



ComEd Home Energy Assessment Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2018 (CY2018)
(01/01/2018-12/31/2018)

Presented to
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FINAL

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TABLE OF CONTENTS

1. Introduction	1
2. Program Description	1
3. Program Savings Detail	3
4. Cumulative Persisting Annual Savings	4
5. Program Savings by Measure	10
6. Impact Analysis Findings and Recommendations	13
6.1 Impact Parameter Estimates	13
6.2 Other Impact Findings and Recommendations	13
6.2.1 All Measures: Building Type	13
6.2.2 Hot Water	14
6.2.3 HVAC	15
6.2.4 Lighting	17
7. Appendix 1. Impact Analysis Methodology	18
7.1 Advanced Power Strips	18
7.2 Water Heater Pipe Insulation	18
7.3 Low Flow Faucet Aerators	18
7.4 Low Flow Showerheads	19
7.5 Advanced Thermostats	19
7.6 Programmable Thermostats, Reprogramming Thermostats, Thermostat Education	20
7.7 LED Replacement	20
7.8 Deemed Values	21
8. Appendix 2. Total Resource Cost Detail	22

LIST OF TABLES AND FIGURES

Figure 2-1. Percent of Measures Installed by Type	3
Figure 4-1. Cumulative Persisting Annual Savings	10
Table 2-1. CY2018 Volumetric Findings Detail	2
Table 3-1. CY2018 Total Annual Incremental Electric Savings	4
Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric	5
Table 4-2. Cumulative Persisting Annual Savings (CPAS) – Gas	7
Table 4-3. Cumulative Persisting Annual Savings (CPAS) – Total	9
Table 5-1. CY2018 Energy Savings by Measure – Electric	10
Table 5-2. CY2018 Demand Savings by Measure	11
Table 5-3. CY2018 Summer Peak Demand Savings by Measure	11
Table 5-4. CY2018 Energy Savings by Measure – Gas	12
Table 5-5. CY2018 Energy Savings by Measure – Total Combining Electricity and Gas	12
Table 6-1. Savings Parameters	13
Table 6-2 Home Type Definition	14
Table 6-3 Impact of Home Type Definition	14
Table 6-4 Hot Water Measure Inputs	15
Table 6-5 Preliminary Verified Measure Per Unit Savings - Lighting	17
Table 7-1 Deemed Savings Input Parameters and Sources	20
Table 7-2. TRM Deemed Savings Input Parameters Used in Verified Analysis	21
Table 8-1 Total Resource Cost Savings Summary	22

1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's CY2018 Home Energy Assessment (HEA) Program. It presents a summary of the energy and demand impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. CY2018 covers January 1, 2018 through December 31, 2018. 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 savings from natural gas measures are included in separate 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) 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. HEA 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, Peoples Gas, North Shore Gas, and Nicor Gas.

In CY2018, the program had 18,107 participants, implemented 18,305 unique projects, and installed 681,729 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 savings could not be claimed), the program had 18,437 participants in CY2018 and 18,646 unique projects.

Table 2-1. CY2018 Volumetric Findings Detail

Participation	Program Overall
Participants*	18,107
Unique Projects†	18,305
Total Measures‡	682,359
Number of Units/Project‡	37.28
Advanced Power Strip - Tier 1	31,453
Pipe Insulation	791
Bathroom Faucet Aerator	561
Kitchen Faucet Aerator	203
Showerheads	893
Advanced Thermostats‡	1,356
Programmable Thermostats‡	2,256
Reprogramming Thermostats/Thermostat Education‡	2,653
LED Installations	642,193

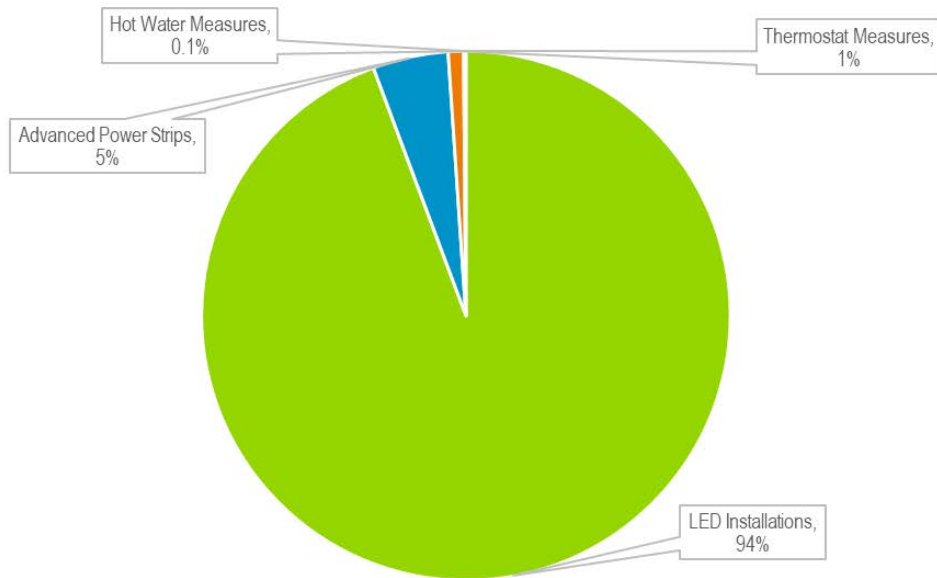
* Participants are defined as unique ComEd account numbers

† Unique Projects are defined as unique Project ID's

‡ Quantity is reported quantity. Navigant later adjusted thermostat quantities in its analysis to prevent counting multiple thermostat measures per home.

Source: ComEd tracking data and Navigant team analysis.

Figure 2-1. Percent of Measures Installed by Type



Source: ComEd tracking data and Navigant team analysis.

3. PROGRAM SAVINGS DETAIL

Table 3-1 summarizes the incremental energy and demand savings the HEA Program achieved in CY2018. The gas savings are only those that the gas utilities are not claiming and ComEd can claim.¹

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

Table 3-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	29,783,400	NR	3,174
Program Gross Realization Rate	0.99	NA	1.01
Verified Gross Savings	29,622,475	32,365	3,208
Program Net-to-Gross Ratio (NTG)	Varies	Varies	Varies
Verified Net Savings	24,149,880	26,215	2,628
Converted from Gas*			
Ex Ante Gross Savings	18,887	NA	NA
Program Gross Realization Rate	0.87	NA	NA
Verified Gross Savings	16,496	NA	NA
Program Net-to-Gross Ratio (NTG)	NA†	NA	NA
Verified Net Savings	16,496	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	29,802,287	NA	3,174
Program Gross Realization Rate	0.99	NA	1.01
Verified Gross Savings	29,638,971	32,365	3,208
Program Net-to-Gross Ratio (NTG)	Varies	Varies	Varies
Verified Net Savings	24,166,376	26,215	2,628

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

† The IL TRM algorithm calculates net savings for advanced thermostats which is the only measure ComEd can claim gas savings from.

