



# ComEd Residential HVAC 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 CY2021 Residential HVAC Program impact evaluation. 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 Residential HVAC Program offers incentives for the installation of qualifying high efficiency equipment including:

- Central air conditioning (CAC) systems
- Air source heat pumps (ASHPs)
- Ductless mini-split heat pumps (DMSHPs)
- Furnace blower motors (electronically commutated motors, or ECMs)
- Ground source heat pumps (GSHPs)
- Advanced thermostats

In CY2021, the program offered the CAC, ASHP, and DMSHP measures through a midstream channel rather than a downstream channel and incentivized duct sealing and the ASHP and CAC tune-up measures. CLEAResult implemented this program in CY2021.

The program had 8,522 participants and distributed 10,249 measures in CY2021 (see Table 2-1).

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

Participation	Total
Participants	8,522
Measures	10,249

*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 and Delivery Channel**

Research Category	Quantity Unit
Midstream Central AC	5,210 Each
Midstream DMSHP	699 Each
Midstream ASHP	336 Each
Advanced Thermostat	2,932 Each
Ground Source Heat Pump - TOS	43 Each
Downstream ASHP - TOS	19 Each
Downstream DMSHP - ER	39 Each
Downstream DMSHP - TOS	31 Each
HVAC Tune Up	877 Each
Ground Source Heat Pump - ER	11 Each
Duct Sealing	36 Each
ECM Furnace Motor - Retrofit	11 Each
Downstream ASHP - ER	1 Each
Downstream Central AC - ER	1 Each
Downstream Central AC - TOS	2 Each
ECM Furnace Motor - Factory Installed	1 Each
<b>Total</b>	<b>10,249</b>

AC – air conditioner

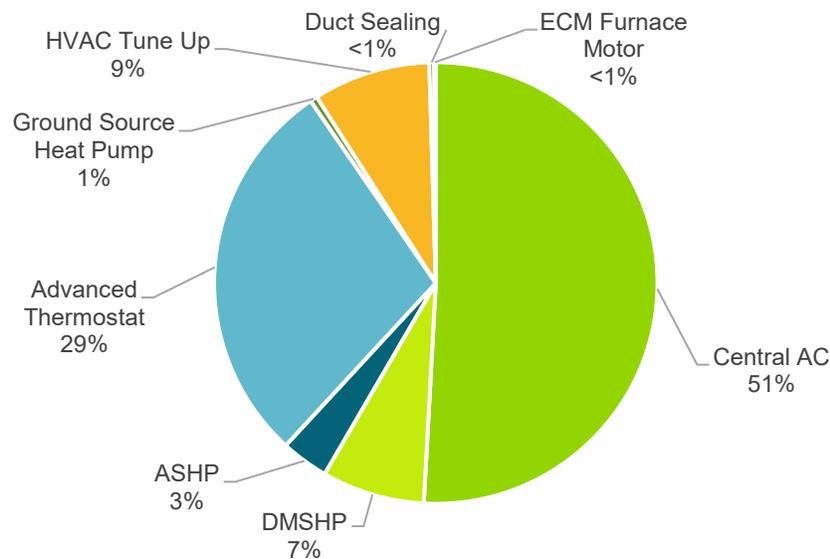
TOS – time of sale

ER – early replacement

Note: The rows are sorted by verified gross savings.

Source: ComEd tracking data and evaluation team analysis

**Figure 2-1. Share of Measures Installed by Type**



Source: ComEd tracking data and evaluation team analysis

### 3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the Residential HVAC 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 Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	Verified Net Savings
Electric Energy Savings - Direct	kWh	6,140,953	1.00	6,141,696	Varies	N/A	N/A	4,838,627
Electric Energy Savings - Converted from Gas <sup>‡</sup>	kWh	7,293,771	1.00	7,280,268	Varies	N/A	N/A	6,545,744
Total Electric Energy Savings	kWh	13,434,723	1.00	13,421,963	Varies	N/A	N/A	11,384,371
Summer Peak <sup>§</sup> Demand Savings	kW	2,461	1.00	2,464	Varies	N/A	N/A	1,956

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

<sup>‡</sup> 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 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."

<sup>§</sup> 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 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 Residential HVAC 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 evaluation team conducted secondary research to determine NTG for the midstream ASHP and midstream DMSHP measures. Based on this research<sup>2</sup>, the team used the Illinois Technical Reference Manual (IL-TRM)<sup>3</sup> default NTG of 0.80 for these measures.

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<sup>2</sup> ComEd Res HVAC Midstream ASHP DMSHP NTG Memo 2021-08-03

<sup>3</sup> In this report, unless stated otherwise, IL-TRM and IL-TRM Errata refers to version 9.0 (v9.0).

