ComEd Weatherization Impact Evaluation Report

Energy Efficiency / Demand Response Plan: Program Year 2019 (CY2019) (1/1/2019-12/31/2019)

Presented to ComEd

FINAL

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ComEd Weatherization Impact Evaluation Report

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1. Introduction

This report presents the results of the impact evaluation of ComEd's CY2019 Weatherization – Market Rate Program. It includes a summary of the energy and demand impacts for the total program broken out by relevant measure and program structure details. The appendix provides the impact analysis methodology and details of the Total Resource Cost inputs. CY2019 covers January 1, 2019 through December 31, 2019.

2. Program Description

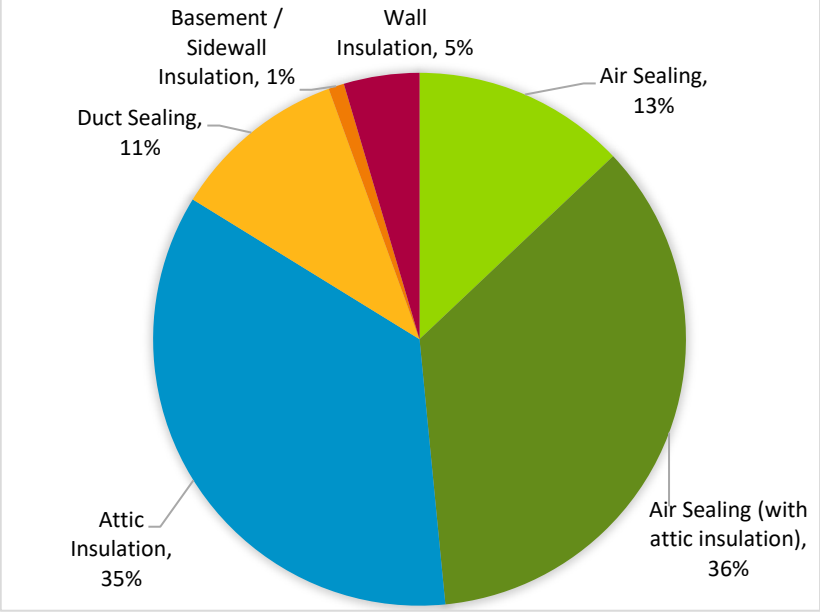
The Weatherization – Market Rate Program offers customer incentives for installing qualified insulation and air sealing measures. Weatherization rebates are instant rebates that are applied to customer invoices by participating program contractors. The program had 1,457 participants in CY2019 and completed 2,943 measures as shown in the following table and graph.

Table 2-1. CY2019 Volumetric Findings Detail

Participation	Quantity
Participants	1,457
Total Measures	2,943
Installed Projects	1,462

Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Percent 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 Weatherization – Market Rate Program achieved in CY2019. ComEd is not reporting any gas saving from the CY2019 Weatherization – Market Rate Program. Therefore, the evaluation team did not include any natural gas in the verified savings.

Table 3-1. CY2019 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Non-Coincident Demand Savings (kW)	Summer Peak* Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	637,646	NR	312
Program Gross Realization Rate	0.95	NA	0.90
Verified Gross Savings	605,461	604	281
Program Net-to-Gross Ratio (NTC	Varies	Varies	Varies
Verified Net Savings	607,730	606	282
Converted from Gas†			
Ex Ante Gross Savings	NA	NA	NA
Program Gross Realization Rate	NA	NA	NA
Verified Gross Savings	NA	NA	NA
Program Net-to-Gross Ratio (NTC	NA	NA	NA
Verified Net Savings	NA	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	637,646	NR	312
Program Gross Realization Rate	0.95	NA	0.90
Verified Gross Savings	605,461	604	281
Program Net-to-Gross Ratio (NTC	Varies	Varies	Varies
Verified Net Savings	607,730	606	282

NR = Not reported (refers a piece of data that was not reported, i.e., non-coincident demand savings)
NA = Mot applicable (refers a piece of data cannnot be produced or does not apply)
* The coincident summer peak period is defined as 1:00-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.
† Gas savings converted to kWh by multiplying therms * 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."
Source: ComEd tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 to Table 4-3 and Figure 4-1 show the measure-specific and total verified gross savings for the Weatherization – Market Rate Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2019. The electric CPAS across all measures installed in 2019 is 607,730 kWh (Table 4-1). The CY2019 gas contribution to CPAS (converted to equivalent electricity) is 0 kWh (Table 4-2). Adding the gas and electric contributions produces 607,730 kWh of total CY2019 contribution to CPAS (Table 4-3).

