

# ComEd Public Housing Retrofits Program Impact Evaluation Report

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

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## 1. Introduction

This report presents the results of the impact evaluation of the CY2021 Public Housing Retrofits Program. 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 Public Housing Retrofits Program works with public housing authorities (PHAs) in ComEd, Nicor Gas, Peoples Gas, and North Shore Gas territories to achieve electric and gas savings. The program is referred to as Public Housing Authority in the net-to-gross (NTG) spreadsheet. The PHA itself is the program participant, though the residents of the properties are directly affected by the program through in-unit (IU) and common area (CA) upgrades.

In CY2021, the program achieved electric and summer peak demand savings for 135 projects across 57 PHA properties, installing 157,400 measures (see Table 2-1). These counts exclude gas savings-only projects, which are detailed in the separate gas utility evaluation reports.

**Table 2-1. Number of Participants and Projects**

<b>Participation</b>	
Participants	57
Total Measures	13,738
Number of Units per Project	117
Installed Projects	135

*Source: ComEd tracking data and evaluation team analysis*

In CY2021, the program provided direct install (DI) measures to residential units, such as light-emitting diodes (LEDs), advanced power strips, low flow faucet aerators, and programmable thermostats. The program also provided CA measures such as space heating and cooling, lighting, and envelope upgrades.

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

**Table 2-2. Number of Measures by Type**

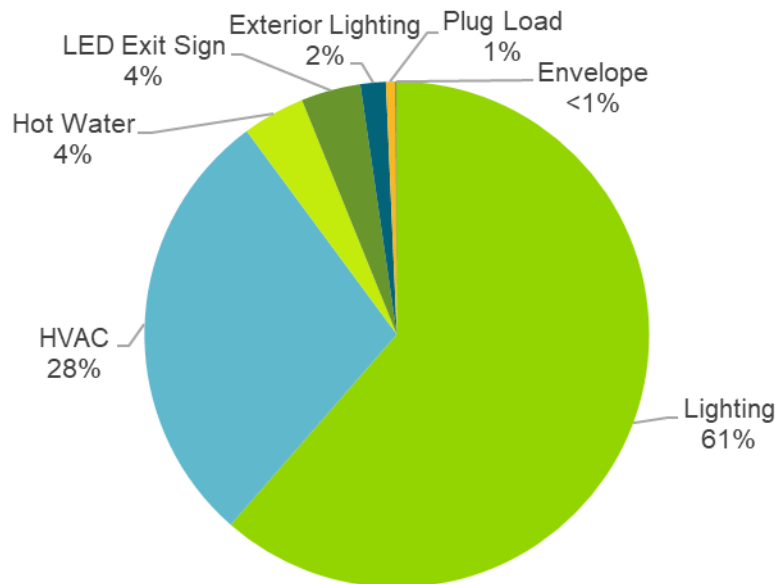
End Use Type	Research Category	Quantity	Unit
Lighting	Linear LED Lighting	3,464	Fixtures
Lighting	Interior LED Lighting	4,591	Lamps/Fixtures
Lighting	Linear Fluorescent - Delamping	385	Fixtures
Exterior Lighting	Exterior LED Lighting	223	Fixtures
LED Exit Sign	LED Exit Sign	525	Fixtures
Envelope	Insulation/Air Sealing	14	Projects
Hot Water	Showerhead	166	Each
Hot Water	Faucet Aerator	357	Each
HVAC	Programmable Thermostat	74	Each
Plug Load	Smart Strip	81	Each
HVAC	Steam Trap Repair/ Replace	2,243	Each
HVAC	Split AC	8	Each
Hot Water	Electric Shower Timer	23	Each
HVAC	Room AC Cover/Gap Sealer	1,486	Each
HVAC	Boiler Tune-Up	82	Each
HVAC	Furnace	12	Each
Hot Water	Water Heater	4	Each
<b>Total</b>		<b>13,738</b>	

HVAC – heating, ventilation, and air conditioning

AC – air conditioner

Source: ComEd tracking data and evaluation team analysis

**Figure 2-1. Share of Measures Installed 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 Public Housing Retrofits Program achieved in CY2021. The gas savings are only those that ComEd may be able to claim, which excludes savings the gas utilities claim, either via joint or non-joint programs.<sup>1</sup>

**Table 3-1. Total Annual Incremental Electric Savings**

Savings Category	Units	Ex Ante Gross Savings	Program Gross Realization Rate	Verified Gross Savings	Program			Verified Net Savings
					Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	
Electric Energy Savings - Direct	kWh	1,384,896	1.01	1,404,776	1.00	N/A	N/A	1,404,776
Electric Energy Savings - Converted from Gas‡	kWh	1,709,203	1.04	1,783,957	1.00	N/A	N/A	1,783,957
Total Electric Energy Savings	kWh	3,094,099	1.03	3,188,733	1.00	N/A	N/A	3,188,733
Summer Peak§ Demand Savings	kW	163	1.05	170	1.00	N/A	N/A	170

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

‡ Gas savings are converted to kilowatt-hours (kWh) by multiplying therms by 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh). The evaluation team will determine which gas savings will be converted to kWh and counted toward ComEd’s electric savings goal while producing the portfolio-wide Summary Report. According to Section 8-103B(b-25) of the Illinois Public Utilities Act, “In no event shall more than 10% of each year’s applicable annual incremental goal as defined in paragraph (7) of subsection (g) of this Section be met through savings of fuels other than electricity.”

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

Source: ComEd tracking data and evaluation team analysis

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

## 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 Public Housing Retrofits 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.



**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	Linear LED Lighting	8.4	474,362	1.00	3,917,238				474,362	474,362	465,352	460,294	460,294	460,294
Lighting	Interior LED Lighting_2025	6.8	365,566	1.00	1,996,038				365,566	365,566	365,566	365,566	188,493	188,493
Lighting	Interior LED Lighting_2028	10.0	53,447	1.00	500,822				53,447	53,447	53,447	53,447	53,447	53,447
Lighting	Linear Fluorescent - Delamping	11.0	245,744	1.00	1,545,385				245,744	245,744	174,222	109,959	109,959	109,959
Exterior Lighting	Exterior LED Lighting	11.6	162,998	1.00	1,894,005				162,998	162,998	162,998	162,998	162,998	162,998
LED Exit Sign	LED Exit Sign	5.0	39,045	1.00	195,226				39,045	39,045	39,045	39,045	39,045	39,045
Envelope	Insulation/Air Sealing	20.0	36,991	1.00	737,950				36,991	36,991	36,991	36,991	36,991	36,991
Hot Water	Showerhead	10.0	6,838	1.00	68,381				6,838	6,838	6,838	6,838	6,838	6,838
Hot Water	Faucet Aerator	10.0	6,203	1.00	62,030				6,203	6,203	6,203	6,203	6,203	6,203
HVAC	Programmable Thermostat	16.0	4,273	1.00	68,360				4,273	4,273	4,273	4,273	4,273	4,273
Plug Load	Smart Strip	7.0	3,337	1.00	23,360				3,337	3,337	3,337	3,337	3,337	3,337
HVAC	Steam Trap Repair/ Replace	6.0	2,303	1.00	13,818				2,303	2,303	2,303	2,303	2,303	2,303
HVAC	Split AC	18.0	1,966	1.00	35,379				1,966	1,966	1,966	1,966	1,966	1,966
Hot Water	Electric Shower Timer	2.0	1,703	1.00	3,407				1,703	1,703				
HVAC	Room AC Cover/Gap Sealer	5.0			1.00									
HVAC	Boiler Tune-Up	3.0			1.00									
HVAC	Furnace	20.0			1.00									
Hot Water	Water Heater	13.0			1.00									
<b>CY2021 Program Total Electric Contribution to CPAS</b>			<b>1,404,776</b>		<b>11,061,400</b>				<b>1,404,776</b>	<b>1,404,776</b>	<b>1,322,540</b>	<b>1,253,221</b>	<b>1,076,147</b>	<b>1,037,102</b>
<b>Historic Program Total Electric Contribution to CPAS‡</b>						<b>2,472,099</b>	<b>5,495,917</b>	<b>6,679,860</b>	<b>5,851,693</b>	<b>5,737,435</b>	<b>5,664,713</b>	<b>5,150,202</b>	<b>4,009,147</b>	<b>3,111,619</b>
<b>Program Total Electric CPAS</b>						<b>2,472,099</b>	<b>5,495,917</b>	<b>6,679,860</b>	<b>7,256,469</b>	<b>7,142,211</b>	<b>6,987,253</b>	<b>6,403,423</b>	<b>5,085,294</b>	<b>4,148,721</b>
<b>CY2021 Program Incremental Expiring Electric Savings§</b>											<b>82,236</b>	<b>69,320</b>	<b>177,073</b>	<b>39,045</b>
<b>Historic Program Incremental Expiring Electric Savings</b>									<b>828,167</b>	<b>114,258</b>	<b>72,722</b>	<b>514,511</b>	<b>1,141,055</b>	<b>897,528</b>
<b>Program Total Incremental Expiring Electric Savings</b>									<b>828,167</b>	<b>114,258</b>	<b>154,958</b>	<b>583,831</b>	<b>1,318,128</b>	<b>936,573</b>

