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ComEd Single Family Assessment Impact Evaluation Report

Energy Efficiency/Demand Response Plan: Program Year 2021 (CY2021) (1/1/2021-12/31/2021)

Prepared for:

ComEd

FINAL

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1. Introduction

This report presents the results of the impact evaluation of the CY2021 Single Family Assessment (SFA) Program—this program is also known as the Home Energy Assessment (HEA) Program (which is how it is labeled in the NTG deemed spreadsheet).

It summarizes the total energy and demand impacts for the program broken out by relevant measure and program structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) analysis inputs. CY2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The SFA Program is an assessment and direct install program jointly implemented by ComEd, Nicor Gas, Peoples Gas, and North Shore Gas (NSG) and implemented by Franklin Energy Services. The gas utilities are claiming all gas savings for this program and their results are presented in separate reports. The primary objective of this residential program is to secure energy savings by offering low-cost efficiency measures for eligible single-family residences through direct installation and virtual assessments. Direct install measures include free light-emitting diodes (LEDs), water-efficient showerheads and faucet aerators, hot water pipe insulation, programmable thermostats, and reprogramming programmable thermostats. They also include co-pay smart thermostats and co-pay advanced power strips. Virtual assessment (VA) measures include free water-efficient showerheads and faucet aerators, hot water pipe insulation, LEDs, and advanced power strips.

In CY2021, the program had 13,771 participants and distributed 417,559 measures (see Table 2-1). Totals in the table reflect projects with measures of non-zero energy savings.

Table 2-1. Number of Participants and Projects

Participation	Direct Install	Virtual Assessment	Total
Unique Participants	12,763	1,024	13,771
Total Measures	381,029	36,530	417,559
Installed Projects	12,886	1,069	13,955

Source: ComEd tracking data and evaluation team analysis

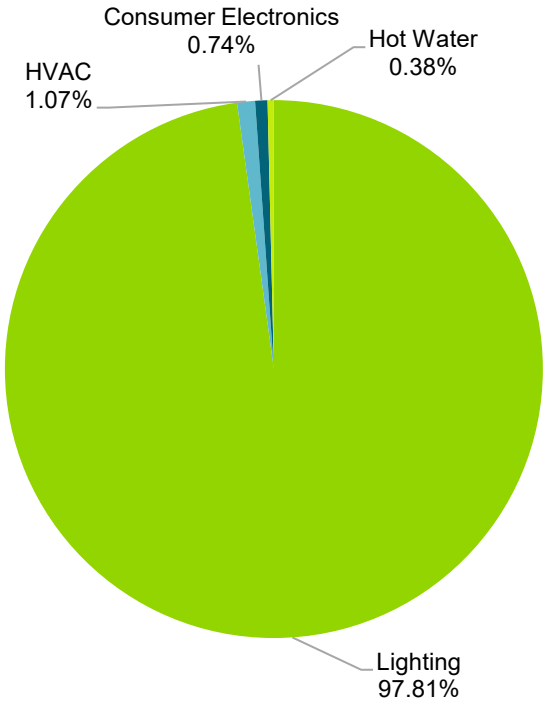
The program included the measures shown in Table 2-2 and Figure 2-1.

Table 2-2. Number of Measures by Type

End Use Type	Research Category	Quantity	Unit
Lighting	LED Specialty Lamp - Interior	209,914	Each
Lighting	LED Omnidirectional Bulb - Interior	144,292	Each
Lighting	LED Specialty Lamp - Exterior	10,658	Each
Lighting	LED Omnidirectional Bulb - Exterior	9,111	Each
Lighting	LED Specialty Lamp - Interior - VA	17,742	Each
Lighting	LED Omnidirectional Bulb - Interior - VA	14,280	Each
HVAC	Advanced Thermostat	1,487	Each
HVAC	Programmable Thermostat	2,997	Each
Consumer Electronics	Advanced Power Strip - Tier 1	3,087	Each
Lighting	LED Omnidirectional Bulb - Exterior - VA	1,401	Each
Lighting	LED Specialty Lamp - Exterior - VA	1,019	Each
Hot Water	Low Flow Showerhead	307	Each
Hot Water	Low Flow Showerhead - VA	83	Each
Hot Water	HW Pipe Insulation	691	Linear Feet
Hot Water	Low Flow Faucet Aerator	228	Each
Hot Water	Low Flow Faucet Aerator - VA	116	Each
Hot Water	HW Pipe Insulation - VA	147	Linear Feet
	Total	**417,559**	

HW = Hot Water
Note: The rows are sorted by verified gross savings.
Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Share of Measures Distributed by End-Use Type



Source: ComEd tracking data and evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the SFA Program achieved in CY2021. The gas utilities are claiming all gas savings for this program.

Table 3-1. Total Annual Incremental Electric Savings

Savings Category	Units	Ex Ante Gross Savings	Program Gross Realization Rate	Verified Gross Savings	Program Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	Verified Net Savings†
Electric Energy Savings - Direct	kWh	17,325,734	0.98	16,921,456	Varies	N/A	N/A	14,246,262
Electric Energy Savings - Converted from Gas	kWh	0	N/A	0	Varies	N/A	N/A	0
Total Electric Energy Savings	kWh	17,325,734	0.98	16,921,456	Varies	N/A	N/A	14,246,262
Summer Peak* Demand Savings	kW	2,401.12	0.99	2,371.12	Varies	N/A	N/A	1,990.64

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

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

† The "Verified Net Savings" in row one (Electric Energy Savings – Direct) includes primary kWh savings as a result of measure implementation. It also includes secondary kWh savings from wastewater treatment and electric heating penalties.

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 SFA Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2021. The electric CPAS across all measures installed in 2021 is shown in Table 4-1. The CY2021 gas contribution to CPAS (converted to equivalent electricity) is shown in Table 4-2. The combined savings are shown in 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 CY2021 contribution and the historic contribution. Figure 4-1 shows the savings across the effective useful life (EUL) of the measures.

The gas and total CPAS tables are being shown as the program has historic gas savings. Guidehouse did not evaluate gas savings for the SFA program in CY2021 as the gas utilities are claiming all gas savings, so the total CPAS only varies due to historic values. Measures installed as part of the virtual assessment channel are differentiated with a VA suffix.

Table 4-1. Cumulative Persisting Annual Savings – Electric

End Use Type	Research Category	EUL	CY2021 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	6,983,602	0.84	44,935,287				5,866,226	5,866,226	5,866,226	5,866,226	3,578,398	3,578,398
Lighting	LED Omnidirectional Bulb - Interior	10.0	5,409,717	0.84	28,537,339				4,544,162	4,544,162	4,544,162	4,544,162	1,726,782	1,726,782
Lighting	LED Specialty Lamp - Exterior	6.9	1,412,026	0.84	6,842,620				1,186,102	1,186,102	1,186,102	1,186,102	723,522	723,522
Lighting	LED Omnidirectional Bulb - Exterior	8.0	1,031,947	0.84	4,784,931				866,835	866,835	866,835	866,835	329,397	329,397
Lighting	LED Specialty Lamp - Interior - VA	10.0	501,503	0.84	3,226,870				421,262	421,262	421,262	421,262	256,970	256,970
Lighting	LED Omnidirectional Bulb - Interior - VA	10.0	444,905	0.84	2,346,963				373,720	373,720	373,720	373,720	142,014	142,014
HVAC	Advanced Thermostat	11.0	350,002	Multiple||	3,204,156				291,287	291,287	291,287	291,287	291,287	291,287
HVAC	Programmable Thermostat	16.0	245,737	0.90	3,538,612				221,163	221,163	221,163	221,163	221,163	221,163
Consumer Electronics	Advanced Power Strip - Tier 1	7.0	195,636	0.85	1,164,035				166,291	166,291	166,291	166,291	166,291	166,291
Lighting	LED Omnidirectional Bulb - Exterior - VA	8.0	134,270	0.84	622,585				112,787	112,787	112,787	112,787	42,859	42,859
Lighting	LED Specialty Lamp - Exterior - VA	6.9	108,460	0.84	525,592				91,106	91,106	91,106	91,106	55,575	55,575
Hot Water	Low Flow Showerhead	10.0	67,611	1.04	703,159				70,316	70,316	70,316	70,316	70,316	70,316
Hot Water	Low Flow Showerhead - VA	10.0	15,060	1.04	156,628				15,663	15,663	15,663	15,663	15,663	15,663
Hot Water	HW Pipe Insulation	15.0	8,854	0.80	106,252				7,083	7,083	7,083	7,083	7,083	7,083
Hot Water	Low Flow Faucet Aerator	10.0	7,578	1.04	78,811				7,881	7,881	7,881	7,881	7,881	7,881
Hot Water	Low Flow Faucet Aerator - VA	10.0	3,078	1.04	32,016				3,202	3,202	3,202	3,202	3,202	3,202
Hot Water	HW Pipe Insulation - VA	15.0	1,469	0.80	17,631				1,175	1,175	1,175	1,175	1,175	1,175
CY2021 Program Total Electric Contribution to CPAS			**16,921,456**		**100,823,486**				**14,246,262**	**14,246,262**	**14,246,262**	**14,246,262**	**7,639,577**	**7,639,577**
Historic Program Total Electric Contribution to CPAS‡						**24,149,880**	**51,570,248**	**64,271,682**	**53,832,348**	**53,832,348**	**53,638,661**	**35,405,432**	**32,265,328**	**29,621,115**
Program Total Electric CPAS						**24,149,880**	**51,570,248**	**64,271,682**	**68,078,610**	**68,078,610**	**67,884,923**	**49,651,693**	**39,904,906**	**37,260,692**
CY2021 Program Incremental Expiring Electric Savings§										-	-	-	**6,606,684**	-
Historic Program Incremental Expiring Electric Savings									**10,439,334**	-	**193,687**	**18,233,230**	**3,140,103**	**2,644,213**
Program Total Incremental Expiring Electric Savings									**10,439,334**	-	**193,687**	**18,233,230**	**9,746,788**	**2,644,213**