The “historic” rows in each table are the CPAS contribution back to CY2018. Historic gas savings are reported in Table 4-2 and Table 4-3 because gas converted kWh savings were reported in CY2018. The “Program Total Electric CPAS” and the “Program Total Gas CPAS” are the sum of the CY2019 contribution and the historic contribution.

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

End Use Type	Research Category	EUL	CY2019 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Shell	Air Sealing (with attic insulation)	20.0	238,179	NA**	4,632,887		238,179	238,179	238,179	238,179	238,179	238,179	238,179	238,179
Shell	Attic Insulation	20.0	140,362	NA**	2,731,806		140,362	140,362	140,362	140,362	140,362	140,362	140,362	140,362
HVAC	Duct Sealing	20.0	118,338	1.01	2,306,500		119,522	119,522	119,522	119,522	119,522	119,522	119,522	119,522
Shell	Air Sealing	20.0	81,670	1.01	1,556,236		82,487	82,487	82,487	82,487	82,487	82,487	82,487	82,487
Shell	Wall Insulation	20.0	16,514	1.01	324,563		16,679	16,679	16,679	16,679	16,679	16,679	16,679	16,679
Shell	Basement / Sidewall Insulation	20.0	10,398	1.01	204,944		10,502	10,502	10,502	10,502	10,502	10,502	10,502	10,502
CY2019 Program Total Electric Contribution to CPAS			605,461		11,756,935		607,730	607,730	607,730	607,730	607,730	607,730	607,730	607,730
Historic Program Total Electric Contribution to CPAS‡						796,737	796,737	796,737	796,737	796,737	796,737	796,737	796,737	796,737
Program Total Electric CPAS						796,737	1,404,467	1,404,467	1,404,467	1,404,467	1,404,467	1,404,467	1,404,467	1,404,467
CY2019 Program Incremental Expiring Electric Savings§								-	-	-	-	-	-	-
Historic Program Incremental Expiring Electric Savings‡§							-	-	-	-	-	-	-	-
Program Total Incremental Expiring Electric Savings§							-	-	-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Shell	Air Sealing (with attic insulation)	238,179	238,179	225,110	225,110	225,110	225,110	225,110	225,110	225,110	225,110	225,110	225,110
Shell	Attic Insulation	140,362	140,362	132,818	132,818	132,818	132,818	132,818	132,818	132,818	132,818	132,818	132,818
HVAC	Duct Sealing	119,522	119,522	111,128	111,128	111,128	111,128	111,128	111,128	111,128	111,128	111,128	111,128
Shell	Air Sealing	82,487	82,487	73,137	73,137	73,137	73,137	73,137	73,137	73,137	73,137	73,137	73,137
Shell	Wall Insulation	16,679	16,679	15,777	15,777	15,777	15,777	15,777	15,777	15,777	15,777	15,777	15,777
Shell	Basement / Sidewall Insulation	10,502	10,502	9,993	9,993	9,993	9,993	9,993	9,993	9,993	9,993	9,993	9,993
CY2019 Program Total Electric Contribution to CPAS		607,730	607,730	567,963	567,963	567,963	567,963	567,963	567,963	567,963	567,963	567,963	567,963
Historic Program Total Electric Contribution to CPAS‡		796,737	796,737	796,737	796,737	796,737	796,737	380,956	380,956	380,956	380,956	380,956	110,972
Program Total Electric CPAS		1,404,467	1,404,467	1,364,700	1,364,700	1,364,700	1,364,700	948,919	948,919	948,919	948,919	948,919	678,935
CY2019 Program Incremental Expiring Electric Savings§		-	-	39,767	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Electric Savings‡§		-	-	-	-	-	-	415,781	-	-	-	-	269,984
Program Total Incremental Expiring Electric Savings§		-	-	39,767	-	-	-	415,781	-	-	-	-	269,984