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	Linear LED Lighting	460,294	460,294	201,691									
Lighting	Interior LED Lighting 2025	156,789											
Lighting	Interior LED Lighting 2028	53,447	42,231	42,231	42,231								
Lighting	Linear Fluorescent - Delamping	109,959	109,959	109,959	109,959	109,959							
Exterior Lighting	Exterior LED Lighting	162,998	162,998	162,998	162,998	162,998	101,026						
LED Exit Sign	LED Exit Sign												
Envelope	Insulation/Air Sealing	36,991	36,991	36,991	36,991	36,804	36,804	36,804	36,804	36,804	36,804	36,804	36,804
Hot Water	Showerhead	6,838	6,838	6,838	6,838								
Hot Water	Faucet Aerator	6,203	6,203	6,203	6,203								
HVAC	Programmable Thermostat	4,273	4,273	4,273	4,273	4,273	4,273	4,273	4,273	4,273	4,273		
Plug Load	Smart Strip	3,337											
HVAC	Steam Trap Repair/ Replace												
HVAC	Split AC	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966
Hot Water	Electric Shower Timer												
HVAC	Room AC Cover/Gap Sealer												
HVAC	Boiler Tune-Up												
HVAC	Furnace												
Hot Water	Water Heater												
<b>CY2021 Program Total Electric Contribution to CPAS</b>		<b>1,003,095</b>	<b>831,753</b>	<b>573,150</b>	<b>371,459</b>	<b>315,999</b>	<b>144,068</b>	<b>43,042</b>	<b>43,042</b>	<b>43,042</b>	<b>43,042</b>	<b>38,769</b>	<b>38,769</b>
<b>Historic Program Total Electric Contribution to CPAS±</b>		<b>2,956,708</b>	<b>1,839,157</b>	<b>1,465,541</b>	<b>1,016,041</b>	<b>443,788</b>	<b>226,231</b>	<b>224,349</b>	<b>165,747</b>	<b>163,934</b>	<b>151,486</b>	<b>151,486</b>	<b>29,770</b>
<b>Program Total Electric CPAS</b>		<b>3,959,803</b>	<b>2,670,910</b>	<b>2,038,691</b>	<b>1,387,500</b>	<b>759,787</b>	<b>370,299</b>	<b>267,391</b>	<b>208,789</b>	<b>206,976</b>	<b>194,528</b>	<b>190,255</b>	<b>68,539</b>
<b>CY2021 Program Incremental Expiring Electric Savings§</b>		<b>34,007</b>	<b>171,342</b>	<b>258,603</b>	<b>201,691</b>	<b>55,460</b>	<b>171,931</b>	<b>101,026</b>				<b>4,273</b>	
<b>Historic Program Incremental Expiring Electric Savings</b>		<b>154,911</b>	<b>1,117,551</b>	<b>373,616</b>	<b>449,500</b>	<b>572,253</b>	<b>217,557</b>	<b>1,882</b>	<b>58,602</b>	<b>1,813</b>	<b>12,448</b>		<b>121,716</b>
<b>Program Total Incremental Expiring Electric Savings</b>		<b>188,918</b>	<b>1,288,893</b>	<b>632,219</b>	<b>651,191</b>	<b>627,713</b>	<b>389,488</b>	<b>102,908</b>	<b>58,602</b>	<b>1,813</b>	<b>12,448</b>	<b>4,273</b>	<b>121,716</b>

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Lighting	Linear LED Lighting												
Lighting	Interior LED Lighting 2025												
Lighting	Interior LED Lighting 2028												
Lighting	Linear Fluorescent - Delamping												
Exterior Lighting	Exterior LED Lighting												
LED Exit Sign	LED Exit Sign												
Envelope	Insulation/Air Sealing	36,804	36,804										
Hot Water	Showerhead												
Hot Water	Faucet Aerator												
HVAC	Programmable Thermostat												
Plug Load	Smart Strip												
HVAC	Steam Trap Repair/ Replace												
HVAC	Split AC												
Hot Water	Electric Shower Timer												
HVAC	Room AC Cover/Gap Sealer												
HVAC	Boiler Tune-Up												
HVAC	Furnace												
Hot Water	Water Heater												
<b>CY2021 Program Total Electric Contribution to CPAS</b>		<b>36,804</b>	<b>36,804</b>										
<b>Historic Program Total Electric Contribution to CPAS±</b>		<b>22,344</b>	<b>4,181</b>	<b>4,181</b>	<b>4,181</b>								
<b>Program Total Electric CPAS</b>		<b>59,148</b>	<b>40,985</b>	<b>4,181</b>	<b>4,181</b>								
<b>CY2021 Program Incremental Expiring Electric Savings§</b>		<b>1,966</b>		<b>36,804</b>									
<b>Historic Program Incremental Expiring Electric Savings</b>		<b>7,426</b>	<b>18,163</b>			<b>4,181</b>							
<b>Program Total Incremental Expiring Electric Savings</b>		<b>9,392</b>	<b>18,163</b>	<b>36,804</b>		<b>4,181</b>							

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  $Y_n$ .

Source: Evaluation team analysis

**Table 4-2. Cumulative Persisting Annual Savings – Gas**

End Use Type	Research Category	EUL	Gross Savings	NTG*	Savings	Verified Net Therms Savings								
						2018	2019	2020	2021	2022	2023	2024	2025	2026
Lighting	Linear LED Lighting	8.4		1.00										
Lighting	Interior LED Lighting_2025	6.8		1.00										
Lighting	Interior LED Lighting_2028	10.0		1.00										
Lighting	Linear Fluorescent - Delamping	11.0		1.00										
Exterior Lighting	Exterior LED Lighting	11.6		1.00										
LED Exit Sign	LED Exit Sign	5.0		1.00										
Envelope	Insulation/Air Sealing	20.0	436	1.00	8,664				436	436	436	436	436	436
Hot Water	Showerhead	10.0	189	1.00	1,890				189	189	189	189	189	189
Hot Water	Faucet Aerator	10.0	173	1.00	1,730				173	173	173	173	173	173
HVAC	Programmable Thermostat	16.0	542	1.00	8,679				542	542	542	542	542	542
Plug Load	Smart Strip	7.0		1.00										
HVAC	Steam Trap Repair/ Replace	6.0	47,562	1.00	285,369				47,562	47,562	47,562	47,562	47,562	47,562
HVAC	Split AC	18.0		1.00										
Hot Water	Electric Shower Timer	2.0		1.00										
HVAC	Room AC Cover/Gap Sealer	5.0	7,581	1.00	37,906				7,581	7,581	7,581	7,581	7,581	
HVAC	Boiler Tune-Up	3.0	4,239	1.00	12,718				4,239	4,239	4,239			
HVAC	Furnace	20.0	132	1.00	2,644				132	132	132	132	132	132
Hot Water	Water Heater	13.0	10	1.00	136				10	10	10	10	10	10
<b>CY2021 Program Total Gas Contribution to CPAS (Therms)</b>			<b>60,865</b>		<b>359,737</b>				<b>60,865</b>	<b>60,865</b>	<b>60,865</b>	<b>56,626</b>	<b>56,626</b>	<b>49,045</b>
<b>CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)†</b>									<b>1,714,544</b>	<b>1,783,957</b>	<b>1,783,957</b>	<b>1,659,701</b>	<b>1,659,701</b>	<b>1,437,495</b>
<b>Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§</b>														
<b>Program Total Gas CPAS (kWh Equivalent)</b>									<b>1,714,544</b>	<b>1,783,957</b>	<b>1,783,957</b>	<b>1,659,701</b>	<b>1,659,701</b>	<b>1,437,495</b>
<b>CY2021 Program Incremental Expiring Gas Savings (Therms)</b>												<b>4,239</b>		<b>7,581</b>
<b>CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)  </b>											<b>(69,413)</b>			<b>222,206</b>
<b>Historic Program Incremental Expiring Gas Savings (kWh Equivalent)#</b>														
<b>Program Total Incremental Expiring Gas Savings (kWh Equivalent)*†</b>											<b>(69,413)</b>		<b>124,257</b>	<b>222,206</b>