**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	
HVAC	Midstream Central AC	18.0	2,013,553	0.80	24,523,738				1,610,842	1,610,842	1,610,842	1,610,842	1,610,842	1,610,842	1,610,842
HVAC	Midstream DMSHP	15.0	1,859,886	0.80	21,096,392				1,487,909	1,487,909	1,487,909	1,487,909	1,487,909	1,487,909	1,487,909
HVAC	Midstream ASHP	16.0	845,587	0.80	10,154,585				676,469	676,469	676,469	676,469	676,469	676,469	676,469
HVAC	Advanced Thermostat	11.0	743,353	Multiple††	6,989,055				635,369	635,369	635,369	635,369	635,369	635,369	635,369
HVAC	Ground Source Heat Pump - TOS	25.0	184,461	0.59	2,720,800				108,832	108,832	108,832	108,832	108,832	108,832	108,832
HVAC	Downstream ASHP - TOS	16.0	129,620	0.57	1,182,136				73,884	73,884	73,884	73,884	73,884	73,884	73,884
HVAC	Downstream DMSHP - ER	15.0	102,604	0.63	711,501				64,640	64,640	64,640	64,640	64,640	64,640	64,640
HVAC	Downstream DMSHP - TOS	15.0	92,629	0.63	875,347				58,356	58,356	58,356	58,356	58,356	58,356	58,356
HVAC	HVAC Tune Up	3.0	70,934	0.80	170,241				56,747	56,747	56,747				
HVAC	Ground Source Heat Pump - ER	25.0	68,620	0.59	842,144				40,486	40,486	40,486	40,486	40,486	40,486	40,486
HVAC	Duct Sealing	20.0	18,632	0.88	325,002				16,396	16,396	16,396	16,396	16,396	16,396	16,396
HVAC	ECM Furnace Motor - Retrofit	6.0	7,542	0.78	35,297				5,883	5,883	5,883	5,883	5,883	5,883	5,883
HVAC	Downstream ASHP - ER	16.0	2,824	0.57	20,673				1,610	1,610	1,610	1,610	1,610	1,610	1,610
HVAC	Downstream Central AC - ER	18.0	826	0.83	6,071				686	686	686	686	686	686	686
HVAC	Downstream Central AC - TOS	18.0	623	0.83	9,313				517	517	517	517	517	517	517
HVAC	ECM Furnace Motor - Factory Installed	6.0	-	0.78	-				-	-	-	-	-	-	-
<b>CY2021 Program Total Electric Contribution to CPAS</b>			<b>6,141,696</b>		<b>69,662,297</b>				<b>4,838,627</b>	<b>4,838,627</b>	<b>4,838,627</b>	<b>4,781,880</b>	<b>4,781,880</b>	<b>4,781,880</b>	<b>4,781,880</b>
<b>Historic Program Total Electric Contribution to CPAS‡</b>						<b>9,255,057</b>	<b>18,819,448</b>	<b>22,705,543</b>	<b>22,705,543</b>	<b>22,705,543</b>	<b>22,602,637</b>	<b>21,987,891</b>	<b>21,645,784</b>	<b>20,322,695</b>	<b>20,322,695</b>
<b>Program Total Electric CPAS</b>						<b>9,255,057</b>	<b>18,819,448</b>	<b>22,705,543</b>	<b>27,544,170</b>	<b>27,544,170</b>	<b>27,441,264</b>	<b>26,769,770</b>	<b>26,427,663</b>	<b>25,104,575</b>	<b>25,104,575</b>
<b>CY2021 Program Incremental Expiring Electric Savings§</b>												<b>56,747</b>			
<b>Historic Program Incremental Expiring Electric Savings</b>											<b>102,906</b>	<b>614,746</b>	<b>342,107</b>	<b>1,323,088</b>	<b>1,323,088</b>
<b>Program Total Incremental Expiring Electric Savings</b>											<b>102,906</b>	<b>671,493</b>	<b>342,107</b>	<b>1,323,088</b>	<b>1,323,088</b>
End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038		
HVAC	Midstream Central AC	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224		
HVAC	Midstream DMSHP	1,480,844	1,480,844	1,480,844	1,446,791	1,255,923	1,255,923	1,255,923	1,255,923	1,255,923	1,255,923				
HVAC	Midstream ASHP	665,099	665,099	625,103	591,495	591,495	591,495	591,495	591,495	591,495	591,495				
HVAC	Advanced Thermostat	635,369	635,369	635,369	635,369	635,369									
HVAC	Ground Source Heat Pump - TOS	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832		
HVAC	Downstream ASHP - TOS	73,884	73,884	73,884	73,884	73,884	73,884	73,884	73,884	73,884	73,884				
HVAC	Downstream DMSHP - ER	48,974	44,161	32,932	32,932	32,932	32,932	32,932	32,932	32,932					
HVAC	Downstream DMSHP - TOS	58,356	58,356	58,356	58,356	58,356	58,356	58,356	58,356	58,356					
HVAC	HVAC Tune Up														
HVAC	Ground Source Heat Pump - ER	36,993	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235		
HVAC	Duct Sealing	16,396	16,396	16,396	16,396	16,104	16,104	16,104	16,104	16,104	16,104	16,104	16,104		
HVAC	ECM Furnace Motor - Retrofit														
HVAC	Downstream ASHP - ER	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101				
HVAC	Downstream Central AC - ER	163	163	163	163	163	163	163	163	163	163	163	163		
HVAC	Downstream Central AC - TOS	517	517	517	517	517	517	517	517	517	517	517	517		
HVAC	ECM Furnace Motor - Factory Installed														
<b>CY2021 Program Total Electric Contribution to CPAS</b>		<b>4,364,752</b>	<b>4,354,182</b>	<b>4,302,957</b>	<b>4,235,297</b>	<b>4,044,136</b>	<b>3,408,767</b>	<b>3,408,767</b>	<b>3,408,767</b>	<b>3,408,767</b>	<b>2,061,556</b>	<b>1,395,075</b>	<b>1,395,075</b>		
<b>Historic Program Total Electric Contribution to CPAS‡</b>		<b>20,315,662</b>	<b>19,184,514</b>	<b>19,184,514</b>	<b>17,885,579</b>	<b>17,272,196</b>	<b>17,272,196</b>	<b>17,272,196</b>	<b>11,415,130</b>	<b>10,768,782</b>	<b>8,282,490</b>	<b>6,489,976</b>	<b>344,202</b>		
<b>Program Total Electric CPAS</b>		<b>24,680,414</b>	<b>23,538,696</b>	<b>23,487,472</b>	<b>22,120,875</b>	<b>21,316,332</b>	<b>20,680,963</b>	<b>20,680,963</b>	<b>14,823,897</b>	<b>14,177,549</b>	<b>10,344,046</b>	<b>7,885,052</b>	<b>1,739,277</b>		
<b>CY2021 Program Incremental Expiring Electric Savings§</b>		<b>417,128</b>	<b>10,570</b>	<b>51,225</b>	<b>67,661</b>	<b>191,161</b>	<b>635,369</b>				<b>1,347,211</b>	<b>666,480</b>			
<b>Historic Program Incremental Expiring Electric Savings</b>		<b>7,033</b>	<b>1,131,147</b>		<b>1,298,936</b>	<b>613,383</b>			<b>5,857,066</b>	<b>646,348</b>	<b>2,486,292</b>	<b>1,792,514</b>	<b>6,145,774</b>		
<b>Program Total Incremental Expiring Electric Savings</b>		<b>424,161</b>	<b>1,141,718</b>	<b>51,225</b>	<b>1,366,596</b>	<b>804,544</b>	<b>635,369</b>		<b>5,857,066</b>	<b>646,348</b>	<b>3,833,503</b>	<b>2,458,994</b>	<b>6,145,774</b>		

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
HVAC	Midstream Central AC												
HVAC	Midstream DMSHP												
HVAC	Midstream ASHP												
HVAC	Advanced Thermostat												
HVAC	Ground Source Heat Pump - TOS	108,832	108,832	108,832	108,832	108,832	108,832	108,832					
HVAC	Downstream ASHP - TOS												
HVAC	Downstream DMSHP - ER												
HVAC	Downstream DMSHP - TOS												
HVAC	HVAC Tune Up												
HVAC	Ground Source Heat Pump - ER	31,235	31,235	31,235	31,235	31,235	31,235	31,235					
HVAC	Duct Sealing	16,104	16,104										
HVAC	ECM Furnace Motor - Retrofit												
HVAC	Downstream ASHP - ER												
HVAC	Downstream Central AC - ER												
HVAC	Downstream Central AC - TOS												
HVAC	ECM Furnace Motor - Factory Installed												
<b>CY2021 Program Total Electric Contribution to CPAS</b>		<b>156,171</b>	<b>156,171</b>	<b>140,067</b>	<b>140,067</b>	<b>140,067</b>	<b>140,067</b>	<b>140,067</b>	-	-	-	-	-
<b>Historic Program Total Electric Contribution to CPAS†</b>		<b>344,202</b>	<b>339,146</b>	<b>339,146</b>	<b>339,146</b>	<b>292,821</b>	<b>159,724</b>	-	-	-	-	-	-
<b>Program Total Electric CPAS</b>		<b>500,373</b>	<b>495,317</b>	<b>479,213</b>	<b>479,213</b>	<b>432,888</b>	<b>299,792</b>	<b>140,067</b>	-	-	-	-	-
<b>CY2021 Program Incremental Expiring Electric Savings§</b>		<b>1,238,904</b>	-	<b>16,104</b>	-	-	-	-	<b>140,067</b>	-	-	-	-
<b>Historic Program Incremental Expiring Electric Savings</b>		-	<b>5,056</b>	-	-	<b>46,325</b>	<b>133,096</b>	<b>159,724</b>	-	-	-	-	-
<b>Program Total Incremental Expiring Electric Savings</b>		<b>1,238,904</b>	<b>5,056</b>	<b>16,104</b>	-	<b>46,325</b>	<b>133,096</b>	<b>159,724</b>	<b>140,067</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  $Y_n$ .

†† Cooling NTG = 0.8, heating NTG = 0.9.