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Shell	Air Sealing (with attic insulation)												
Shell	Attic Insulation												
HVAC	Duct Sealing												
Shell	Air Sealing												
Shell	Wall Insulation												
Shell	Basement / Sidewall Insulation												
CY2019 Program Total Electric Contribution to CPAS						-							
Historic Program Total Electric Contribution to CPAS‡		110,972	110,972	110,972	110,972	-							
Program Total Electric CPAS		110,972	110,972	110,972	110,972	-							
CY2019 Program Incremental Expiring Electric Savings§		567,963	-	-	-	-							
Historic Program Incremental Expiring Electric Savings‡§		-	-	-	-	110,972							
Program Total Incremental Expiring Electric Savings§		567,963	-	-	-	110,972							

Note: The green highlighted cell shows program total first year electric savings. The gray cells are blank, indicating values irrelevant to the CY2019 contribution to CPAS.
* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
** Air sealing can be completed with, or without attic insulation and has different NTG ratios in each case. The TRM recommends net calculations only for Air Sealing with Attic Insulation.
† Lifetime savings are the sum of CPAS savings through the EUL.
‡ Historical savings go back to CY2018
§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n
Source: Evaluation team analysis

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

End Use Type	Research Category	EUL	CY2019 Verified Gross Savings (Therms)	NTG*	Lifetime Net Savings (Therms)†	Verified Net Therms Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Shell	Air Sealing (with attic insulation)	20.0		NA**	-	-	-	-	-	-	-	-	-	-
Shell	Attic Insulation	20.0		NA**	-	-	-	-	-	-	-	-	-	-
HVAC	Duct Sealing	20.0		1.01	-	-	-	-	-	-	-	-	-	-
Shell	Air Sealing	20.0		1.01	-	-	-	-	-	-	-	-	-	-
Shell	Wall Insulation	20.0		1.01	-	-	-	-	-	-	-	-	-	-
Shell	Basement / Sidewall Insulation	20.0		1.01	-	-	-	-	-	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (Therms)			-		-		-	-	-	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)‡					-		-	-	-	-	-	-	-	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§						1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074
Program Total Gas CPAS (kWh Equivalent)‡						1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074
CY2019 Program Incremental Expiring Gas Savings (Therms)‖								-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (kWh Equivalent)‡‖								-	-	-	-	-	-	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§‖							-	-	-	-	-	-	-	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡‖							-	-	-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Shell	Air Sealing (with attic insulation)	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Attic Insulation	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Duct Sealing	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Air Sealing	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Wall Insulation	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Basement / Sidewall Insulation	-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (Therms)		-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§		1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	908,272	908,272	908,272	908,272	908,272	158,352
Program Total Gas CPAS (kWh Equivalent)‡		1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	1,388,074	908,272	908,272	908,272	908,272	908,272	158,352
CY2019 Program Incremental Expiring Gas Savings (Therms)‖		-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (kWh Equivalent)‡‖		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§		-	-	-	-	-	-	479,802	-	-	-	-	749,920
Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡‖		-	-	-	-	-	-	479,802	-	-	-	-	749,920

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Shell	Air Sealing (with attic insulation)	-											
Shell	Attic Insulation	-											
HVAC	Duct Sealing	-											
Shell	Air Sealing	-											
Shell	Wall Insulation	-											
Shell	Basement / Sidewall Insulation	-											
CY2019 Program Total Gas Contribution to CPAS (Therms)		-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§		158,352	158,352	158,352	158,352								
Program Total Gas CPAS (kWh Equivalent)‡		158,352	158,352	158,352	158,352	-	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (Therms)||		-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Gas Savings (kWh Equivalent)‡||		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§		-	-	-	-	158,352	-	-	-	-	-	-	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡||		-	-	-	-	158,352	-	-	-	-	-	-	-