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	Linear LED Lighting												
Lighting	Interior LED Lighting_2025												
Lighting	Interior LED Lighting_2028												
Lighting	Linear Fluorescent - Delamping												
Exterior Lighting	Exterior LED Lighting												
LED Exit Sign	LED Exit Sign												
Envelope	Insulation/Air Sealing	436	436	436	436	431	431	431	431	431	431	431	431
Hot Water	Showerhead	189	189	189	189								
Hot Water	Faucet Aerator	173	173	173	173								
HVAC	Programmable Thermostat	542	542	542	542	542	542	542	542	542	542		
Plug Load	Smart Strip												
HVAC	Steam Trap Repair/ Replace												
HVAC	Split AC												
Hot Water	Electric Shower Timer												
HVAC	Room AC Cover/Gap Sealer												
HVAC	Boiler Tune-Up												
HVAC	Furnace	132	132	132	132	132	132	132	132	132	132	132	132
Hot Water	Water Heater	10	10	10	10	10	10	10					
<b>CY2021 Program Total Gas Contribution to CPAS (Therms)</b>		<b>1,483</b>	<b>1,483</b>	<b>1,483</b>	<b>1,483</b>	<b>1,116</b>	<b>1,116</b>	<b>1,116</b>	<b>1,105</b>	<b>1,105</b>	<b>1,105</b>	<b>563</b>	<b>563</b>
<b>CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡</b>		<b>43,467</b>	<b>43,467</b>	<b>43,467</b>	<b>43,467</b>	<b>32,700</b>	<b>32,700</b>	<b>32,700</b>	<b>32,392</b>	<b>32,392</b>	<b>32,392</b>	<b>16,494</b>	<b>16,494</b>
<b>Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§</b>													
<b>Program Total Gas CPAS (kWh Equivalent)</b>		<b>43,467</b>	<b>43,467</b>	<b>43,467</b>	<b>43,467</b>	<b>32,700</b>	<b>32,700</b>	<b>32,700</b>	<b>32,392</b>	<b>32,392</b>	<b>32,392</b>	<b>16,494</b>	<b>16,494</b>
<b>CY2021 Program Incremental Expiring Gas Savings (Therms)</b>		<b>47,562</b>				<b>367</b>			<b>10</b>			<b>542</b>	
<b>CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)</b>		<b>1,394,028</b>				<b>10,767</b>			<b>307</b>			<b>15,898</b>	
<b>Historic Program Incremental Expiring Gas Savings (kWh Equivalent)#</b>													
<b>Program Total Incremental Expiring Gas Savings (kWh Equivalent)*†</b>		<b>1,394,028</b>				<b>10,767</b>			<b>307</b>			<b>15,898</b>	

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Lighting	Linear LED Lighting												
Lighting	Interior LED Lighting_2025												
Lighting	Interior LED Lighting_2028												
Lighting	Linear Fluorescent - Delamping												
Exterior Lighting	Exterior LED Lighting												
LED Exit Sign	LED Exit Sign												
Envelope	Insulation/Air Sealing	431	431										
Hot Water	Showerhead												
Hot Water	Faucet Aerator												
HVAC	Programmable Thermostat												
Plug Load	Smart Strip												
HVAC	Steam Trap Repair/ Replace												
HVAC	Split AC												
Hot Water	Electric Shower Timer												
HVAC	Room AC Cover/Gap Sealer												
HVAC	Boiler Tune-Up												
HVAC	Furnace	132	132										
Hot Water	Water Heater												
<b>CY2021 Program Total Gas Contribution to CPAS (Therms)</b>		<b>563</b>	<b>563</b>										
<b>CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡</b>		<b>16,494</b>	<b>16,494</b>										
<b>Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§</b>													
<b>Program Total Gas CPAS (kWh Equivalent)</b>		<b>16,494</b>	<b>16,494</b>										
<b>CY2021 Program Incremental Expiring Gas Savings (Therms)</b>				<b>563</b>									
<b>CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)  </b>				<b>16,494</b>									
<b>Historic Program Incremental Expiring Gas Savings (kWh Equivalent)#</b>													
<b>Program Total Incremental Expiring Gas Savings (kWh Equivalent)*†</b>				<b>16,494</b>									

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 Y<sub>n-1</sub> - CPAS Y<sub>n</sub>.

Source: Evaluation team analysis

**Table 4-3. Cumulative Persisting Annual Savings – Total**

End Use Type	Research Category	CY2021 Verified Gross Savings			Lifetime Net Savings (kWh)†	Verified Net kWh Savings (Including Those Converted from Gas Savings)											
		EUL	(kWh)	NTG*		2018	2019	2020	2021	2022	2023	2024	2025	2026			
Lighting	Linear LED Lighting	8.4	474,362	1.00	3,917,238				474,362	474,362	465,352	460,294	460,294	460,294			
Lighting	Interior LED Lighting_2025	6.8	365,566	1.00	1,996,038				365,566	365,566	365,566	365,566	188,493	188,493			
Lighting	Interior LED Lighting_2028	10.0	53,447	1.00	500,822				53,447	53,447	53,447	53,447	53,447	53,447			
Lighting	Linear Fluorescent - Delamping	11.0	245,744	1.00	1,545,385				245,744	245,744	174,222	109,959	109,959	109,959			
Exterior Lighting	Exterior LED Lighting	11.6	162,998	1.00	1,894,005				162,998	162,998	162,998	162,998	162,998	162,998			
LED Exit Sign	LED Exit Sign	5.0	39,045	1.00	195,226				39,045	39,045	39,045	39,045	39,045	39,045			
Envelope	Insulation/Air Sealing	20.0	49,767	1.00	991,894				49,767	49,767	49,767	49,767	49,767	49,767			
Hot Water	Showerhead	10.0	12,378	1.00	123,784				12,378	12,378	12,378	12,378	12,378	12,378			
Hot Water	Faucet Aerator	10.0	11,274	1.00	112,740				11,274	11,274	11,274	11,274	11,274	11,274			
HVAC	Programmable Thermostat	16.0	20,171	1.00	322,731				20,171	20,171	20,171	20,171	20,171	20,171			
Plug Load	Smart Strip	7.0	3,337	1.00	23,360				3,337	3,337	3,337	3,337	3,337	3,337			
HVAC	Steam Trap Repair/ Replace	6.0	1,396,331	1.00	8,377,985				1,396,331	1,396,331	1,396,331	1,396,331	1,396,331	1,396,331			
HVAC	Split AC	18.0	1,966	1.00	35,379				1,966	1,966	1,966	1,966	1,966	1,966			
Hot Water	Electric Shower Timer	2.0	1,703	1.00	3,407				1,703	1,703							
HVAC	Room AC Cover/Gap Sealer	5.0	222,206	1.00	1,111,028				222,206	222,206	222,206	222,206	222,206				
HVAC	Boiler Tune-Up	3.0	124,257	1.00	372,770				124,257	124,257	124,257						
HVAC	Furnace	20.0	3,875	1.00	77,501				3,875	3,875	3,875	3,875	3,875	3,875			
Hot Water	Water Heater	13.0	3,875	1.00	3,997				307	307	307	307	307	307			
<b>CY2021 Program Total Contribution to CPAS</b>			<b>3,192,301</b>		<b>21,605,290</b>				<b>3,188,733</b>	<b>3,188,733</b>	<b>3,106,498</b>	<b>2,912,921</b>	<b>2,735,848</b>	<b>2,474,597</b>			
<b>Historic Program Total Contribution to CPAS‡</b>									<b>2,472,099</b>	<b>5,495,917</b>	<b>6,679,860</b>	<b>5,851,693</b>	<b>5,737,435</b>	<b>5,664,713</b>	<b>5,150,202</b>	<b>4,009,147</b>	<b>3,111,619</b>
<b>Program Total CPAS</b>									<b>2,472,099</b>	<b>5,495,917</b>	<b>6,679,860</b>	<b>9,040,427</b>	<b>8,926,169</b>	<b>8,771,211</b>	<b>8,063,123</b>	<b>6,744,996</b>	<b>5,586,216</b>
<b>CY2021 Program Incremental Expiring Savings§</b>																	
<b>Historic Program Incremental Expiring Savings  </b>																	
<b>Program Total Incremental Expiring Savings#</b>																	