Source: Evaluation team analysis

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

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings (Therms)	Lifetime Net Savings NTG* (Therms)†	Verified Net Therms Savings									
					2018	2019	2020	2021	2022	2023	2024	2025	2026	
HVAC	Midstream Central AC	18.0	-	0.80	-	-	-	-	-	-	-	-	-	
HVAC	Midstream DMSHP	15.0	-	0.80	-	-	-	-	-	-	-	-	-	
HVAC	Midstream ASHP	16.0	-	0.80	-	-	-	-	-	-	-	-	-	
HVAC	Advanced Thermostat	11.0	236,790	Multiple††	2,344,218	-	-	213,111	213,111	213,111	213,111	213,111	213,111	
HVAC	Ground Source Heat Pump - TOS	25.0	-	0.59	-	-	-	-	-	-	-	-	-	
HVAC	Downstream ASHP - TOS	16.0	-	0.57	-	-	-	-	-	-	-	-	-	
HVAC	Downstream DMSHP - ER	15.0	-	0.63	-	-	-	-	-	-	-	-	-	
HVAC	Downstream DMSHP - TOS	15.0	-	0.63	-	-	-	-	-	-	-	-	-	
HVAC	HVAC Tune Up	3.0	-	0.80	-	-	-	-	-	-	-	-	-	
HVAC	Ground Source Heat Pump - ER	25.0	-	0.59	-	-	-	-	-	-	-	-	-	
HVAC	Duct Sealing	20.0	11,702	0.88	205,955	-	-	10,298	10,298	10,298	10,298	10,298	10,298	
HVAC	ECM Furnace Motor - Retrofit	6.0	(103)	0.78	(483)	-	-	(80)	(80)	(80)	(80)	(80)	(80)	
HVAC	Downstream ASHP - ER	16.0	-	0.57	-	-	-	-	-	-	-	-	-	
HVAC	Downstream Central AC - ER	18.0	-	0.83	-	-	-	-	-	-	-	-	-	
HVAC	Downstream Central AC - TOS	18.0	-	0.83	-	-	-	-	-	-	-	-	-	
HVAC	ECM Furnace Motor - Factory Installed	6.0	-	0.78	-	-	-	-	-	-	-	-	-	
<b>CY2021 Program Total Gas Contribution to CPAS (Therms)</b>			<b>248,389</b>	<b>2,549,690</b>				<b>223,328</b>	<b>223,328</b>	<b>223,328</b>	<b>223,328</b>	<b>223,328</b>	<b>223,328</b>	
<b>CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡</b>								<b>6,545,744</b>	<b>6,545,744</b>	<b>6,545,744</b>	<b>6,545,744</b>	<b>6,545,744</b>	<b>6,545,744</b>	
<b>Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§</b>						<b>9,010,884</b>	<b>20,163,675</b>	<b>28,677,238</b>	<b>28,677,238</b>	<b>28,677,238</b>	<b>28,677,238</b>	<b>28,504,088</b>	<b>27,621,382</b>	<b>26,325,460</b>
<b>Program Total Gas CPAS (kWh Equivalent)</b>						<b>9,010,884</b>	<b>20,163,675</b>	<b>28,677,238</b>	<b>35,222,981</b>	<b>35,222,981</b>	<b>35,222,981</b>	<b>35,049,832</b>	<b>34,167,125</b>	<b>32,871,204</b>
<b>CY2021 Program Incremental Expiring Gas Savings (Therms)</b>														
<b>CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)  </b>														
<b>Historic Program Incremental Expiring Gas Savings (kWh Equivalent)</b>											<b>173,149</b>	<b>882,707</b>	<b>1,295,921</b>	
<b>Program Total Incremental Expiring Gas Savings (kWh Equivalent)</b>											<b>173,149</b>	<b>882,707</b>	<b>1,295,921</b>	

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
HVAC	Midstream Central AC	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Midstream DMSHP	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Midstream ASHP	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Advanced Thermostat	213,111	213,111	213,111	213,111	213,111	-	-	-	-	-	-	-
HVAC	Ground Source Heat Pump - TOS	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Downstream ASHP - TOS	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Downstream DMSHP - ER	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Downstream DMSHP - TOS	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	HVAC Tune Up	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Ground Source Heat Pump - ER	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Duct Sealing	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298
HVAC	ECM Furnace Motor - Retrofit	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Downstream ASHP - ER	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Downstream Central AC - ER	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Downstream Central AC - TOS	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	ECM Furnace Motor - Factory Installed	-	-	-	-	-	-	-	-	-	-	-	-
<b>CY2021 Program Total Gas Contribution to CPAS (Therms)</b>		<b>223,408</b>	<b>223,408</b>	<b>223,408</b>	<b>223,408</b>	<b>223,408</b>	<b>10,298</b>	<b>10,298</b>	<b>10,298</b>	<b>10,298</b>	<b>10,298</b>	<b>10,298</b>	<b>10,298</b>
<b>CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)†</b>		<b>6,548,102</b>	<b>6,548,102</b>	<b>6,548,102</b>	<b>6,548,102</b>	<b>6,548,102</b>	<b>301,827</b>	<b>301,827</b>	<b>301,827</b>	<b>301,827</b>	<b>301,827</b>	<b>301,827</b>	<b>301,827</b>
<b>Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§</b>		<b>26,261,291</b>	<b>19,939,774</b>	<b>19,939,774</b>	<b>12,366,077</b>	<b>8,332,478</b>	<b>8,332,478</b>	<b>8,332,478</b>	<b>5,650,743</b>	<b>2,628,501</b>	<b>119,021</b>	<b>119,021</b>	<b>119,021</b>
<b>Program Total Gas CPAS (kWh Equivalent)</b>		<b>32,809,393</b>	<b>26,487,877</b>	<b>26,487,877</b>	<b>18,914,179</b>	<b>14,880,581</b>	<b>8,634,305</b>	<b>8,634,305</b>	<b>5,952,570</b>	<b>2,930,328</b>	<b>420,847</b>	<b>420,847</b>	<b>420,847</b>
<b>CY2021 Program Incremental Expiring Gas Savings (Therms)</b>		<b>(80)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>213,111</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)  </b>		<b>(2,358)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>6,246,275</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Historic Program Incremental Expiring Gas Savings (kWh Equivalent)</b>		<b>64,169</b>	<b>6,321,517</b>	<b>-</b>	<b>7,573,698</b>	<b>4,033,598</b>	<b>-</b>	<b>-</b>	<b>2,681,736</b>	<b>3,022,242</b>	<b>2,509,480</b>	<b>-</b>	<b>-</b>
<b>Program Total Incremental Expiring Gas Savings (kWh Equivalent)</b>		<b>61,811</b>	<b>6,321,517</b>	<b>-</b>	<b>7,573,698</b>	<b>4,033,598</b>	<b>6,246,275</b>	<b>-</b>	<b>2,681,736</b>	<b>3,022,242</b>	<b>2,509,480</b>	<b>-</b>	<b>-</b>

