Guidehouse

# ComEd Residential HVAC Impact Evaluation Report

**Energy Efficiency / Demand Response Plan:**
**Program Year 2020 (CY2020)**
**(1/1/2020-12/31/2020)**

**Prepared for:**

**ComEd**

**FINAL**

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# 1. Introduction

This report presents results from the CY2020 impact evaluation of ComEd's Residential HVAC (HVAC Rebates) 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) inputs. CY2020 covers January 1, 2020 through December 31, 2020.

# 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), and advanced thermostats. In CY2020, the program offered the CAC measure through a midstream channel rather than a downstream channel and incentivized duct sealing and the ASHP and CAC tune-up measures. CLEAResult was the implementer for this program in CY2020. The program is referred to as "Heating and Cooling Rebate" in the NTG spreadsheet.

The program had 8,801 participants in CY2020, and installed 10,970 projects, as Table 2-1 and Figure 2-1 show.

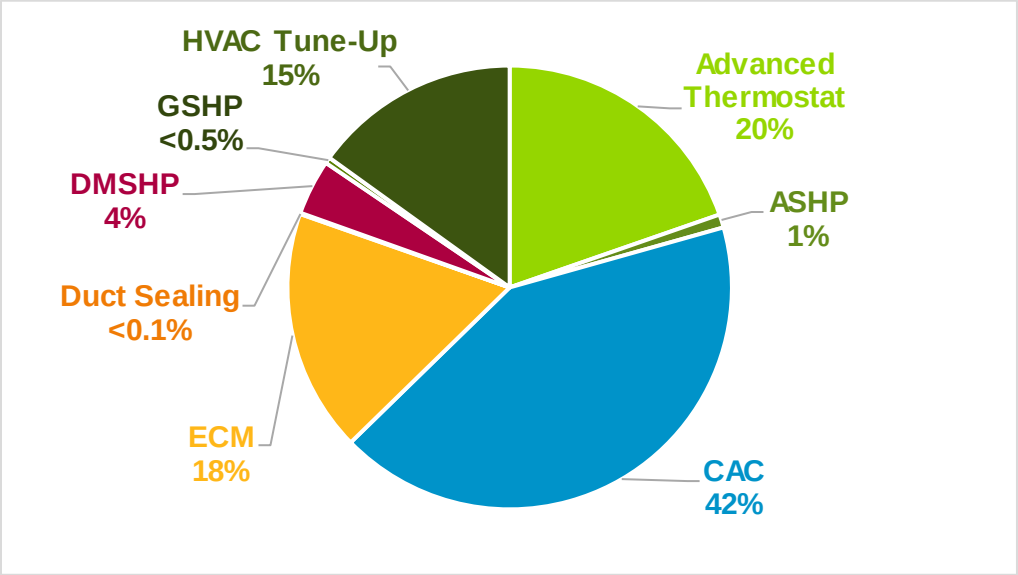
**Table 2-1. CY2020 Volumetric Findings Detail**

| Participation | Total |
|---|---|
| Participants | 8,801 |
| Installed Projects | 10,970 |
| Midstream Central AC | 3,569 |
| Advanced Thermostat | 2,158 |
| ECM Furnace Motor - Factory Installed | 1,913 |
| HVAC Tune Up - CAC | 1,649 |
| Central Air Conditioning | 1,044 |
| Ductless Heat Pump | 442 |
| Air Source Heat Pump | 106 |
| Ground Source Heat Pump | 49 |
| ECM Furnace Motor - Retrofit | 27 |
| Duct Sealing | 10 |
| HVAC Tune Up - ASHP | 3 |

*Participants include distinct ComEd account numbers.

*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 CY2020. The gas savings are only those that ComEd may be able to claim, which excludes savings the gas utilities claim, either via joint or non-joint programs.[1] The program had overall realization rates of 0.63 and 0.97 for energy and demand savings, respectively, and 1.06 for therm savings.

[1] The evaluation determines which gas savings are counted toward the goal while producing the portfolio-wide summary report.

**Table 3-1. CY2020 Total Annual Incremental Electric Savings**

| Savings Category | Energy Savings (kWh) | Summer Peak* Demand Savings (kW) |
|---|---|---|
| Electricity | | |
| Ex Ante Gross Savings | 8,068,210 | 2,142 |
| Program Gross Realization Rate | 0.63 | 0.97 |
| Verified Gross Savings | 5,065,935 | 2,087 |
| Program Net-to-Gross Ratio (NTG) | Varies | Varies |
| Verified Net Savings | 3,886,094 | 1,685 |
| Converted from Gas† | | |
| Ex Ante Gross Savings | 10,486,331 | NA |
| Program Gross Realization Rate | 1.06 | NA |
| Verified Gross Savings | 11,120,539 | NA |
| Program Net-to-Gross Ratio (NTG) | Varies | NA |
| Verified Net Savings | 8,513,562 | NA |
| Total Electric Plus Gas | | |
| Ex Ante Gross Savings | 18,554,541 | 2,142 |
| Program Gross Realization Rate | 0.87 | 0.97 |
| Verified Gross Savings | 16,186,474 | 2,087 |
| Program Net-to-Gross Ratio (NTG) | Varies | Varies |
| Verified Net Savings | 12,399,656 | 1,685 |

NA = not applicable (refers to a piece of data that cannot be produced or does not apply)

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

† Gas savings 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 determines which gas savings are 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.”

*Source: ComEd tracking data and evaluation team analysis*

# 4. Cumulative Persisting Annual Savings

Table 4-1 to Table 4-3 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 CY2020. The electric CPAS across all measures installed in 2020 is 3,886,094 kWh (Table 4-1). The CY2020 gas contribution to CPAS (converted to equivalent electricity) is 8,513,562 kWh (Table 4-2). Adding the gas and electric contributions produces 12,399,656 kWh of total CY2020 contribution to CPAS (Table 4-3). Figure 4-1 shows the savings across the effective useful life (EUL) of the measures. The historic rows in each table are the CPAS contribution back to CY2018. The Program Total Electric CPAS and the Program Total Gas CPAS rows are the sum of the CY2020 contribution and the historic contribution. The evaluation team conducted secondary research to determine NTG for the midstream central AC, HVAC tune-up – CAC and HVAC tune-up – ASHP measures and based on this research used the TRM default NTG of 0.80 for these measures.

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

| End Use Type | Research Category | EUL | CY2020 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 | 1,373,905 | 0.80 | 16,719,105 | | | 1,099,124 | 1,099,124 | 1,099,124 | 1,099,124 | 1,099,124 | 1,099,124 | 843,697 |
| HVAC | ECM Furnace Motor - Factory Installed | 6.0 | 1,132,211 | 0.78 | 5,298,746 | | | 883,124 | 883,124 | 883,124 | 883,124 | 883,124 | 883,124 | |
| HVAC | Ductless Mini Split Heat Pump | 15.0 | 1,014,996 | 0.63 | 8,446,606 | | | 639,448 | 639,448 | 639,448 | 639,448 | 639,448 | 639,448 | 512,213 |
| HVAC | Advanced Thermostat | 11.0 | 600,597 | NA†† | 6,606,572 | | | 600,597 | 600,597 | 600,597 | 600,597 | 600,597 | 600,597 | 600,597 |
| HVAC | Central AC | 18.0 | 325,498 | 0.83 | 4,637,830 | | | 270,163 | 270,163 | 270,163 | 270,163 | 270,163 | 270,163 | 251,404 |
| HVAC | Ground Source Heat Pump | 25.0 | 275,895 | 0.59 | 4,017,539 | | | 162,778 | 162,778 | 162,778 | 162,778 | 162,778 | 162,778 | 162,778 |
| HVAC | Air Source Heat Pump | 16.0 | 189,301 | 0.57 | 1,529,951 | | | 107,901 | 107,901 | 107,901 | 107,901 | 107,901 | 107,901 | 88,254 |
| HVAC | HVAC Tune Up - CAC | 3.0 | 126,113 | 0.80 | 302,672 | | | 100,891 | 100,891 | 100,891 | | | | |
| HVAC | ECM Furnace Motor - Retrofit | 6.0 | 18,591 | 0.78 | 87,006 | | | 14,501 | 14,501 | 14,501 | 14,501 | 14,501 | 14,501 | |
| HVAC | Duct Sealing | 20.0 | 6,308 | 0.88 | 106,069 | | | 5,551 | 5,551 | 5,551 | 5,551 | 5,551 | 5,551 | 5,551 |
| HVAC | HVAC Tune Up - ASHP | 3.0 | 2,519 | 0.80 | 6,046 | | | 2,015 | 2,015 | 2,015 | | | | |
| CY2020 Program Total Electric Contribution to CPAS | | | 5,065,935 | | 47,758,144 | | | 3,886,094 | 3,886,094 | 3,886,094 | 3,783,188 | 3,783,188 | 3,783,188 | 2,464,495 |
| Historic Program Total Electric Contribution to CPAS‡ | | | | | | 9,255,057 | 18,819,448 | 18,819,448 | 18,819,448 | 18,819,448 | 18,819,448 | 18,204,702 | 17,862,595 | 17,858,200 |
| Program Total Electric CPAS | | | | | | 9,255,057 | 18,819,448 | 22,705,543 | 22,705,543 | 22,705,543 | 22,602,637 | 21,987,891 | 21,645,784 | 20,322,695 |
| CY2020 Program Incremental Expiring Electric Savings§ | | | | | | | | | - | - | 102,906 | - | - | 1,318,693 |
| Historic Program Incremental Expiring Electric Savings‡§ | | | | | | | | - | - | - | - | 614,746 | 342,107 | 4,395 |
| Program Total Incremental Expiring Electric Savings§ | | | | | | | | - | - | - | 102,906 | 614,746 | 342,107 | 1,323,088 |