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	LED Specialty Lamp - Interior	3,578,398	3,578,398	3,578,398	3,578,398								
Lighting	LED Omnidirectional Bulb - Interior	1,726,782	1,726,782	1,726,782	1,726,782								
Lighting	LED Specialty Lamp - Exterior	651,170											
Lighting	LED Omnidirectional Bulb - Exterior	329,397	329,397										
Lighting	LED Specialty Lamp - Interior - VA	256,970	256,970	256,970	256,970								
Lighting	LED Omnidirectional Bulb - Interior - VA	142,014	142,014	142,014	142,014								
HVAC	Advanced Thermostat	291,287	291,287	291,287	291,287	291,287							
HVAC	Programmable Thermostat	221,163	221,163	221,163	221,163	221,163	221,163	221,163	221,163	221,163	221,163		
Consumer Electronics	Advanced Power Strip - Tier 1	166,291											
Lighting	LED Omnidirectional Bulb - Exterior - VA	42,859	42,859										
Lighting	LED Specialty Lamp - Exterior - VA	50,017											
Hot Water	Low Flow Showerhead	70,316	70,316	70,316	70,316								
Hot Water	Low Flow Showerhead - VA	15,663	15,663	15,663	15,663								
Hot Water	HW Pipe Insulation	7,083	7,083	7,083	7,083	7,083	7,083	7,083	7,083	7,083			
Hot Water	Low Flow Faucet Aerator	7,881	7,881	7,881	7,881								
Hot Water	Low Flow Faucet Aerator - VA	3,202	3,202	3,202	3,202								
Hot Water	HW Pipe Insulation - VA	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175			
CY2021 Program Total Electric Contribution to CPAS		**7,561,668**	**6,694,190**	**6,321,933**	**6,321,933**	**520,709**	**229,422**	**229,422**	**229,422**	**229,422**	**221,163**	-	-
Historic Program Total Electric Contribution to CPAS‡		**28,930,035**	**11,407,156**	**6,232,915**	**843,985**	**576,103**	**576,103**	**12,475**	**4,095**	-	-	-	-
Program Total Electric CPAS		**36,491,703**	**18,101,346**	**12,554,848**	**7,165,919**	**1,096,812**	**805,525**	**241,897**	**233,517**	**229,422**	**221,163**	-	-
CY2021 Program Incremental Expiring Electric Savings§		**77,910**	**867,478**	**372,257**	-	**5,801,224**	**291,287**	-	-	-	**8,259**	**221,163**	-
Historic Program Incremental Expiring Electric Savings		**691,080**	**17,522,879**	**5,174,241**	**5,388,929**	**267,882**	-	**563,628**	**8,381**	**4,095**	-	-	-
Program Total Incremental Expiring Electric Savings		**768,990**	**18,390,357**	**5,546,498**	**5,388,929**	**6,069,106**	**291,287**	**563,628**	**8,381**	**4,095**	**8,259**	**221,163**	-

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2021 contribution to CPAS.

* A deemed value. Source: Illinois Stakeholder Advisory Group (SAG) website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† 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.
|| Advanced thermostat measures have a net-to-gross (NTG) value of 0.8 for cooling and 0.9 for heating.
Source: Evaluation team analysis

Table 4-2. Cumulative Persisting Annual Savings – Gas

End Use Type	Research Category	EUL	CY2021 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		0.84	-									
Lighting	LED Omnidirectional Bulb - Interior	10.0		0.84	-									
Lighting	LED Specialty Lamp - Exterior	6.9		0.84	-									
Lighting	LED Omnidirectional Bulb - Exterior	8.0		0.84	-									
Lighting	LED Specialty Lamp - Interior - VA	10.0		0.84	-									
Lighting	LED Omnidirectional Bulb - Interior - VA	10.0		0.84	-									
HVAC	Advanced Thermostat	11.0		0.90#	-									
HVAC	Programmable Thermostat	16.0		0.90	-									
Consumer Electronics	Advanced Power Strip - Tier 1	7.0		0.85	-									
Lighting	LED Omnidirectional Bulb - Exterior - VA	8.0		0.84	-									
Lighting	LED Specialty Lamp - Exterior - VA	6.9		0.84	-									
Hot Water	Low Flow Showerhead	10.0		1.04	-									
Hot Water	Low Flow Showerhead - VA	10.0		1.04	-									
Hot Water	HW Pipe Insulation	15.0		0.80	-									
Hot Water	Low Flow Faucet Aerator	10.0		1.04	-									
Hot Water	Low Flow Faucet Aerator - VA	10.0		1.04	-									
Hot Water	HW Pipe Insulation - VA	15.0		0.80	-									
CY2021 Program Total Gas Contribution to CPAS (Therms)			-		-				-	-	-	-	-	-
CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡						-	-	-	-	-	-	-	-	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§						**16,496**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**
Program Total Gas CPAS (kWh Equivalent)						**16,496**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**	**33,601**
CY2021 Program Incremental Expiring Gas Savings (Therms)										-	-	-	-	-
CY2021 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												
Lighting	LED Specialty Lamp - Exterior												
Lighting	LED Omnidirectional Bulb - Exterior												
Lighting	LED Specialty Lamp - Interior - VA												
Lighting	LED Omnidirectional Bulb - Interior - VA												
HVAC	Advanced Thermostat												
HVAC	Programmable Thermostat												
Consumer Electronics	Advanced Power Strip - Tier 1												
Lighting	LED Omnidirectional Bulb - Exterior - VA												
Lighting	LED Specialty Lamp - Exterior - VA												
Hot Water	Low Flow Showerhead												
Hot Water	Low Flow Showerhead - VA												
Hot Water	HW Pipe Insulation												
Hot Water	Low Flow Faucet Aerator												
Hot Water	Low Flow Faucet Aerator - VA												
Hot Water	HW Pipe Insulation - VA												
CY2021 Program Total Gas Contribution to CPAS (Therms)		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§		**33,601**	**17,106**	**17,106**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Program Total Gas CPAS (kWh Equivalent)		**33,601**	**17,106**	**17,106**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CY2021 Program Incremental Expiring Gas Savings (Therms)		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)‖		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)		**-**	**16,496**	**-**	**17,106**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
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 CY2021.

* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† 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.

Advanced thermostat measures have a NTG value of 0.9 for gas savings. The Illinois Technical Reference Manual v9.0 (IL-TRM)[1] Errata instructs gas savings to be calculated using only a heating reduction and heating effective in-service rate (ISR), so the evaluation team assumed only a heating NTG value should be applied to obtain the verified net savings.

Source: Evaluation team analysis

[1] In this report, unless stated otherwise, IL-TRM and IL-TRM Errata refer to version 9.0 (v9.0).