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	Linear LED Lighting	460,294	460,294	201,691									
Lighting	Interior LED Lighting_2025	156,789											
Lighting	Interior LED Lighting_2028	53,447	42,231	42,231	42,231								
Lighting	Linear Fluorescent - Delamping	109,959	109,959	109,959	109,959	109,959	-						
Exterior Lighting	Exterior LED Lighting	162,998	162,998	162,998	162,998	162,998	101,026						
LED Exit Sign	LED Exit Sign												
Envelope	Insulation/Air Sealing	49,767	49,767	49,767	49,767	49,423	49,423	49,423	49,423	49,423	49,423	49,423	49,423
Hot Water	Showerhead	12,378	12,378	12,378	12,378								
Hot Water	Faucet Aerator	11,274	11,274	11,274	11,274								
HVAC	Programmable Thermostat	20,171	20,171	20,171	20,171	20,171	20,171	20,171	20,171	20,171	20,171		
Plug Load	Smart Strip	3,337											
HVAC	Steam Trap Repair/ Replace												
HVAC	Split AC	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966	1,966
Hot Water	Electric Shower Timer												
HVAC	Room AC Cover/Gap Sealer												
HVAC	Boiler Tune-Up												
HVAC	Furnace	3,875	3,875	3,875	3,875	3,875	3,875	3,875	3,875	3,875	3,875	3,875	3,875
Hot Water	Water Heater	307	307	307	307	307	307	307	307	307	307	307	307
<b>CY2021 Program Total Contribution to CPAS</b>		<b>1,046,563</b>	<b>875,220</b>	<b>616,617</b>	<b>414,926</b>	<b>348,699</b>	<b>176,768</b>	<b>75,741</b>	<b>75,434</b>	<b>75,434</b>	<b>75,434</b>	<b>55,263</b>	<b>55,263</b>
<b>Historic Program Total Contribution to CPAS‡</b>		<b>2,956,708</b>	<b>1,839,157</b>	<b>1,465,541</b>	<b>1,016,041</b>	<b>443,788</b>	<b>226,231</b>	<b>224,349</b>	<b>165,747</b>	<b>163,934</b>	<b>151,486</b>	<b>151,486</b>	<b>29,770</b>
<b>Program Total CPAS</b>		<b>4,003,270</b>	<b>2,714,377</b>	<b>2,082,158</b>	<b>1,430,967</b>	<b>792,487</b>	<b>402,998</b>	<b>300,090</b>	<b>241,181</b>	<b>239,368</b>	<b>226,920</b>	<b>206,749</b>	<b>85,033</b>
<b>CY2021 Program Incremental Expiring Savings§</b>		<b>1,428,035</b>	<b>171,342</b>	<b>258,603</b>	<b>201,691</b>	<b>66,227</b>	<b>171,931</b>	<b>101,026</b>	<b>307</b>			<b>20,171</b>	
<b>Historic Program Incremental Expiring Savings  </b>		<b>154,911</b>	<b>1,117,551</b>	<b>373,616</b>	<b>449,500</b>	<b>572,253</b>	<b>217,557</b>	<b>1,882</b>	<b>58,602</b>	<b>1,813</b>	<b>12,448</b>		<b>121,716</b>
<b>Program Total Incremental Expiring Savings#</b>		<b>1,582,946</b>	<b>1,288,893</b>	<b>632,219</b>	<b>651,191</b>	<b>638,481</b>	<b>389,488</b>	<b>102,908</b>	<b>58,909</b>	<b>1,813</b>	<b>12,448</b>	<b>20,171</b>	<b>121,716</b>

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Lighting	Linear LED Lighting												
Lighting	Interior LED Lighting_2025												
Lighting	Interior LED Lighting_2028												
Lighting	Linear Fluorescent - Delamping												
Exterior Lighting	Exterior LED Lighting												
LED Exit Sign	LED Exit Sign												
Envelope	Insulation/Air Sealing	49,423	49,423										
Hot Water	Showerhead												
Hot Water	Faucet Aerator												
HVAC	Programmable Thermostat												
Plug Load	Smart Strip												
HVAC	Steam Trap Repair/ Replace												
HVAC	Split AC												
Hot Water	Electric Shower Timer												
HVAC	Room AC Cover/Gap Sealer												
HVAC	Boiler Tune-Up												
HVAC	Furnace	3,875	3,875										
Hot Water	Water Heater												
<b>CY2021 Program Total Contribution to CPAS</b>		<b>53,298</b>	<b>53,298</b>										
<b>Historic Program Total Contribution to CPAS†</b>		<b>22,344</b>	<b>4,181</b>	<b>4,181</b>	<b>4,181</b>								
<b>Program Total CPAS</b>		<b>75,642</b>	<b>57,479</b>	<b>4,181</b>	<b>4,181</b>								
<b>CY2021 Program Incremental Expiring Savings§</b>		<b>1,966</b>		<b>53,298</b>									
<b>Historic Program Incremental Expiring Savings  </b>		<b>7,426</b>	<b>18,162</b>				<b>4,181</b>						
<b>Program Total Incremental Expiring Savings#</b>		<b>9,392</b>	<b>18,162</b>	<b>53,298</b>			<b>4,181</b>						

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-ntq-recommendations-for-2021>.

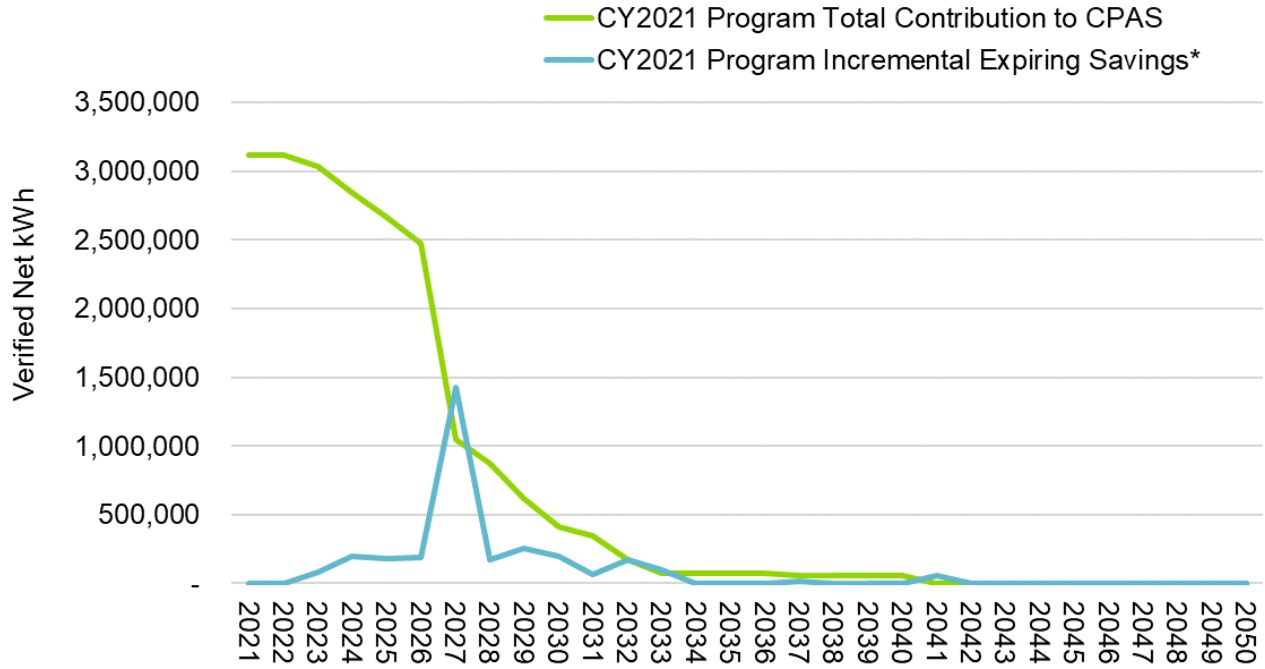
† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2018.

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

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 research categories shown in Table 5-1 and Figure 5-1. Appendix B details savings by measure.

