all entries in the tracking data: "Pipe_Insulation_Rnew_Value," "GPM_base," "GPM_low," "C_exist," "C_new." Guidehouse used the TRM default values for these inputs.

Recommendation 7: Guidehouse recommends that Franklin Energy collect these values on-site and report them in the tracking data, when feasible.

6.2.5 HVAC

The table below shows the electric savings realization rate details for HVAC measures.

Table 6-8. Verified Measure Total Savings - HVAC

End Use Type	Research Category	Unit	Ex Ante Gross kWh Savings	Ex Ante Gross Peak kW Savings	Verified Gross kWh Savings	Verified Gross Peak kW Savings	kWh Savings RR	Peak kW Savings RR
HVAC	Gas Tstat - Nest E ($75) Baseline Program	each	208,082	81.14	206,252	81.60	0.99	1.01
HVAC	Gas Tstat - Furnace - Re-Program	each	169,988	0.00	166,530	0.00	0.98	NA
HVAC	Gas Tstat - Nest ($150) Baseline Manual	each	144,638	49.38	144,366	49.92	1.00	1.01
HVAC	Gas Tstat - Furnace - Program	each	120,036	0.00	117,378	0.00	0.98	NA
HVAC	Gas Tstat - Nest ($150) Baseline Program	each	84,982	33.14	85,276	33.49	1.00	1.01
HVAC	Electric Tstat - Resistance - Program	each	87,782	0.00	81,352	0.00	0.93	NA
HVAC	Electric Tstat - Resistance - Re-Program	each	85,200	0.00	75,143	0.00	0.88	NA
HVAC	Electric Tstat - Heat Pump - Re-Program	each	73,557	0.00	69,783	0.00	0.95	NA
HVAC	Gas Tstat - Nest E ($75) Baseline Manual	each	66,847	22.82	66,533	23.03	1.00	1.01
HVAC	Electric Tstat - Heat Pump - Program	each	58,391	0.00	54,299	0.00	0.93	NA
HVAC	Electric Tstat - Nest E ($75) - Resistance - Program	each	62,156	3.82	54,190	3.63	0.87	0.95
HVAC	Electric Tstat - Nest ($150) - Resistance - Program	each	55,544	3.41	49,806	3.28	0.90	0.96
HVAC	Gas Tstat - Nest E ($75) Baseline Program CONDO	each	8,256	3.72	8,414	3.79	1.02	1.02
HVAC	Electric Tstat - Nest ($150) - Heat Pump - Program	each	7,573	0.73	6,337	0.67	0.84	0.91
HVAC	Gas Tstat - Nest ($150) Baseline Manual CONDO	each	4,234	1.69	4,194	1.67	0.99	0.99
HVAC	Electric Tstat - Nest E ($75) - Heat Pump - Program	each	3,366	0.32	3,114	0.32	0.93	0.99
HVAC	Gas Tstat - Nest ($150) Baseline Program CONDO	each	2,702	1.22	2,781	1.25	1.03	1.03
HVAC	Gas Tstat - Nest E ($75) Baseline Manual CONDO	each	1,693	0.68	1,729	0.70	1.02	1.03
HVAC	Gas Tstat - Smart Stat (IE Pilot - $0) Baseline Manual	each	952	0.32	832	0.29	0.87	0.90
HVAC	Gas Tstat - Smart Stat (IE Pilot - $0) Baseline Program	each	625	0.24	635	0.25	1.02	1.03
HVAC	Gas Tstat - Smart Stat (IE Pilot - $0) Baseline Manual CONDO	each	169	0.07	168	0.07	0.99	1.03
HVAC	Gas Tstat - Smart Stat (IE Pilot - $0) Baseline Program CONDO	each	150	0.07	148	0.07	0.98	1.03

NA = Not applicable

Findings 8 through 9 outline differeneces between ex ante and verified calculations that had a direct impact on savings, while Findings 10 through 13 document assumptions that may have, but likely did not, have an impact on savings.