| End Use Type | Research Category | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | |
| HVAC | ECM Furnace Motor - Factory Installed | | | | | | | | | | | | |
| HVAC | Ductless Mini Split Heat Pump | 512,213 | 512,213 | 512,213 | 512,213 | 512,213 | 512,213 | 512,213 | 512,213 | | | | |
| HVAC | Advanced Thermostat | 600,597 | 600,597 | 600,597 | 600,597 | | | | | | | | |
| HVAC | Central AC | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | |
| HVAC | Ground Source Heat Pump | 162,778 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 |
| HVAC | Air Source Heat Pump | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | | | |
| HVAC | HVAC Tune Up - CAC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Retrofit | | | | | | | | | | | | |
| HVAC | Duct Sealing | 5,551 | 5,551 | 5,551 | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 |
| HVAC | HVAC Tune Up - ASHP | | | | | | | | | | | | |
| CY2020 Program Total Electric Contribution to CPAS | | 2,464,495 | 2,461,441 | 2,461,441 | 2,460,946 | 1,860,349 | 1,860,349 | 1,860,349 | 1,860,349 | 1,348,136 | 1,259,881 | 1,259,881 | 164,780 |
| Historic Program Total Electric Contribution to CPAS‡ | | 17,851,167 | 16,723,073 | 16,723,073 | 15,424,632 | 15,411,847 | 15,411,847 | 15,411,847 | 9,554,781 | 9,420,646 | 7,022,609 | 5,230,095 | 179,422 |
| Program Total Electric CPAS | | 20,315,662 | 19,184,514 | 19,184,514 | 17,885,579 | 17,272,196 | 17,272,196 | 17,272,196 | 11,415,130 | 10,768,782 | 8,282,490 | 6,489,976 | 344,202 |
| CY2020 Program Incremental Expiring Electric Savings§ | | - | 3,054 | - | 495 | 600,597 | - | - | - | 512,213 | 88,254 | - | 1,095,101 |
| Historic Program Incremental Expiring Electric Savings‡§ | | 7,033 | 1,128,094 | - | 1,298,441 | 12,785 | - | - | 5,857,066 | 134,134 | 2,398,037 | 1,792,514 | 5,050,674 |
| Program Total Incremental Expiring Electric Savings§ | | 7,033 | 1,131,147 | - | 1,298,936 | 613,383 | - | - | 5,857,066 | 646,348 | 2,486,292 | 1,792,514 | 6,145,774 |

| End Use Type | Research Category | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Factory Installed | | | | | | | | | | | | |
| HVAC | Ductless Mini Split Heat Pump | | | | | | | | | | | | |
| HVAC | Advanced Thermostat | | | | | | | | | | | | |
| HVAC | Central AC | | | | | | | | | | | | |
| HVAC | Ground Source Heat Pump | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | | | | | | |
| HVAC | Air Source Heat Pump | | | | | | | | | | | | |
| HVAC | HVAC Tune Up - CAC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Retrofit | | | | | | | | | | | | |
| HVAC | Duct Sealing | 5,056 | | | | | | | | | | | |
| HVAC | HVAC Tune Up - ASHP | | | | | | | | | | | | |
| CY2020 Program Total Electric Contribution to CPAS | | 164,780 | 159,724 | 159,724 | 159,724 | 159,724 | 159,724 | - | - | - | - | - | - |
| Historic Program Total Electric Contribution to CPAS‡ | | 179,422 | 179,422 | 179,422 | 179,422 | 133,096 | - | - | - | - | - | - | - |
| Program Total Electric CPAS | | 344,202 | 339,146 | 339,146 | 339,146 | 292,821 | 159,724 | - | - | - | - | - | - |
| CY2020 Program Incremental Expiring Electric Savings§ | | - | 5,056 | - | - | - | - | 159,724 | - | - | - | - | - |
| Historic Program Incremental Expiring Electric Savings‡§ | | - | - | - | - | 46,325 | 133,096 | - | - | - | - | - | - |
| Program Total Incremental Expiring Electric Savings§ | | - | 5,056 | - | - | 46,325 | 133,096 | 159,724 | - | - | - | - | - |

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2020 contribution to CPAS.

*A deemed value. Source found on the Illinois Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/ntg_2020.

† 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 $Y_{n}$.

†† Algorithm 5.3.16 of the Illinois Statewide Technical Reference Manual v8.0 (TRM v8.0) yields net savings and does not require a net-to-gross (NTG) adjustment.

*Source: Evaluation team analysis*

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

| End Use Type | Research Category | EUL | CY2020 Verified Gross Savings (Therms) | NTG* | Lifetime Net Savings (Therms)† | Verified Net Therms Savings 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | 18.0 | - | 0.80 | - | | | - | - | - | - | - | - | - |
| HVAC | ECM Furnace Motor - Factory Installed | 6.0 | - | 0.78 | - | | | - | - | - | - | - | - | |
| HVAC | Ductless Mini Split Heat Pump | 15.0 | 233,853 | 0.63 | 1,811,981 | | | 147,327 | 147,327 | 147,327 | 147,327 | 147,327 | 147,327 | 103,113 |
| HVAC | Advanced Thermostat | 11.0 | 137,619 | NA†† | 1,513,804 | | | 137,619 | 137,619 | 137,619 | 137,619 | 137,619 | 137,619 | 137,619 |
| HVAC | Central AC | 18.0 | - | 0.83 | - | | | - | - | - | - | - | - | - |
| HVAC | Ground Source Heat Pump | 25.0 | 5,057 | 0.59 | 47,038 | | | 2,984 | 2,984 | 2,984 | 2,984 | 2,984 | 2,984 | 2,984 |
| HVAC | Air Source Heat Pump | 16.0 | - | 0.57 | - | | | - | - | - | - | - | - | - |
| HVAC | HVAC Tune Up - CAC | 3.0 | - | 0.80 | - | | | - | - | - | | | | |
| HVAC | ECM Furnace Motor - Retrofit | 6.0 | - | 0.78 | - | | | - | - | - | - | - | - | |
| HVAC | Duct Sealing | 20.0 | 2,882 | 0.88 | 46,485 | | | 2,536 | 2,536 | 2,536 | 2,536 | 2,536 | 2,536 | 2,536 |
| HVAC | HVAC Tune Up - ASHP | 3.0 | - | 0.80 | - | | | - | - | - | | | | |
| CY2020 Program Total Gas Contribution to CPAS (Therms) | | | 379,411 | | 3,419,307 | | | 290,466 | 290,466 | 290,466 | 290,466 | 290,466 | 290,466 | 246,252 |
| CY2020 Program Total Gas Contribution to CPAS (kWh Equivalent)‡ | | | | | | - | - | 8,513,562 | 8,513,562 | 8,513,562 | 8,513,562 | 8,513,562 | 8,513,562 | 7,217,641 |
| Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§ | | | | | | 9,010,884 | 20,163,675 | 20,163,675 | 20,163,675 | 20,163,675 | 20,163,675 | 19,990,526 | 19,107,819 | 19,107,819 |
| Program Total Gas CPAS (kWh Equivalent)‡ | | | | | | 9,010,884 | 20,163,675 | 28,677,238 | 28,677,238 | 28,677,238 | 28,677,238 | 28,504,088 | 27,621,382 | 26,325,460 |
| CY2020 Program Incremental Expiring Gas Savings (Therms)‖ | | | | | | | | | - | - | - | - | - | 44,214 |
| CY2020 Program Incremental Expiring Gas Savings (kWh Equivalent)‡‖ | | | | | | | | | - | - | - | - | - | 1,295,921 |
| Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§‖ | | | | | | | | - | - | - | - | 173,149 | 882,707 | - |
| Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡‖ | | | | | | | | - | - | - | - | 173,149 | 882,707 | 1,295,921 |