**Table 5-1. Number of Measures by Type**

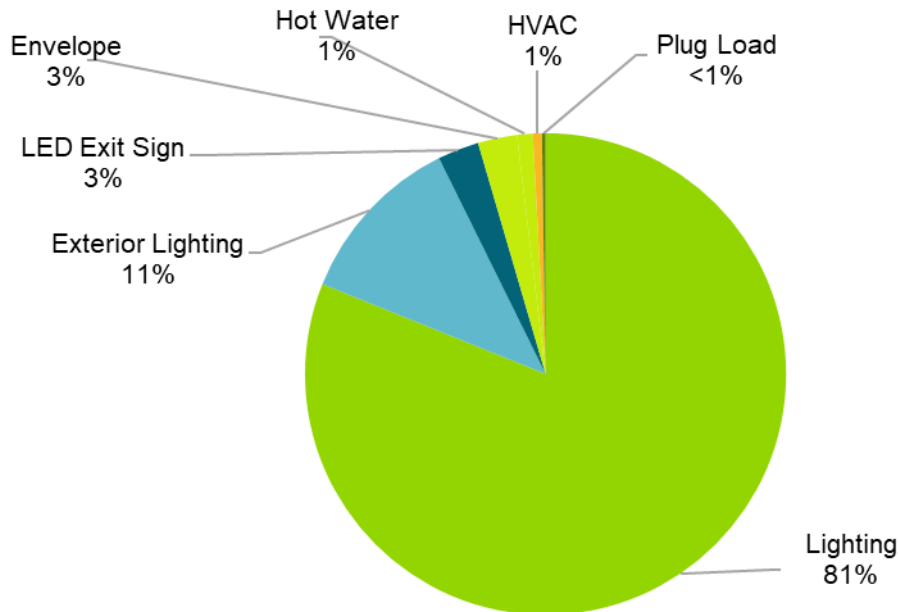
End Use Type	Research Category	Quantity	Unit
Lighting	Linear LED Lighting	3,464	Fixtures
Lighting	Interior LED Lighting	4,591	Lamps/Fixtures
Lighting	Linear Fluorescent - Delamping	385	Fixtures
Exterior Lighting	Exterior LED Lighting	223	Fixtures
LED Exit Sign	LED Exit Sign	525	Fixtures
Envelope	Insulation/Air Sealing	14	Projects
Hot Water	Showerhead	166	Each
Hot Water	Faucet Aerator	357	Each
HVAC	Programmable Thermostat	74	Each
Plug Load	Smart Strip	81	Each
HVAC	Steam Trap Repair/ Replace	2,243	Each
HVAC	Split AC	8	Each
Hot Water	Electric Shower Timer	23	Each
HVAC	Room AC Cover/Gap Sealer	1,486	Each
HVAC	Boiler Tune-Up	82	Each
HVAC	Furnace	12	Each
Hot Water	Water Heater	4	Each
	<b>Total</b>	<b>13,738</b>	

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

The rows are sorted by verified electric savings.

Source: ComEd tracking data and evaluation team analysis

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



Source: ComEd tracking data and evaluation team analysis

Measure-level energy and demand savings are provided in Table 5-2 and Table 5-3.

**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	Linear LED Lighting	472,381	1.00	474,362	1.00	474,362	8.4
Lighting	Interior LED Lighting	406,498	1.03	419,013	1.00	419,013	7.8
Lighting	Linear Fluorescent - Delamping	245,744	1.00	245,744	1.00	245,744	11.0
Exterior Lighting	Exterior LED Lighting	163,355	1.00	162,998	1.00	162,998	11.6
LED Exit Sign	LED Exit Sign	34,871	1.12	39,045	1.00	39,045	5.0
Envelope	Insulation/Air Sealing	36,801	1.01	36,991	1.00	36,991	20.0
Hot Water	Showerhead	6,838	1.00	6,838	1.00	6,838	10.0
Hot Water	Faucet Aerator	6,203	1.00	6,203	1.00	6,203	10.0
HVAC	Programmable Thermostat	2,886	1.48	4,273	1.00	4,273	16.0
Plug Load	Smart Strip	3,337	1.00	3,337	1.00	3,337	7.0
HVAC	Steam Trap Repair/ Replace	2,303	1.00	2,303	1.00	2,303	6.0
HVAC	Split AC	1,976	0.99	1,966	1.00	1,966	18.0
Hot Water	Electric Shower Timer	1,703	1.00	1,703	1.00	1,703	2.0
HVAC	Room AC Cover/Gap Sealer	0	N/A	0	1.00	0	5.0
HVAC	Boiler Tune-Up	0	N/A	0	1.00	0	3.0
HVAC	Furnace	0	N/A	0	1.00	0	20.0
Hot Water	Water Heater	0	N/A	0	1.00	0	13.0
<b>Total</b>		<b>1,384,896</b>	<b>1.01</b>	<b>1,404,776</b>		<b>1,404,776</b>	

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

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>.

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	Linear LED Lighting	70.15	1.00	70.18	1.00	70.18
Lighting	Interior LED Lighting	46.87	1.07	50.36	1.00	50.36
Lighting	Linear Fluorescent - Delamping	33.96	1.00	33.96	1.00	33.96
Exterior Lighting	Exterior LED Lighting	2.43	1.00	2.43	1.00	2.43
LED Exit Sign	LED Exit Sign	4.05	1.00	4.05	1.00	4.05
Envelope	Insulation/Air Sealing	0.40	2.17	0.87	1.00	0.87
Hot Water	Showerhead	0.70	1.00	0.70	1.00	0.70
Hot Water	Faucet Aerator	1.70	1.00	1.70	1.00	1.70
HVAC	Programmable Thermostat	0.00	NA	0.00	1.00	0.00
Plug Load	Smart Strip	0.37	1.00	0.37	1.00	0.37
HVAC	Steam Trap Repair/ Replace	0.00	NA	0.00	1.00	0.00
HVAC	Split AC	2.11	2.62	5.52	1.00	5.52
Hot Water	Electric Shower Timer	0.25	1.00	0.25	1.00	0.25
HVAC	Room AC Cover/Gap Sealer	0.00	N/A	0.00	1.00	0.00
HVAC	Boiler Tune-Up	0.00	N/A	0.00	1.00	0.00
HVAC	Furnace	0.00	N/A	0.00	1.00	0.00
Hot Water	Water Heater	0.00	N/A	0.00	1.00	0.00
<b>Total</b>		<b>163.01</b>	<b>1.05</b>	<b>170.41</b>		<b>170.41</b>

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>.

Source: ComEd tracking data and evaluation team analysis

The Public Housing Retrofits 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 <sub>water</sub> )	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Lighting	Linear LED Lighting	0	0	N/A	0	1.00	0
Lighting	Interior LED Lighting	0	0	N/A	0	1.00	0
Lighting	Linear Fluorescent - Delamping	0	0	N/A	0	1.00	0
Exterior Lighting	Exterior LED Lighting	0	0	N/A	0	1.00	0
LED Exit Sign	LED Exit Sign	0	0	N/A	0	1.00	0
Envelope	Insulation/Air Sealing	0	0	N/A	0	1.00	0
Hot Water	Showerhead	322,237	1,614	1.00	1,614	1.00	1,614
Hot Water	Faucet Aerator	364,420	1,826	1.00	1,826	1.00	1,826
HVAC	Programmable Thermostat	0	0	N/A	0	1.00	0
Plug Load	Smart Strip	0	0	N/A	0	1.00	0
HVAC	Steam Trap Repair/ Replace	895,733	2,303	1.00	2,303	1.00	2,303
HVAC	Split AC	0	0	N/A	0	1.00	0
Hot Water	Electric Shower Timer	13,961	70	1.00	70	1.00	70
HVAC	Room AC Cover/Gap Sealer	0	0	N/A	0	1.00	0
HVAC	Boiler Tune-Up	0	0	N/A	0	1.00	0
HVAC	Furnace	0	0	N/A	0	1.00	0
Hot Water	Water Heater	0	0	N/A	0	1.00	0
<b>Total</b>		<b>1,596,351</b>	<b>5,813</b>	<b>1.00</b>	<b>5,813</b>		<b>5,813</b>

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

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>.

Source: ComEd tracking data and evaluation team analysis

The Public Housing Retrofits Program includes measures that save gas. Table 5-5 shows the measure-level gas savings.

**Table 5-5. Energy Savings by Measure – Gas**

End Use Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTG*	Verified Net Savings (Therms)	EUL (years)
Lighting	Linear LED Lighting	0	NA	0	1.00	0	8.4
Lighting	Interior LED Lighting	0	NA	0	1.00	0	7.8
Lighting	Linear Fluorescent - Delamping	0	NA	0	1.00	0	11.0
Exterior Lighting	Exterior LED Lighting	0	NA	0	1.00	0	11.6
LED Exit Sign	LED Exit Sign	0	NA	0	1.00	0	5.0
Envelope	Insulation/Air Sealing	436	1.00	436	1.00	436	20.0
Hot Water	Showerhead	189	1.00	189	1.00	189	10.0
Hot Water	Faucet Aerator	173	1.00	173	1.00	173	10.0
HVAC	Programmable Thermostat	366	1.48	542	1.00	542	16.0
Plug Load	Smart Strip	0	NA	0	1.00	0	7.0
HVAC	Steam Trap Repair/ Replace	47,558	1.00	47,562	1.00	47,562	6.0
HVAC	Split AC	0	NA	0	1.00	0	18.0
Hot Water	Electric Shower Timer	0	NA	0	1.00	0	2.0
HVAC	Room AC Cover/Gap Sealer	5,213	1.45	7,581	1.00	7,581	5.0
HVAC	Boiler Tune-Up	4,239	1.00	4,239	1.00	4,239	3.0
HVAC	Furnace	132	1.00	132	1.00	132	20.0
Hot Water	Water Heater	9	1.22	10	1.00	10	13.0
<b>Total Therms</b>		<b>58,315</b>	<b>1.04</b>	<b>60,865</b>		<b>60,865</b>	
<b>Total kWh Converted From Therms†</b>		<b>1,709,203</b>	<b>1.04</b>	<b>1,783,957</b>		<b>1,783,957</b>	

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>.