Finding 8: Franklin Energy claimed savings for more than one thermostat per home. Guidehouse averaged the savings for thermostats installed in the same home.

There were instances where Franklin Energy claimed savings for more than one thermostat per "Account Number." Per TRM v7.0, savings for only one thermostat can be claimed per household. This occurred in about 1.6 percent of projects. Examples of this finding are Project ID 3933478 and 4034419.

Note the TRM assigns "household energy savings" for thermostat measures. To determine the appropriate savings, Guidehouse assumed all installed thermostats shared equal responsibility for this "household energy savings." Thus, we averaged savings of all thermostats for a given account number. For example, a home with two claimed thermostats, one with 100 kWh savings and another with 200 kWh savings, would achieve verified savings of 150 kWh total savings.

Recommendation 8: Guidehouse recommends ComEd claim savings for only one programmable or one advanced thermostat per household.

Finding 9: Ex ante savings for thermostat measures did not account for differences in climate zone. The cooling degree days (CDD) and heating degree days (HDD) climate zones should be based off of each project's zip code in the tracking data. For example, all projects with the measure name "Gas Tstat – Nest E ($75 Baseline Program)" had an ex ante savings of 208 kWh regardless of climate zone.

Recommendation 9: Guidehouse recommends Franklin Energy use appropriate inputs based off of climate zones.

Finding 10: The heating fuel in the MeasureName field did not always match the value in the Heating_Fuel field. Guidehouse used the MeasureName column to determine Heating Fuel. Guidehouse found differences in the heating fuel indicated by the "MeasureName" and "Heating_Fuel" fields in the tracking data. This discrepancy appeared in approximately four percent of HVAC projects. For example, several projects (e.g., project IDs 3855670, 3692555, 4139445) have "Natural Gas" in the Heating_Fuel field, but the measure name begins with "Electric" implying electric heating.

In PY9, Franklin Energy informed Guidehouse that the "MeasureName" is more accurate than data in tracked fields. Therefore, in order to determine a home's heating fuel, Guidehouse deferred to the "MeasureName" column where all measures either began with "Gas" – implying natural gas heating – or Electric" – implying electric heating.

Recommendation 10: Guidehouse recommends Franklin Energy record heating fuel in the measure name and "Heating_Fuel" field consistently for each project.

Finding 11: The heating fuel in the MeasureName field did not always match the value in the Heating_System_Type field. Guidehouse used the MeasureName column to determine Heating System type. Like Finding 10 above, Guidehouse found differences in the heating system type indicated by the "MeasureName" and "Heating_System_Type" fields in the tracking data. For example, project ID 4064690 has "Boiler" in the Heating_System_Type field, but "Resistance" in the measure name, implying electric resistance heating.

In PY9, Franklin Energy informed Guidehouse that the "MeasureName" is more accurate than data in tracked fields. Therefore, in order to determine a home's heating system type, Guidehouse deferred to the "MeasureName" column where all measures contained either "Resistance" – implying electric resistance heating – "Heat Pump" – implying heat pump heating – or "Furnace" or "Gas" – implying furnace heating.

Recommendation 11: Guidehouse recommends Franklin Energy record heating system type in the measure name and "Heating_System_Type" field consistently for each project.

Finding 12: The existing thermostat type in the MeasureName field did not always match the value in the Existing_Thermostat_Type field. Guidehouse used the MeasureName column to determine existing thermostat type. Guidehouse found differences in the existing thermostat type indicated by the "MeasureName" and "Existing_Thermostat_Type" fields in the tracking data. One significant discrepancy was the 123 projects with "Smart" in the Existing_Thermostat_Type field. All measure names list a baseline thermostat of Manual or Programmable, none of them have a smart thermostat baseline. Example ProjectIDs include 3861625, 4044781, 3831957, 3754011, 4021841.

In PY9, Franklin Energy informed us that the "MeasureName" is more accurate than data in tracked fields. Therefore, in order to determine a home's existing thermostat type, Guidehouse deferred to the "MeasureName" column where all measures contained either "Program" – implying an existing programmable thermostat– or "Manual" – implying an existing manual thermostat.