Note: The coincident Summer Peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August. The demand savings are defined as the difference in kW in the baseline and post installation period for the measures installed in year 2018.

NR: Not reported

NA = Not applicable

Source: ComEd tracking data and Navigant team analysis.

4. CUMULATIVE PERSISTING ANNUAL SAVINGS

The measure-specific and total verified gross savings for the Home Energy Assessment Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following tables and figure. The CY2018 electric CPAS across all measures is 24,149,880 kWh. The program achieved 16,496 kWh CPAS equivalent of gas savings converted to electricity that might be counted toward ComEd's goal² (the middle table in the following set of tables). Adding the savings converted from gas savings to the electric savings produces a total of 24,166,376 kWh of total CPAS.

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

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

End Use Type	Measure	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings							
						2018	2019	2020	2021	2022	2023	2024	2025
Electronics	Advanced Power Strip - Tier 1	7.0	2,235,365	0.95	14,865,175	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	
Hot Water	HW Pipe Insulation	15.0	18,285	0.80	219,415	14,628	14,628	14,628	14,628	14,628	14,628	14,628	14,628
Hot Water	Low Flow Faucet Aerator - Bathroom	9.0	13,716	1.00	123,447	13,716	13,716	13,716	13,716	13,716	13,716	13,716	13,716
Hot Water	Low Flow Faucet Aerator - Kitchen	9.0	12,455	1.00	112,099	12,455	12,455	12,455	12,455	12,455	12,455	12,455	12,455
Hot Water	Low Flow Showerhead	10.0	304,107	0.80	2,432,859	243,286	243,286	243,286	243,286	243,286	243,286	243,286	243,286
HVAC	Advanced Thermostat	10.0	324,253	NA‡	3,242,534	324,253	324,253	324,253	324,253	324,253	324,253	324,253	324,253
HVAC	Advanced Thermostat - Nest	10.0	1,758	NA‡	17,576	1,758	1,758	1,758	1,758	1,758	1,758	1,758	1,758
HVAC	Programmable Thermostat	5.0	215,208	0.90	968,435	193,687	193,687	193,687	193,687	193,687			
HVAC	Programmable Thermostat - Reprogram	2.0	246,379	0.90	443,483	221,741	221,741						
Lighting	LED Omnidirectional Bulb - Exterior	6.1	1,164,466	0.80	4,085,338	931,573	931,573	931,573	416,329	416,329	416,329	41,633	
Lighting	LED Omnidirectional Bulb - Interior	10.0	6,509,497	0.80	28,239,216	5,207,598	5,207,598	5,207,598	1,802,346	1,802,346	1,802,346	1,802,346	1,802,346
Lighting	LED Specialty Lamp	10.0	17,890,736	0.80	143,125,887	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589
Lighting	LED Specialty Lamp - Recessed/Track	15.0	686,250	0.80	8,235,006	549,000	549,000	549,000	549,000	549,000	549,000	549,000	549,000
CY2018 Program Total Electric CPAS			29,622,475		206,110,468	24,149,880	24,149,880	23,928,139	20,007,644	20,007,644	19,813,957	19,439,261	17,274,032
CY2018 Program Expiring Electric Savings§							0	221,741	4,142,236	4,142,236	4,335,923	4,710,619	6,875,849

End Use Type	Measure	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Electronics	Advanced Power Strip - Tier 1													
Hot Water	HW Pipe Insulation	14,628	14,628	14,628	14,628	14,628	14,628	14,628						
Hot Water	Low Flow Faucet Aerator - Bathroom	13,716												
Hot Water	Low Flow Faucet Aerator - Kitchen	12,455												
Hot Water	Low Flow Showerhead	243,286	243,286											
HVAC	Advanced Thermostat	324,253	324,253											
HVAC	Advanced Thermostat - Nest	1,758	1,758											
HVAC	Programmable Thermostat													
HVAC	Programmable Thermostat - Reprogram													
Lighting	LED Omnidirectional Bulb - Exterior													
Lighting	LED Omnidirectional Bulb - Interior	1,802,346	1,802,346											
Lighting	LED Specialty Lamp	14,312,589	14,312,589											
Lighting	LED Specialty Lamp - Recessed/Track	549,000	549,000	549,000	549,000	549,000	549,000	549,000						
CY2018 Program Total Electric CPAS		17,274,032	17,247,860	563,628	563,628	563,628	563,628	563,628	0	0	0	0	0	0
CY2018 Program Expiring Electric Savings§		6,875,849	6,902,021	23,586,252	23,586,252	23,586,252	23,586,252	23,586,252	24,149,880	24,149,880	24,149,880	24,149,880	24,149,880	24,149,880

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

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

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

‡ The IL TRM algorithm calculates net savings for advanced thermostats.

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

NA = Not applicable

Source: Navigant analysis

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

End Use Type	Measure	EUL	CY2018 Verified Gross Savings (Therms)	NTG*	Lifetime Net Savings†	Verified Net Therms Savings							
						2018	2019	2020	2021	2022	2023	2024	2025
Electronics	Advanced Power Strip - Tier 1	7.0	0	0.95	0								
Hot Water	HW Pipe Insulation	15.0	0	0.80	0								
Hot Water	Low Flow Faucet Aerator - Bathroom	9.0	0	1.00	0								
Hot Water	Low Flow Faucet Aerator - Kitchen	9.0	0	1.00	0								
Hot Water	Low Flow Showerhead	10.0	0	0.80	0								
HVAC	Advanced Thermostat	10.0	0	NA‡	0								
HVAC	Advanced Thermostat - Nest	10.0	563	NA‡	5,628	563	563	563	563	563	563	563	563
HVAC	Programmable Thermostat	5.0	0	0.90	0								
HVAC	Programmable Thermostat - Reprogram	2.0	0	0.90	0								
Lighting	LED Omnidirectional Bulb - Exterior Baseline	6.1	0	0.80	0								
Lighting	LED Omnidirectional Bulb - Interior Baseline	10.0	0	0.80	0								
Lighting	LED Specialty Lamp	10	0	0.80	0								
Lighting	LED Specialty Lamp - Recessed/Track	15	0	0.80	0								
CY2018 Program Total Gas CPAS (Therms)			563		5,628	563	563	563	563	563	563	563	563
CY2018 Program Total Gas CPAS (kWh Equivalent)§			16,496		164,957	16,496	16,496	16,496	16,496	16,496	16,496	16,496	16,496
CY2018 Program Expiring Gas Savings (Therms) 							0	0	0	0	0	0	0
CY2018 Program Expiring Gas Savings (kWh Equivalent)§, 							0	0	0	0	0	0	0