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

Source: ComEd tracking data and evaluation team analysis

Table 5-6 is combined savings from Table 5-2 and Table 5-5.

**Table 5-6. Energy Savings by Measure – Total**

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Lighting	Linear LED Lighting	472,381	1.00	474,362	1.00	474,362
Lighting	Interior LED Lighting	406,498	1.03	419,013	1.00	419,013
Lighting	Linear Fluorescent - Delamping	245,744	1.00	245,744	1.00	245,744
Exterior Lighting	Exterior LED Lighting	163,355	1.00	162,998	1.00	162,998
LED Exit Sign	LED Exit Sign	34,871	1.12	39,045	1.00	39,045
Envelope	Insulation/Air Sealing	49,575	1.00	49,767	1.00	49,767
Hot Water	Showerhead	12,376	1.00	12,378	1.00	12,378
Hot Water	Faucet Aerator	11,272	1.00	11,274	1.00	11,274
HVAC	Programmable Thermostat	13,621	1.48	20,171	1.00	20,171
Plug Load	Smart Strip	3,337	1.00	3,337	1.00	3,337
HVAC	Steam Trap Repair/ Replace	1,396,235	1.00	1,396,331	1.00	1,396,331
HVAC	Split AC	1,976	0.99	1,966	1.00	1,966
Hot Water	Electric Shower Timer	1,703	1.00	1,703	1.00	1,703
HVAC	Room AC Cover/Gap Sealer	152,789	1.45	222,206	1.00	222,206
HVAC	Boiler Tune-Up	124,240	1.00	124,257	1.00	124,257
HVAC	Furnace	3,873	1.00	3,875	1.00	3,875
Hot Water	Water Heater	252	1.22	307	1.00	307
<b>Total†</b>		<b>3,094,099</b>	<b>1.03</b>	<b>3,188,733</b>		<b>3,188,733</b>

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

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

Source: ComEd tracking data and evaluation team analysis

## 6. Impact Analysis Findings and Recommendations

The evaluation of the CY2021 program resulted in an overall realization rate of 1.01 and 1.05 for energy and demand savings, respectively. There is only one measure that has a realization rate of lower than 1.00. Table B-1 presents the end use-level realization rates and program savings percentages to give context to the recommendations. Table B-2 shows the per-unit ex ante and verified savings for each unique measure in the CY2021 tracking data. The evaluation team developed the following recommendations based on findings from the CY2021 evaluation. These recommendations suggest ways to improve the measure-level realization rates.

### 6.1 Overarching

**Finding 1.** Per the TRM (Section 4.4.38), floor height for room AC cover/gap sealer measures should be the number of floors times eight feet. The TRM does not advise to use actual floor height data, if available. In the program tracking data, floor height values are inconsistent with respect to how they relate to the actual number of floors in the building: In some cases, the total tracked floor height is eight feet, even though the building has multiple floors; in other cases, the tracked floor height is not eight feet but is greater than or less than the number of floors times eight feet. Ex ante savings uses the tracked value for floor height to estimate therms savings while ex post uses the TRM approach of multiplying the number of floors by eight feet. This adjustment resulted in larger per unit savings for most records and an overall realization rate of 145% for this measure.

**Recommendation 1.** Per the TRM (Section 4.4.38), calculate and report therms savings for room AC cover/ gap sealer measures using the tracked number of floors multiplied by eight feet.

**Finding 2.** The program tracking data did not separately identify savings associated with water reductions, making a comparison of ex ante and ex post savings difficult.

**Recommendation 2.** Break out savings associated with water reductions as a separate field in the program tracking data.

**Finding 3.** In multiple cases, ex ante savings applied assumptions from the Illinois Technical Reference Manual v9.0 (IL-TRM)<sup>2</sup> for a building type that was not consistent with the type provided in the tracking database and the number of reported stories:

- For programmable thermostats, the ex ante calculations used a multifamily household factor (HF) of 0.65 instead of a single-family HF of 1. The ex post calculations corrected this per the IL-TRM, resulting in a 1.48 energy savings realization rate.
- For individual water heaters, the ex ante calculations used the multifamily value for number of people per household of 2.1 instead of the single-family value of 2.56. The ex post calculations corrected this per the IL-TRM, resulting in a 1.22 energy savings realization rate.
- In the case of split AC, ex ante savings for one of the measures applied full load hour and coincidence factor (CF) assumptions from the IL-TRM for single-family homes.

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<sup>2</sup> In this report, unless stated otherwise, IL-TRM and IL-TRM Errata refers to version 9.0 (v9.0).

Application of the correct values resulted in a 0.99 energy savings realization rate and had a negligible impact on verified peak demand savings.

**Recommendation 3.** Apply the IL-TRM assumptions consistent with the building type provided in the tracking database.

## 6.2 Lighting

The five lighting categories account for a combined 95% of ex ante gross kWh savings. Realization rates for all five categories were 1.00 or greater.

**Finding 4.** For several interior LEDs, linear LEDs, and LED exit signs that operate continuously, the ex ante savings applied hours or CF assumptions for mid-rise or high-rise buildings. The evaluation team applied hours for 24/7 operation to calculate verified savings. This change resulted in a 1.12 energy savings realization rate for LED exit signs and was a main driver of the 1.07 peak demand realization rate for interior LEDs but had a negligible impact on the verified savings for linear LEDs.

**Recommendation 4.** For 24/7 measures, apply measure-specific hour of use and CF assumptions rather than building type-specific assumptions.

## 6.3 Attic Insulation and Air Sealing

**Finding 5.** In some cases, ex ante savings did not include kWh and kW from cooling savings for attic insulation even though the database indicates central cooling is present. The evaluation team added cooling savings for these records, resulting in higher verified energy and peak demand savings.

**Recommendation 5.** Account for cooling savings according to the IL-TRM.

**Finding 6.** In one case, the ex ante calculations applied the  $IE_{NetCorrection}$  multiplier of 1.10 to estimate gas furnace fan runtime savings for air sealing and attic insulation. The IL-TRM Errata memorandum removes the multiplier. The evaluation team followed the IL-TRM Errata approach, resulting in lower verified electric energy savings.

**Recommendation 6.** Do not apply the  $IE_{NetCorrection}$  multiplier to develop kWh heating savings for natural gas systems because the adjustment has already been applied in the therms algorithm.

**Finding 7.** The ex ante approach included the PJM summer peak CF of 0.466 instead of the summer system peak CF of 0.68, resulting in an underestimation of demand savings. The evaluation team used the summer system peak CF to calculate verified savings, contributing to the peak demand realization rate of 2.17.

**Recommendation 7.** Use the IL-TRM algorithm in Section 5.6.5 and apply the correct summer system peak CF value of 0.68.

## 6.4 Split AC

**Finding 8.** The ex ante approach did not calculate the kW savings using the algorithm in the IL-TRM. In addition, the ex ante approach used the PJM CF of 0.466 value instead of the summer system peak CF value of 0.68. The evaluation team applied the IL-TRM algorithm and used the summer system peak CF to calculate verified savings. These changes were the main driver of the 2.62 peak demand realization rate.

**Recommendation 8.** Use the IL-TRM algorithm in Section 5.3.3 and apply the correct CF value of 0.68.

## Appendix A. Impact Analysis Methodology

The evaluation team calculated gross verified savings for the Public Housing Retrofits Program by applying savings algorithms from the IL-TRM and IL-TRM Errata memorandum. The team determined verified gross savings for each program measure by:

- Reviewing the savings algorithm inputs in the measure workbook for agreement with the IL-TRM and IL-TRM Errata.
- Validating savings algorithms were applied correctly.
- Prioritizing project-specific information to inform savings calculations where the IL-TRM advises to use actual values. For variables where project information did not include project-specific actual values, the team relied on defaults from the IL-TRM.
- Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in the team's calculations if the workbook did not agree with the IL-TRM.
- Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

The team calculated verified net energy and demand (coincident peak and overall) savings by multiplying the verified gross savings estimates by a NTG ratio of 1.0. For CY2021, the Public Housing Retrofits Program's NTG estimate was defined by a consensus process through the Illinois SAG.



## Appendix B. Impact Findings Detailed Results

Table B-1 presents the end use-level realization rates and program savings percentages to give context to the team’s recommendations.