Recommendation 12: Guidehouse recommends Franklin Energy confirm there were no smart thermostat baselines and Guidehouse recommends Franklin Energy record existing thermostat type in the measure name and "Existing_Thermostat_Type" field consistently for each project.

Finding 13: There were several instances where a smart thermostat measure's cooling system type was not "Central AC," which is the cooling type assumed by TRM v7.0. Guidehouse assumed that all smart thermostat measures had a cooling type of "Central AC." TRM 7.0's "5.3.16 Advanced Thermostats" section consistently assumes a central AC unit: the coincidence factors are defined for central AC units, and the SEER values are defined for air source heat pump and central AC and not window AC. Guidehouse was unable to find an example of a smart thermostat technically capable of controlling a window AC unit.

Projects with window AC may still claim electric heating savings if eligible. Based on the "Cooling_System_Type" field in the tracking data, the one percent of advanced thermostat projects that had window AC also had gas heating (project IDs: 3774825, 4064742, 3962626, 4139451, 3719194, 3757897, 4075100, 4092158).

Recommendation 13: Guidehouse recommends FranklinEnergy record cooling system type for each project according to program guidelines. If the Cooling System Type is, in fact, not Central AC, the savings should not be counted.

6.2.6 Lighting

Finding 14: Ex ante savings are inconsistent with TRM v7.0 inputs. Ex ante savings consistently overestimated electric savings, determined using TRM v7.0 inputs, by approximately five percent. This is likely due to the misapplication of a program-wide NTG value (see Finding 1).

Recommendation 14: Guidehouse recommends Franklin Energy use a NTG value of 0.84 when converting ex ante net savings to ex ante gross savings for lighting measures in CY2019.

Table 6-9. Lighting Baseline Adjustments

MeasureName	WattsBase	WattsEE	Specialty Bulb Type	Baseline Adjustment Year	WattsBase After Baseline Adjustment
Exterior LED - 11W (75W)	53	11		2021	28.2
Exterior LED - 15W (100W)	72	15		2021	45.4
Exterior LED - 15W PAR38 (120W)	120	15	Exterior reflector	2024	43.5
Exterior LED - 5W Candelabra (40W)	40	5	Exterior reflector	2024	8.9
Exterior LED - 6W (40W)	29	6		2024	11.8
Exterior LED - 8W Flood (65W)	65	8	Exterior reflector	2024	18.4
Exterior LED - 9W (60W)	43	9		2021	20.0
Interior LED - 11W (75W)	53	11		2021	28.2
Interior LED - 15W (100W)	72	15		2021	45.4
Interior LED - 5W Candelabra (40W)	40	5	Candelabra	2024	8.9
Interior LED - 6/12/19W 3-Way (50/100/150W)	75	12	Three-way	2024	30.0
Interior LED - 6W (40W)	29	6		2021	11.8
Interior LED - 6W Globe (40/60W)	50	6	Globe	2024	12.2
Interior LED - 7W Mini-Flood PAR20 (45W)	45	7	Interior reflector	2024	11.1
Interior LED - 7W Mini-Flood PAR20 (50W)	50	7	Interior reflector	2024	13.8
Interior LED - 7W Track Light (50W)	50	7	Interior reflector	2024	12.8
Interior LED - 7W Track Light (50W) - Pin Base GU5.3	50	7	Interior reflector	2024	12.8
Interior LED - 8W Flood (65W)	65	8	Interior reflector	2024	18.4
Interior LED - 9W (60W)	43	9		2021	20.0

Heating Penalty

Finding 15: Guidehouse used the "Heating_Fuel" field to inform the heating penalties. However, as explained in Finding 10, the "Heating_Fuel" field is often inaccurate and disagrees with the heating fuel specified in the thermostat measure's measure name. However, unlike thermostat measures which begin with "Gas" or "Electric" there is no indication of the heating fuel in lighting measures' measure name. To improve the calculations' accuracy, Guidehouse identified lighting projects where thermostats were also installed and used the heating fuel given in the thermostat measure name. This occurred in approximately 37 percent of lighting projects. The remaining 63 percent of lighting projects were forced to use the "Heating_Fuel" field.