End Use Type	Measure	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Electronics	Advanced Power Strip - Tier 1													
Hot Water	HW Pipe Insulation													
Hot Water	Low Flow Faucet Aerator - Bathroom													
Hot Water	Low Flow Faucet Aerator - Kitchen													
Hot Water	Low Flow Showerhead													
HVAC	Advanced Thermostat													
HVAC	Advanced Thermostat - Nest	563	563											
HVAC	Programmable Thermostat													
HVAC	Programmable Thermostat - Reprogram													
Lighting	LED Omnidirectional Bulb - Exterior Baseline Shift													
Lighting	LED Omnidirectional Bulb - Interior Baseline Shift													
Lighting	LED Specialty Lamp													
Lighting	LED Specialty Lamp - Recessed/Track													
CY2018 Program Total Gas CPAS (Therms)		563	563	0	0	0	0	0	0	0	0	0	0	0
CY2018 Program Total Gas CPAS (kWh Equivalent)§		16,496	16,496	0	0	0	0	0	0	0	0	0	0	0
CY2018 Program Expiring Gas Savings (Therms) 		0	0	563	563	563	563	563	563	563	563	563	563	563
CY2018 Program Expiring Gas Savings (kWh Equivalent)§		0	0	16,496	16,496	16,496	16,496	16,496	16,496	16,496	16,496	16,496	16,496	16,496

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

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

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

‡ The IL TRM algorithm calculates net savings for advanced thermostats.

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

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

NA = Not applicable

Source: Navigant analysis

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

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings (Including Those Converted from Gas Savings)									
						2018	2019	2020	2021	2022	2023	2024	2025		
Electronics	Advanced Power Strip - Tier 1	7.0	2,235,365	0.95	14,865,175	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	2,123,596	
Hot Water	HW Pipe Insulation	15.0	18,285	0.80	219,415	14,628	14,628	14,628	14,628	14,628	14,628	14,628	14,628	14,628	
Hot Water	Low Flow Faucet Aerator - Bathroom	9.0	13,716	1.00	123,447	13,716	13,716	13,716	13,716	13,716	13,716	13,716	13,716	13,716	
Hot Water	Low Flow Faucet Aerator - Kitchen	9.0	12,455	1.00	112,099	12,455	12,455	12,455	12,455	12,455	12,455	12,455	12,455	12,455	
Hot Water	Low Flow Showerhead	10.0	304,107	0.80	2,432,859	243,286	243,286	243,286	243,286	243,286	243,286	243,286	243,286	243,286	
HVAC	Advanced Thermostat	10	324,253	NA‡	3,242,534	324,253	324,253	324,253	324,253	324,253	324,253	324,253	324,253	324,253	
HVAC	Advanced Thermostat - Nest	10	1,758	NA‡	182,533	18,253	18,253	18,253	18,253	18,253	18,253	18,253	18,253	18,253	
HVAC	Programmable Thermostat	5	215,208	0.90	968,435	193,687	193,687	193,687	193,687	193,687	193,687	193,687	193,687	193,687	
HVAC	Programmable Thermostat - Reprogram	2	246,379	0.90	443,483	221,741	221,741								
Lighting	LED Omnidirectional Bulb - Exterior	6	1,164,466	0.80	4,085,338	931,573	931,573	931,573	416,329	416,329	416,329	416,329	416,329	416,329	
Lighting	LED Omnidirectional Bulb - Interior	10	6,509,497	0.80	28,239,216	5,207,598	5,207,598	5,207,598	1,802,346	1,802,346	1,802,346	1,802,346	1,802,346	1,802,346	
Lighting	LED Specialty Lamp	10	17,890,736	0.80	143,125,887	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	14,312,589	
Lighting	LED Specialty Lamp - Recessed/Track	15	686,250	0.80	8,235,006	549,000	549,000	549,000	549,000	549,000	549,000	549,000	549,000	549,000	
CY2018 Program Total CPAS			28,936,225		206,275,425	24,166,376	24,166,376	23,944,635	20,024,140	20,024,140	19,830,463	19,455,757	17,290,527		
CY2018 Program Expiring Savings§							0	221,741	4,142,236	4,142,236	4,335,923	4,710,619	6,875,849		

End Use Type	Research Category	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Electronics	Advanced Power Strip - Tier 1													
Hot Water	HW Pipe Insulation	14,628	14,628	14,628	14,628	14,628	14,628	14,628						
Hot Water	Low Flow Faucet Aerator - Bathroom	13,716												
Hot Water	Low Flow Faucet Aerator - Kitchen	12,455												
Hot Water	Low Flow Showerhead	243,286	243,286											
HVAC	Advanced Thermostat	324,253	324,253											
HVAC	Advanced Thermostat - Nest	18,253	18,253											
HVAC	Programmable Thermostat													
HVAC	Programmable Thermostat - Reprogram													
Lighting	LED Omnidirectional Bulb - Exterior													
Lighting	LED Omnidirectional Bulb - Interior	1,802,346	1,802,346											
Lighting	LED Specialty Lamp	14,312,589	14,312,589											
Lighting	LED Specialty Lamp - Recessed/Track	549,000	549,000	549,000	549,000	549,000	549,000	549,000						
CY2018 Program Total CPAS		17,290,527	17,264,355	563,628	563,628	563,628	563,628	563,628	0	0	0	0	0	0
CY2018 Program Expiring Savings§		6,875,849	6,902,021	23,602,748	23,602,748	23,602,748	23,602,748	23,602,748	24,166,376	24,166,376	24,166,376	24,166,376	24,166,376	24,166,376

Note: The green highlighted cell shows program total first year electric savings (including direct electric savings and those converted from gas).
 * A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.
 † Lifetime savings are the sum of CPAS savings through the EUL.
 ‡ The IL TRM algorithm calculates net savings for advanced thermostats.
 § Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
 NA = Not applicable
 Source: Navigant analysis

Figure 4-1. Cumulative Persisting Annual Savings



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

Source: Navigant analysis

5. PROGRAM SAVINGS BY MEASURE

The program includes 12 measures as shown in the following tables. The LED measures collectively represented 87 percent of net kWh savings; the next most significant measure was the Advanced Power Strip – Tier 1, representing 8.8 percent of net kWh savings. The advanced thermostat is the only measure with gas savings. ComEd is eligible to claim the gas savings of eight Nest E thermostat installations as part of an income eligible pilot program.