**Table B-1. Savings and Realization Rates by Research Category**

Research Category	Total % Ex Ante kWh Savings	Total % Ex Ante kW Savings	Total % Ex Ante Therm Savings	kWh RR	kW RR	Therm RR
Linear LED Lighting	34%	43%	0%	1.00	1.00	N/A
Interior LED Lighting	29%	29%	0%	1.03	1.07	N/A
Linear Fluorescent -	18%	21%	0%	1.00	1.00	N/A
Exterior LED Lighting	12%	1%	0%	1.00	1.00	N/A
LED Exit Sign	3%	2%	0%	1.12	1.00	N/A
Insulation/Air Sealing	3%	0%	3%	1.01	2.17	1.00
Showerhead	0%	0%	1%	1.00	1.00	1.00
Faucet Aerator	0%	1%	1%	1.00	1.00	1.00
Programmable Therr	0%	0%	2%	1.48	N/A	1.48
Smart Strip	0%	0%	0%	1.00	1.00	N/A
Steam Trap Repair/	0%	0%	75%	1.00	N/A	1.00
Split AC	0%	1%	0%	0.99	2.62	N/A
Electric Shower Time	0%	0%	0%	1.00	1.00	N/A
Room AC Cover/Gap	0%	0%	9%	N/A	N/A	1.47
Boiler Tune-Up	0%	0%	7%	N/A	N/A	1.00
Furnace	0%	0%	1%	N/A	N/A	1.00
Water Heater	0%	0%	0%	N/A	N/A	1.22

RR – realization rate

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

Source: Evaluation team analysis

Table B-2 shows the per-unit ex ante and verified savings for each unique measure in the CY2021 tracking data.

**Table B-2. Verified Measure Per-Unit Impact Detail – Electric**

End Use Type	Research Category	Measure	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings Realization Rate	Verified Gross Peak kW/Unit Savings	Peak kW Savings Realization Rate	Source (IL-TRM Section*)
Exterior Lighting	Exterior LED Lighting	<175W HID to LED SPIA	Fixtures	436.08	0.02	436.08	1.00	0.02	1.00	Section 4.5.4.
Exterior Lighting	Exterior LED Lighting	176-250W HID to LED SPIA	Fixtures	660.51	0.00	660.51	1.00	0.00	N/A	Section 4.5.4.
Exterior Lighting	Exterior LED Lighting	251-400W HID to LED SPIA	Fixtures	959.35	0.00	959.35	1.00	0.00	N/A	Section 4.5.4.
Exterior Lighting	Exterior LED Lighting	401-600W HID to LED SPIA	Fixtures	1508.63	0.00	1419.45	0.94	0.00	N/A	Section 4.5.4.
Exterior Lighting	Exterior LED Lighting	801-1000W HID to LED SPIA	Fixtures	3377.86	0.00	3377.86	1.00	0.00	N/A	Section 4.5.4.
LED Exit Sign	LED Exit Sign	LED Exit Sign CHI Retrofit_2LF_CA SPIA	Fixtures	105.04	0.01	105.04	1.00	0.01	1.00	Section 4.5.5.
LED Exit Sign	LED Exit Sign	LED Exit Sign CHI Retrofit_1LF_CA SPIA	Fixtures	38.74	0.01	52.21	1.35	0.01	1.00	Section 4.5.5.
LED Exit Sign	LED Exit Sign	LED Exit Sign Retrofit_1LF_CA SPIA	Fixtures	27.44	0.00	27.44	1.00	0.00	1.00	Section 4.5.5.
LED Exit Sign	LED Exit Sign	LED Exit Sign Battery_Incan_CA 24/7 SPIA	Fixtures	321.10	0.02	321.10	1.00	0.02	1.00	Section 4.5.5.
Lighting	Linear Fluorescent - Delamping	2L 2ft T8U Delamp 2L 2ft Linear Retrofit CA SPIA	Fixtures	268.55	0.04	268.55	1.00	0.04	1.00	Section 4.5.2.
Lighting	Linear Fluorescent - Delamping	4L 4ft T8 Delamp 2L 4ft Linear Retrofit CA SPIA	Fixtures	582.17	0.09	582.17	1.00	0.09	1.00	Section 4.5.2.
Lighting	Linear Fluorescent - Delamping	4L 4ft T12 Delamp 2L 4ft TLED CA SPIA	Fixtures	708.67	0.09	708.67	1.00	0.09	1.00	Section 4.5.2.
Lighting	Linear Fluorescent - Delamping	4L 4ft T12 Delamp 2L 4ft Linear Retrofit CA SPIA	Fixtures	734.92	0.09	734.92	1.00	0.09	1.00	Section 4.5.2.
Lighting	Linear Fluorescent - Delamping	2L 2ft T12U Delamp 2L 2ft Linear Retrofit CA SPIA	Fixtures	436.04	0.07	436.04	1.00	0.07	1.00	Section 4.5.2.
Lighting	Linear Fluorescent - Delamping	4L 4ft T8 Delamp 2L 4ft TLED CA SPIA	Fixtures	542.69	0.09	542.69	1.00	0.09	1.00	Section 4.5.2.
Lighting	Interior LED Lighting	18W Pin-CFL_7W LED Retro_CA 24/7 SPIA	Lamps/Fixtures	113.72	0.01	113.72	1.00	0.01	1.15	Section 4.5.4.
Lighting	Interior LED Lighting	26W Pin-CFL_10W LED Retro_CA 24/7 SPIA	Lamps/Fixtures	164.29	0.02	165.67	1.01	0.02	1.14	Section 4.5.4.
Lighting	Interior LED Lighting	32W Pin-CFL_13W LED Retro_CA 24/7 SPIA	Lamps/Fixtures	92.26	0.02	169.43	1.84	0.02	1.38	Section 4.5.4.
Lighting	Interior LED Lighting	42W Pin-CFL_20W LED Retro_CA 24/7 SPIA	Lamps/Fixtures	147.32	0.02	210.40	1.43	0.03	1.11	Section 4.5.4.
Lighting	Interior LED Lighting	Omnidirectional 9W LED Lamp SPIA	Lamps/Fixtures	230.51	0.03	230.51	1.00	0.03	1.00	Section 4.5.4.

End Use Type	Research Category	Measure	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings Realization Rate	Verified Gross Peak kW/Unit Savings	Peak kW Savings Realization Rate	Source (IL-TRM Section*)
Lighting	Interior LED Lighting	Omnidirectional 9W LED Lamp DI	Lamps/Fixture	60.96	0.01	60.96	1.00	0.01	1.00	Section 4.5.4.
Lighting	Interior LED Lighting	Omnidirectional 15W LED Lamp SPIA	Lamps/Fixture	271.32	0.04	271.32	1.00	0.04	1.00	Section 4.5.4.
Lighting	Interior LED Lighting	Omnidirectional 15W LED Lamp DI	Lamps/Fixture	93.23	0.01	93.23	1.00	0.01	1.00	Section 4.5.4.
Lighting	Interior LED Lighting	Candelabra 5W LED Lamp DI	Lamps/Fixture	216.30	0.03	216.32	1.00	0.03	1.00	Section 4.5.4.
Lighting	Interior LED Lighting	Globe 6W LED Lamp DI	Lamps/Fixture	26.98	0.00	26.98	1.00	0.00	1.00	Section 4.5.4.
Lighting	Interior LED Lighting	Flood 8W LED Lamp DI	Lamps/Fixture	103.95	0.01	103.95	1.00	0.01	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	"9" T9 Dbl Circline 55W_25W LED Retro_CA 24/7 SPIA"	Fixtures	315.58	0.03	315.58	1.00	0.04	1.11	Section 4.5.4.
Lighting	Linear LED Lighting	1L 2ft T8_TLED_CA SPIA	Fixtures	44.93	0.01	44.93	1.00	0.01	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 2ft T8_Linear Retrofit_CA SPIA	Fixtures	89.19	0.01	89.19	1.00	0.01	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 2ft T12_Linear Retrofit_CA SPIA	Fixtures	137.22	0.02	138.38	1.01	0.02	1.01	Section 4.5.4.
Lighting	Linear LED Lighting	2L 2ft T12_TLED_CA SPIA	Fixtures	174.56	0.03	176.04	1.01	0.03	1.01	Section 4.5.4.
Lighting	Linear LED Lighting	2L 2ft T8_TLED_CA SPIA	Fixtures	89.27	0.01	89.27	1.00	0.01	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	1L 3ft T8_TLED_CA SPIA	Fixtures	67.91	0.01	70.71	1.04	0.01	1.04	Section 4.5.4.
Lighting	Linear LED Lighting	2L 3ft T8_TLED_CA SPIA	Fixtures	137.00	0.02	137.00	1.00	0.02	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	1L 4ft T8_TLED_CA SPIA	Fixtures	89.24	0.01	89.24	1.00	0.01	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	1L 4ft T12_TLED_CA SPIA	Fixtures	189.30	0.03	189.30	1.00	0.03	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 4ft T8_TLED_CA SPIA	Fixtures	150.60	0.02	150.60	1.00	0.02	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	4L 4ft T8_TLED_CA SPIA	Fixtures	344.18	0.05	344.18	1.00	0.05	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 4ft T8_Linear Retrofit_CA SPIA	Fixtures	160.22	0.02	162.95	1.02	0.02	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 4ft T12_Linear Retrofit_CA SPIA	Fixtures	325.46	0.05	325.46	1.00	0.05	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 4ft T12_TLED_CA SPIA	Fixtures	264.72	0.04	264.72	1.00	0.04	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	3L 4ft T8_TLED_CA SPIA	Fixtures	261.05	0.04	261.05	1.00	0.04	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	3L 4ft T12_TLED_CA SPIA	Fixtures	434.81	0.05	434.81	1.00	0.05	1.00	Section 4.5.4.