Recommendation 15: Guidehouse recommends Franklin Energy accurately record heating fuel in the "Heating_Fuel" field to ensure the accurate calculation of heating penalties.

Finding 16: Guidehouse calculated electric heating penalties for lighting measures. These penalties were included in the calculations for gross and net savings for lighting measures (Table 5-5).

Recommendation 16: Guidehouse recommends Franklin Energy report heating penalties in a separate field in the tracking data and include heating penalties in its ex ante gross and net kWh savings.

7. Appendix 1. Impact Analysis Methodology

Guidehouse calculated verified gross and net savings using the following algorithms as defined by theTRM v7.0 in CY2019.

7.1 Advanced Power Strips

Tier 1:

Verified Gross Annual kWh savings = Deemed Energy Savings Per Unit
Verified Gross Annual kW Savings = Gross Annual Energy Savings / HOU
Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU * CF

7.2 Water Heater Pipe Insulation

Verified Gross Annual kWh Savings = $((C_{exist}/R_{exist} - C_{new}/R_{new}) * \text{Length of Insulation} * \Delta T * 8{,}766) / (\text{Water Heater Efficiency} * 3{,}413)$

Where:

- C_{exist} = Circumference of pipe (ft) (Diameter (in) * π/12)
- C_{new} = Circumference of pipe (ft) (Diameter (in) * π/12)
- R_{exist} = Existing pipe thermal resistance, Deemed
- R_{new} = Total pipe thermal resistance after adding insulation, claimed based on pipe insulation used
- ΔT = Temperature difference between the water in the pipe and the surrounding air, Deemed
- 3,413 = Conversion from BTU to kWh

7.3 Low Flow Faucet Aerators

Verified Gross Annual kWh Savings = $((GPM_{base} * L_{base} – GPM_{low} * L_{low}) * \text{Household} * 365.25 * DF / FPH) * EPG_{electric} * ISR$

Where:

- GPM_{base} = Average baseline flowrate, Gallons per minute, Deemed
- L_{base} = Average baseline daily faucet use per capita, Deemed
- GPM_{low} = Average low flowrate, Gallons per minute, Deemed
- L_{low} = Average baseline daily faucet use per capita, Deemed
- Household = Average number of people per household, Deemed
- 365.25 = Number of days per year
- DF = Drain Factor, Deemed
- FPH = Faucets per household, Deemed
- $EPG_{electric}$ = Energy per gallon of water used supplied by electric water heater, Deemed
- ISR = In Service Rate, Deemed

Verified Gross Annual kW Savings = Gross Annual Energy Savings / HOU
Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU * CF

7.4 Low Flow Showerheads

Verified Gross Annual kWh Savings = ((GPM$_{base}$ * L$_{base}$ – GPM$_{low}$ * L$_{low}$) * Household * SPCD * 365.25 / SPH) * EPG$_{electric}$ * ISR

Where:

- SPCD = Showers per capita per day, Deemed
- SPH = Showers per household, Deemed

Verified Gross Annual kW Savings = Gross Annual Energy Savings / HOU
Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU * CF

7.5 Advanced Thermostats

Guidehouse use the algorithms from the TRM v7.0, Section 5.3.16 to verify savings for advanced thermostats.

Verified Gross Annual kWh Savings = Electric Heating Consumption * Heating Reduction * HF * ISR + (ΔTherms * F_e * 29.3)

Verified Gross Annual Therms Savings = Gas Heating Consumption * Heating Reduction * HF * ISR

Where:

- Heating Reduction = Assumed percentage reduction in total household heating energy consumption due to advanced thermostat, Deemed
- HF = Household Factor, Deemed
- ISR = In Service Rate, Deemed
- F_e = Furnace fan energy consumption as a percentage of annual fuel consumption, Deemed
- 29.3 = kWh per therm conversion

The deemed input parameters for smart thermostats are summarized in the table below.