| End Use Type | Research Category | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | - | - | - | - | - | - | - | - | - | - | - | |
| HVAC | ECM Furnace Motor - Factory Installed | | | | | | | | | | | | |
| HVAC | Ductless Mini Split Heat Pump | 103,113 | 103,113 | 103,113 | 103,113 | 103,113 | 103,113 | 103,113 | 103,113 | | | | |
| HVAC | Advanced Thermostat | 137,619 | 137,619 | 137,619 | 137,619 | | | | | | | | |
| HVAC | Central AC | - | - | - | - | - | - | - | - | - | - | - | |
| HVAC | Ground Source Heat Pump | 2,984 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 |
| HVAC | Air Source Heat Pump | - | - | - | - | - | - | - | - | - | | | |
| HVAC | HVAC Tune Up - CAC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Retrofit | | | | | | | | | | | | |
| HVAC | Duct Sealing | 2,536 | 2,536 | 2,536 | 2,112 | 2,112 | 2,112 | 2,112 | 2,112 | 2,112 | 2,112 | 2,112 | 2,112 |
| HVAC | HVAC Tune Up - ASHP | | | | | | | | | | | | |
| CY2020 Program Total Gas Contribution to CPAS (Therms) | | 246,252 | 244,631 | 244,631 | 244,206 | 106,588 | 106,588 | 106,588 | 106,588 | 3,475 | 3,475 | 3,475 | 3,475 |
| CY2020 Program Total Gas Contribution to CPAS (kWh Equivalent)‡ | | 7,217,641 | 7,170,127 | 7,170,127 | 7,157,686 | 3,124,088 | 3,124,088 | 3,124,088 | 3,124,088 | 101,845 | 101,845 | 101,845 | 101,845 |
| Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§ | | 19,043,650 | 12,769,648 | 12,769,648 | 5,208,391 | 5,208,391 | 5,208,391 | 5,208,391 | 2,526,655 | 2,526,655 | 17,175 | 17,175 | 17,175 |
| Program Total Gas CPAS (kWh Equivalent)‡ | | 26,261,291 | 19,939,774 | 19,939,774 | 12,366,077 | 8,332,478 | 8,332,478 | 8,332,478 | 5,650,743 | 2,628,501 | 119,021 | 119,021 | 119,021 |
| CY2020 Program Incremental Expiring Gas Savings (Therms)‖ | | - | 1,621 | - | 424 | 137,619 | - | - | - | 103,113 | - | - | - |
| CY2020 Program Incremental Expiring Gas Savings (kWh Equivalent)‡‖ | | - | 47,514 | - | 12,441 | 4,033,598 | - | - | - | 3,022,242 | - | - | - |
| Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§‖ | | 64,169 | 6,274,002 | - | 7,561,257 | - | - | - | 2,681,736 | - | 2,509,480 | - | - |
| Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡‖ | | 64,169 | 6,321,517 | - | 7,573,698 | 4,033,598 | - | - | 2,681,736 | 3,022,242 | 2,509,480 | - | - |

| End Use Type | Research Category | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Factory Installed | | | | | | | | | | | | |
| HVAC | Ductless Mini Split Heat Pump | | | | | | | | | | | | |
| HVAC | Advanced Thermostat | | | | | | | | | | | | |
| HVAC | Central AC | | | | | | | | | | | | |
| HVAC | Ground Source Heat Pump | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | | | | | | |
| HVAC | Air Source Heat Pump | | | | | | | | | | | | |
| HVAC | HVAC Tune Up - CAC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Retrofit | | | | | | | | | | | | |
| HVAC | Duct Sealing | 2,112 | | | | | | | | | | | |
| HVAC | HVAC Tune Up - ASHP | | | | | | | | | | | | |
| CY2020 Program Total Gas Contribution to CPAS (Therms) | | 3,475 | 1,363 | 1,363 | 1,363 | 1,363 | 1,363 | - | - | - | - | - | - |
| CY2020 Program Total Gas Contribution to CPAS (kWh Equivalent)‡ | | 101,845 | 39,943 | 39,943 | 39,943 | 39,943 | 39,943 | - | - | - | - | - | - |
| Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§ | | 17,175 | 17,175 | 17,175 | 17,175 | (37,077) | - | - | - | - | - | - | - |
| Program Total Gas CPAS (kWh Equivalent)‡ | | 119,021 | 57,118 | 57,118 | 57,118 | 2,865 | 39,943 | - | - | - | - | - | - |
| CY2020 Program Incremental Expiring Gas Savings (Therms)‖ | | - | 2,112 | - | - | - | - | 1,363 | - | - | - | - | - |
| CY2020 Program Incremental Expiring Gas Savings (kWh Equivalent)‡‖ | | - | 61,903 | - | - | - | - | 39,943 | - | - | - | - | - |
| Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§‖ | | - | - | - | - | 54,252 | (37,077) | - | - | - | - | - | - |
| Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡‖ | | - | 61,903 | - | - | 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 no contribution to calculating CPAS in CY2020.

*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

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

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

§ Historic savings go back to CY2018.

‖ Incremental expiring savings are equal to CPAS Yn-1 - CPAS $Y_n$.

†† Algorithm 5.3.16 of TRM v8.0 yields net savings and does not require a NTG adjustment.