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
HVAC	Midstream Central AC												
HVAC	Midstream DMSHP												
HVAC	Midstream ASHP												
HVAC	Advanced Thermostat												
HVAC	Ground Source Heat Pump - TOS	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Downstream ASHP - TOS												
HVAC	Downstream DMSHP - ER												
HVAC	Downstream DMSHP - TOS												
HVAC	HVAC Tune Up												
HVAC	Ground Source Heat Pump - ER	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Duct Sealing	10,298	10,298										
HVAC	ECM Furnace Motor - Retrofit												
HVAC	Downstream ASHP - ER												
HVAC	Downstream Central AC - ER												
HVAC	Downstream Central AC - TOS												
HVAC	ECM Furnace Motor - Factory Installed												
<b>CY2021 Program Total Gas Contribution to CPAS (Therms)</b>		<b>10,298</b>	<b>10,298</b>	-	-	-	-	-	-	-	-	-	-
<b>CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)†</b>		<b>301,827</b>	<b>301,827</b>	-	-	-	-	-	-	-	-	-	-
<b>Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§</b>		<b>119,021</b>	<b>57,118</b>	<b>57,118</b>	<b>57,118</b>	<b>2,865</b>	<b>39,943</b>	-	-	-	-	-	-
<b>Program Total Gas CPAS (kWh Equivalent)</b>		<b>420,847</b>	<b>358,945</b>	<b>57,118</b>	<b>57,118</b>	<b>2,865</b>	<b>39,943</b>	-	-	-	-	-	-
<b>CY2021 Program Incremental Expiring Gas Savings (Therms)</b>		-	-	10,298	-	-	-	-	-	-	-	-	-
<b>CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)  </b>		-	-	301,827	-	-	-	-	-	-	-	-	-
<b>Historic Program Incremental Expiring Gas Savings (kWh Equivalent)</b>		-	61,903	-	-	54,252	(37,077)	39,943	-	-	-	-	-
<b>Program Total Incremental Expiring Gas Savings (kWh Equivalent)</b>		-	61,903	301,827	-	54,252	(37,077)	39,943	-	-	-	-	-

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>.

†† Cooling NTG = 0.8, heating NTG = 0.9.

Source: Evaluation team analysis

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

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings		Lifetime Net Savings (kWh)†	Verified Net kWh Savings (Including Those Converted from Gas Savings)										
			(kWh)	NTG*		2018	2019	2020	2021	2022	2023	2024	2025	2026		
HVAC	Midstream Central AC	18.0	2,013,553	0.80	24,523,738				1,610,842	1,610,842	1,610,842	1,610,842	1,610,842	1,610,842	1,610,842	
HVAC	Midstream DMSHP	15.0	1,859,886	0.80	21,096,392				1,487,909	1,487,909	1,487,909	1,487,909	1,487,909	1,487,909	1,487,909	
HVAC	Midstream ASHP	16.0	845,587	0.80	10,154,585				676,469	676,469	676,469	676,469	676,469	676,469	676,469	
HVAC	Advanced Thermostat	11.0	7,683,659	Multiple††	75,698,084				6,881,644	6,881,644	6,881,644	6,881,644	6,881,644	6,881,644	6,881,644	
HVAC	Ground Source Heat Pump - TOS	25.0	184,461	0.59	2,720,800				108,832	108,832	108,832	108,832	108,832	108,832	108,832	
HVAC	Downstream ASHP - TOS	16.0	129,620	0.57	1,182,136				73,884	73,884	73,884	73,884	73,884	73,884	73,884	
HVAC	Downstream DMSHP - ER	15.0	102,604	0.63	711,501				64,640	64,640	64,640	64,640	64,640	64,640	64,640	
HVAC	Downstream DMSHP - TOS	15.0	92,629	0.63	875,347				58,356	58,356	58,356	58,356	58,356	58,356	58,356	
HVAC	HVAC Tune Up	3.0	70,934	0.80	170,241				56,747	56,747	56,747	56,747	56,747	56,747	56,747	
HVAC	Ground Source Heat Pump - ER	25.0	68,620	0.59	842,144				40,486	40,486	40,486	40,486	40,486	40,486	40,486	
HVAC	Duct Sealing	20.0	361,617	0.88	6,361,539				318,223	318,223	318,223	318,223	318,223	318,223	318,223	
HVAC	ECM Furnace Motor - Retrofit	6.0	4,519	0.78	21,147				3,524	3,524	3,524	3,524	3,524	3,524	3,524	
HVAC	Downstream ASHP - ER	16.0	2,824	0.57	20,673				1,610	1,610	1,610	1,610	1,610	1,610	1,610	
HVAC	Downstream Central AC - ER	18.0	826	0.83	6,071				686	686	686	686	686	686	686	
HVAC	Downstream Central AC - TOS	18.0	623	0.83	9,313				517	517	517	517	517	517	517	
HVAC	ECM Furnace Motor - Factory Installed	6.0	-	0.78	-				-	-	-	-	-	-	-	
<b>CY2021 Program Total Contribution to CPAS</b>			<b>13,421,963</b>		<b>144,393,713</b>				<b>11,384,371</b>	<b>11,384,371</b>	<b>11,384,371</b>	<b>11,327,624</b>	<b>11,327,624</b>	<b>11,327,624</b>	<b>11,327,624</b>	
<b>Historic Program Total Contribution to CPAS‡</b>						<b>18,265,941</b>	<b>38,983,124</b>	<b>51,382,780</b>	<b>51,382,780</b>	<b>51,382,780</b>	<b>51,279,874</b>	<b>50,491,979</b>	<b>49,267,165</b>	<b>46,648,155</b>	<b>46,648,155</b>	
<b>Program Total CPAS</b>						<b>18,265,941</b>	<b>38,983,124</b>	<b>51,382,780</b>	<b>62,767,151</b>	<b>62,767,151</b>	<b>62,664,245</b>	<b>61,819,603</b>	<b>60,594,789</b>	<b>57,975,779</b>	<b>57,975,779</b>	
<b>CY2021 Program Incremental Expiring Savings§</b>												<b>56,747</b>				
<b>Historic Program Incremental Expiring Savings</b>											<b>102,906</b>	<b>787,896</b>	<b>1,224,814</b>	<b>2,619,010</b>	<b>2,619,010</b>	
<b>Program Total Incremental Expiring Savings</b>											<b>102,906</b>	<b>844,643</b>	<b>1,224,814</b>	<b>2,619,010</b>	<b>2,619,010</b>	
End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038			
HVAC	Midstream Central AC	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224	1,238,224			
HVAC	Midstream DMSHP	1,480,844	1,480,844	1,480,844	1,446,791	1,255,923	1,255,923	1,255,923	1,255,923	1,255,923						
HVAC	Midstream ASHP	665,099	665,099	625,103	591,495	591,495	591,495	591,495	591,495	591,495	591,495					
HVAC	Advanced Thermostat	6,881,644	6,881,644	6,881,644	6,881,644	6,881,644										
HVAC	Ground Source Heat Pump - TOS	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832	108,832			
HVAC	Downstream ASHP - TOS	73,884	73,884	73,884	73,884	73,884	73,884	73,884	73,884	73,884	73,884					
HVAC	Downstream DMSHP - ER	48,974	44,161	32,932	32,932	32,932	32,932	32,932	32,932	32,932						
HVAC	Downstream DMSHP - TOS	58,356	58,356	58,356	58,356	58,356	58,356	58,356	58,356	58,356						
HVAC	HVAC Tune Up															
HVAC	Ground Source Heat Pump - ER	36,993	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235	31,235			
HVAC	Duct Sealing	318,223	318,223	318,223	318,223	317,931	317,931	317,931	317,931	317,931	317,931	317,931	317,931			
HVAC	ECM Furnace Motor - Retrofit															
HVAC	Downstream ASHP - ER	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101					
HVAC	Downstream Central AC - ER	163	163	163	163	163	163	163	163	163	163	163	163			
HVAC	Downstream Central AC - TOS	517	517	517	517	517	517	517	517	517	517	517	517			
HVAC	ECM Furnace Motor - Factory Installed															
<b>CY2021 Program Total Contribution to CPAS</b>			<b>10,912,855</b>	<b>10,902,284</b>	<b>10,851,059</b>	<b>10,783,399</b>	<b>10,592,238</b>	<b>3,710,594</b>	<b>3,710,594</b>	<b>3,710,594</b>	<b>3,710,594</b>	<b>2,363,382</b>	<b>1,696,902</b>	<b>1,696,902</b>		
<b>Historic Program Total Contribution to CPAS‡</b>			<b>46,576,953</b>	<b>39,124,289</b>	<b>39,124,289</b>	<b>30,251,655</b>	<b>25,604,674</b>	<b>25,604,674</b>	<b>25,604,674</b>	<b>17,065,873</b>	<b>13,397,283</b>	<b>8,401,511</b>	<b>6,608,997</b>	<b>463,223</b>		
<b>Program Total CPAS</b>			<b>57,489,807</b>	<b>50,026,573</b>	<b>49,975,348</b>	<b>41,035,054</b>	<b>36,196,912</b>	<b>29,315,268</b>	<b>29,315,268</b>	<b>20,776,466</b>	<b>17,107,876</b>	<b>10,764,893</b>	<b>8,305,899</b>	<b>2,160,125</b>		
<b>CY2021 Program Incremental Expiring Savings§</b>			<b>414,769</b>	<b>10,570</b>	<b>51,225</b>	<b>67,661</b>	<b>191,161</b>	<b>6,881,644</b>				<b>1,347,211</b>	<b>666,480</b>			
<b>Historic Program Incremental Expiring Savings</b>			<b>71,203</b>	<b>7,452,664</b>		<b>8,872,633</b>	<b>4,646,981</b>		<b>8,538,802</b>	<b>3,668,590</b>	<b>4,995,772</b>	<b>1,792,514</b>	<b>6,145,774</b>	<b>6,145,774</b>		
<b>Program Total Incremental Expiring Savings</b>			<b>485,972</b>	<b>7,463,234</b>	<b>51,225</b>	<b>8,940,294</b>	<b>4,838,142</b>	<b>6,881,644</b>		<b>8,538,802</b>	<b>3,668,590</b>	<b>6,342,983</b>	<b>2,458,994</b>	<b>6,145,774</b>		