Table 7-1 Advanced Thermostat - Deemed Savings Input Parameters and Sources

Verified Gross and Net Input Parameters	Value	Data Source
Electric Heating Consumption (Electric Resistance / Heat Pump / Gas)	20,778 / 12,222 / 0	TRM v7.0, Section 5.3.16
Heating Reduction (Manual Baseline / Programmable BL / Unknown BL)	0.088 / 0.056 / 0.070	TRM v7.0, Section 5.3.16
Smart Thermostat HF (Single Family / Mobile home / Multi Family)	1 / 0.83 / 0.65	TRM v7.0, Section 5.3.16
Smart Thermostat ISR	1	TRM v7.0, Section 5.3.16
Smart Thermostat F_e	0.0314	TRM v7.0, Section 5.3.16

7.6 Programmable Thermostats, Reprogramming Thermostats, Thermostat Education

Verified Gross Annual kWh Savings = Electric Heating Consumption * Heating Reduction * HF * ISR + (ΔTherms * F_e * 29.3)

Where:

- Heating Reduction = Assumed percentage reduction in total household heating energy consumption due to programmable thermostat, Deemed
- HF = Household Factor, Deemed
- ISR = In Service Rate, Deemed
- F_e = Furnace fan energy consumption as a percentage of annual fuel consumption, Deemed
- 29.3 = kWh per therm conversion
- ΔTherms is calculated as follows

ΔTherms = %FossHeat * Gas Heating Consumption * Heating Reduction * HF * ISR

7.7 LED Replacement

Verified Gross Annual kWh Savings = Quantity * ΔWatts/1000 * ISR * (1 - Leakage) * HOU * WHF_{energy}

Where:

- ΔWatts = Difference between Baseline Wattage and Efficient (LED) Wattage, Evaluated
- Leakage = Adjustment to account for the percentage of program bulbs that move out of the Utility Jurisdiction, Deemed
- HOU = Annual Hours of Use, Deemed
- WHF_{energy} = Energy Waste Heat Factor, Deemed

Verified Gross Annual kW Savings = Program Bulb Quantity * ΔWatts/1000
Verified Gross Annual Peak kW Savings = Gross Annual kW Savings * Peak Load Coincidence Factor * WHF_{demand}

Where:

- Peak Load Coincidence Factor is calculated as the percentage of program bulbs turned on during peak hours (weekdays from 1 to 5 p.m.) throughout the summer.
- WHF_{demand} = Demand Waste Heat Factor

7.8 Deemed Values

Guidehouse calculated verified gross savings for the CY2018 HEA Program using algorithms, assumptions, and input parameters defined in the TRM v6.0. Table 7-2 shows the deemed input values used in these algorithms and calculations.