Table 4-3. Cumulative Persisting Annual Savings – Total

End Use Type	Research Category	EUL	CY2021 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	6,983,602	0.84	44,935,287				5,866,226	5,866,226	5,866,226	5,866,226	3,578,398	3,578,398
Lighting	LED Omnidirectional Bulb - Interior	10.0	5,409,717	0.84	28,537,339				4,544,162	4,544,162	4,544,162	4,544,162	1,726,782	1,726,782
Lighting	LED Specialty Lamp - Exterior	6.9	1,412,026	0.84	6,842,620				1,186,102	1,186,102	1,186,102	1,186,102	723,522	723,522
Lighting	LED Omnidirectional Bulb - Exterior	8.0	1,031,947	0.84	4,784,931				866,835	866,835	866,835	866,835	329,397	329,397
Lighting	LED Specialty Lamp - Interior - VA	10.0	501,503	0.84	3,226,870				421,262	421,262	421,262	421,262	256,970	256,970
Lighting	LED Omnidirectional Bulb - Interior - VA	10.0	444,905	0.84	2,346,963				373,720	373,720	373,720	373,720	142,014	142,014
HVAC	Advanced Thermostat	11.0	350,002	Multiple||	3,204,156				291,287	291,287	291,287	291,287	291,287	291,287
HVAC	Programmable Thermostat	16.0	245,737	0.90	3,538,612				221,163	221,163	221,163	221,163	221,163	221,163
Consumer Electronics	Advanced Power Strip - Tier 1	7.0	195,636	0.85	1,164,035				166,291	166,291	166,291	166,291	166,291	166,291
Lighting	LED Omnidirectional Bulb - Exterior - VA	8.0	134,270	0.84	622,585				112,787	112,787	112,787	112,787	42,859	42,859
Lighting	LED Specialty Lamp - Exterior - VA	6.9	108,460	0.84	525,592				91,106	91,106	91,106	91,106	55,575	55,575
Hot Water	Low Flow Showerhead	10.0	67,611	1.04	703,159				70,316	70,316	70,316	70,316	70,316	70,316
Hot Water	Low Flow Showerhead - VA	10.0	15,060	1.04	156,628				15,663	15,663	15,663	15,663	15,663	15,663
Hot Water	HW Pipe Insulation	15.0	8,854	0.80	106,252				7,083	7,083	7,083	7,083	7,083	7,083
Hot Water	Low Flow Faucet Aerator	10.0	7,578	1.04	78,811				7,881	7,881	7,881	7,881	7,881	7,881
Hot Water	Low Flow Faucet Aerator - VA	10.0	3,078	1.04	32,016				3,202	3,202	3,202	3,202	3,202	3,202
Hot Water	HW Pipe Insulation - VA	15.0	1,469	0.80	17,631				1,175	1,175	1,175	1,175	1,175	1,175
CY2021 Program Total Contribution to CPAS			**16,921,456**		**100,823,486**				**14,246,262**	**14,246,262**	**14,246,262**	**14,246,262**	**7,639,577**	**7,639,577**
Historic Program Total Contribution to CPAS‡						**24,166,376**	**51,603,850**	**64,305,284**	**53,865,950**	**53,865,950**	**53,672,263**	**35,439,033**	**32,298,930**	**29,654,717**
Program Total CPAS						**24,166,376**	**51,603,850**	**64,305,284**	**68,112,211**	**68,112,211**	**67,918,524**	**49,685,295**	**39,938,507**	**37,294,294**
CY2021 Program Incremental Expiring Savings§										-	-	-	**6,606,684**	-
Historic Program Incremental Expiring Savings									**10,439,334**	-	**193,687**	**18,233,230**	**3,140,103**	**2,644,213**
Program Total Incremental Expiring Savings									**10,439,334**	-	**193,687**	**18,233,230**	**9,746,788**	**2,644,213**

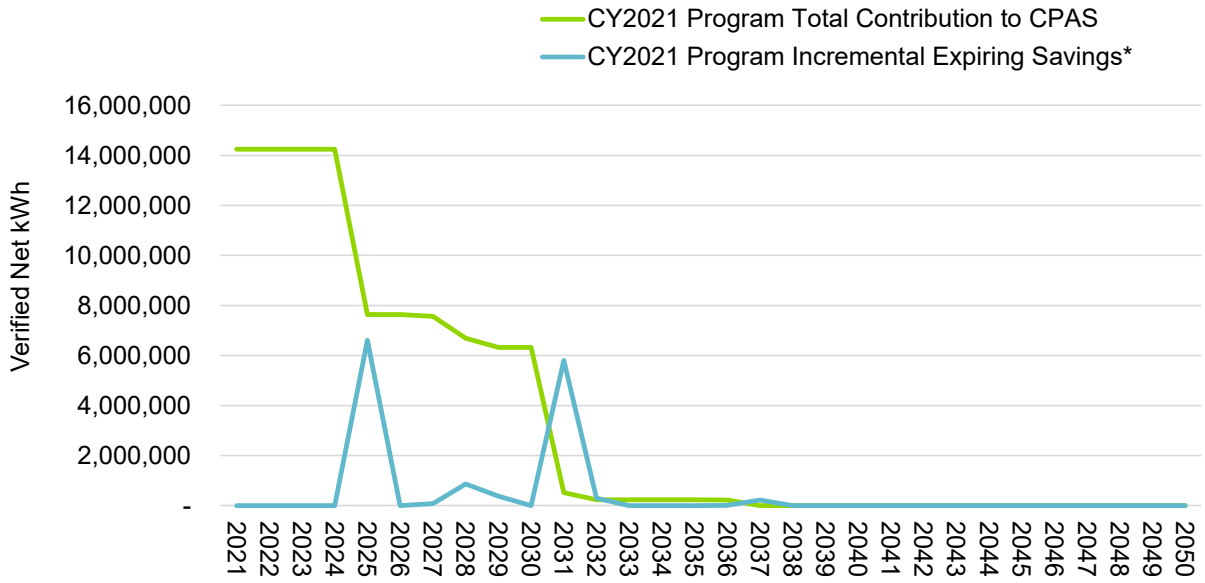
End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	LED Specialty Lamp - Interior	3,578,398	3,578,398	3,578,398	3,578,398								
Lighting	LED Omnidirectional Bulb - Interior	1,726,782	1,726,782	1,726,782	1,726,782								
Lighting	LED Specialty Lamp - Exterior	651,170											
Lighting	LED Omnidirectional Bulb - Exterior	329,397	329,397										
Lighting	LED Specialty Lamp - Interior - VA	256,970	256,970	256,970	256,970								
Lighting	LED Omnidirectional Bulb - Interior - VA	142,014	142,014	142,014	142,014								
HVAC	Advanced Thermostat	291,287	291,287	291,287	291,287	291,287							
HVAC	Programmable Thermostat	221,163	221,163	221,163	221,163	221,163	221,163	221,163	221,163	221,163	221,163		
Consumer Electronics	Advanced Power Strip - Tier 1	166,291											
Lighting	LED Omnidirectional Bulb - Exterior - VA	42,859	42,859										
Lighting	LED Specialty Lamp - Exterior - VA	50,017											
Hot Water	Low Flow Showerhead	70,316	70,316	70,316	70,316								
Hot Water	Low Flow Showerhead - VA	15,663	15,663	15,663	15,663								
Hot Water	HW Pipe Insulation	7,083	7,083	7,083	7,083	7,083	7,083	7,083	7,083	7,083			
Hot Water	Low Flow Faucet Aerator	7,881	7,881	7,881	7,881								
Hot Water	Low Flow Faucet Aerator - VA	3,202	3,202	3,202	3,202								
Hot Water	HW Pipe Insulation - VA	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175			
CY2021 Program Total Contribution to CPAS		**7,561,668**	**6,694,190**	**6,321,933**	**6,321,933**	**520,709**	**229,422**	**229,422**	**229,422**	**229,422**	**221,163**	**-**	**-**
Historic Program Total Contribution to CPAS‡		**28,963,636**	**11,424,262**	**6,250,020**	**843,985**	**576,103**	**576,103**	**12,475**	**4,095**	**-**	**-**	**-**	**-**
Program Total CPAS		**36,525,304**	**18,118,451**	**12,571,954**	**7,165,919**	**1,096,812**	**805,525**	**241,897**	**233,517**	**229,422**	**221,163**	**-**	**-**
CY2021 Program Incremental Expiring Savings§		**77,910**	**867,478**	**372,257**	**-**	**5,801,224**	**291,287**	**-**	**-**	**-**	**8,259**	**221,163**	**-**
Historic Program Incremental Expiring Savings		**691,080**	**17,539,375**	**5,174,241**	**5,406,035**	**267,882**	**-**	**563,628**	**8,381**	**4,095**	**-**	**-**	**-**
Program Total Incremental Expiring Savings		**768,990**	**18,406,853**	**5,546,498**	**5,406,035**	**6,069,106**	**291,287**	**563,628**	**8,381**	**4,095**	**8,259**	**221,163**	**-**

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 CY2021.

* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† 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.
|| Advanced thermostat measures have a NTG value of 0.8 for cooling and 0.9 for heating.
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 included the measures shown in Table 5-1 and Figure 5-1.