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
HVAC	Midstream Central AC												
HVAC	Midstream DMSHP												
HVAC	Midstream ASHP												
HVAC	Advanced Thermostat												
HVAC	Ground Source Heat Pump - TOS	108,832	108,832	108,832	108,832	108,832	108,832	108,832					
HVAC	Downstream ASHP - TOS												
HVAC	Downstream DMSHP - ER												
HVAC	Downstream DMSHP - TOS												
HVAC	HVAC Tune Up												
HVAC	Ground Source Heat Pump - ER	31,235	31,235	31,235	31,235	31,235	31,235	31,235					
HVAC	Duct Sealing	317,931	317,931										
HVAC	ECM Furnace Motor - Retrofit												
HVAC	Downstream ASHP - ER												
HVAC	Downstream Central AC - ER												
HVAC	Downstream Central AC - TOS												
HVAC	ECM Furnace Motor - Factory Installed												
<b>CY2021 Program Total Contribution to CPAS</b>		<b>457,998</b>	<b>457,998</b>	<b>140,067</b>	<b>140,067</b>	<b>140,067</b>	<b>140,067</b>	<b>140,067</b>	-	-	-	-	-
<b>Historic Program Total Contribution to CPAS†</b>		<b>463,223</b>	<b>396,264</b>	<b>396,264</b>	<b>396,264</b>	<b>295,686</b>	<b>199,667</b>	-	-	-	-	-	-
<b>Program Total CPAS</b>		<b>921,221</b>	<b>854,262</b>	<b>536,331</b>	<b>536,331</b>	<b>435,753</b>	<b>339,734</b>	<b>140,067</b>	-	-	-	-	-
<b>CY2021 Program Incremental Expiring Savings§</b>		<b>1,238,904</b>	-	<b>317,931</b>	-	-	-	-	<b>140,067</b>	-	-	-	-
<b>Historic Program Incremental Expiring Savings</b>		-	<b>66,959</b>	-	-	<b>100,578</b>	<b>96,019</b>	<b>199,667</b>	-	-	-	-	-
<b>Program Total Incremental Expiring Savings</b>		<b>1,238,904</b>	<b>66,959</b>	<b>317,931</b>	-	<b>100,578</b>	<b>96,019</b>	<b>199,667</b>	<b>140,067</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-ntg-recommendations-for-2021>.

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

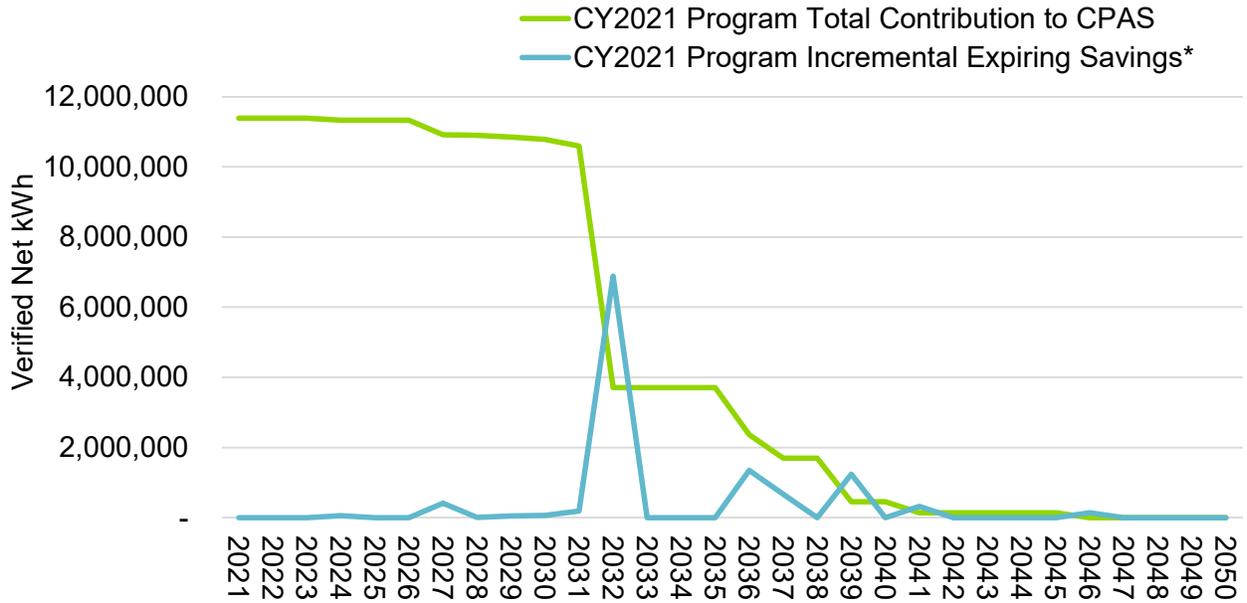
‡ Historic savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y<sub>n-1</sub> - CPAS Y<sub>n</sub>.

†† Cooling NTG = 0.8, heating NTG = 0.9.

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.