*Source: Evaluation team analysis*

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

| End Use Type | Research Category | EUL | CY2020 Verified Gross Savings (kWh) | NTG* | Lifetime Net Savings (kWh)† | Verified Net kWh Savings (Including Those Converted from Gas Savings) 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | 18.0 | 1,373,905 | 0.80 | 16,719,105 | | | 1,099,124 | 1,099,124 | 1,099,124 | 1,099,124 | 1,099,124 | 1,099,124 | 843,697 |
| HVAC | ECM Furnace Motor - Factory Installed | 6.0 | 1,132,211 | 0.78 | 5,298,746 | | | 883,124 | 883,124 | 883,124 | 883,124 | 883,124 | 883,124 | |
| HVAC | Ductless Mini Split Heat Pump | 15.0 | 7,869,224 | 0.63 | 61,555,765 | | | 4,957,611 | 4,957,611 | 4,957,611 | 4,957,611 | 4,957,611 | 4,957,611 | 3,534,455 |
| HVAC | Advanced Thermostat | 11.0 | 4,634,196 | NA†† | 50,976,154 | | | 4,634,196 | 4,634,196 | 4,634,196 | 4,634,196 | 4,634,196 | 4,634,196 | 4,634,196 |
| HVAC | Central AC | 18.0 | 325,498 | 0.83 | 4,637,830 | | | 270,163 | 270,163 | 270,163 | 270,163 | 270,163 | 270,163 | 251,404 |
| HVAC | Ground Source Heat Pump | 25.0 | 424,127 | 0.59 | 5,396,218 | | | 250,235 | 250,235 | 250,235 | 250,235 | 250,235 | 250,235 | 250,235 |
| HVAC | Air Source Heat Pump | 16.0 | 189,301 | 0.57 | 1,529,951 | | | 107,901 | 107,901 | 107,901 | 107,901 | 107,901 | 107,901 | 88,254 |
| HVAC | HVAC Tune Up - CAC | 3.0 | 126,113 | 0.80 | 302,672 | | | 100,891 | 100,891 | 100,891 | | | | |
| HVAC | ECM Furnace Motor - Retrofit | 6.0 | 18,591 | 0.78 | 87,006 | | | 14,501 | 14,501 | 14,501 | 14,501 | 14,501 | 14,501 | |
| HVAC | Duct Sealing | 20.0 | 90,789 | 0.88 | 1,468,533 | | | 79,895 | 79,895 | 79,895 | 79,895 | 79,895 | 79,895 | 79,895 |
| HVAC | HVAC Tune Up - ASHP | 3.0 | 2,519 | 0.80 | 6,046 | | | 2,015 | 2,015 | 2,015 | | | | |
| CY2020 Program Total Contribution to CPAS | | | 16,186,474 | | 147,978,027 | | | 12,399,656 | 12,399,656 | 12,399,656 | 12,296,750 | 12,296,750 | 12,296,750 | 9,682,136 |
| Historic Program Total Contribution to CPAS‡ | | | | | | 18,265,941 | 38,983,124 | 38,983,124 | 38,983,124 | 38,983,124 | 38,983,124 | 38,195,228 | 36,970,415 | 36,966,019 |
| Program Total CPAS | | | | | | 18,265,941 | 38,983,124 | 51,382,780 | 51,382,780 | 51,382,780 | 51,279,874 | 50,491,979 | 49,267,165 | 46,648,155 |
| CY2020 Program Incremental Expiring Savings§ | | | | | | | | | - | - | 102,906 | - | - | 2,614,614 |
| Historic Program Incremental Expiring Savings‡§ | | | | | | | | - | - | - | - | 787,896 | 1,224,814 | 4,395 |
| Program Total Incremental Expiring Savings§ | | | | | | | | - | - | - | 102,906 | 787,896 | 1,224,814 | 2,619,010 |

| End Use Type | Research Category | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | 843,697 | |
| HVAC | ECM Furnace Motor - Factory Installed | | | | | | | | | | | | |
| HVAC | Ductless Mini Split Heat Pump | 3,534,455 | 3,534,455 | 3,534,455 | 3,534,455 | 3,534,455 | 3,534,455 | 3,534,455 | 3,534,455 | | | | |
| HVAC | Advanced Thermostat | 4,634,196 | 4,634,196 | 4,634,196 | 4,634,196 | | | | | | | | |
| HVAC | Central AC | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | 251,404 | |
| HVAC | Ground Source Heat Pump | 250,235 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 |
| HVAC | Air Source Heat Pump | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | 88,254 | | | |
| HVAC | HVAC Tune Up - CAC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Retrofit | | | | | | | | | | | | |
| HVAC | Duct Sealing | 79,895 | 79,895 | 79,895 | 66,959 | 66,959 | 66,959 | 66,959 | 66,959 | 66,959 | 66,959 | 66,959 | 66,959 |
| HVAC | HVAC Tune Up - ASHP | | | | | | | | | | | | |
| CY2020 Program Total Contribution to CPAS | | 9,682,136 | 9,631,568 | 9,631,568 | 9,618,632 | 4,984,436 | 4,984,436 | 4,984,436 | 4,984,436 | 1,449,981 | 1,361,727 | 1,361,727 | 266,626 |
| Historic Program Total Contribution to CPAS‡ | | 36,894,817 | 29,492,721 | 29,492,721 | 20,633,023 | 20,620,238 | 20,620,238 | 20,620,238 | 12,081,436 | 11,947,302 | 7,039,784 | 5,247,270 | 196,597 |
| Program Total CPAS | | 46,576,953 | 39,124,289 | 39,124,289 | 30,251,655 | 25,604,674 | 25,604,674 | 25,604,674 | 17,065,873 | 13,397,283 | 8,401,511 | 6,608,997 | 463,223 |
| CY2020 Program Incremental Expiring Savings§ | | - | 50,568 | - | 12,936 | 4,634,196 | - | - | - | 3,534,455 | 88,254 | - | 1,095,101 |
| Historic Program Incremental Expiring Savings‡§ | | 71,203 | 7,402,096 | - | 8,859,698 | 12,785 | - | - | 8,538,802 | 134,134 | 4,907,518 | 1,792,514 | 5,050,674 |
| Program Total Incremental Expiring Savings§ | | 71,203 | 7,452,664 | - | 8,872,633 | 4,646,981 | - | - | 8,538,802 | 3,668,590 | 4,995,772 | 1,792,514 | 6,145,774 |

| End Use Type | Research Category | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Factory Installed | | | | | | | | | | | | |
| HVAC | Ductless Mini Split Heat Pump | | | | | | | | | | | | |
| HVAC | Advanced Thermostat | | | | | | | | | | | | |
| HVAC | Central AC | | | | | | | | | | | | |
| HVAC | Ground Source Heat Pump | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | | | | | | |
| HVAC | Air Source Heat Pump | | | | | | | | | | | | |
| HVAC | HVAC Tune Up - CAC | | | | | | | | | | | | |
| HVAC | ECM Furnace Motor - Retrofit | | | | | | | | | | | | |
| HVAC | Duct Sealing | 66,959 | | | | | | | | | | | |
| HVAC | HVAC Tune Up - ASHP | | | | | | | | | | | | |
| CY2020 Program Total Contribution to CPAS | | 266,626 | 199,667 | 199,667 | 199,667 | 199,667 | 199,667 | - | - | - | - | - | - |
| Historic Program Total Contribution to CPAS‡ | | 196,597 | 196,597 | 196,597 | 196,597 | 96,019 | - | - | - | - | - | - | - |
| Program Total CPAS | | 463,223 | 396,264 | 396,264 | 396,264 | 295,686 | 199,667 | - | - | - | - | - | - |
| CY2020 Program Incremental Expiring Savings§ | | - | 66,959 | - | - | - | - | 199,667 | - | - | - | - | - |
| Historic Program Incremental Expiring Savings‡§ | | - | - | - | - | 100,578 | 96,019 | - | - | - | - | - | - |
| Program Total Incremental Expiring Savings§ | | - | 66,959 | - | - | 100,578 | 96,019 | 199,667 | - | - | - | - | - |

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 no contribution to calculating CPAS in CY2020.

*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

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

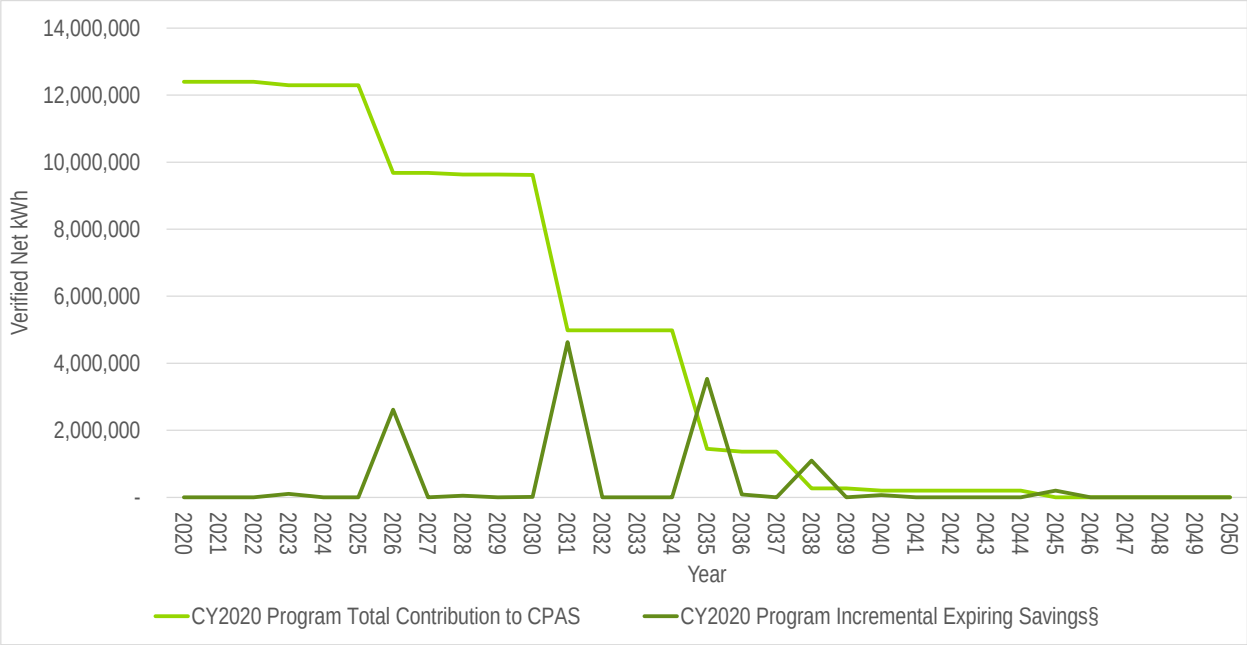
‡ Historic savings go back to CY2018.