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 CY2019.
* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
** Air sealing can be completed with, or without attic insulation and has different NTG ratios in each case. The TRM recommends net calculations only for Air Sealing with Attic Insulation.
† 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.
Source: Evaluation team analysis

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

End Use Type	Research Category	EUL	CY2019 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
Shell	Air Sealing	20.0	238,179	NA**	4,632,887		238,179	238,179	238,179	238,179	238,179	238,179	238,179	238,179
Shell	Air Sealing (with attic insulation)**	20.0	140,362	NA**	2,731,806		140,362	140,362	140,362	140,362	140,362	140,362	140,362	140,362
Shell	Attic Insulation	20.0	118,338	1.01	2,306,500		119,522	119,522	119,522	119,522	119,522	119,522	119,522	119,522
HVAC	Duct Sealing	20.0	81,670	1.01	1,556,236		82,487	82,487	82,487	82,487	82,487	82,487	82,487	82,487
Shell	Basement / Sidewall Insulation	20.0	16,514	1.01	324,563		16,679	16,679	16,679	16,679	16,679	16,679	16,679	16,679
Shell	Wall Insulation	20.0	10,398	1.01	204,944		10,502	10,502	10,502	10,502	10,502	10,502	10,502	10,502
CY2019 Program Total Contribution to CPAS			605,461		11,756,935		607,730	607,730	607,730	607,730	607,730	607,730	607,730	607,730
Historic Program Total Contribution to CPAS‡						2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811
Program Total CPAS						2,184,811	2,792,541	2,792,541	2,792,541	2,792,541	2,792,541	2,792,541	2,792,541	2,792,541
CY2019 Program Incremental Expiring Savings§								-	-	-	-	-	-	-
Historic Program Incremental Expiring Savings‡§							-	-	-	-	-	-	-	-
Program Total Incremental Expiring Savings§							-	-	-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Shell	Air Sealing	238,179	238,179	225,110	225,110	225,110	225,110	225,110	225,110	225,110	225,110	225,110	225,110
Shell	Air Sealing (with attic insulation)**	140,362	140,362	132,818	132,818	132,818	132,818	132,818	132,818	132,818	132,818	132,818	132,818
Shell	Attic Insulation	119,522	119,522	111,128	111,128	111,128	111,128	111,128	111,128	111,128	111,128	111,128	111,128
HVAC	Duct Sealing	82,487	82,487	73,137	73,137	73,137	73,137	73,137	73,137	73,137	73,137	73,137	73,137
Shell	Basement / Sidewall Insulation	16,679	16,679	15,777	15,777	15,777	15,777	15,777	15,777	15,777	15,777	15,777	15,777
Shell	Wall Insulation	10,502	10,502	9,993	9,993	9,993	9,993	9,993	9,993	9,993	9,993	9,993	9,993
CY2019 Program Total Contribution to CPAS		607,730	607,730	567,963	567,963	567,963	567,963	567,963	567,963	567,963	567,963	567,963	567,963
Historic Program Total Contribution to CPAS‡		2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	2,184,811	1,289,228	1,289,228	1,289,228	1,289,228	1,289,228	269,324
Program Total CPAS		2,792,541	2,792,541	2,752,774	2,752,774	2,752,774	2,752,774	1,857,191	1,857,191	1,857,191	1,857,191	1,857,191	837,287
CY2019 Program Incremental Expiring Savings§		-	-	39,767	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Savings‡§		-	-	-	-	-	-	895,583	-	-	-	-	1,019,904
Program Total Incremental Expiring Savings§		-	-	39,767	-	-	-	895,583	-	-	-	-	1,019,904

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Shell	Air Sealing	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Air Sealing (with attic insulation)**	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Attic Insulation	-	-	-	-	-	-	-	-	-	-	-	-
HVAC	Duct Sealing	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Basement / Sidewall Insulation	-	-	-	-	-	-	-	-	-	-	-	-
Shell	Wall Insulation	-	-	-	-	-	-	-	-	-	-	-	-
CY2019 Program Total Contribution to CPAS		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Total Contribution to CPAS‡		269,324	269,324	269,324	269,324	-	-	-	-	-	-	-	-
Program Total CPAS		269,324	269,324	269,324	269,324	-	-	-	-	-	-	-	-
CY2019 Program Incremental Expiring Savings§		567,963	-	-	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Savings‡§		-	-	-	-	269,324	-	-	-	-	-	-	-
Program Total Incremental Expiring Savings§		567,963	-	-	-	269,324	-	-	-	-	-	-	-

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 CY2019.

* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.

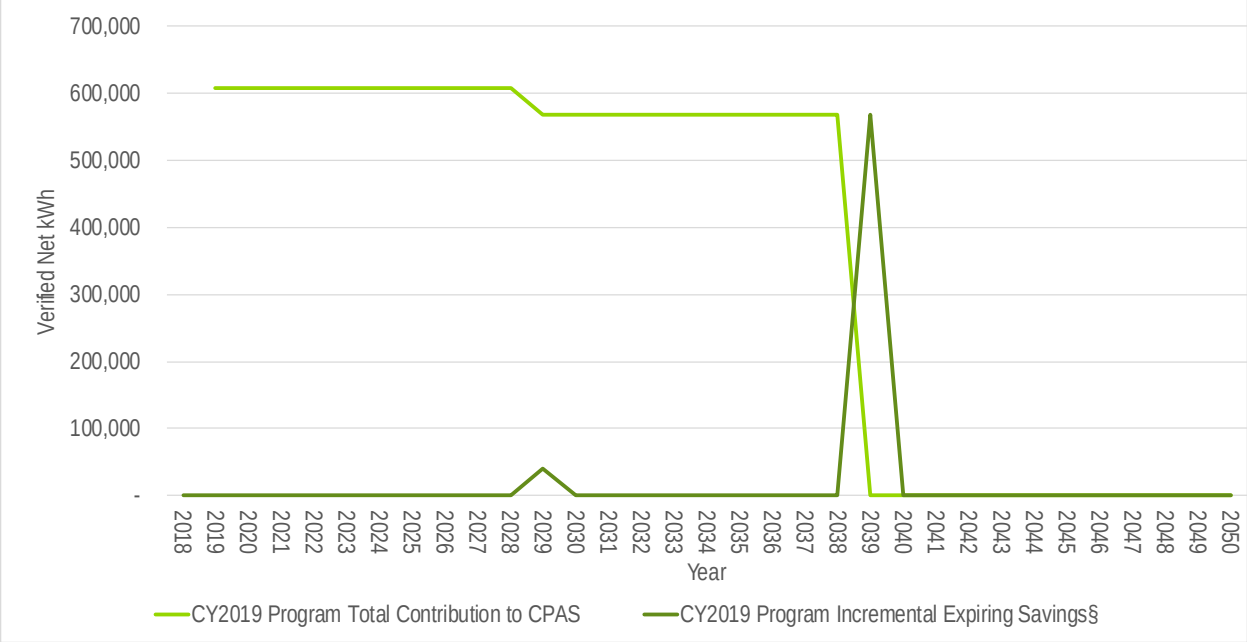
** Air sealing can be completed with, or without attic insulation and has different NTG ratios in each case. The TRM recommends net calculations only for Air Sealing with Attic Insulation.

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

‡ Historic savings go back to CY2018.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings