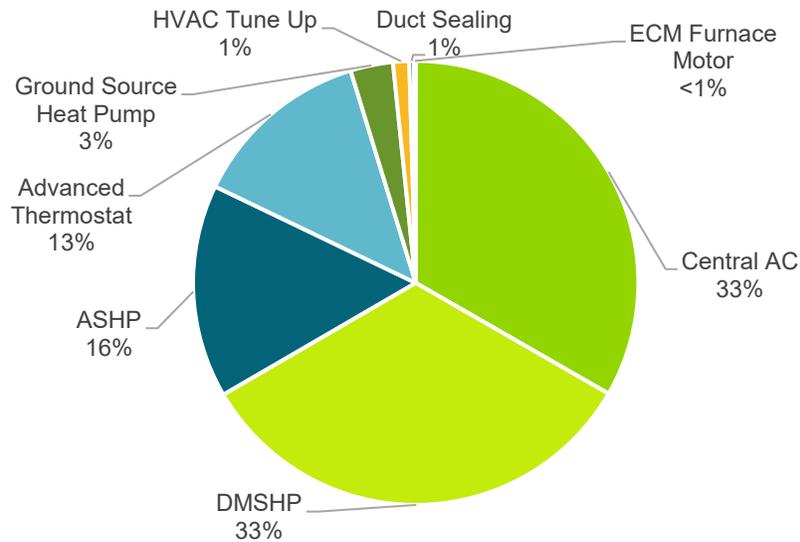
**Table 5-1. Number of Measures by Type and Delivery Channel**

Research Category	Quantity Unit
Midstream Central AC	5,210 Each
Midstream DMSHP	699 Each
Midstream ASHP	336 Each
Advanced Thermostat	2,932 Each
Ground Source Heat Pump - TOS	43 Each
Downstream ASHP - TOS	19 Each
Downstream DMSHP - ER	39 Each
Downstream DMSHP - TOS	31 Each
HVAC Tune Up	877 Each
Ground Source Heat Pump - ER	11 Each
Duct Sealing	36 Each
ECM Furnace Motor - Retrofit	11 Each
Downstream ASHP - ER	1 Each
Downstream Central AC - ER	1 Each
Downstream Central AC - TOS	2 Each
ECM Furnace Motor - Factory Installed	1 Each
<b>Total</b>	<b>10,249</b>

Notes: This is the same table as Table 2-2.  
The rows are sorted by verified gross 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 the following tables. None of the measures produced water savings so secondary energy savings from water reduction measures is zero.

**Table 5-2. Energy Savings by Measure – Electric**

Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	EUL (years)
Midstream Central AC	2,013,553	1.00	2,013,553	0.80	1,610,842	18.0
Midstream DMSHP	1,859,886	1.00	1,859,886	0.80	1,487,909	15.0
Midstream ASHP	845,587	1.00	845,587	0.80	676,469	16.0
Advanced Thermostat	745,986	1.00	743,353	Multiple††	635,369	11.0
Ground Source Heat Pump - TOS	192,885	0.96	184,461	0.59	108,832	25.0
Downstream ASHP - TOS	130,037	1.00	129,620	0.57	73,884	16.0
Downstream DMSHP - ER	94,998	1.08	102,604	0.63	64,640	15.0
Downstream DMSHP - TOS	89,368	1.04	92,629	0.63	58,356	15.0
HVAC Tune Up	73,134	0.97	70,934	0.80	56,747	3.0
Ground Source Heat Pump - ER	64,573	1.06	68,620	0.59	40,486	25.0
Duct Sealing	18,676	1.00	18,632	0.88	16,396	20.0
ECM Furnace Motor - Retrofit	7,578	1.00	7,542	0.78	5,883	6.0
Downstream ASHP - ER	2,824	1.00	2,824	0.57	1,610	16.0
Downstream Central AC - ER	553	1.49	826	0.83	686	18.0
Downstream Central AC - TOS	623	1.00	623	0.83	517	18.0
ECM Furnace Motor - Factory Installed	690	0.00	0	0.78	0	6.0
<b>Total</b>	<b>6,140,953</b>	<b>1.00</b>	<b>6,141,696</b>		<b>4,838,627</b>	

\* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021> and ComEd Res HVAC Midstream ASHP DMSHP NTG Memo 2021-08-03.

†† Cooling NTG = 0.8, heating NTG = 0.9.

Source: ComEd tracking data and evaluation team analysis

**Table 5-3. Summer Peak Demand Savings by Measure**

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)
Midstream Central AC	1,943.78	1.00	1,943.78	0.80	1,555.02
Midstream DMSHP	58.64	1.00	58.64	0.80	46.92
Midstream ASHP	30.36	1.00	30.36	0.80	24.29
Advanced Thermostat	318.85	1.00	318.23	Multiple††	254.58
Ground Source Heat Pump - TOS	41.51	1.11	46.07	0.59	27.18
Downstream ASHP - TOS	0.76	0.64	0.48	0.57	0.28
Downstream DMSHP - ER	9.31	1.05	9.81	0.63	6.18
Downstream DMSHP - TOS	2.58	1.09	2.80	0.63	1.77
HVAC Tune Up	26.95	1.00	26.95	0.80	21.56
Ground Source Heat Pump - ER	16.53	0.96	15.87	0.59	9.36
Duct Sealing	6.61	1.00	6.61	0.88	5.82
ECM Furnace Motor - Retrofit	2.11	0.95	2.02	0.78	1.57
Downstream ASHP - ER	1.01	1.00	1.01	0.57	0.58
Downstream Central AC - ER	0.75	1.00	0.75	0.83	0.62
Downstream Central AC - TOS	0.65	1.00	0.65	0.83	0.54
ECM Furnace Motor - Factory Installed	0.19	0.00	0.00	0.78	0.00
<b>Total</b>	<b>2,460.60</b>	<b>1.00</b>	<b>2,464.04</b>		<b>1,956.27</b>

\* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021> and ComEd Res HVAC Midstream ASHP DMSHP NTG Memo 2021-08-03.

†† Cooling NTG = 0.8, heating NTG = 0.9.

Source: ComEd tracking data and evaluation team analysis

The Residential HVAC Program includes measures that save gas. Table 5-4 shows the measure-level gas savings.

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

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTG*	Verified Net Savings (Therms)	EUL (years)
Midstream Central AC	0	N/A	0	0.80	0	18.0
Midstream DMSHP	0	N/A	0	0.80	0	15.0
Midstream ASHP	0	N/A	0	0.80	0	16.0
Advanced Thermostat	237,184	1.00	236,790	Multiple††	213,111	11.0
Ground Source Heat Pump - TOS	0	N/A	0	0.59	0	25.0
Downstream ASHP - TOS	0	N/A	0	0.57	0	16.0
Downstream DMSHP - ER	0	N/A	0	0.63	0	15.0
Downstream DMSHP - TOS	0	N/A	0	0.63	0	15.0
HVAC Tune Up	0	N/A	0	0.80	0	3.0
Ground Source Heat Pump - ER	0	N/A	0	0.59	0	25.0
Duct Sealing	11,702	1.00	11,702	0.88	10,298	20.0
ECM Furnace Motor - Retrofit	-35	2.96	-103	0.78	-80	6.0
Downstream ASHP - ER	0	N/A	0	0.57	0	16.0
Downstream Central AC - ER	0	N/A	0	0.83	0	18.0
Downstream Central AC - TOS	0	N/A	0	0.83	0	18.0
ECM Furnace Motor - Factory Installed	-2	0.00	0	0.78	0	6.0
<b>Total Therms</b>	<b>248,849</b>	<b>1.00</b>	<b>248,389</b>		<b>223,328</b>	
<b>Total kWh Converted From Therms†</b>	<b>7,293,771</b>	<b>1.00</b>	<b>7,280,268</b>		<b>6,545,744</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> and ComEd Res HVAC Midstream ASHP DMSHP NTG Memo 2021-08-03.

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

†† Cooling NTG = 0.8, heating NTG = 0.9.

Source: ComEd tracking data and evaluation team analysis

Table 5-5 is combined savings from Table 5-2 and Table 5-4.