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

†† Algorithm 5.3.16 of TRM v8.0 yields net savings and does not require a NTG adjustment.

*Source: Evaluation team analysis*

**Figure 4-1. Cumulative Persisting Annual Savings**



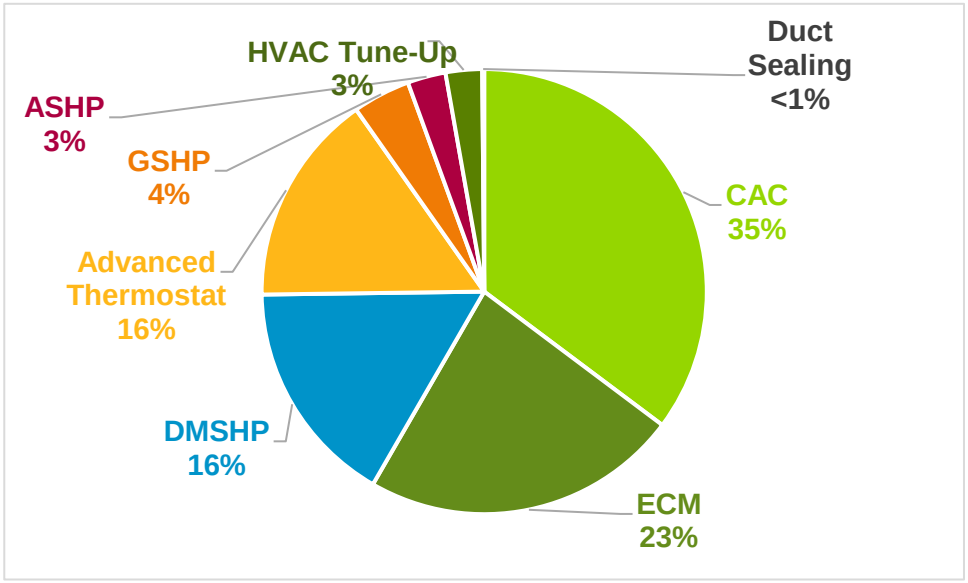

§ Expiring savings are equal to CPAS $Y_{n-1}$ - CPAS $Y_n$.

*Source: Evaluation team analysis*

# 5. Program Savings by Measure

The program includes 11 measures, as the following tables show. In CY2020, the midstream central AC and factory installed ECM furnace motor measures contributed substantial savings (see Figure 5-1).

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




*Source: Evaluation team analysis*

## Table 5-1. CY2020 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) |
|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | 1,263,213 | 1.09 | 1,373,905 | 0.80 | 1,099,124 | 18.0 |
| HVAC | ECM Furnace Motor - Factory Installed | 1,193,099 | 0.95 | 1,132,211 | 0.78 | 883,124 | 6.0 |
| HVAC | Ductless Mini Split Heat Pump | 3,694,450 | 0.27 | 1,014,996 | 0.63 | 639,448 | 15.0 |
| HVAC | Advanced Thermostat | 602,732 | 1.00 | 600,597 | NA | 600,597 | 11.0 |
| HVAC | Central AC | 473,397 | 0.69 | 325,498 | 0.83 | 270,163 | 18.0 |
| HVAC | Ground Source Heat Pump | 413,582 | 0.67 | 275,895 | 0.59 | 162,778 | 25.0 |
| HVAC | Air Source Heat Pump | 276,747 | 0.68 | 189,301 | 0.57 | 107,901 | 16.0 |
| HVAC | HVAC Tune Up - CAC | 126,113 | 1.00 | 126,113 | 0.80 | 100,891 | 3.0 |
| HVAC | ECM Furnace Motor - Retrofit | 16,050 | 1.16 | 18,591 | 0.78 | 14,501 | 6.0 |
| HVAC | Duct Sealing | 6,308 | 1.00 | 6,308 | 0.88 | 5,551 | 20.0 |
| HVAC | HVAC Tune Up - ASHP | 2,519 | 1.00 | 2,519 | 0.80 | 2,015 | 3.0 |
| | Total | 8,068,210 | 0.63 | 5,065,935 | NA | 3,886,094 | NA |

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.
NA = not applicable (refers to a piece of data cannot be produced or does not apply)
*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.
*Source: ComEd tracking data and evaluation team analysis*

## Table 5-2. CY2020 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) |
|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | 1,187.02 | 1.13 | 1,336.51 | 0.80 | 1,069.21 |
| HVAC | ECM Furnace Motor - Factory Installed | 165.60 | 0.41 | 67.75 | 0.78 | 52.85 |
| HVAC | Ductless Mini Split Heat Pump | 19.11 | 3.33 | 63.64 | 0.63 | 40.09 |
| HVAC | Advanced Thermostat | 177.05 | 1.00 | 176.74 | NA | 176.74 |
| HVAC | Central AC | 471.79 | 0.65 | 307.76 | 0.83 | 255.44 |
| HVAC | Ground Source Heat Pump | 50.10 | 1.23 | 61.39 | 0.59 | 36.22 |
| HVAC | Air Source Heat Pump | 17.95 | 0.86 | 15.51 | 0.57 | 8.84 |
| HVAC | HVAC Tune Up - CAC | 50.48 | 1.00 | 50.48 | 0.80 | 40.39 |
| HVAC | ECM Furnace Motor - Retrofit | 1.13 | 4.53 | 5.14 | 0.78 | 4.01 |
| HVAC | Duct Sealing | 1.79 | 1.00 | 1.79 | 0.88 | 1.58 |
| HVAC | HVAC Tune Up - ASHP | 0.11 | 1.00 | 0.11 | 0.80 | 0.09 |
| | Total | 2,142.13 | 0.97 | 2,086.82 | NA | 1,685.45 |

NA = not applicable (refers to a piece of data cannot be produced or does not apply)
*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.
*Source: ComEd tracking data and evaluation team analysis*

## Table 5-3. CY2020 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) |
|---|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | NA | NA | NA | 0.80 | NA | 18.0 |
| HVAC | ECM Furnace Motor - Factory Installed | 0 | NA | 0 | 0.78 | 0 | 6.0 |
| HVAC | Ductless Mini Split Heat Pump | 212,690 | 1.10 | 233,853 | 0.63 | 147,327 | 15.0 |
| HVAC | Advanced Thermostat | 137,795 | 1.00 | 137,619 | NA | 137,619 | 11.0 |
| HVAC | Central AC | NA | NA | NA | 0.83 | NA | 18.0 |
| HVAC | Ground Source Heat Pump | 4,405 | 1.15 | 5,057 | 0.59 | 2,984 | 25.0 |
| HVAC | Air Source Heat Pump | NA | NA | NA | 0.57 | NA | 16.0 |
| HVAC | HVAC Tune Up - CAC | NA | NA | NA | 0.80 | NA | 3.0 |
| HVAC | ECM Furnace Motor - Retrofit | 0 | NA | 0 | 0.78 | 0 | 6.0 |
| HVAC | Duct Sealing | 2,883 | 1.00 | 2,882 | 0.88 | 2,536 | 20.0 |
| HVAC | HVAC Tune Up - ASHP | NA | NA | NA | 0.80 | NA | 3.0 |
| | Total Therms | 357,773 | 1.06 | 379,411 | NA | 290,466 | NA |
| | Total kWh Converted From Therms† | 10,486,331 | 1.06 | 11,120,539 | NA | 8,513,562 | NA |