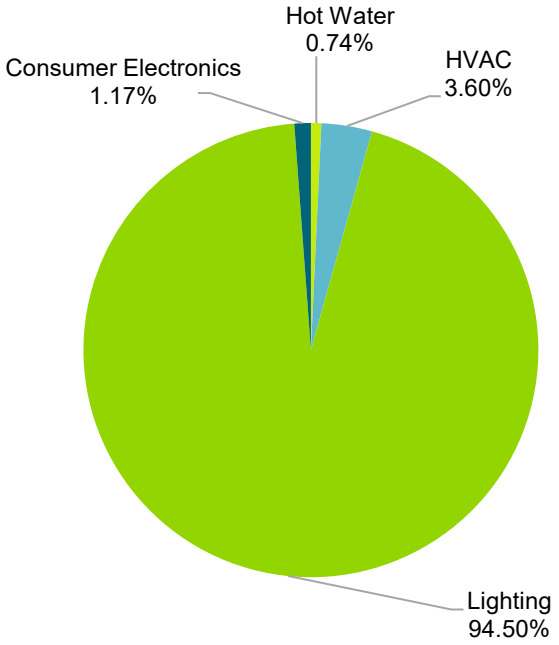
Table 5-1. Number of Measures by Type

End Use Type	Research Category	Quantity	Unit
Lighting	LED Specialty Lamp - Interior	209,914	Each
Lighting	LED Omnidirectional Bulb - Interior	144,292	Each
Lighting	LED Specialty Lamp - Exterior	10,658	Each
Lighting	LED Omnidirectional Bulb - Exterior	9,111	Each
Lighting	LED Specialty Lamp - Interior - VA	17,742	Each
Lighting	LED Omnidirectional Bulb - Interior - VA	14,280	Each
HVAC	Advanced Thermostat	1,487	Each
HVAC	Programmable Thermostat	2,997	Each
Consumer Electronics	Advanced Power Strip - Tier 1	3,087	Each
Lighting	LED Omnidirectional Bulb - Exterior - VA	1,401	Each
Lighting	LED Specialty Lamp - Exterior - VA	1,019	Each
Hot Water	Low Flow Showerhead	307	Each
Hot Water	Low Flow Showerhead - VA	83	Each
Hot Water	HW Pipe Insulation	691	Linear Feet
Hot Water	Low Flow Faucet Aerator	228	Each
Hot Water	Low Flow Faucet Aerator - VA	116	Each
Hot Water	HW Pipe Insulation - VA	147	Linear Feet
	Total	**417,559**	

Note: This is the same table as Table 2-2.

Source: ComEd tracking data and evaluation team analysis

Figure 5-1. Verified Net Savings by End Use Type – Electric



Source: ComEd tracking data and evaluation team analysis

Measure-level energy and demand savings are provided in the following tables.

Table 5-2. 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	7,043,826	0.99	6,983,602	0.84	5,866,226	10.0
Lighting	LED Omnidirectional Bulb - Interior	5,461,180	0.99	5,409,717	0.84	4,544,162	10.0
Lighting	LED Specialty Lamp - Exterior	1,412,029	1.00	1,412,026	0.84	1,186,102	6.9
Lighting	LED Omnidirectional Bulb - Exterior	1,031,948	1.00	1,031,947	0.84	866,835	8.0
Lighting	LED Specialty Lamp - Interior - VA	597,324	0.84	501,503	0.84	421,262	10.0
Lighting	LED Omnidirectional Bulb - Interior - VA	530,701	0.84	444,905	0.84	373,720	10.0
HVAC	Advanced Thermostat	372,968	0.94	350,002	Multiple†	291,287	11.0
HVAC	Programmable Thermostat	245,652	1.00	245,737	0.90	221,163	16.0
Consumer Electronics	Advanced Power Strip - Tier 1	239,909	0.82	195,636	0.85	166,291	7.0
Lighting	LED Omnidirectional Bulb - Exterior - VA	158,015	0.85	134,270	0.84	112,787	8.0
Lighting	LED Specialty Lamp - Exterior - VA	127,640	0.85	108,460	0.84	91,106	6.9
Hot Water	Low Flow Showerhead	65,495	1.03	67,611	1.04	70,316	10.0
Hot Water	Low Flow Showerhead - VA	17,673	0.85	15,060	1.04	15,663	10.0
Hot Water	HW Pipe Insulation	8,530	1.04	8,854	0.80	7,083	15.0
Hot Water	Low Flow Faucet Aerator	7,314	1.04	7,578	1.04	7,881	10.0
Hot Water	Low Flow Faucet Aerator - VA	3,638	0.85	3,078	1.04	3,202	10.0
Hot Water	HW Pipe Insulation - VA	1,892	0.78	1,469	0.80	1,175	15.0
	Total	**17,325,734**	**0.98**	**16,921,456**		**14,246,262**	

Note: The savings in this table include secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd. The savings account for electric heating penalties, where applicable.

* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† Advanced thermostat measures have a NTG value of 0.8 for cooling and 0.9 for heating.

Source: ComEd tracking data and evaluation team analysis

Table 5-3. 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	1,063.54	1.01	1,079.42	0.84	906.71
Lighting	LED Omnidirectional Bulb - Interior	679.21	1.02	695.07	0.84	583.86
Lighting	LED Specialty Lamp - Exterior	155.75	1.00	155.86	0.84	130.92
Lighting	LED Omnidirectional Bulb - Exterior	113.82	1.00	113.82	0.84	95.61
Lighting	LED Specialty Lamp - Interior - VA	90.42	0.86	77.82	0.84	65.37
Lighting	LED Omnidirectional Bulb - Interior - VA	66.21	0.87	57.42	0.84	48.24
HVAC	Advanced Thermostat	181.26	0.68	123.42	0.80†	98.73
HVAC	Programmable Thermostat	0.00	N/A	0.00	0.90	0.00
Consumer Electronics	Advanced Power Strip - Tier 1	0.00	N/A	21.95	0.85	18.66
Lighting	LED Omnidirectional Bulb - Exterior - VA	17.43	0.85	14.83	0.84	12.46
Lighting	LED Specialty Lamp - Exterior - VA	14.08	0.85	11.97	0.84	10.05
Hot Water	Low Flow Showerhead	7.77	1.00	7.77	1.04	8.08
Hot Water	Low Flow Showerhead - VA	2.09	0.83	1.73	1.04	1.80
Hot Water	HW Pipe Insulation	0.00	N/A	1.01	0.80	0.81
Hot Water	Low Flow Faucet Aerator	6.30	0.99	6.23	1.04	6.48
Hot Water	Low Flow Faucet Aerator - VA	3.25	0.81	2.63	1.04	2.74
Hot Water	HW Pipe Insulation - VA	0.00	N/A	0.17	0.80	0.13
	Total	**2,401.12**	**0.99**	**2,371.12**		**1,990.64**

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).
* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.
† Advanced thermostat measures have a NTG value of 0.8 for demand savings. The IL-TRM Errata instructs demand savings to be calculated using only a cooling demand reduction and cooling effective ISR, so the evaluation team assumed only a cooling NTG value should be applied to obtain the verified net savings.

Source: ComEd tracking data and evaluation team analysis

The SFA Program includes measures that save water. That reduction in water produces secondary kWh savings from water supply and wastewater treatment. Table 5-4 shows the secondary measure-level savings. The savings in this table are included in the electricity savings in the previous tables in this section.

Table 5-4. 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	0	NR	N/A	0	0.84	0
Lighting	LED Omnidirectional Bulb - Interior	0	NR	N/A	0	0.84	0
Lighting	LED Specialty Lamp - Exterior	0	NR	N/A	0	0.84	0
Lighting	LED Omnidirectional Bulb - Exterior	0	NR	N/A	0	0.84	0
Lighting	LED Specialty Lamp - Interior - VA	0	NR	N/A	0	0.84	0
Lighting	LED Omnidirectional Bulb - Interior - VA	0	NR	N/A	0	0.84	0
HVAC	Advanced Thermostat	0	NR	N/A	0	Multiple†	0
HVAC	Programmable Thermostat	0	NR	N/A	0	0.90	0
Consumer Electronics	Advanced Power Strip - Tier 1	0	NR	N/A	0	0.85	0
Lighting	LED Omnidirectional Bulb - Exterior - VA	0	NR	N/A	0	0.84	0
Lighting	LED Specialty Lamp - Exterior - VA	0	NR	N/A	0	0.84	0
Hot Water	Low Flow Showerhead	559,784,361	NR	N/A	2,117	1.04	2,201
Hot Water	Low Flow Showerhead - VA	151,053,353	NR	N/A	462	1.04	480
Hot Water	HW Pipe Insulation	0	NR	N/A	0	0.80	0
Hot Water	Low Flow Faucet Aerator	84,570,475	NR	N/A	336	1.04	349
Hot Water	Low Flow Faucet Aerator - VA	42,391,871	NR	N/A	128	1.04	133
Hot Water	HW Pipe Insulation - VA	0	NR	N/A	0	0.80	0
	Total	**837,800,060**	**NR**	**N/A**	**3,042**		**3,164**

Note: The savings in this table reflect only secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd, not those claimed by gas utilities.
N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).
NR = not reported in the tracking data.
Note: The savings in this table reflect only secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd, not those claimed by gas utilities.
* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.
† Advanced thermostat measures have a NTG value of 0.8 for cooling and 0.9 for heating.

Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

The issues that had the largest effect on adjusting ex ante gross savings include legacy findings carried over from the CY2020 impact evaluation report. These include the following, with the finding number from this report listed with the topic:

- **VA ISR (Finding 3):** VA measures are to use a separate ISR value as referenced in the Guidehouse August 2020 memo.[2] The evaluation team found the ex ante savings values did not use the VA ISR values for VA hot water and LED measures, causing a discrepancy in realization rates.
- **Multiple thermostats (Finding 5):** The tracking data contained instances of a single home claiming savings for more than one thermostat. According to the IL-TRM, savings should only be claimed for one thermostat of any type in a household. The evaluation team averaged the savings of multiple thermostats installed in the same home to represent only counting savings for one thermostat per household.
- **Existing thermostat type (Finding 4):** The tracking data listed existing thermostat types for some measures that did not match the measure name field. The evaluation team used the measure name details in the verified analysis.
- **Secondary water savings (Findings 8 and 9):** Secondary savings from water supply and treatment are not accounted for in the ex ante water measures' savings values. The tracking data summary states energy values do not account for converted gallons savings.
- **Building type (Findings 1, 6, and 11):** The ex ante savings values do not always differentiate savings inputs, such as ISR values, by building type where the IL-TRM and Master Measure Database (MMDB) instructs to do so.

The CY2021 energy and peak demand realization rates for all measure types are presented in Table 5-2 and Table 5-3.

The evaluation team developed several recommendations for ComEd and the IC based on findings from the CY2021 evaluation.

6.1 Ex Ante Savings Inputs

Finding 1. The evaluation team could not identify savings inputs used in many of the ex ante calculations. This finding applies to LEDs, low flow showerheads, low flow faucet aerators, and hot water pipe insulation. Table B-1 through Table B-6 in Appendix B outline the inputs and values the evaluation team used in the verified savings and the realization rates.

Finding 2. LED measures' ex ante calculations used one heating equipment efficiency value (nHeat) for all measures. The IL-TRM instructs that the nHeat value varies based on heating system type and age. Details on how the evaluation team assigned nHeat and the resulting verified heating penalty values can be seen in Table B-7 and Table B-8, respectively.

> **Recommendation 1.** Review the inputs the evaluation team used (see Table B-2 through Table B-7) and update the inputs used in ex ante savings calculations. This

[2] Single Family Virtual Assessment ISR Memo 2020-08-20.docx

information should be specified in the tracking data where fields are provided. Use input values in line with the IL-TRM for all measures and the low flow custom average flow rate in gallons per minute (GPM_low) value for faucet aerators as specified in the MMDB 2021.

6.2 Virtual Assessment Measures – ISR

Finding 3. Ex ante calculations did not use the VA ISR values for applicable measures. The verified savings values used the VA ISR value from the memo Guidehouse provided in August 2020[3] for VA LED and VA hot water measures. VA measures had an energy realization rate of 0.85 and achieved 7.76% of verified gross savings.

> **Recommendation 2**. Use the VA ISR values from the Guidehouse memo (shown in Table B-9) to determine ex ante savings for all VA measures in CY2021.

6.3 HVAC – Advanced and Programmable Thermostats

Advanced thermostats had an energy realization rate of 0.95 and achieved 2.08% of verified gross savings where the programmable thermostats had an energy realization rate of 1.00 and achieved 1.45% of verified gross savings.

Finding 4. The evaluation team used the measure name field in the tracking data to determine the baseline thermostat type and found that the existing thermostat type field in the tracking did not always match what was listed in the measure name. The team searched the measure name for “Base Manual” and “Programmable Installed” for the *manual* baseline and “Base Prog” or “Reprogram” for the *programmable* baseline. The evaluation team and the IC discussed this finding during the Wave 1 analysis and came to the assignments as shown in Table B-10. There were 75 cases where the information provided in the existing thermostat type tracking data field conflicted with the evaluation team’s existing type assignment, which is detailed in Table B-10.

> **Recommendation 3.** Ensure the existing thermostat field consistently matches the details included in the measure name.

Finding 5. The program claimed savings for more than one thermostat per ComEd account number for 10 participants. The project IDs associated with these accounts are in Table B-11. Per the IL-TRM, savings should only be claimed for one thermostat per household. For these 10 participants, the evaluation team verified savings for one thermostat per household by averaging the savings for the thermostats installed.

> **Recommendation 4.** Claim savings for one thermostat per household per the guidance in the IL-TRM.

6.4 Advanced Power Strips – Tier 1

The advanced power strip measure had an energy realization rate of 0.82 and accounted for 1.16% of verified gross savings.

[3] Single Family Virtual Assessment ISR Memo 2020-08-20.docx

Finding 6. Ex ante savings used a direct install ISR value for the $10 co-pay measures and a single-family leave-behind ISR value for the free VA measures. Based on program details, the co-pay measures should use a time-of-sale ISR value and the free VA measures should use a leave-behind ISR value according to their building type in compliance with the IL-TRM. This discrepancy caused ex ante savings to be overestimated for co-pay measures and multifamily free measures.

> **Recommendation 5.** Ensure correct ISR values are used in each measure's savings calculation or provide more information in support of the values being used in the ex ante savings. Table B-3 illustrates the ISR values used in the verified savings calculations, sourced from the IL-TRM.

Finding 7. The evaluation team found one advanced power strip measure type beginning with "ZZZ_" (see bottom row of Table B-3). ComEd informed Guidehouse the "ZZZ_" is a note that payment should not have been collected, but the measure is to be treated as co-pay. The evaluation team calculated savings for this measure using a time-of-sale ISR value where the ex ante savings used the direct install ISR value. This ISR change resulted in a realization rate of 0.82.

> **Recommendation 6.** Ensure the tracking data documents measure details like this ("ZZZ_") where a piece of the measure name requires more context. This could be done by adding a measure notes column in the tracking data for written details or by adding a comment to the tracking data summary workbook.

6.5 Hot Water Measures

Finding 8. The magnitude of reported ex ante water gallons in the tracking data is larger than expected. The evaluation team used the water gallons equations in the IL-TRM to calculate the gallons used in the verified secondary water supply and treatment savings.

> **Recommendation 7.** Calculate water gallons savings using the equations provided in the IL-TRM for applicable hot water measures.

Finding 9. The tracking data does not have a reported field for secondary water supply and treatment savings. While this did not directly impact savings, a separate column with these savings would help to ensure that the savings align and enable the evaluation team to better pinpoint the source of total energy savings discrepancies.

> **Recommendation 8.** Report secondary water supply and treatment kWh savings in the tracking data for showerhead and aerator measures in a separate field from gross gallons. The evaluation team acknowledges this is a work-in-progress from CY2020 and that ComEd and the IC will coordinate to report these consistently going forward.

Finding 10. The showerhead and aerator measures' ex ante energy savings in the tracking data were only the primary savings and did not include secondary water savings. This caused the ex ante savings to be underestimated. The IL-TRM instructs that water measures should report the energy savings as a combination of the primary savings and the secondary water supply and treatment savings.

Recommendation 9. Calculate secondary water savings for applicable measures and include these values in the overall ex ante energy savings.

Finding 11. The following fields (which may be used for pipe insulation, showerhead, and aerator measures) were blank for all entries in the tracking data: "Pipe_Insulation_Rnew_Value," "GPM_base," "GPM_low," "C_exist," and "C_new." The team used the IL-TRM and the 2021 MMDB to source these values.

Recommendation 10. The IC should collect "Pipe_Insulation_Rnew_Value," "GPM_base," "GPM_low," "C_exist," and "C_new" values when they are onsite and report them in the tracking data. If the values are already available in the MMDB file, should populate the fields in the tracking data rather than leaving them blank.