Table 5-1. CY2018 Energy Savings by Measure – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	Effective Useful Life
Electronics	Advanced Power Strip - Tier 1	2,236,308	1.00	2,235,365	0.95	2,123,596	7.0
Hot Water	HW Pipe Insulation	17,969	1.02	18,285	0.80	14,628	15.0
Hot Water	Low Flow Faucet Aerator - Bathroom	9,200	1.49	13,716	1.00	13,716	9.0
Hot Water	Low Flow Faucet Aerator - Kitchen	26,538	0.47	12,455	1.00	12,455	9.0
Hot Water	Low Flow Showerhead	292,868	1.04	304,107	0.80	243,286	10.0
HVAC	Advanced Thermostat	328,693	0.99	324,253	NA†	324,253	10.0
HVAC	Advanced Thermostat - Nest	1,996	0.88	1,758	NA†	1,758	10.0
HVAC	Programmable Thermostat	240,022	0.90	215,208	0.90	193,687	5.0
HVAC	Programmable Thermostat - Reprogram	267,911	0.92	246,379	0.90	221,741	2.0
Lighting	LED Omnidirectional Bulb - Exterior	1,164,467	1.00	1,164,466	0.80	931,573	6.1
Lighting	LED Omnidirectional Bulb - Interior	6,515,558	1.00	6,509,497	0.80	5,207,598	10.0
Lighting	LED Specialty Lamp	17,993,942	0.99	17,890,736	0.80	14,312,589	10.0
Lighting	LED Specialty Lamp - Recessed/Track	687,927	1.00	686,250	0.80	549,000	15.0
Total		29,783,400	0.99	29,622,475		24,149,880	

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

† The IL TRM algorithm calculates net savings for advanced thermostats.

NA = Not Applicable

Source: ComEd tracking data and Navigant team analysis.

Table 5-2. CY2018 Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTG*	Verified Net Demand Reduction (kW)
Electronics	Advanced Power Strip - Tier 1	NR	NA	313.56	0.95	297.88
Hot Water	HW Pipe Insulation	NR	NA	2.09	0.80	1.67
Hot Water	Low Flow Faucet Aerator - Bathroom	NR	NA	811.17	1.00	811.17
Hot Water	Low Flow Faucet Aerator - Kitchen	NR	NA	141.59	1.00	141.59
Hot Water	Low Flow Showerhead	NR	NA	1,100.44	0.80	880.35
HVAC	Advanced Thermostat	NR	NA	424.69	NA†	424.69
HVAC	Advanced Thermostat - Nest	NR	NA	2.42	NA†	2.42
HVAC	Programmable Thermostat	NR	NA	0.00	0.90	0.00
HVAC	Programmable Thermostat - Reprogram	NR	NA	0.00	0.90	0.00
Lighting	LED Omnidirectional Bulb - Exterior	NR	NA	470.77	0.80	376.61
Lighting	LED Omnidirectional Bulb - Interior	NR	NA	8,997.73	0.80	7,198.19
Lighting	LED Specialty Lamp	NR	NA	19,267.78	0.80	15,414.23
Lighting	LED Specialty Lamp - Recessed/Track	NR	NA	832.36	0.80	665.89
Total		NR	NA	32,364.61		26,214.70

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

† The IL TRM algorithm calculates net savings for advanced thermostats.

NR = Not reported

NA = Not applicable

Source: ComEd tracking data and Navigant team analysis.

Table 5-3. CY2018 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)
Electronics	Advanced Power Strip - Tier 1	250.96	1.00	250.85	0.95	238.31
Hot Water	HW Pipe Insulation	2.05	1.02	2.09	0.80	1.67
Hot Water	Low Flow Faucet Aerator - Bathroom	14.26	1.25	17.85	1.00	17.85
Hot Water	Low Flow Faucet Aerator - Kitchen	6.21	0.50	3.12	1.00	3.12
Hot Water	Low Flow Showerhead	26.96	1.13	30.59	0.80	24.47
HVAC	Advanced Thermostat	103.53	0.96	98.95	NA†	98.95
HVAC	Advanced Thermostat - Nest	0.61	0.92	0.56	NA†	0.56
HVAC	Programmable Thermostat	0.00	NA	0.00	0.90	0.00
HVAC	Programmable Thermostat - Reprogram	0.00	NA	0.00	0.90	0.00
Lighting	LED Omnidirectional Bulb - Exterior	128.45	1.00	128.52	0.80	102.82
Lighting	LED Omnidirectional Bulb - Interior	638.14	1.00	638.84	0.80	511.07
Lighting	LED Specialty Lamp	1,926.43	1.02	1,961.23	0.80	1,568.98
Lighting	LED Specialty Lamp - Recessed/Track	76.14	0.99	75.74	0.80	60.60
Total		3,173.74	1.01	3,208.33		2,628.39

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

† The IL TRM algorithm calculates net savings for advanced thermostats.

NA = Not applicable

Source: ComEd tracking data and Navigant team analysis.

Table 5-4. CY2018 Energy Savings by Measure – Gas

End Use Type	Research Category	Ex Ante Gross Savings	Verified Gross Realization Rate	Verified Gross Savings	NTG*	Verified Net Savings	Effective Useful Life
Electronics	Advanced Power Strip - Tier 1	0	NA	0	0.95	0	7.0
Hot Water	HW Pipe Insulation	0	NA	0	0.80	0	15.0
Hot Water	Low Flow Faucet Aerator - Bathroom	0	NA	0	1.00	0	9.0
Hot Water	Low Flow Faucet Aerator - Kitchen	0	NA	0	1.00	0	9.0
Hot Water	Low Flow Showerhead	0	NA	0	0.80	0	10.0
HVAC	Advanced Thermostat	0	NA	0	NA†	0	10.0
HVAC	Advanced Thermostat - Nest	644	0.87	563	NA†	563	10.0
HVAC	Programmable Thermostat	0	NA	0	0.90	0	5.0
HVAC	Programmable Thermostat - Reprogram	0	NA	0	0.90	0	2.0
Lighting	LED Omnidirectional Bulb - Exterior	0	NA	0	0.80	0	6.1
Lighting	LED Omnidirectional Bulb - Interior	0	NA	0	0.80	0	10.0
Lighting	LED Specialty Lamp	0	NA	0	0.80	0	10.0
Lighting	LED Specialty Lamp - Recessed/Track	0	NA	0	0.80	0	15.0
Total Therms		644	0.87	563		563	
Total kWh Converted from Therms‡		18,887	0.87	16,496		16,496	

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

† The IL 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).

NA = Not applicable

Source: ComEd tracking data and Navigant team analysis.