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

Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Midstream Central AC	2,013,553	1.00	2,013,553	0.80	1,610,842
Midstream DMSHP	1,859,886	1.00	1,859,886	0.80	1,487,909
Midstream ASHP	845,587	1.00	845,587	0.80	676,469
Advanced Thermostat	7,697,854	1.00	7,683,659	Multiple††	6,881,644
Ground Source Heat Pump - TOS	192,885	0.96	184,461	0.59	108,832
Downstream ASHP - TOS	130,037	1.00	129,620	0.57	73,884
Downstream ASHP - ER	94,998	1.08	102,604	0.63	64,640
Downstream DMSHP - TOS	89,368	1.04	92,629	0.63	58,356
HVAC Tune Up	73,134	0.97	70,934	0.80	56,747
Ground Source Heat Pump - ER	64,573	1.06	68,620	0.59	40,486
Duct Sealing	361,662	1.00	361,617	0.88	318,223
ECM Furnace Motor - Retrofit	6,558	0.69	4,519	0.78	3,524
Downstream ASHP - ER	2,824	1.00	2,824	0.57	1,610
Downstream Central AC - ER	553	1.49	826	0.83	686
Downstream Central AC - TOS	623	1.00	623	0.83	517
ECM Furnace Motor - Factory Installed	628	0.00	0	0.78	0
<b>Total†</b>	<b>13,434,723</b>	<b>1.00</b>	<b>13,421,963</b>		<b>11,384,371</b>

\* A deemed value. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021> and ComEd Res HVAC Midstream ASHP DMSHP NTG Memo 2021-08-03.

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

†† Cooling NTG = 0.8, heating NTG = 0.9.

Source: ComEd tracking data and evaluation team analysis

## 6. Impact Analysis Findings and Recommendations

The program had an energy realization rate of 1.00 for CY2021. The evaluation team verified slightly higher savings for some measures and slightly lower savings for others, resulting in a negligible change in the overall program verified savings. The issues that had the largest effect on adjusting ex ante gross savings were the advanced thermostat quantity adjustment and claiming domestic hot water (DHW) savings for all fuel switching GSHP measures.

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

### 6.1 Advanced Thermostat

**Finding 1.** The program claimed ex ante savings for more than one thermostat per household at six site addresses. The program reported savings for 2,938 advanced thermostats at 2,932 unique site addresses. Guidehouse identified unique addresses using the customer name and service address parameters in the tracking data and verified savings for one thermostat per unique site address.

**Recommendation 1.** Only claim savings for one thermostat per household for this measure to be consistent with the IL-TRM, Section 5.3.16.

### 6.2 Ground Source Heat Pump

**Finding 2.** The program claimed DHW savings for all fuel switching projects irrespective of whether the installed GSHP displaced the existing gas DHW. Guidehouse verified DHW savings for 9 out of the 26 projects where the new system DHW parameter in the tracking data was “yes.”

**Recommendation 2.** Only claim DHW savings for projects where the installed GSHP displaces the existing DHW system.

**Finding 3.** The program calculated savings for projects EA-0009949950 and EA-0010034146 using a TOS classification for the existing gas furnace heating system. Guidehouse calculated verified therm savings for these projects using an ER classification based on the ER-TOS methodology in the IL-TRM and the ex ante calculator.

**Recommendation 3.** Classify projects as ER or TOS using the ER-TOS methodology in the IL-TRM and the ex ante calculator.

**Finding 4.** The program calculated peak demand savings for all 15 new construction projects using a baseline energy efficiency ratio (EER) value of 11.8. Guidehouse calculated demand savings for these projects using a baseline EER value of 11.0 corresponding to an ASHP system type per the IL-TRM, Section 5.3.8.

**Recommendation 4.** Use an EER of 11.0 to calculate demand savings for new construction projects per the IL-TRM, Section 5.3.8.

**Finding 5.** The program calculated demand savings for project ID EA-0010250922 with an ER classification for the cooling system using an EER value of 12 corresponding to a GSHP system

type per the IL-TRM, Section 5.3.8. Guidehouse calculated demand savings for these projects using the actual EER value of the existing GSHP system based on the tracking data.

**Recommendation 5.** Use the actual EER value for ER measures when available to calculate demand savings.

### 6.3 HVAC Tune-Up

**Finding 6.** The program calculated ex ante savings for the HVAC tune-up – ASHP measure for project ID EA-0009950175 using a heating season performance factor (HSPF) of 1.0. Guidehouse calculated verified savings for this project using a HSPF of 6.8 per the IL-TRM, Section 5.3.10.

**Recommendation 6.** Use a HSPF of 6.8 if the actual HSPF of the existing ASHP receiving maintenance is unknown per the IL-TRM, Section 5.3.10.

### 6.4 ECM Furnace Motors – Retrofit

**Finding 7.** The program calculated savings for two project IDs (EA-0010327748 and EA-0010135189) with an unknown existing cooling system using savings corresponding to a CAC cooling system type. Guidehouse calculated verified savings for these projects using savings corresponding to the unknown cooling system type per the IL-TRM, Section 5.3.5.

**Recommendation 7.** Calculate savings using the correct system installation scenario per the IL-TRM, Section 5.3.5.

**Finding 8.** The ex ante therms for this measure did not account for the cooling system size and used the heating kWh savings per ton of cooling. Guidehouse calculated verified therms by multiplying the heating kWh savings per ton of cooling by the cooling size in tons per the IL-TRM, Section 5.3.5.

**Recommendation 8.** Account for the cooling system size when calculating therms savings for this measure per the IL-TRM, Section 5.3.5.

**Finding 9.** For this measure, the ex ante therms for all projects were calculated using heating kWh savings per ton of cooling corresponding to heating climate zone 2. Guidehouse calculated verified therms for all projects using heating kWh savings per ton of cooling corresponding to the heating climate zone in which the measure was installed.

**Recommendation 9.** Use heating kWh savings per ton of cooling corresponding to the heating climate zone in which the measure is installed.

### 6.5 Duct Sealing

**Finding 10.** The program calculated ex ante cooling energy savings for project ID EA-0009861861 with an unknown existing cooling efficiency using seasonal energy efficiency ratio (SEER) 13. Guidehouse calculated verified savings for this project using a cooling efficiency of SEER 10 based on the age of the cooling system provided in the tracking data per the IL-TRM, Section 5.3.4.

**Recommendation 10.** Use cooling efficiency values corresponding to the age of the cooling equipment if actual efficiency is unknown per the IL-TRM, Section 5.3.4.

**Finding 11.** The program calculated ex ante cooling energy savings for project ID EA-0009828675 using full load cooling hours from the IL-TRM, Section 5.3.4 corresponding to a single-family home. The tracking data for this project indicates the measure was installed in a multifamily home. Guidehouse calculated verified energy savings for this project using full load cooling hours corresponding to a multifamily home.

**Recommendation 11.** Use full load cooling hours corresponding to the home type in which the measure is installed.

## 6.6 Measures Not Offered in CY2021

The next set of measures are from legacy 2020 projects that were part of the CY2021 tracking data. These measures are no longer offered under the program's downstream channel in CY2021 and in the future. As a result, the evaluation team does not have any recommendations for these measures; the findings explain the realization rate.

### 6.6.1 Downstream DMSHP

**Finding 12.** The program did not calculate any ex ante heating savings for five projects with no existing heating system. Guidehouse calculated verified heating savings for these projects using a TOS or new construction baseline, resulting in higher verified gross savings.