6.6 Building Type

ComEd defines a multifamily building as a building with five or more units.[4] The evaluation team used this definition to determine building type mapping for the CY2021 analysis. The team used the building type mapping shown in Table B-12.

Finding 12. Several hot water and HVAC measures have "CONDO" in the measure name but are marked as a five-unit building. This does not impact savings but is important for data accuracy.

Recommendation 11. Ensure measures are correctly named to match their listed building type in the tracking data.

[4] Vincent Gutierrez, email message to Nishant Mehta, "Re: HEA - Res Building Type," October 1, 2018.

Appendix A. Impact Analysis Methodology

Guidehouse determined the verified gross savings for each measure by:

- Reviewing the tracking data for completeness and alignment of savings values with the MMDB, IL-TRM, and IL-TRM Errata, where applicable.
- Validating the savings algorithms were applied correctly.
- Cross-checking per-unit savings values in the tracking data with verified values obtained using the MMDB, IL-TRM, and IL-TRM Errata, where applicable, to determine the cause behind any discrepancy. Single-family and multifamily inputs were defined using Table B-12 and were a key factor in verifying savings inputs were applied correctly.
- Multiplying the verified per-unit savings by the verified quantity. Verified quantities matched quantities provided in the tracking data except for thermostat measures; some households claimed savings for more than one measure, so quantity and savings were averaged.

Appendix B. Impact Findings Detailed Results

Table B-1 presents the ex ante and verified savings values and realization rates for each lighting measure type. The table combines the savings of each measure type's direct install and VA measures.

Table B-1. Lighting Measure Savings and Realization Rates Summary

Measure Name	Ex Ante Energy Savings (kWh)	Verified Energy Savings (kWh)	Energy Savings Realization Rate	Ex Ante Demand Savings (kW)	Verified Demand Savings (kW)	Demand Savings Realization Rate
Exterior LED - 11W (75W)	158,057	154,824	0.98	17.43	17.03	0.98
Exterior LED - 15W (100W)	804,295	788,389	0.98	88.72	86.94	0.98
Exterior LED - 15W PAR38 (120W)	720,783	715,506	0.99	79.50	78.95	0.99
Exterior LED - 4W Candelabra (40W)	594,115	587,861	0.99	65.53	64.93	0.99
Exterior LED - 6W (40W)	1,291	1,226	0.95	0.14	0.13	0.94
Exterior LED - 8W Flood (65W)	224,771	217,118	0.97	24.79	23.94	0.97
Exterior LED - 9W (60W)	226,320	221,778	0.98	24.96	24.55	0.98
Interior LED - 11W (75W)	336,819	337,896	1.00	41.96	42.12	1.00
Interior LED - 15W (100W)	638,023	638,184	1.00	79.25	80.31	1.01
Interior LED - 15W PAR38 (120W)	308,590	309,026	1.00	46.33	46.77	1.01
Interior LED - 4W Candelabra (40W)	1,551,549	1,548,662	1.00	233.81	234.45	1.00
Interior LED - 5W Mini Globe (25W)	210,564	210,578	1.00	32.13	32.50	1.01
Interior LED - 6/12/19W 3-Way (50/100/150W)	644,926	647,534	1.00	98.07	99.09	1.01
Interior LED - 6W (40W)	90,052	90,826	1.01	11.34	11.54	1.02
Interior LED - 6W Globe (40/60W)	886,146	883,709	1.00	134.26	135.19	1.01
Interior LED - 7W Mini-Flood PAR20 (45W)	369,916	369,097	1.00	56.47	56.27	1.00
Interior LED - 7W Track Light (50W) - Pin Base GU5.3	100,044	99,770	1.00	15.42	15.41	1.00
Interior LED - 7W Track Light (50W) - Prong Base GU10	270,968	270,293	1.00	41.77	41.78	1.00
Interior LED - 8W Flood (65W)	3,298,447	3,282,632	1.00	495.71	495.78	1.00
Interior LED - 9W (60W)	4,926,986	4,900,568	0.99	612.87	618.51	1.01

Note: This table combines the savings of the direct install and VA version of each measure.

Source: ComEd tracking data and evaluation team analysis

Baseline and efficient wattage values used in the evaluation team's verified savings calculations can be seen in Table B-2.

Table B-2. Lighting Wattage Summary

Measure Name	Baseline Wattage	Efficient Wattage	Specialty Bulb Type
Interior LED - 9W (60W)	43	9	Specialty - Generic Interior
Interior LED - 11W (75W)	53	11	Specialty - Generic Interior
Exterior LED - 9W (60W)	43	9	Exterior reflector
Interior LED - 6W (40W)	29	6	Specialty - Generic Interior
Interior LED - 15W (100W)	72	15	Specialty - Generic Interior
Exterior LED - 15W (100W)	72	15	Exterior reflector
Exterior LED - 11W (75W)	53	11	Exterior reflector
Exterior LED - 6W (40W)	29	6	Exterior reflector
Interior LED - 4W Candelabra (40W)	40	4	Candelabra
Interior LED - 5W Mini Globe (25W)	25	5	Globe
Interior LED - 7W Mini-Flood PAR20 (45W)	45	7	Interior reflector
Interior LED - 8W Flood (65W)	65	8	Interior reflector
Interior LED - 6W Globe (40/60W)	40	6	Globe
Interior LED - 6/12/19W 3-Way (50/100/150W)	75	12	Three-way
Exterior LED - 4W Candelabra (40W)	40	4	Candelabra
Interior LED - 7W Track Light (50W) - Prong Base GU10	50	7	Interior reflector
Interior LED - 7W Track Light (50W) - Pin Base GU5.3	50	7	Interior reflector
Exterior LED - 15W PAR38 (120W)	120	15	Exterior reflector
Exterior LED - 8W Flood (65W)	65	8	Exterior reflector
Interior LED - 15W PAR38 (120W)	120	15	Specialty - Generic Interior

Note: Direct install and VA versions of each measure contain the same information presented in this table.

Source: ComEd tracking data, evaluation team analysis, IL-TRM

Table B-3 presents the ex ante and verified savings values for each type of advanced power strip. It includes the ISR values used in the verified calculations to help explain the presented realization rate.

Table B-3. Advanced Power Strip Discrepancy

Measure Name	Residential Building Type	ISR	Ex Ante kWh per unit	Verified kWh per unit	Verified RR kWh
Smart Strip - Tricklestar ($10) - Tier 1 - DD	MF	0.71	103.00	73.13	71%
Smart Strip - Tricklestar ($10) - Tier 1 - DD	SF	0.71	103.00	73.13	71%
VA-Smart Strip - Tricklestar (FREE) - Tier 1 - DD	MF	0.40	56.65	41.20	73%
VA-Smart Strip - Tricklestar (FREE) - Tier 1 - DD	SF	0.55	56.65	56.65	100%
ZZZ_VA-Smart Strip - Tricklestar ($10) - Tier 1 - DD	SF	0.71	103.00	73.13	71%

RR = realization rate, MF = multifamily and SF = single family

Source: Evaluation team analysis of utility tracking data

Input values used in the hot water measures' verified savings calculations can be seen in Table B-4 through Table B-6.

Table B-4. Low Flow Showerhead Savings Inputs

TRM Measure	VA?	Building Type	GPM_base	GPM_low	L_base	L_low	Household	SPCD	SPH	EPG_electric	ISR
Low Flow Showerhead	Yes	SF	2.24	1.5	7.8	7.8	2.56	0.6	1.79	0.117	0.80
Low Flow Showerhead	No	MF	2.24	1.5	7.8	7.8	2.10	0.6	1.30	0.117	0.95
Low Flow Showerhead	Yes	MF	2.24	1.5	7.8	7.8	2.10	0.6	1.30	0.117	0.80
Low Flow Showerhead	No	SF	2.24	1.5	7.8	7.8	2.56	0.6	1.79	0.117	0.97

Source: ComEd tracking data, evaluation team analysis, IL-TRM

Table B-5. Low Flow Faucet Aerator Savings Inputs

TRM Measure	VA?	Faucet Type	Building Type	GPM_base	GPM_low	L_base	L_low	Household	EPG_electric	ISR
Low Flow Faucet Aerator	Yes	Bathroom	SF	1.53	0.9691919	1.6	1.6	2.56	0.0795	0.78
Low Flow Faucet Aerator	Yes	Kitchen	SF	1.63	1.4089526	4.5	4.5	2.56	0.0969	0.77
Low Flow Faucet Aerator	No	Bathroom	SF	1.53	0.9691919	1.6	1.6	2.56	0.0795	0.95
Low Flow Faucet Aerator	No	Kitchen	SF	1.63	1.4089526	4.5	4.5	2.56	0.0969	0.95
Low Flow Faucet Aerator	Yes	Bathroom	MF	1.53	0.9691919	1.6	1.6	2.1	0.0795	0.78
Low Flow Faucet Aerator	Yes	Kitchen	MF	1.63	1.4089526	4.5	4.5	2.1	0.0969	0.77
Low Flow Faucet Aerator	No	Bathroom	MF	1.53	0.9691919	1.6	1.6	2.1	0.0795	0.95
Low Flow Faucet Aerator	No	Kitchen	MF	1.63	1.4089526	4.5	4.5	2.1	0.0969	0.91