Table 5-5. CY2018 Energy Savings by Measure – Total Combining Electricity and Gas

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Electronics	Advanced Power Strip - Tier 1	2,236,308	1.00	2,235,365	0.95	2,123,596
Hot Water	HW Pipe Insulation	17,969	1.02	18,285	0.80	14,628
Hot Water	Low Flow Faucet Aerator - Bathroom	9,200	1.49	13,716	1.00	13,716
Hot Water	Low Flow Faucet Aerator - Kitchen	26,538	0.47	12,455	1.00	12,455
Hot Water	Low Flow Showerhead	292,868	1.04	304,107	0.80	243,286
HVAC	Advanced Thermostat	328,693	0.99	324,253	NA†	324,253
HVAC	Advanced Thermostat - Nest	20,883	0.87	18,253	NA†	18,253
HVAC	Programmable Thermostat	240,022	0.90	215,208	0.90	193,687
HVAC	Programmable Thermostat - Reprogram	267,911	0.92	246,379	0.90	221,741
Lighting	LED Omnidirectional Bulb - Exterior	1,164,467	1.00	1,164,466	0.80	931,573
Lighting	LED Omnidirectional Bulb - Interior	6,515,558	1.00	6,509,497	0.80	5,207,598
Lighting	LED Specialty Lamp	17,993,942	0.99	17,890,736	0.80	14,312,589
Lighting	LED Specialty Lamp - Recessed/Track	687,927	1.00	686,250	0.80	549,000
Total‡		29,802,287	0.99	29,638,971		24,166,376

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

† The IL TRM algorithm calculates net savings for advanced thermostats.

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

NA = Not applicable

Source: ComEd tracking data and Navigant 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. Navigant calculated savings for each measure following algorithms defined by the Illinois Technical Reference Manual (IL TRM) version 6.0 and IL TRM v6.0 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			IL SAG Consensus†
Advanced Power Strip – Tier 1	71.1	kWh		IL TRM v6.0 – Section 5.2.1
HW Pipe Insulation	Varies	kWh		IL TRM v6.0 – Section 5.4.1
Low Flow Faucet Aerator - Bathroom	Varies	kWh		IL TRM v6.0 – Section 5.4.4
Low Flow Faucet Aerator - Kitchen	Varies	kWh		IL TRM v6.0 – Section 5.4.4
Low Flow Showerhead	Varies	kWh		IL TRM v6.0 – Section 5.4.5
Advanced Thermostat	Varies	kWh and/or therms	Deemed	IL TRM v6.0 – Section 5.3.16
Programmable Thermostat	Varies	kWh		IL TRM v6.0 – Section 5.3.11
Programmable Thermostat – Reprogram	Varies	kWh		IL TRM v6.0 – Section 5.3.11
LED Omnidirectional Bulb – Exterior	Varies	kWh		IL TRM v6.0 Errata – Section 5.5.8
LED Omnidirectional Bulb – Interior	Varies	kWh		IL TRM v6.0 Errata – Section 5.5.8
LED Specialty Lamp	Varies	kWh		IL TRM v6.0 Errata – Section 5.5.6
LED Specialty Lamp – Recessed/Track	Varies	kWh		IL TRM v6.0 Errata – Section 5.5.6

* State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>.

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

6.2 Other Impact Findings and Recommendations

6.2.1 All Measures: Building Type

For CY2019, ComEd has indicated that they will define MF as a building with four or more units³. Navigant used this working definition to determine its mapping for CY2018 to be as consistent as possible across program years. Navigant used the following building type mapping as shown in the table below:

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

Table 6-2 Home Type Definition

Tracking Data Residential_Building_Type	Navigant Assigned Building Type
Single Family	Single Family
Condo	Multi-Family
2-Unit	Single Family

Source: Navigant Analysis of CY2018 Tracking Data

Finding 1: Navigant's home type definition affected hot water, HVAC, and lighting savings: The inputs associated with the assigned building type impacted savings for hot water, HVAC, and lighting measures. Navigant calculated savings using the residential building type field in the tracking data; when the building type was "Condo", MF inputs were used, otherwise SF inputs were used (see Table 8-1). The implementer used SF inputs for all measures.

Table 6-3 Impact of Home Type Definition

Research Category	kWh Savings RR (Using all SF-inputs)	Actual Verified kWh Savings RR
Low Flow Faucet Aerator – Bathroom	0.99	1.49
Low Flow Faucet Aerator – Kitchen	1.00	0.47
Low Flow Showerhead	1.00	1.04
Advanced Thermostat	1.02	0.99
Programmable Thermostat	0.99	0.90
Reprogrammable Thermostat	0.99	0.92

Source: Navigant Analysis of CY2018 Tracking Data

As shown in the table above, the all-SF assumption underestimated savings for bathroom faucet aerators and low flow showerheads and overestimated savings for kitchen faucet aerator, advanced thermostat, programmable thermostat, and reprogrammable thermostat. In the case of the low flow showerhead, the all-SF assumption is wholly responsible for the realization rate disparity.

Recommendation 1: Navigant recommends that the implementation contractor calculate savings in accordance with the building type provided in the residential building type field. Navigant recommends that the implementation contractor use the home type definition and map Residential_Building_Type per guidance in Table 8-1

6.2.2 Hot Water

Finding 2: Navigant found inconsistent hot water inputs between utility data. Navigant found differences in values used for aerators and pipe insulation between the gas data and electric data (Table 8-3). The implementer informed Navigant that the custom values reflect collected data. In order to ensure the consistency of inputs across the joint programs, Navigant used the same custom values for HEA.

Table 6-4 Hot Water Measure Inputs

Measure	Input	Nicor Gas HES: Implementer and Navigant Used	PGL/NSG HEJ: Implementer and Navigant Used	ComEd HEA: Implementer Used from TRM	ComEd HEA: Navigant Used
Aerator - Bathroom	GPM_base	1.5355	1.5355	1.39	1.5355
Aerator - Bathroom	GPM_low	0.969	0.969	0.94	0.969
Aerator - Kitchen	GPM_base	1.6351	1.6351	1.39	1.6351
Aerator - Kitchen	GPM_low	1.406	1.406	0.94	1.406
HW Pipe Insulation	Rnew	4	4	3.8	4

Source: Navigant Analysis of CY2018 Tracking Data

Recommendation 2: Navigant recommends Franklin use the values provided in Table 8-3 column “ComEd HEA: Navigant Used” to calculate ex ante savings to ensure consistency between the joint programs.

Finding 3: Navigant used the MeasureName column to determine Hot Water Fuel Type. Navigant found differences in the hot water fuel type indicated by the “MeasureName” and “Hot_Water_Fuel” columns in the tracking data. In PY9, Franklin informed Navigant that the “MeasureName” is more accurate than data in tracked fields for thermostat measures. Navigant applied this same logic to hot water fuel and deferred to the “MeasureName” column where all measures begin with “Electric” implying that there are electric water heating systems for all projects.