NA = not applicable (refers to a piece of data cannot be produced or does not apply)
*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.
† 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 5-4. CY2020 Energy Savings by Measure – Total Combining Electricity and Gas

| End Use Type | Research Category | Ex Ante Gross Savings (kWh) | Verified Gross Realization Rate | Verified Gross Savings (kWh) | NTG* | Verified Net Savings (kWh) |
|---|---|---|---|---|---|---|
| HVAC | Midstream Central AC | 1,263,213 | 1.09 | 1,373,905 | 0.80 | 1,099,124 |
| HVAC | ECM Furnace Motor - Factory Installed | 1,193,099 | 0.95 | 1,132,211 | 0.78 | 883,124 |
| HVAC | Ductless Mini Split Heat Pump | 9,928,402 | 0.79 | 7,869,224 | 0.63 | 4,957,611 |
| HVAC | Advanced Thermostat | 4,641,515 | 1.00 | 4,634,196 | NA | 4,634,196 |
| HVAC | Central AC | 473,397 | 0.69 | 325,498 | 0.83 | 270,163 |
| HVAC | Ground Source Heat Pump | 542,690 | 0.78 | 424,127 | 0.59 | 250,235 |
| HVAC | Air Source Heat Pump | 276,747 | 0.68 | 189,301 | 0.57 | 107,901 |
| HVAC | HVAC Tune Up - CAC | 126,113 | 1.00 | 126,113 | 0.80 | 100,891 |
| HVAC | ECM Furnace Motor - Retrofit | 16,050 | 1.16 | 18,591 | 0.78 | 14,501 |
| HVAC | Duct Sealing | 90,795 | 1.00 | 90,789 | 0.88 | 79,895 |
| HVAC | HVAC Tune Up - ASHP | 2,519 | 1.00 | 2,519 | 0.80 | 2,015 |
| | Total† | 18,554,541 | 0.87 | 16,186,474 | NA | 12,399,656 |

NA = not applicable (refers to a piece of data cannot be produced or does not apply)
*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.
† The total includes the electric equivalent of the total therms.

*Source: ComEd tracking data and evaluation team analysis*

# 6. Impact Analysis Findings and Recommendations

## 6.1 Impact Parameter Estimates

Guidehouse used the savings algorithms and inputs deemed by the TRM v8.0 and TRM v8.0 Errata, where applicable, to calculate the energy and demand savings for each measure installed as a part of the program in CY2020. Table 6-1 presents the deemed input parameter sources that the evaluation team used for each measure. The TRM v8.0 allows for custom or actual values to be used for some of the input parameters. The team based these values on the program tracking database when available.

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

**Table 6-1. Savings Parameters**

| Measure Name | Custom Input Parameters | Deemed Input Parameters | Source* |
|---|---|---|---|
| Midstream Central AC | Seasonal Energy Efficiency Ratio (SEER), Capacity, $SEER_{adj}$, Energy Efficiency Ratio (EER) | SEER, $DeratingCool_{Base}$, $DeratingCool_{Eff}$, Full-Load Hours (FLH), EER, Coincidence Factor (CF), Early Replacement Rate | TRM v8.0 – Section 5.3.3 |
| ECM Furnace Motor – Factory Installed | Capacity Cooling | Capacity Cooling, kWh Savings per Ton, kW Savings per Ton | TRM v8.0 – Section 5.3.5 |
| Ductless Mini Split Heat Pump | Capacity Cooling, SEER, Capacity Heating, Heating System Performance Factor (HSPF), $SEER_{adj}$, $HSPF_{adj}$, EER, Annual Fuel Utilization Efficiency (AFUE) | FLH Cooling, SEER, FLH Heating, HSPF, EER, CF, Gas Heating Load, kWh to Therm, AFUE | TRM v8.0 – Section 5.3.12 |
| Advanced Thermostat | %Electric Heat, %AC, Existing Thermostat Type | Electric Heating Consumption, Household Factor (HF), In-Service Rate (ISR), Furnace Fan Energy Consumption ($F_e$), Heating Reduction, Cooling Reduction, SEER, EER, CF, Gas Heating Consumption, Capacity Cooling | TRM v8.0 – Section 5.3.16 |
| Central AC | SEER, Capacity, $SEER_{adj}$, EER | SEER, $DeratingCool_{Base}$, $DeratingCool_{Eff}$, FLH, EER, CF | TRM v8.0 – Section 5.3.3 |
| Ground Source Heat Pump | Capacity Cooling, SEER, Capacity Heating, HSPF, $SEER_{adj}$, $HSPF_{adj}$, EER, AFUE | FLH Cooling, SEER, FLH Heating, HSPF, EER, CF, Gas Heating Load, kWh to Therm, AFUE, Gallons per Day (GPD), Household, Tank Temperatures ($T_{OUT}$ and $T_{IN}$), Energy Factor (EF), Specific Weight of Water | TRM v8.0 – Section 5.3.8 |
| Air Source Heat Pump | Capacity Cooling, SEER, Capacity Heating, HSPF, $SEER_{adj}$, $HSPF_{adj}$, EER | FLH Cooling, SEER, $DeratingCool_{Base}$, $DeratingCool_{Eff}$, FLH Heating, HSPF, $DeratingHeat_{Base}$, $DeratingHeat_{Eff}$, EER, CF | TRM v8.0 – Section 5.3.1 |
| HVAC Tune-Up – CAC | Capacity Cooling, SEER | FLH Cooling, Maintenance Energy Savings Factor (MFe), SEER, EER, Maintenance Demand Savings Factor (MFd), CF | TRM v8.0 – Section 5.3.10 |
| ECM Furnace Motor – Retrofit | Capacity Cooling | Capacity cooling, kWh savings per ton, kW savings per ton | TRM v8.0 – Section 5.3.3 |
| Duct Sealing | Cooling Capacity, Heating Capacity, SEER, Duct Leakage Reduction | Supply Loss Factor (SLF), Return Loss Factor (RLF), FLH Cooling, Thermal Regain Factor (TRF), $F_e$, FLH Heating, SEER, Coefficient of Performance (COP), CF, Equipment Efficiency, System Efficiency | TRM v8.0 – Section 5.3.4 |
| HVAC Tune-Up - ASHP | Capacity Cooling, SEER, HSPF, Capacity Heating | FLH Cooling, MFe, SEER, EER, MFd, HSPF, FLH Heating, CF | TRM v8.0 – Section 5.3.10 |

*TRM is the Illinois Statewide Technical Reference Manual version 8.0 from http://www.ilsag.info/technical-reference-manual.html. The NTG values can be found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

*Source: Evaluation team analysis*

## 6.2 Other Impact Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2020 evaluation. These findings suggest ways to improve the measure-level realization rates. Table 6-2 presents the measure-level realization rates and program savings percentages to give context to the team's recommendations.

**Table 6-2. Measure-Level Savings and Realization Rates**

| Research Category | Verified Gross Realization Rate | Percentage of Verified Net Savings |
|---|---|---|
| Ductless Mini Split Heat Pump | 0.79 | 40.0% |
| Advanced Thermostat | 1.00 | 37.4% |
| Midstream Central AC | 1.09 | 8.9% |
| ECM Furnace Motor - Factory Installed | 0.95 | 7.1% |
| Central AC | 0.69 | 2.2% |
| Ground Source Heat Pump | 0.78 | 2.0% |
| Air Source Heat Pump | 0.68 | 0.9% |
| Duct Sealing | 0.91 | 0.6% |
| ECM Furnace Motor - Retrofit | 1.16 | 0.1% |

*Source: Evaluation team analysis of CY2020 ComEd tracking data*

### 6.2.1 Advanced Thermostat

**Finding 1.** The evaluation team found two ComEd accounts that claimed ex ante savings for three thermostats each. The three thermostats are distinguished in the Record Locator ID field as Original, Reissue, and Void; however, savings are claimed for all three thermostats. Guidehouse capped the savings at one thermostat per household for this measure as per the TRM v8.0. The Rebate ID for the two ComEd accounts are given below:

- EA-0006245958
- EA-0006264959

Advanced thermostats represent 37.4% of the program savings and had a verified gross realization rate of 1.00.