Source: *ComEd tracking data, evaluation team analysis, IL-TRM*

Table B-6. Pipe Insulation Savings Inputs

TRM Measure	VA?	Cexist	Cnew	Rexist	Rnew	dT	nDHW_electric	ISR
HW Pipe Insulation	No	0.196	0.458	1	4	60	0.98	1.00
HW Pipe Insulation	Yes	0.196	0.458	1	4	60	0.98	0.78

Source: *ComEd tracking data, evaluation team analysis, IL-TRM*

Table B-7 outlines the nHeat definition as seen in the IL-TRM. The Heating Fuel and Heating System Type columns contain relevant information seen in the tracking data, and the TRM System Type and nHeat columns are the corresponding information from the IL-TRM.

Table B-7. nHeat Values

Heating Fuel	Heating System Type	TRM System Type	nHeat
Electric	Electric Baseboard	Resistance	1.00
	Forced Air	Resistance	1.00
	Heat Pump, 1965-2005	Heat Pump, before 2006	1.70
	Heat Pump, 2008-2010	Heat Pump, after 2006-2014	1.92
	Heat Pump, 2018-2020	Heat Pump, 2015 on	2.04
	Other	Unknown	1.28
Natural Gas	N/A	N/A	0.70
Propane	N/A	N/A	0.70

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

Source: ComEd tracking data, evaluation team analysis, IL-TRM

Table B-8 shows the ex ante and verified heating penalty values for each LED measure and its corresponding IL-TRM name. This table presents electric heating penalty values only.

Table B-8. Ex Ante and Verified Electric Heating Penalty Comparison

TRM Measure	Measure Name	Ex Ante Heating Penalty	Verified Electric Heating Penalty
LED Omnidirectional Bulb - Interior	Interior LED - 11W (75W)	-6,565.48	-6,486.72
LED Omnidirectional Bulb - Interior	Interior LED - 15W (100W)	-10,548.65	-10,163.77
LED Omnidirectional Bulb - Interior	Interior LED - 6W (40W)	-2,876.31	-2,619.25
LED Omnidirectional Bulb - Interior	Interior LED - 9W (60W)	-85,107.23	-83,519.36
LED Omnidirectional Bulb - Interior	VA-Interior LED - 11W (75W)	-444.76	-377.93
LED Omnidirectional Bulb - Interior	VA-Interior LED - 15W (100W)	-977.26	-830.41
LED Omnidirectional Bulb - Interior	VA-Interior LED - 6W (40W)	-46.39	-39.42
LED Omnidirectional Bulb - Interior	VA-Interior LED - 9W (60W)	-10,458.38	-8,814.93
LED Specialty Lamp - Interior	Interior LED - 15W PAR38 (120W)	-3,821.02	-3,821.02
LED Specialty Lamp - Interior	Interior LED - 4W Candelabra (40W)	-22,589.05	-22,379.86
LED Specialty Lamp - Interior	Interior LED - 5W Mini Globe (25W)	-5,596.39	-5,559.29
LED Specialty Lamp - Interior	Interior LED - 6/12/19W 3-Way (50/100/150W)	-15,825.69	-15,492.06
LED Specialty Lamp - Interior	Interior LED - 6W Globe (40/60W)	-17,646.28	-17,229.56
LED Specialty Lamp - Interior	Interior LED - 7W Mini-Flood PAR20 (45W)	-9,867.87	-9,823.72
LED Specialty Lamp - Interior	Interior LED - 7W Track Light (50W) - Pin Base GU5.3	-3,311.90	-3,288.64
LED Specialty Lamp - Interior	Interior LED - 7W Track Light (50W) - Prong Base GU10	-9,024.17	-8,814.62
LED Specialty Lamp - Interior	Interior LED - 8W Flood (65W)	-39,995.08	-39,275.30
LED Specialty Lamp - Interior	VA-Interior LED - 4W Candelabra (40W)	-2,454.78	-2,085.91
LED Specialty Lamp - Interior	VA-Interior LED - 5W Mini Globe (25W)	-431.03	-364.95
LED Specialty Lamp - Interior	VA-Interior LED - 6/12/19W 3-Way (50/100/150W)	-600.98	-510.67
LED Specialty Lamp - Interior	VA-Interior LED - 6W Globe (40/60W)	-1,621.68	-1,378.00
LED Specialty Lamp - Interior	VA-Interior LED - 7W Mini-Flood PAR20 (45W)	-1,060.63	-901.25
LED Specialty Lamp - Interior	VA-Interior LED - 7W Track Light (50W) - Pin Base GU5.3	-592.50	-503.46
LED Specialty Lamp - Interior	VA-Interior LED - 7W Track Light (50W) - Prong Base GU10	-1,640.76	-1,363.15
LED Specialty Lamp - Interior	VA-Interior LED - 8W Flood (65W)	-4,007.56	-3,405.37

Source: Evaluation team analysis of utility tracking data

Table B-9 is from Guidehouse's August 2020 memo,[5] outlining the custom ISR values for VA measures. Advanced power strips are not included as the VA advanced power strip measures use a leave-behind ISR value from the IL-TRM.

[5] Single Family Virtual Assessment ISR Memo 2020-08-20.docx

Table B-9. VA ISR Values

Measure Category	Prospective Custom ISR for CY2021 Single Family Virtual Assessment Measures
Showerheads	0.795
Aerators - Bathroom	0.780
Aerators - Kitchen	0.765
DWH Pipe Insulation	0.780
Omnidirectional LEDs	0.803
Specialty LEDs	0.803

Source: Single Family Virtual Assessment ISR Memo 2020-08-20.docx

The existing thermostat type discrepancy as outlined in Finding 4 can be seen in Table B-10. This table presents the measure name from the tracking data that the evaluation team used to deduce the verified existing thermostat type, as well as the tracking data's existing thermostat type information. A count of each discrepancy can be seen in the Quantity column.

Table B-10. Thermostat Baseline Type Discrepancy

Measure Name	Tracking Data Existing Thermostat Type	Verified Existing Thermostat Type	Quantity
SF - Gas - Nest ($150) - Base Prog - Furnace&AC	Manual	Programmable	1
SF - Gas - Nest E ($75) - Base Prog - Furnace&AC	Manual	Programmable	2
SF - Gas - Sensi ($75) - Base Prog - Furnace&AC	Manual	Programmable	4
SF - Gas Tstat - Reprogram Existing - Furnace	Manual	Programmable	4
VA-SF - Gas - Nest ($150) - Base Prog - Furnace&AC	Manual	Programmable	1
VA-SF - Gas - Nest E ($75) - Base Prog - Furnace&AC	Manual	Programmable	1
VA-SF - Gas - Sensi ($75) - Base Prog - Furnace&AC	Manual	Programmable	3
VA-SF - Gas Tstat - Reprogram Existing - Furnace	Manual	Programmable	1
Condo - Electric - Nest ($150) - Base Manual - Furnace&AC	Programmable In Program	Manual	1
SF - Electric - Nest E ($75) - Base Manual - Heat Pump	Programmable In Program	Manual	1
SF - Electric - Sensi ($75) - Base Manual - Furnace&AC	Programmable In Program	Manual	1
SF - Gas - Nest ($150) - Base Manual - Furnace&AC	Programmable In Program	Manual	4
SF - Gas - Nest E ($75) - Base Manual - Furnace&AC	Programmable In Program	Manual	4
SF - Gas - Sensi ($75) - Base Manual - Furnace&AC	Programmable In Program	Manual	4
SF - Gas Tstat - Programmable Installed - Furnace	Programmable In Program	Manual	2
VA-Condo - Electric - Nest ($150) - Base Manual - Furnace&AC	Programmable In Program	Manual	1
VA-SF - Gas - Nest ($150) - Base Manual - Furnace&AC	Programmable In Program	Manual	2
VA-SF - Gas - Nest E ($75) - Base Manual - Furnace&AC	Programmable In Program	Manual	2
VA-SF - Gas - Sensi ($75) - Base Manual - Furnace&AC	Programmable In Program	Manual	2
SF - Gas - Nest ($150) - Base Manual - Furnace&AC	Programmable On Hold	Manual	1
SF - Gas - Nest E ($75) - Base Manual - Furnace&AC	Programmable On Hold	Manual	7
SF - Gas - Sensi ($75) - Base Manual - Furnace&AC	Programmable On Hold	Manual	5
SF - Gas Tstat - Programmable Installed - Furnace	Programmable On Hold	Manual	4
VA-SF - Gas - Nest ($150) - Base Manual - Furnace&AC	Programmable On Hold	Manual	1
VA-SF - Gas - Nest E ($75) - Base Manual - Furnace&AC	Programmable On Hold	Manual	4
VA-SF - Gas - Sensi ($75) - Base Manual - Furnace&AC	Programmable On Hold	Manual	8
SF - Gas - Nest ($150) - Base Manual - Furnace&AC	Smart	Manual	1
SF - Gas - Nest E ($75) - Base Manual - Furnace&AC	Smart	Manual	1
SF - Gas - Sensi ($75) - Base Manual - Furnace&AC	Smart	Manual	1
VA-SF - Gas - Sensi ($75) - Base Manual - Furnace&AC	Smart	Manual	1

Source: ComEd tracking data, evaluation team analysis

Table B-11 contains the project IDs of the households that claimed savings for more than one thermostat.