Recommendation 3: Navigant recommends Franklin confirm that all listed hot water measures have electric water heating and that the “Hot_Water_Fuel” column is inaccurate. Navigant also recommends Franklin report hot water fuel in the measure name and the “Hot_Water_Fuel” field consistently for each project.

6.2.3 HVAC

Navigant took the steps below to evaluate savings for HVAC measures. The assumptions made within these steps – along with the building type dependence explained above in the All Measures: Building Type section – explain the difference in realization rates. Findings 4 through 6 outline changes that had a direct impact on savings, while Findings 7 through 10 document assumptions that may have, but likely did not, have an impact on savings.

Finding 4: Navigant claimed Savings for one thermostat per home: averaged multiple thermostat savings at the same home. There were instances where a single “Account Number” claimed savings for more than one thermostat. Per IL TRM v6.0, savings for only one thermostat can be claimed per household. This occurred in about one percent of projects and examples of this finding are Project ID 2722276 and 3203597.

To determine the appropriate savings, Navigant assumed that 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 which installed two thermostats, one with 100 kWh savings and another with 200 kWh savings, would achieve verified savings of 150 kWh total savings.

Recommendation 4: Navigant recommends Franklin claim savings for only one programmable or one advanced thermostat per household.

Finding 5: Navigant used climate zone dependent inputs. Navigant assigned the appropriate cooling degree days (CDD) and heating degree days (HDD) climate zones based on each

project's zip code in the tracking data. The climate zones determined by Navigant were identical to those given in the tracking data (CDD, HDD columns). However, it appears that the implementer used inputs which assumed a climate zone 2 location regardless of the project's actual climate zone. This effected inputs such as FLH and annual household heating consumption for electrically heated single-family homes (Elec_Heating_Consumption). Examples of this finding are Project ID 3361613 and 3428921, which both have a 105 percent realization rate.

Recommendation 5: Navigant recommends Franklin use appropriate inputs based on climate zones.

Finding 6: Navigant changed EUL for Nest Thermostats to 10 years. The tracking data had one year as the effective useful life (EUL) of Nest thermostats, but ten years for all other advanced thermostats. The EUL of advanced thermostats in the IL TRM v6.0 is 10 years. Navigant estimated cumulative persisting annual savings (CPAS) for Nest thermostats using 10 years.

Recommendation 6: Navigant recommends Franklin use 10 year for the EUL for all advanced thermostats.

Finding 7: Navigant used the MeasureName column to determine Heating Fuel. Similar to Finding 3 above, Navigant found differences in the heating fuel indicated by the "MeasureName" and "Heating_Fuel" fields in the tracking data. In PY9, Franklin informed Navigant that the "MeasureName" is more accurate than data in tracked fields. Therefore, in order to determine a home's heating fuel, Navigant deferred to the "MeasureName" column where all measures either began with "Gas" – implying natural gas heating – or "Electric" – implying electric heating.

Recommendation 7: Navigant recommends Franklin record heating fuel in the measure name and "Heating_Fuel" field consistently for each project to avoid any confusion.

Finding 8: Navigant used the MeasureName column to determine Heating System Type. Like Findings 3 and 7 above, Navigant found differences in the heating system type indicated by the "MeasureName" and "Heating_System_Type" fields in the tracking data. In PY9, Franklin informed Navigant that the "MeasureName" is more accurate than data in tracked fields. Therefore, in order to determine a home's heating system type, Navigant 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 8: Navigant recommends Franklin record heating system type in the measure name and "Heating_System_Type" field consistently for each project to avoid any confusion.

Finding 9: Navigant used the MeasureName column to determine Existing Thermostat Type. Navigant found differences in the existing thermostat type indicated by the "MeasureName" and "Existing_Thermostat_Type" fields in the tracking data. In PY9, Franklin informed us that the "MeasureName" is more accurate than data in tracked fields. Therefore, in order to determine a home's existing thermostat type, Navigant deferred to the "MeasureName" column where all measures contained either "Program" – implying an existing programmable thermostat– or "Manual" – implying an existing manual thermostat.

Recommendation 9: Navigant recommends Franklin record existing thermostat type in the measure name and "Existing_Thermostat_Type" field consistently for each project to avoid any confusion.

Finding 10: Navigant assumed "Central AC" for Advanced Thermostats. Based on the "Cooling_System_Type" field in the tracking data, one percent of advanced thermostat projects had something other than central air conditioning (AC). However, according to

program guidelines, advanced thermostats must be installed in homes with Central AC so Navigant assumed all advanced thermostat measures were installed in homes with Central AC.

Recommendation 10: Navigant recommends Franklin record cooling system type for each project according to program guidelines.

6.2.4 Lighting

The table below shows savings details for lighting measures.

Table 6-5 Preliminary Verified Measure Per Unit Savings - Lighting

End Use Type	Research Category	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings RR	Verified Gross Peak kW/Unit	Peak kW Savings RR
Lighting	Exterior LED - 11W (75W)	101	0.01	101	1.00	0.01	1.00
Lighting	Exterior LED - 15W (100W)	137	0.02	137	1.00	0.02	1.00
Lighting	Exterior LED - 15W PAR38 (120W)	242	0.03	242	1.00	0.03	1.00
Lighting	Exterior LED - 5W Candelabra (40W)	85	0.00	84	0.99	0.01	2.27
Lighting	Exterior LED - 6W (40W)	55	0.01	55	1.00	0.01	1.00
Lighting	Exterior LED - 8W Flood (65W)	137	0.02	137	1.00	0.02	1.00
Lighting	Exterior LED - 9W (60W)	82	0.01	82	1.00	0.01	1.00
Lighting	Interior LED - 11W (75W)	33	0.00	33	1.00	0.00	1.00
Lighting	Interior LED - 15W (100W)	44	0.00	44	1.00	0.00	1.01
Lighting	Interior LED - 5W Candelabra (40W)	43	0.00	43	1.00	0.00	1.01
Lighting	Interior LED - 6/12/19W 3-Way (50/100/150W)	59	0.01	55	0.93	0.01	0.93
Lighting	Interior LED - 6W (40W)	18	0.00	18	1.00	0.00	1.02
Lighting	Interior LED - 6W Globe (40/60W)	29	0.00	29	1.01	0.00	0.98
Lighting	Interior LED - 7W Mini-Flood PAR20 (50W)	38	0.00	38	1.00	0.00	1.00
Lighting	Interior LED - 7W Track Light (50W)	38	0.00	38	1.00	0.00	1.00
Lighting	Interior LED - 7W Track Light (50W) - Pin Base GU5.3	38	0.00	38	1.00	0.00	0.99
Lighting	Interior LED - 8W Flood (65W)	50	0.01	50	1.00	0.01	1.00
Lighting	Interior LED - 9W (60W)	27	0.00	26	1.00	0.00	1.00
Lighting	Interior LED - 8W Mini-Flood PAR20 (45W)	27	0.00	26	1.00	0.00	1.00

Source: Navigant Analysis of CY2018 Tracking Data

LED Specialty Lamp

Finding 11: “Exterior” Coincidence Factor for “Exterior Candelabra”. As stated in Navigant’s CY2018 Wave 1 Data Review Memo⁴, Navigant used a coincidence factor value of 0.273 (exterior) rather than the implementer’s value of 0.121 (candelabra). Navigant views the location (exterior or interior) as being a reasonable indicator of time of use than the lighting type (candelabra). So, by extension, the exterior candelabra’s coincidence factor should be the exterior coincidence factor rather than the interior candelabra’s coincidence factor.