**Recommendation 1.** Guidehouse recommends ComEd only claim savings for one thermostat per household for this measure as per the TRM v8.0.

### 6.2.2 Midstream CAC

**Finding 2.** All 3,569 midstream CAC projects have realization rates not equal to 1.00 (ranging from 0.41 to 1.75 for energy and -0.24 to 2.01 for demand) with an average of 1.09. This is likely due to the ex ante calculations using the flat SEER rating and not the actual air conditioning, heating and refrigeration institute (AHRI) SEER field from the tracking data. The evaluation team calculated verified energy demand savings using the SEER and EER efficiency values from the tracking data. This measure represents 8.9% of the program savings.

**Recommendation 2.** Guidehouse recommends ComEd and the implementer update the ex ante calculations to use the AHRI SEER and EER efficiency values from the tracking data to calculate energy and demand savings for this measure.

### 6.2.3 ECM Furnace Motors

**Finding 3.** The evaluation team found 604 factory-installed ECM furnace motor projects that calculated ex ante electric energy and demand savings using the per-unit savings corresponding to the retrofit (Existing or Federal Minimum Efficiency CAC) condition shown in Table 6-3. The evaluation team calculated savings using the per-unit savings corresponding to the factory-installed (CAC Receiving Rebate (Most Common)) condition consistent with the other 1,309 factory-installed ECM furnace motor projects. This measure represents 7.1% of the program savings and had a verified gross realization rate of 0.95.

**Table 6-3. ECM Deemed Savings Values**

| Parameter | Region | Factory-Installed – CAC Receiving Rebate (Most Common) | Retrofit – Existing or Federal Minimum Efficiency CAC |
|---|---|---|---|
| kWh Savings per Ton | Rockford | 198 | 229 |
| | Chicago | 195 | 230 |
| kW Savings per Ton | Rockford | 0.01 | 0.064 |
| | Chicago | 0.01 | 0.064 |

*Sources: TRM v8.0, Section 5.3.5 and evaluation team analysis of CY2020 ComEd tracking data*

**Recommendation 3.** Guidehouse recommends ComEd use the per-unit savings corresponding to the CAC Receiving Rebate (Most Common) condition from the TRM v8.0 for the factory-installed ECM furnace motors projects.

**Finding 4.** The evaluation team found 25 retrofit ECM furnace motor projects that calculated electric energy and demand savings using the per-unit savings corresponding to the factory-installed (CAC Receiving Rebate (Most Common)) condition shown in Table 6-3. The evaluation team calculated savings using the per-unit savings corresponding to the retrofit (Existing or Federal Minimum Efficiency CAC) condition consistent with the two other retrofit ECM furnace motor projects. This measure represents 0.1% of the program savings and had a verified gross realization rate of 1.16.

**Recommendation 4.** Guidehouse recommends ComEd use the per-unit savings corresponding to the Existing or Federal Minimum Efficiency CAC condition from the TRM v8.0 for the retrofit ECM furnace motors projects.

### 6.2.4 Ground Source Heat Pump

**Finding 5.** For the two project ID EA-0006442713 fuel switching GSHP projects, the implementer calculated ex ante therm savings using a time-of-sale (TOS) classification for the heating system. The evaluation team calculated therm savings for these projects using an early replacement (ER) classification based on the ER-TOS methodology in the TRM and the ex ante calculator. This measure represents 2.0% of the program savings and had a verified gross realization rate of 0.78.

**Recommendation 5.** Guidehouse recommends ComEd and the implementer classify projects as ER or TOS using the ER-TOS methodology in the TRM and the ex ante calculator.

**Finding 6.** For two fuel switching GSHP projects, the implementer calculated ex ante kWh savings using a value of 1.0 for the $HSPF_{ASHP}$ parameter. The evaluation team calculated the kWh savings for these projects using a value of 8.2 for the $HSPF_{ASHP}$ parameter as per the TRM v8.0. Using this value resulted in low kWh realization rates for these projects (0.08 and 0.09). The two project IDs are as follows:

- EA-0006711722
- EA-0006604990

**Recommendation 6.** Guidehouse recommends ComEd and the implementer use a value of 8.2 for the $HSPF_{ASHP}$ parameter as per the TRM v8.0.

**Finding 7.** For three GSHP projects, the implementer calculated ex ante kWh savings using a TOS classification for the cooling system. The evaluation team calculated kWh savings for these projects using an ER classification based on the ER-TOS methodology in the TRM and the ex ante calculator. The three projects are as follows:

- EA-0008385748
- EA-0006604990
- EA-0006972197

**Recommendation 7.** Guidehouse recommends ComEd and the implementer classify projects as ER or TOS using the ER-TOS methodology in the TRM and the ex ante calculator.

**Finding 8.** For 21 GSHP projects with an existing GSHP system classified as TOS, the implementer calculated ex ante kWh and kW savings using a value of 14.0 and 13.4 for the $SEER_{BASE}$ and $EER_{BASE}$ parameters, respectively. The evaluation team calculated kWh and kW savings for these projects using a value of 13.0 and 11.0 for the $SEER_{BASE}$ and $EER_{BASE}$ parameters, respectively. The TRM v8.0 does not provide explicit guidance on the $SEER_{BASE}$ value when the existing cooling equipment is a GSHP, so the $SEER_{BASE}$ of a GSHP, stated as 13.0 in the TRM v8.0 under Section 5.3.8, Part c, Roman Numeral 5, is recommended to serve as a proxy.

**Recommendation 8.** Guidehouse recommends ComEd and the implementer update the $SEER_{BASE}$ and $EER_{BASE}$ values for an existing GSHP system to 13.0 and 11.0, respectively, as per the TRM v8.0.

### 6.2.5 Duct Sealing

**Finding 9.** The evaluation team found that ex ante therm savings for seven out of the nine projects with a gas heating system were calculated using a custom heating equipment efficiency as shown in Table 6-4..While these values were not included in the tracking data, the evaluation team used the heating equipment efficiency values shown in Table 6-4 to calculate verified savings after confirmation from the implementer that these values are accurate and represent the actual heating efficiency of the heating equipment. This measure represents 0.6% of the program savings and had a verified gross realization rate of 0.91.

**Table 6-4. Duct Sealing – Heating Equipment Efficiency**

| Rebate ID | Heating Equipment Efficiency |
|---|---|
| EA-0006604010 | 96% |
| EA-0007839530 | 92% |
| EA-0008184672 | 97% |
| EA-0008235700 | 92% |
| EA-0008374847 | 95% |
| EA-0008504374 | 90% |
| EA-0008504429 | 95% |

*Source: Evaluation team analysis*

**Recommendation 9.** Guidehouse recommends ComEd and the implementer provide the custom heating equipment efficiency values for this measure as part of the tracking data moving forward.

### 6.2.6 Measures No Longer Offered in CY2021

The next set of measures will no longer be offered under the downstream channel of this program in CY2021. The evaluation team thus does not have any recommendations for these measures, the findings explain the realization rate.

#### *6.2.6.1 Ductless Mini-Split Heat Pump*

**Finding 10.** The evaluation team found 266 projects with a missing cooling system age in the tracking data. The evaluation team used an age of 12.11 years, the average of the Age Cooling System field for DMSHPs in the 2020 end of year (EOY) data, for the existing cooling equipment age for these projects. This resulted in the team classifying 95 of them as early replacement. The implementer calculated ex ante savings for these projects using the time-of-sale assumption. This measure represents 40.0% of the program savings and had a verified gross realization rate of 0.79.