**Finding 13.** The program did not calculate any ex ante cooling kWh or peak demand savings for project ID EA-0008478846 with an existing electric furnace heating and no existing cooling system. Guidehouse calculated verified cooling kWh and peak demand savings for this project assuming the decision to replace the existing system included a desire to add cooling per the IL-TRM, Section 5.3.12. This finding did not appreciably impact the CY2021 measure realization rate.

**Finding 14.** The program calculated ex ante savings for five projects using a TOS classification for the heating system. Guidehouse calculated verified savings for these projects using an ER classification based on the ER-TOS methodology in the IL-TRM and the ex ante calculator, resulting in higher verified gross savings.

### 6.6.2 Downstream ASHP

**Finding 15.** The program claimed ex ante savings for three project IDs (EA-0008722195, EA-0008808509, and EA-0009092280) with an existing CAC or no cooling system and that had no heating system using a TOS baseline assumption for CAC and a new construction baseline assumption for heating system. Guidehouse calculated verified savings for these projects with no existing heating system using a new construction baseline assumption for both heating and cooling. This finding did not appreciably impact the CY2021 measure realization rate.

### 6.6.3 Downstream CAC

**Finding 16.** For the one early replacement project (EA-0009257523) for this measure, Guidehouse de-rated the existing SEER value provided in the tracking data based on the

reported age of the existing cooling system by 1% per year per IL-TRM, Section 5.3.3. The ex ante calculations did not de-rate the existing SEER value for this project. This project had a verified gross realization rate of 1.49.

#### **6.6.4 ECM Furnace Motors – Factory Installed**

**Finding 17.** The program claimed savings for this measure for one project ID (EA-0005326693) installed on August 7, 2019. The factory-installed scenario is no longer applicable for this measure per the IL-TRM, Section 5.3.5 as federal standards (effective July 3, 2019) make ECM blower fan motors a requirement for residential furnaces. Guidehouse calculated no verified savings for this project.

## Appendix A. Impact Analysis Methodology

### A.1 Verified Gross Program Savings Analysis Approach

The evaluation 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, where applicable.
- Validating the savings algorithm was applied correctly.
- 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 evaluation team relied on the following documents to verify the per-unit savings for each program measure:

- Final CY2021 tracking database files provided by ComEd:
  - HVAC: “HVC\_CY2021\_EOY\_Data\_Rev2\_2022-01-27.xlsx”
  - Geothermal heat pumps: “GEO\_CY2021\_EOY\_Data\_Rev0\_2022-01-12.xlsx”
- IL-TRM and IL-TRM Errata for deemed input parameters or secondary evaluation research to verify any custom inputs used in the ex ante calculations.

### A.2 Verified Net Program Savings Analysis Approach

The team calculated verified net energy and coincident peak demand savings by multiplying the verified gross savings estimates by NTG ratios. In CY2021, the NTG estimates used to calculate the net verified savings were based on past evaluation research and defined by a consensus process through the Illinois SAG. The NTG for the midstream ASHP and midstream DMSHP measures were based on secondary research conducted by the evaluation team.

## Appendix B. Total Resource Cost Detail

Table B-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 B-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)	Gross Cost-Effectiveness Savings (kWh)§	Gross Cost-Effectiveness Savings (Therms)§	Net Cost-Effectiveness Savings (kWh)§	Net Cost-Effectiveness Savings (Therms)§	
HVAC	Midstream Central AC‡	Each	5,210	18.0	Yes	2,013,553	1,943.78	0	0	0	0	0.80	0.80	0.80	1,610,842	1,555.02	0	0	0	0	0	0	0	0	0
HVAC	Midstream DMSHP‡	Each	699	15.0	Yes	1,859,886	58.64	0	0	0	0	0.80	0.80	0.80	1,487,909	46.92	0	0	0	0	0	-2,166,194	135,512	-1,732,956	108,409
HVAC	Midstream ASHP‡	Each	336	16.0	Yes	845,587	30.36	0	0	0	0	0.80	0.80	0.80	676,469	24.29	0	0	0	0	0	-2,840,204	130,519	-2,272,163	104,415
HVAC	Advanced Thermostat	Each	2,932	11.0	No	743,353	318.23	236,790	0	0	0	Multiple††	Multiple††	Multiple††	635,369	254.58	213,111	0	0	0	0	0	0	0	0
HVAC	Ground Source Heat Pump - TOS	Each	43	25.0	No	184,461	46.07	0	0	0	0	0.59	0.59	0.59	108,832	27.18	0	0	0	0	0	-67,488	15,389	-39,818	9,080
HVAC	Downstream ASHP - TOS	Each	19	16.0	No	129,620	0.48	0	0	0	0	0.57	0.57	0.57	73,884	0.28	0	0	0	0	0	0	0	0	0
HVAC	Downstream DMSHP - ER‡	Each	39	15.0	Yes	102,604	9.81	0	0	0	0	0.63	0.63	0.63	64,640	6.18	0	0	0	0	0	-56,465	10,590	-35,573	6,672
HVAC	Downstream DMSHP - TOS	Each	31	15.0	No	92,629	2.80	0	0	0	0	0.63	0.63	0.63	58,356	1.77	0	0	0	0	0	-12,613	1,883	-7,946	1,186
HVAC	HVAC Tune Up	Each	877	3.0	No	70,934	26.95	0	0	0	0	0.80	0.80	0.80	56,747	21.56	0	0	0	0	0	0	0	0	0
HVAC	Ground Source Heat Pump - ER‡	Each	11	25.0	Yes	68,620	15.87	0	0	0	0	0.59	0.59	0.59	40,486	9.36	0	0	0	0	0	-21,695	6,253	-12,800	3,689
HVAC	Duct Sealing	Each	36	20.0	No	18,632	6.61	11,702	0	0	0	0.88	0.88	0.88	16,396	5.82	10,298	0	0	0	0	0	0	0	0
HVAC	ECM Furnace Motor - Retrofit	Each	11	6.0	No	7,542	2.02	-103	0	0	0	0.78	0.78	0.78	5,883	1.57	-80	0	0	0	0	0	0	0	0
HVAC	Downstream ASHP - ER‡	Each	1	16.0	Yes	2,824	1.01	0	0	0	0	0.57	0.57	0.57	1,610	0.58	0	0	0	0	0	0	0	0	0
HVAC	Downstream Central AC - ER‡	Each	1	18.0	Yes	826	0.75	0	0	0	0	0.83	0.83	0.83	686	0.62	0	0	0	0	0	0	0	0	0
HVAC	Downstream Central AC - TOS	Each	2	18.0	No	623	0.65	0	0	0	0	0.83	0.83	0.83	517	0.54	0	0	0	0	0	0	0	0	0
HVAC	ECM Furnace Motor - Factory Installed	Each	1	6.0	No	0	0.00	0	0	0	0	0.78	0.78	0.78	0	0.00	0	0	0	0	0	0	0	0	0
<b>Total</b>			<b>10,249</b>	<b>15.9</b>		<b>6,141,696</b>	<b>2,464</b>	<b>248,389</b>	<b>0</b>	<b>0</b>	<b>0</b>				<b>4,838,627</b>	<b>1,956</b>	<b>223,328</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-5,164,660</b>	<b>300,145</b>	<b>-4,101,256</b>	<b>233,451</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.

† ER measures are flagged as YES, otherwise a NO is indicated in the column.

†† Cooling NTG = 0.8, heating NTG = 0.9.

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

§ The savings shown for these measures are calculated using the alternative formula shown in the IL-TRM for calculating savings from fuel switching measures for the TRC analysis.

Source: ComEd tracking data and evaluation team analysis