Recommendation 11: Navigant recommends Franklin change the exterior candelabra coincidence factor from 0.121 to 0.273.

⁴ ComEd Home Energy Assessments CY2018 Wave 1 Data Review Memo 2018-12-18

LED Specialty Lamp – Recessed/Track

Finding 12: Baseline Wattage (75W) for Interior LED - 6/12/19W 3-Way (50/100/150W). The implementer calculated energy and demand savings using 80W for the baseline wattage for this bulb. After reviewing the efficient bulb’s specification sheet, Navigant determined 75W is more appropriate based on 1300 lumens for the efficient 12W bulb.

Recommendation 12: Navigant recommends Franklin change the baseline wattage for the Interior LED – 6/12/19 W 3-Way (50/100/150W) from 80W to 75W.

Heating Penalty (for TRC table in Section 8)

Finding 13: Navigant used the “Heating_Fuel” field to inform the heating penalties shown in Table 9-1. However, as explained in Finding 7, 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, Navigant identified lighting projects where thermostats were also installed and used the heating fuel given in the thermostat measure name. This occurred in approximately 33 percent of lighting projects. The remaining 67 percent of lighting projects were forced to use the “Heating_Fuel” field.

Recommendation 13: Navigant recommends Franklin accurately record heating fuel in the “Heating_Fuel” field to ensure the accurate calculation of heating penalties.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant calculated verified gross and net savings using the following algorithms as defined by the IL TRM v6.0 in CY2018.

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 = $((1/R_{exist} - 1/R_{new}) * \text{Length of Insulation} * \text{Circumference of Pipe} * \Delta T * 8,766) / (\text{Water Heater Efficiency} * 3,413)$

Where:

- 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

Navigant use the algorithms from the IL TRM v6.0, Section 5.3.16 to verify savings for advanced thermostats.

Verified Gross Annual kWh Savings = Electric Heating Consumption * Heating Reduction * HF * ISR + $(\Delta Therms * F_e * 29.3)$

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 Deemed Savings Input Parameters and Sources

Verified Gross and Net Input Parameters	Value	Data Source
Smart Thermostat Electric Heating Consumption (Electric Resistance / Heat Pump / Gas)	20,771 / 12,218 / 0	IL TRM v6.0, Section 5.3.16
Smart Thermostat Heating Reduction (Manual Baseline / Programmable BL / Unknown BL)	0.088 / 0.056 / 0.074	IL TRM v6.0, Section 5.3.16
Smart Thermostat HF (Single Family / Multi Family)	1 / 0.65	IL TRM v6.0, Section 5.3.16
Smart Thermostat ISR	1	IL TRM v6.0, Section 5.3.16
Smart Thermostat F _e	0.0314	IL TRM v6.0, 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 = %Fossil Heat * Gas Heating Consumption * Heating Reduction * HF * ISR

7.7 LED Replacement

Verified Gross Annual kWh Savings = Program Bulb Quantity * ΔWatts/1000 * ISR * HOU * WHF_{energy}

Where:

- ΔWatts = Difference between Baseline Wattage and Efficient (LED) Wattage, Evaluated
- 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

Navigant calculated verified gross savings for the CY2018 HEA Program using algorithms, assumptions, and input parameters defined in the IL 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	IL TRM v6.0, Section 5.5.8
LED Omnidirectional HOU (Interior / Exterior)	759 / 2,475	IL TRM v6.0, Section 5.5.8
LED Specialty HOU (Interior Reflector / Interior 3-Way / Interior Candelabra / Interior Globe / Exterior)	861 / 850 / 1190 / 639 / 861	IL TRM v6.0, Section 5.5.6
LED WHF _{energy} (SF Interior / MF Interior / Exterior)	1.06 / 1.04 / 1.00	IL TRM v6.0, Section 5.5.8
LED WHF _{demand} (SF Interior / MF Interior / Exterior)	1.11 / 1.07 / 1.00	IL TRM v6.0, Section 5.5.8
LED Omnidirectional CF (Interior / Exterior)	0.071 / 0.273	IL TRM v6.0, Section 5.5.8
LED Specialty HOU (Interior Reflector / Interior 3-Way / Interior Candelabra / Interior Globe / Exterior)	0.091 / 0.078 / 0.121 / 0.075 / 0.273	IL TRM v6.0, Section 5.5.6
Faucet Aerator GPM _{base} (Kitchen / Bathroom)	1.6351 / 1.5355	Joint programs (see Table 8-3)
Faucet Aerator L _{base} (Kitchen / Bathroom)	4.5 / 1.6	IL TRM v6.0, Section 5.4.4
Faucet Aerator GPM _{low} (Kitchen / Bathroom)	1.406 / 0.969	Joint programs (see Table 8-3)
Faucet Aerator L _{low} (Kitchen / Bathroom)	4.5 / 1.6	IL TRM v6.0, Section 5.4.4
Faucet Aerator Household (Single Family / Multi Family)	2.56 / 2.1	IL TRM v6.0, Section 5.4.4
Faucet Aerator DF (Kitchen / Bathroom)	0.75 / 0.90	IL TRM v6.0, Section 5.4.4
Faucet Aerator FPH (Kitchen / SF Bath / MF Bath)	1 / 2.83 / 1.5	IL TRM v6.0, Section 5.4.4
Faucet Aerator EPG _{electric} (Kitchen / Bathroom)	0.0969 / 0.0795	IL TRM v6.0, Section 5.4.4
Faucet Aerator ISR (SF Kitchen / MF Kitchen / Bath)	0.95 / 0.91 / 0.95	IL TRM v6.0, Section 5.4.4
Faucet Aerator HOU (SF K / SF B / MF K / MF B)	94 / 14 / 77 / 22	IL TRM v6.0, Section 5.4.4
Faucet Aerator CF	0.022	IL TRM v6.0, Section 5.4.4
Shower GPM _{base}	2.67	IL TRM v6.0, Section 5.4.5
Shower L _{base}	7.8	IL TRM v6.0, Section 5.4.5
Shower GPM _{low}	1.5	IL TRM v6.0, Section 5.4.5
Shower L _{low}	7.8	IL TRM v6.0, Section 5.4.5
Shower Household (Single Family / Multi Family)	2.56 / 2.1	IL TRM v6.0, Section 5.4.5
Shower SPCD	0.6	IL TRM v6.0, Section 5.4.5
Shower SPH (Single Family / Multi Family)	1.79 / 1.3	IL TRM v6.0, Section 5.4.5
Shower EPG _{electric}	0.117	IL TRM v6.0, Section 5.4.5
Shower ISR (Single Family / Multi Family)	0.98 / 0.95	IL TRM v6.0, Section 5.4.5
Shower HOU (Single Family / Multi Family)	302 / 248	IL TRM v6.0, Section 5.4.5
Shower CF	0.0278	IL TRM v6.0, Section 5.4.5
Advanced Power Strip Energy Savings (Tier 1)	71.1	IL TRM v6.0, Section 5.2.1
Advanced Power Strip ISR	0.69	IL TRM v6.0, Section 5.2.1
Advanced Power Strip CF	0.80	IL TRM v6.0, Section 5.2.1