**Finding 11.** The evaluation team found 223 projects with a missing heating system age in the tracking data. The evaluation team used an age of 15.33 years, the average of the Existing Heating System Age field for DMSHPs in the 2020 EOY data, for the existing heating equipment age for these projects. This resulted in the team classifying 126 of them as early replacement. The implementer calculated ex ante savings for these projects using the time-of-sale assumption.

**Finding 12.** For 99 fuel switching DMSHP projects, the implementer calculated ex ante kWh savings using a value of 1.0 for the $HSPF_{ASHP}$ parameter. The evaluation team calculated the kWh savings for these projects using a value of 8.2 for the $HSPF_{ASHP}$ parameter as per the TRM v8.0. Using this value resulted in low kWh realization rates for these projects (0.03-0.06).

**Finding 13.** For eight fuel switching DMSHP projects, the implementer calculated ex ante therm savings using a TOS classification for the heating system. The evaluation team calculated therm

savings for these projects using an ER classification based on the ER-TOS methodology in the TRM and the ex ante calculator. The eight projects are as follows:

- EA-0006141971
- EA-0006929885
- EA-0007686185
- EA-0007847199
- EA-0007933424
- EA-0008021988
- EA-0008397425
- EA-0008382069

#### *6.2.6.2 Central AC*

**Finding 14.** The evaluation team found 560 projects with a missing cooling system age in the tracking data. The evaluation team used an age of 19.80 years, the average of the Age Cooling System field for CACs in the 2020 EOY data, for the existing cooling equipment age for these projects. This resulted in the team classifying them as time-of-sale projects. The implementer calculated ex ante savings for 244 of these projects using the early replacement assumption. This measure represents 2.2% of the program savings and had a verified gross realization rate of 0.69.

**Finding 15.** For early replacement measures, the evaluation team de-rated the existing SEER and EER values, if available, based on the reported age of the existing cooling system by 1% per year as per the TRM v8.0, Section 5.3.3. The implementer did not de-rate the existing SEER or EER efficiency values for these projects.

#### *6.2.6.3 Air Source Heat Pump*

**Finding 16.** 66 projects had a missing cooling system age in the tracking system. The evaluation team used an age of 17.88 years, the average of the Age Cooling System field for ASHPs in the 2020 EOY data, for the existing cooling equipment age for these projects. This resulted in the team classifying 53 of them as time-of-sale projects. The implementer calculated ex ante savings for five of these time-of-sale projects using the early replacement assumption. This measure represents 0.9% of the program savings and had a verified gross realization rate of 0.68.

**Finding 17.** 53 projects had a missing heating system age in the tracking system. The evaluation team used an age of 16.75 years, the average of the Existing Heating System Age field for ASHPs in the 2020 EOY data, for the existing heating equipment age for these projects. This resulted in the team classifying them as time of sale projects. The implementer calculated ex ante savings for nineteen of these projects using the early retirement assumption.

**Finding 18.** For project ID EA-0007057311, the evaluation team classified the cooling system as ER by comparing the age of the existing cooling system (CAC) against the measure life of a CAC (18 years). The implementer calculated ex ante savings for this project as TOS. The team believes this is likely because the implementer compared the age of the existing cooling system against the measure life of an ASHP (16 years) rather than the measure life a CAC.

**Finding 19.** For project ID EA-0007616190, the evaluation team de-rated the existing SEER value based on the reported age of the existing cooling system by 1% per year as per the TRM

v8.0, Section 5.3.3. The implementer did not de-rate the existing SEER efficiency value 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 TRM v8.0 and TRM v8.0 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 TRM v8.0.
- Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

Guidehouse downloaded the final tracking data and measure workbook for the CY2020 impact evaluation from the ComEd Evaluation Share file site. The evaluation team relied on the following documents to verify the per-unit savings for each program measure:

- Final CY2020 tracking database files:
  - HVAC: "HVC_CY2020_EOY_Data_Rev2_01292021.xlsx"
  - Geothermal heat pumps: "GEO_CY2020_EOY_Data_Rev0_01122021.xlsx"
- TRM v8.0 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 a NTG ratio. In CY2020, 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.

# 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. Additional required cost data (e.g., measure costs, program-level incentive and non-incentive costs) is not included in this table and will be provided 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 Energy Savings (kWh) | Gross Peak Demand Reduction (kW) | Gross Gas Savings (Therms) | Gross Secondary Savings due to Water Reduction (kWh) | Gross Heating Penalty (kWh) | Gross Heating Penalty (Therms) | NTG (kWh) | NTG (kW) | NTG (Therms) | Net Electric Energy Savings (kWh) | Net Peak Demand Reduction (kW) | Net Gas Savings (Therms) | Net Secondary Savings due to Water Reduction (kWh) | Net Heating Penalty (kWh) | Net Heating Penalty (Therms) | 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 | 3,569 | 18.0 | Yes | 1,373,905 | 1,336.51 | NA | 0 | 0 | 0 | 0.80 | 0.80 | 0.80 | 1,099,124 | 1,069.21 | NA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | ECM Furnace Motor - Factory Installed | Each | 1,913 | 6.0 | No | 1,132,211 | 67.75 | 0 | 0 | 0 | 0 | 0.78 | 0.78 | 0.78 | 883,124 | 52.85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | Ductless Mini Split Heat Pump‡ | Each | 442 | 15.0 | Yes | 1,014,996 | 63.64 | 233,853 | 0 | 0 | 0 | 0.63 | 0.63 | 0.63 | 639,448 | 40.09 | 147,327 | 0 | 0 | 0 | -731,072 | 328,230 | -460,575 | 206,785 |
| HVAC | Advanced Thermostat†† | Each | 2,158 | 11.0 | No | 600,597 | 176.74 | 137,619 | 0 | 0 | 0 | NA | NA | NA | 600,597 | 176.74 | 137,619 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | Central AC‡ | Each | 1,044 | 18.0 | Yes | 325,498 | 307.76 | NA | 0 | 0 | 0 | 0.83 | 0.83 | 0.83 | 270,163 | 255.44 | NA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | Ground Source Heat Pump‡ | Each | 49 | 25.0 | Yes | 275,895 | 61.39 | 5,057 | 0 | 0 | 0 | 0.59 | 0.59 | 0.59 | 162,778 | 36.22 | 2,984 | 0 | 0 | 0 | -124,817 | 24,296 | -73,642 | 14,335 |
| HVAC | Air Source Heat Pump‡ | Each | 106 | 16.0 | Yes | 189,301 | 15.51 | NA | 0 | 0 | 0 | 0.57 | 0.57 | 0.57 | 107,901 | 8.84 | NA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | HVAC Tune Up - CAC | Each | 1,649 | 3.0 | No | 126,113 | 50.48 | NA | 0 | 0 | 0 | 0.80 | 0.80 | 0.80 | 100,891 | 40.39 | NA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | ECM Furnace Motor - Retrofit | Each | 27 | 6.0 | No | 18,591 | 5.14 | 0 | 0 | 0 | 0 | 0.78 | 0.78 | 0.78 | 14,501 | 4.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | Duct Sealing‡ | Each | 10 | 20.0 | Yes | 6,308 | 1.79 | 2,882 | 0 | 0 | 0 | 0.88 | 0.88 | 0.88 | 5,551 | 1.58 | 2,536 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HVAC | HVAC Tune Up - ASHP | Each | 3 | 3.0 | No | 2,519 | 0.11 | NA | 0 | 0 | 0 | 0.80 | 0.80 | 0.80 | 2,015 | 0.09 | NA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | | 13.8 | | 5,065,935 | 2,087 | 379,411 | 0 | 0 | 0 | NA | NA | NA | 3,886,094 | 1,685 | 290,466 | 0 | 0 | 0 | -855,889 | 352,526 | -534,217 | 221,120 |

NA = not applicable

*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.

‡ The EUL for this measure varies over time. See Table 4-1 to Table 4-3.

§ The savings shown for this measure are calculated using the alternative formula shown in the TRM v8.0 for calculating savings from fuel switching measures for the TRC analysis.

†† Algorithm 5.3.16 of TRM v8.0 yields net savings and does not require a NTG adjustment.

*Source: ComEd tracking data and evaluation team analysis*