Table 7-2. TRM Deemed Savings Input Parameters Used in Verified Analysis

Verified Gross and Net Input Parameters	Value	Data Source
LED ISR	0.969	TRM v7.0, Section 5.5.8
LED Omnidirectional HOU (Interior / Exterior)	1,089 / 2,475	TRM v7.0, Section 5.5.8
LED Specialty HOU (Interior / Exterior)	763 / 2,475	TRM v7.0, Section 5.5.6
LED WHF_{energy} (SF Interior / MF Interior / Exterior)	1.06 / 1.04 / 1.00	TRM v7.0, Section 5.5.8
LED WHF_{demand} (SF Interior / MF Interior / Exterior)	1.11 / 1.07 / 1.00	TRM v7.0, Section 5.5.8
LED Omnidirectional CF (Interior / Exterior)	0.128 / 0.273	TRM v7.0, Section 5.5.8
LED Specialty CF (SF Interior / MF Interior / Exterior)	1.11 / 1.07 / 1.0	TRM v7.0, Section 5.5.6
Faucet Aerator GPM_{base} (Kitchen / Bathroom)	1.63 / 1.53	TRM v7.0, Section 5.4.4
Faucet Aerator L_{base} (Kitchen / Bathroom)	4.5 / 1.6	TRM v7.0, Section 5.4.4
Faucet Aerator GPM_{low} (Kitchen / Bathroom)	1.406 / 0.969	Joint programs (see Table 6-5)
Faucet Aerator L_{low} (Kitchen / Bathroom)	4.5 / 1.6	TRM v7.0, Section 5.4.4
Faucet Aerator Household (Single Family / Multi Family)	2.56 / 2.1	TRM v7.0, Section 5.4.4
Faucet Aerator DF (Kitchen / Bathroom)	0.75 / 0.90	TRM v7.0, Section 5.4.4
Faucet Aerator FPH (Kitchen / SF Bath / MF Bath)	1 / 2.83 / 1.5	TRM v7.0, Section 5.4.4
Faucet Aerator $EPG_{electric}$ (Kitchen / Bathroom)	0.0969 / 0.0795	TRM v7.0, Section 5.4.4
Faucet Aerator ISR (SF Kitchen / MF Kitchen / Bath)	0.95 / 0.91 / 0.95	TRM v7.0, Section 5.4.4
Faucet Aerator Hours (SF K / SF B / MF K / MF B)	102 / 14 / 84 / 22	TRM v7.0, Section 5.4.4
Faucet Aerator CF	0.022	TRM v7.0, Section 5.4.4
Shower GPM_{base}	2.24	TRM v7.0, Section 5.4.5
Shower L_{base}	7.8	TRM v7.0, Section 5.4.5
Shower GPM_{low}	1.5	TRM v7.0, Section 5.4.5
Shower L_{low}	7.8	TRM v7.0, Section 5.4.5
Shower Household (Single Family / Multi Family)	2.56 / 2.1	TRM v7.0, Section 5.4.5
Shower SPCD	0.6	TRM v7.0, Section 5.4.5
Shower SPH (Single Family / Multi Family)	1.79 / 1.3	TRM v7.0, Section 5.4.5
Shower $EPG_{electric}$	0.117	TRM v7.0, Section 5.4.5
Shower ISR (Single Family / Multi Family)	0.98 / 0.95	TRM v7.0, Section 5.4.5
Shower Hours (Single Family / Multi Family)	255 / 208	TRM v7.0, Section 5.4.5
Shower CF	0.0278	TRM v7.0, Section 5.4.5
Advanced Power Strip Energy Savings (Tier 1)	71.1	TRM v7.0, Section 5.2.1
Advanced Power Strip ISR	0.69	TRM v7.0, Section 5.2.1
Advanced Power Strip CF	0.80	TRM v7.0, Section 5.2.1
Advanced Power Strip Hours (Tier 1)	7,129	TRM v7.0, Section 5.2.1

Verified Gross and Net Input Parameters	Value	Data Source
Programmable Thermostat Electric Heating Consumption (CZ 2) (Electric Resistance / Heat Pump / Gas)	20,777 / 12,222 / 0	TRM v7.0, Section 5.3.11
Programmable Thermostat Electric Heating Consumption (CZ 3) (Electric Resistance / Heat Pump / Gas)	17,794 / 10,467 / 0	TRM v7.0, Section 5.3.11
Programmable Thermostat Gas Heating Consumption [Therms] (CZ 2) (Electric Resistance / Heat Pump / Gas)	0 / 0 / 1,005	TRM v7.0, Section 5.3.11
Programmable Thermostat Gas Heating Consumption [Therms] (CZ 3) (Electric Resistance / Heat Pump / Gas)	0 / 0 / 861	TRM v7.0, Section 5.3.11
Programmable Thermostat Heating Reduction	0.062	TRM v7.0, Section 5.3.11
Programmable Thermostat HF (Single Family / Mobile home / Multi Family)	1 / 0.83 / 0.65	TRM v7.0, Section 5.3.11
Programmable Thermostat ISR	1	TRM v7.0, Section 5.3.11
Programmable Thermostat F_e	0.0314	TRM v7.0, Section 5.3.11
DHW R_{exist}	1	TRM v7.0, Section 5.4.1
DHW R_{new}	4.15	TRM v7.0, Section 5.4.1
DHW ΔT	60	TRM v7.0, Section 5.4.1
DHW $\eta DHW_{electric}$	0.98	TRM v7.0, Section 5.4.1
DHW C_{exist}	0.196	TRM v7.0, Section 5.4.1 (0.75” pipe)
DHW C_{new}	0.458	TRM v7.0, Section 5.4.1 (0.75” pipe + 1/2” foam)