Table B-11. Project IDs with Multiple Thermostats

Project ID	Measure Name
7149903	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
6970067	SF - Gas - Sensi ($75) - Base Prog - Furnace&AC-HEA 21
6970067	SF - Gas - Sensi ($75) - Base Prog - Furnace&AC-NO SAVINGS-HEA 21
6970067	SF - Gas Tstat - Reprogram Existing - Furnace-NO SAVINGS-HEA 21
7104167	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
7540645	SF - Gas Tstat - Programmable Installed - Furnace-HEA 21
7669597	SF - Gas - Sensi ($75) - Base Prog - Furnace&AC-HEA 21
7905151	SF - Gas - Nest ($150) - Base Prog - Furnace&AC-HEA 21
7803077	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
7847105	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
7910329	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
8013026	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
8044499	SF - Electric - Sensi ($75) - Base Prog - Furnace&AC-HEA 21
8072518	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
8275728	SF - Gas - Nest E ($75) - Base Manual - Furnace&AC-HEA 21
8351314	CONDO - Gas Tstat - Reprogram Existing - Furnace-HEA 21
8351314	CONDO - Gas Tstat - Reprogram Existing - Furnace-NO SAVINGS-HEA 21
8373143	SF - Gas Tstat - Reprogram Existing - Furnace-HEA 21
8550312	Condo - Gas - Nest ($150) - Base Prog - Furnace&AC-HEA 21
8550312	Condo - Gas - Nest ($150) - Base Prog - Furnace&AC-NO SAVINGS-HEA 21
8661440	SF - Electric - Nest E ($75) - Base Prog - Furnace&AC-HEA 21
8675606	SF - Gas - Nest E ($75) - Base Prog - Furnace&AC-HEA 21
8581364	SF - Gas Tstat - Programmable Installed - Furnace-HEA 21
8900994	SF - Gas - Sensi ($75) - Base Manual - Furnace&AC-HEA 21

Source: Evaluation team analysis of utility tracking data

ComEd's building type definitions are listed in Table B-12. The evaluation used these definitions in its analysis.

Table B-12. Home Type Definitions

Tracking Data Residential Building Type	Guidehouse Assigned Building Type
One Unit	Single Family
Two Unit	Single Family
Three Unit	Single Family
Four Unit	Single Family
Five Unit	Multifamily
Condo (6 or more)	Multifamily
Mobile Home	Mobile Home

Source: Gutierrez, Vincent. "Re: HEA - Res Building Type." Message to Nishant Mehta. October 01, 2018. Email

Appendix C. Total Resource Cost Detail

Table C-1 shows the TRC cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. This table does not include additional required cost data (e.g., measure costs, program-level incentives, and non-incentive costs). ComEd will provide this data to the evaluation team later.

Table C-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings‡ (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings‡ (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Lighting	LED Specialty Lamp - Interior	Each	209914	10	No	6,983,602	1,079.42	0	0	-125,684	-156,903	0.84	0.84	0.84	5,866,226	906.71	0	0	-105,575	-131,799
Lighting	LED Omnidirectional Bulb - Interior	Each	144292	10	No	5,409,717	695.07	0	0	-102,789	-121,492	0.84	0.84	0.84	4,544,162	583.86	0	0	-86,343	-102,053
Lighting	LED Specialty Lamp - Exterior	Each	10658	6.9	No	1,412,026	155.86	0	0	0	0	0.84	0.84	0.84	1,186,102	130.92	0	0	0	0
Lighting	LED Omnidirectional Bulb - Exterior	Each	9111	8	No	1,031,947	113.82	0	0	0	0	0.84	0.84	0.84	866,835	95.61	0	0	0	0
Lighting	LED Specialty Lamp - Interior - VA	Each	17742	10	No	501,503	77.82	0	0	-10,513	-11,271	0.84	0.84	0.84	421,262	65.37	0	0	-8,831	-9,468
Lighting	LED Omnidirectional Bulb - Interior - VA	Each	14280	10	No	444,905	57.42	0	0	-10,063	-9,994	0.84	0.84	0.84	373,720	48.24	0	0	-8,453	-8,395
HVAC	Advanced Thermostat	Each	1487	11	No	350,002	123.42	0	0	0	0	Multiple§	0.80||	0.90#	291,287	98.73	0	0	0	0
HVAC	Programmable Thermostat	Each	2997	16	No	245,737	0	0	0	0	0	0.9	0.9	0.9	221,163	0	0	0	0	0
Consumer Electronics	Advanced Power Strip - Tier 1	Each	3087	7	No	195,636	21.95	0	0	0	0	0.85	0.85	0.85	166,291	18.66	0	0	0	0
Lighting	LED Omnidirectional Bulb - Exterior - VA	Each	1401	8	No	134,270	14.83	0	0	0	0	0.84	0.84	0.84	112,787	12.46	0	0	0	0
Lighting	LED Specialty Lamp - Exterior - VA	Each	1019	6.9	No	108,460	11.97	0	0	0	0	0.84	0.84	0.84	91,106	10.05	0	0	0	0
Hot Water	Low Flow Showerhead	Each	307	10	No	65,495	7.77	0	2117	0	0	1.04	1.04	1.04	68,115	8.08	0	2201	0	0
Hot Water	Low Flow Showerhead - VA	Each	83	10	No	14,598	1.73	0	462	0	0	1.04	1.04	1.04	15,182	1.80	0	480	0	0
Hot Water	HW Pipe Insulation	Linear Feet	691	15	No	8,854	1.01	0	0	0	0	0.8	0.8	0.8	7,083	0.81	0	0	0	0
Hot Water	Low Flow Faucet Aerator	Each	228	10	No	7,242	6.23	0	336	0	0	1.04	1.04	1.04	7,532	6.48	0	349	0	0
Hot Water	Low Flow Faucet Aerator - VA	Each	116	10	No	2,950	2.63	0	128	0	0	1.04	1.04	1.04	3,068	2.74	0	133	0	0
Hot Water	HW Pipe Insulation - VA	Linear Feet	147	15	No	1,469	0.17	0	0	0	0	0.8	0.8	0.8	1,175	0.13	0	0	0	0
	Total					**16,918,413**	**2,371**	**0**	**3,042**	**-249,049**	**-299,660**				**14,243,097**	**1,991**	**0**	**3,164**	**-209,201**	**-251,715**

Note: To avoid double counting, the verified gross kWh and net kWh used in the TRC analysis exclude secondary energy savings from water reduction measures.

* 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 kWh savings account for electric heating penalties, where applicable. The electric heating penalties columns show the magnitude of adjustments applied to the program savings. Gas heating penalties represent the program therms heating penalties. The therms penalties are not required to be applied to the program savings.

§ Advanced thermostat measures have a NTG value of 0.8 for cooling and 0.9 for heating.

|| Advanced thermostat measures have a NTG value of 0.9 for gas savings. The IL-TRM Errata instructs gas savings to be calculated using only a heating reduction and heating effective ISR, so the evaluation team assumed only a heating NTG value should be applied to obtain the verified net savings.

†§ Advanced thermostat measures have a NTG value of 0.8 for demand savings. The IL-TRM Errata instructs demand savings to be calculated using only a cooling demand reduction and cooling effective ISR, so the evaluation team assumed only a cooling NTG value should be applied to obtain the verified net savings.

Source: ComEd tracking data and evaluation team analysis