End Use Type	Research Category	Measure	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings Realization Rate	Verified Gross Peak kW/Unit Savings	Peak kW Savings Realization Rate	Source (IL-TRM Section*)
Lighting	Linear LED Lighting	3L 4ft T8_Linear Retrofit_CA SPIA	Fixtures	267.04	0.04	267.04	1.00	0.04	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	4L 4ft T8_Linear Retrofit_CA SPIA	Fixtures	286.25	0.04	286.25	1.00	0.04	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 8ft T12_TLED_CA SPIA	Fixtures	698.26	0.11	698.26	1.00	0.11	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 8ft T12_Linear Retrofit_CA SPIA	Fixtures	548.87	0.07	548.87	1.00	0.07	1.00	Section 4.5.4.
Lighting	Linear LED Lighting	2L 8ft T8_TLED_CA SPIA	Fixtures	364.16	0.06	364.16	1.00	0.06	1.00	Section 4.5.4.
Envelope	Insulation/Air Sealing	CA Attic Insulation and Air Sealing PRE	Projects	2628.62	0.03	2642.24	1.01	0.06	2.17	Section 5.6.5.
HVAC	Room AC Cover/Gap Sealer	IU AC Cover and Gap Sealer CAP	Each	0.00	0.00	0.00	N/A	0.00	N/A	Section 4.4.38.
HVAC	Split AC	IU Split AC CAP (CEE Tier 2)	Each	247.04	0.26	245.69	0.99	0.69	2.62	Section 5.3.3.
HVAC	Boiler Tune-Up	CA Boiler Tune-Up CAP	Each	0.00	0.00	0.00	N/A	0.00	N/A	Section 4.4.2.
HVAC	Furnace	IU Furnace CAP	Each	0.00	0.00	0.00	N/A	0.00	N/A	Section 5.3.7.
HVAC	Steam Trap Repair/Replace	Untested Steam Trap Repair/Replace CAP	Each	1.03	0.00	1.03	1.00	0.00	N/A	Section 4.4.16
HVAC	Programmable Thermostat	IU Programmable Thermostat DI	Each	39.01	0.00	60.01	1.54	0.00	N/A	Section 5.3.11.
HVAC	Programmable Thermostat	IU Reprogram Thermostat DI	Each	39.00	0.00	57.71	1.48	0.00	N/A	Section 5.3.11.
Hot Water	Faucet Aerator	IU Electric Aerator (Non-Cook County) - Bathroom DI	Each	36.71	0.03	36.71	1.00	0.03	1.00	Section 5.4.4.
Hot Water	Faucet Aerator	IU Electric Aerator (Non-Cook County) - Kitchen DI	Each	182.03	0.05	182.03	1.00	0.05	1.00	Section 5.4.4.
Hot Water	Faucet Aerator	IU Gas Aerator (Non-Cook County) - Bathroom DI	Each	2.18	0.00	2.18	1.00	0.00	N/A	Section 5.4.4.
Hot Water	Faucet Aerator	IU Gas Aerator (Non-Cook County) - Kitchen DI	Each	8.95	0.00	8.95	1.00	0.00	N/A	Section 5.4.4.
Hot Water	Showerhead	IU Electric Showerhead (Non-Cook County) - DI	Each	249.31	0.03	249.31	1.00	0.03	1.00	Section 5.4.5.
Hot Water	Showerhead	IU Electric Showerhead (Non-Cook County) - Handheld DI	Each	249.31	0.03	249.31	1.00	0.03	1.00	Section 5.4.5.
Hot Water	Showerhead	IU Gas Showerhead (Non-Cook County) - DI	Each	10.24	0.00	10.24	1.00	0.00	N/A	Section 5.4.5.
Hot Water	Showerhead	IU Gas Showerhead (Non-Cook County) - Handheld DI	Each	10.24	0.00	10.24	1.00	0.00	N/A	Section 5.4.5.
Hot Water	Electric Shower Timer	IU Electric Shower Timer (Non-Cook County) - DI	Each	74.06	0.01	74.06	1.00	0.01	1.00	Section 5.4.9.
Hot Water	Water Heater	IU Individual DHW Heater CAP	Each	0.00	0.00	0.00	N/A	0.00	N/A	Section 5.4.2
Plug Load	Smart Strip	IU Smart Strip - Tricklestar - Tier 1 - DD DI	Each	103.00	0.01	103.00	1.00	0.01	1.00	Section 5.2.1.

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

\* IL-TRM v9.0 and IL-TRM v9.0 Errata, where applicable.

*Source: Evaluation team analysis*

## 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 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	Linear LED Lighting	Fixtures	3,464	8.4	No	474,362	70.18	0	0	-10,941	-2,936	1.00	1.00	1.00	474,362	70.18	0	0	-10,941	-2,936
Lighting	Interior LED Lighting	Lamps/Fixtures	4,591	7.8	No	419,013	50.36	0	0	-4,845	-2,175	1.00	1.00	1.00	419,013	50.36	0	0	-4,845	-2,175
Lighting	Linear Fluorescent - Delamping	Fixtures	385	11.0	No	245,744	33.96	0	0	-108,438	-2,795	1.00	1.00	1.00	245,744	33.96	0	0	-108	-2,795
Exterior Lighting	Exterior LED Lighting	Fixtures	223	11.6	No	162,998	2.43	0	0	0	0	1.00	1.00	1.00	162,998	2.43	0	0	0	0
LED Exit Sign	LED Exit Sign	Fixtures	525	5.0	No	39,045	4.05	0	0	-42	-189	1.00	1.00	1.00	39,045	4.05	0	0	-42	-189
Envelope	Insulation/Air Sealing	Projects	14	20.0	No	36,991	0.87	436	0	0	0	1.00	1.00	1.00	36,991	0.87	436	0	0	0
Hot Water	Showerhead	Each	166	10.0	No	5,224	0.70	189	1,614	0	0	1.00	1.00	1.00	5,224	0.70	189	1,614	0	0
Hot Water	Faucet Aerator	Each	357	10.0	No	4,377	1.70	173	1,826	0	0	1.00	1.00	1.00	4,377	1.70	173	1,826	0	0
HVAC	Programmable Thermostat	Each	74	16.0	No	4,273	0	542	0	0	0	1.00	1.00	1.00	4,273	0	542	0	0	0
Plug Load	Smart Strip	Each	81	7.0	No	3,337	0.37	0	0	0	0	1.00	1.00	1.00	3,337	0.37	0	0	0	0
HVAC	Steam Trap Repair/ Replace	Each	2,243	6.0	No	0	0	47562	2,303	0	0	1.00	1.00	1.00	0	0	47562	2303	0	0
HVAC	Split AC	Each	8	18.0	No	1,966	5.52	0	0	0	0	1.00	1.00	1.00	1,966	5.52	0	0	0	0
Hot Water	Electric Shower Timer	Each	23	2.0	No	1,633	0.25	0	70	0	0	1.00	1.00	1.00	1,633	0.25	0	70	0	0
HVAC	Room AC Cover/Gap Sealer	Each	1,486	5.0	No	0	0	7581	0	0	0	1.00	1.00	1.00	0	0	7581	0	0	0
HVAC	Boiler Tune-Up	Each	82	3.0	No	0	0	4239	0	0	0	1.00	1.00	1.00	0	0	4239	0	0	0
HVAC	Furnace	Each	12	20.0	No	0	0	132	0	0	0	1.00	1.00	1.00	0	0	132	0	0	0
Hot Water	Water Heater	Each	4	13.0	No	0	0	10	0	0	0	1.00	1.00	1.00	0	0	10	0	0	0
<b>Total</b>			<b>0</b>	<b>9.3</b>		<b>1,398,963</b>	<b>170</b>	<b>60,865</b>	<b>5,813</b>	<b>-15,936</b>	<b>-8,095</b>				<b>1,398,963</b>	<b>170</b>	<b>60,865</b>	<b>5,813</b>	<b>-15,936</b>	<b>-8,095</b>

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 EUL for this measure varies over time. See the CPAS tables (Table 4-1 to Table 4-3).

†§ 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.

Source: ComEd tracking data and evaluation team analysis