8. Appendix 2. Total Resource Cost Detail

Table 8-1 shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to the evaluation team later.

Table 8-1. 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)
Consumer Electronics	Advanced Power Strip - Tier 1	each	41,411	7.0	No	2,943,080	330.27	0	0	0	0.85	0.85	0.85	2,501,618	280.73	0	0	0
Hot Water	HW Pipe Insulation	linear foot	778	15.0	No	10,476	1.20	0	0	0	0.80	0.80	0.80	8,381	0.96	0	0	0
Hot Water	Low Flow Faucet Aerator - Bathroom	each	574	10.0	No	14,287	18.07	0	0	0	1.04	1.04	1.04	14,858	18.79	0	0	0
Hot Water	Low Flow Faucet Aerator - Kitchen	each	169	10.0	No	10,091	2.33	0	0	0	1.04	1.04	1.04	10,495	2.42	0	0	0
Hot Water	Low Flow Showerhead	each	1,062	10.0	No	227,850	26.99	0	0	0	1.04	1.04	1.04	236,964	28.07	0	0	0
HVAC	Advanced Thermostat	each	2,470	11.0	No	632,992	203.36	0	0	0	NA‖	NA‖	NA‖	632,992	203.36	0	0	0
HVAC	Advanced Thermostat - IE Pilot	each	9	11.0	No	1,782	0.68	584	0	0	NA‖	NA‖	NA‖	1,782	0.68	584	0	0
HVAC	Programmable Thermostat	each	2,215	8.0	No	253,029	0.00	0	0	0	0.90	0.90	0.90	227,726	0.00	0	0	0
HVAC	Programmable Thermostat - Reprogram	each	3,098	2.0	No	311,455	0.00	0	0	0	0.90	0.90	0.90	280,310	0.00	0	0	0
Lighting	LED Omnidirectional Bulb - Exterior‡	each	15,768	6.1	No	1,790,008	197.63	0	0	0	0.84	0.84	0.84	1,503,606	166.01	0	0	0
Lighting	LED Omnidirectional Bulb - Interior‡	each	256,928	10.0	No	9,999,201	1,248.23	0	0	0	0.84	0.84	0.84	8,399,329	1,048.51	0	0	0
Lighting	LED Specialty Lamp - Exterior‡	each	17,215	6.1	No	2,280,330	252.12	0	0	0	0.84	0.84	0.84	1,915,477	211.78	0	0	0
Lighting	LED Specialty Lamp - Interior‡	each	381,307	10.0	No	13,902,581	2,106.19	0	0	0	0.84	0.84	0.84	11,678,168	1,769.20	0	0	0
	Total		723,003			32,377,162	4,387.06	584	0	0				27,411,706	3,730.51	584	0	0

Note: The verified gross kWh and net kWh excludes secondary energy savings from water reduction measures (Table 8-1 shows difference of kWh savings from Table 5-1 and Table 5-6)
* The total of the EUL column is the weighted average measure life (WAML), and is calculated as the sum product of EUL and measure savings divided by total program savings.
† Early Replacement (ER) measures are flagged as YES, otherwise a NO is indicated in the column.
‡ The annual savings for this measure vary over time. See the CPAS tables (Table 4-1 to Table 4-3).
|| The TRM algorithm calculates net savings for advanced thermostats.
NA = Not applicable
Source: ComEd tracking data and evaluation team analysis