Verified Gross and Net Input Parameters	Value	Data Source
Advanced Power Strip HOU (Tier 1)	7,129	IL TRM v6.0, Section 5.2.1
Programmable Thermostat Electric Heating Consumption (CZ 2) (Electric Resistance / Heat Pump / Gas)	20,771 / 12,218 / 0	IL TRM v6.0, Section 5.3.11
Programmable Thermostat Electric Heating Consumption (CZ 3) (Electric Resistance / Heat Pump / Gas)	17,789 / 10,464 / 0	IL TRM v6.0, Section 5.3.11
Programmable Thermostat Gas Heating Consumption [Therms] (CZ 2) (Electric Resistance / Heat Pump / Gas)	0 / 0 / 1,005	IL TRM v6.0, Section 5.3.11
Programmable Thermostat Gas Heating Consumption [Therms] (CZ 3) (Electric Resistance / Heat Pump / Gas)	0 / 0 / 861	IL TRM v6.0, Section 5.3.11
Programmable Thermostat Heating Reduction	0.062	IL TRM v6.0, Section 5.3.11
Programmable Thermostat HF (Single Family / Multi Fwaamily)	1 / 0.65	IL TRM v6.0, Section 5.3.11
Programmable Thermostat ISR	1	IL TRM v6.0, Section 5.3.11
Programmable Thermostat F _e	0.0314	IL TRM v6.0, Section 5.3.11
DHW R _{exist}	1	IL TRM v6.0, Section 5.4.1
DHW R _{new}	4	Joint programs (see Table 8-3)
DHW ΔT	60	IL TRM v6.0, Section 5.4.1
DHW η _{DHW} ^{electric}	.98	IL TRM v6.0, Section 5.4.1
DHW Circumference of Pipe	0.196	IL TRM v6.0, Section 5.4.1

8. APPENDIX 2. TOTAL RESOURCE COST DETAIL

Table 9-1, below, shows the Total Resource Cost (TRC) table. It includes only the cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation later.

Table 8-1 Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity*	Effective Useful Life	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	Verified Gross Savings Therms	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG	Verified Net Savings (kWh)	Verified Net Peak Demand Reduction (kW)	Verified Net Savings Therms	Verified Net Heating Penalty (kWh)	Verified Net Heating Penalty (Therms)
Electronics	Advanced Power Strip - Tier 1	each	31,453	7.0	2,235,385	250.85	0	0	0	0.95	2,123,596	238.31	0	0	0
Hot Water	HW Pipe Insulation	linear foot	791	15.0	18,285	2.09	0	0	0	0.80	14,628	1.67	0	0	0
Hot Water	Low Flow Faucet Aerator - Bathroom	each	561	9.0	13,716	17.85	0	0	0	1.00	13,716	17.85	0	0	0
Hot Water	Low Flow Faucet Aerator - Kitchen	each	203	9.0	12,455	3.12	0	0	0	1.00	12,455	3.12	0	0	0
Hot Water	Low Flow Showerhead	each	893	10.0	304,107	30.59	0	0	0	0.80	243,286	24.47	0	0	0
HVAC	Advanced Thermostat	each	1,317	10.0	324,253	98.95	0	0	0	1.00	324,253	98.95	0	0	0
HVAC	Advanced Thermostat - Nest	each	8	10.0	18,253	0.56	563	0	0	1.00	18,253	0.56	563	0	0
HVAC	Programmable Thermostat	each	2,229	5.0	215,208	0.00	0	0	0	0.90	193,687	0.00	0	0	0
HVAC	Programmable Thermostat - Reprogram	each	2,621	2.0	246,379	0.00	0	0	0	0.90	221,741	0.00	0	0	0
Lighting	LED Omnidirectional Bulb - Exterior**	each	10,832	6.1	1,164,490	128.52	0	0	0	0.80	931,573	102.82	0	0	0
Lighting	LED Omnidirectional Bulb - Interior**	each	238,511	10.0	6,509,497	638.84	0	(65,273)	(140,702)	0.80	5,207,598	511.07	0	(52,218)	(112,562)
Lighting	LED Specialty Lamp	each	374,760	10.0	17,890,736	1,961.23	0	(156,194)	(343,973)	0.80	14,312,589	1,568.98	0	(124,955)	(275,179)
Lighting	LED Specialty Lamp - Recessed/Track	each	18,090	15.0	686,250	75.74	0	(10,914)	(14,479)	0.80	549,000	60.60	0	(8,731)	(11,583)

* Quantity in table is the adjusted quantity. Navigant used an adjusted quantity for thermostats to adjust for the counting of multiple thermostats for a single household. A household with 2 programmable thermostat measures would have its quantity changed from 2 to 1 and a household with 2 programmable thermostat measures and 1 advanced thermostat measures would have each of its quantities changed to 0.66 and 0.33, respectively. The total post-adjustment quantity of advanced thermostats is 1,325, the total post-adjustment quantity for programmable thermostats is 2,621, and the total post-adjustment quantity for reprogrammed programmable thermostats is 2,228. Reported quantities are included in Table 2-1. CY2018 Volumetric Findings Detail.

** CY2018 contribution to CPAS for these measures vary over time. See CPAS tables in Section 4.

Source: ComEd tracking data and Navigant team analysis.