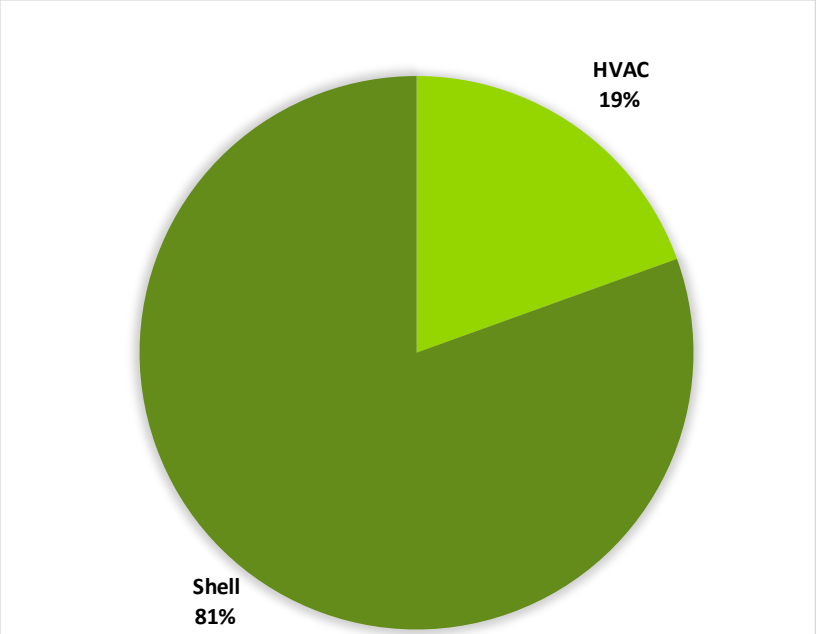


* Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.
Source: Evaluation team analysis

5. Program Savings by Measure

The program includes six measures as shown in the following tables. The Shell end-use measures contributed the majority of CY2019 savings (see Figure 5-1).

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



Source: ComEd tracking data and evaluation team analysis

Table 5-1. CY2019 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)
Shell	Air Sealing (with attic insulation)	250,102	0.95	238,179	NA	238,179	20.0
Shell	Attic Insulation	139,562	1.01	140,362	NA	140,362	20.0
HVAC	Duct Sealing	128,418	0.92	118,338	1.01	119,522	20.0
Shell	Air Sealing	88,938	0.92	81,670	1.01	82,487	20.0
Shell	Wall Insulation	20,359	0.81	16,514	1.01	16,679	20.0
Shell	Basement / Sidewall Insulation	10,267	1.01	10,398	1.01	10,502	20.0
	Total	637,646	0.95	605,461	NA	607,730	NA

NA = Not applicable
NR = Not reported
* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
Note: The savings in this table includes secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd.
Source: ComEd tracking data and evaluation team analysis

Table 5-2. CY2019 Non-Coincident Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Non-Coincident Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Non-Coincident Demand Reduction (kW)	NTG*	Verified Net Non-Coincident Demand Reduction (kW)
Shell	Air Sealing (with attic insulation)	NR	NA	278.75	NA	278.75
Shell	Attic Insulation	NR	NA	125.93	NA	125.93
HVAC	Duct Sealing	NR	NA	87.52	1.01	88.39
Shell	Air Sealing	NR	NA	87.31	1.01	88.18
Shell	Wall Insulation	NR	NA	15.44	1.01	15.60
Shell	Basement / Sidewall Insulation	NR	NA	9.37	1.01	9.47
	Total	NR	NA	604.32	NA	606.32

NA = Not applicable
NR = Not reported
* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
Source: ComEd tracking data and evaluation team analysis

Table 5-3. CY2019 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)
Shell	Air Sealing (with attic insulation)	134.42	0.97	129.90	NA	129.90
Shell	Attic Insulation	73.31	0.80	58.68	NA	58.68
HVAC	Duct Sealing	48.29	0.84	40.78	1.01	41.19
Shell	Air Sealing	42.41	0.96	40.69	1.01	41.09
Shell	Wall Insulation	9.51	0.76	7.20	1.01	7.27
Shell	Basement / Sidewall Insulation	4.15	1.05	4.37	1.01	4.41
	Total	312.08	0.90	281.62	NA	282.55

NA = Not applicable
* A deemed value. Source: is to be found on the Illinois SAG web site here: https://www.ilsag.info/ntg_2019.
Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

6.1 Impact Parameter Estimates

The Guidehouse team estimate verified unit level savings for each program measure applying impact formulas found in the Illinois Technical Reference Manual (TRM) v7.0. Table 6-1 presents key parameters and net savings calculation references.

Table 6-1. Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	# measures	Evaluated	
NTG	Varies	%	Deemed	SAG Consensus
Measure Type and Eligibility	Varies		Deemed	
Gross Savings per Unit	Varies	kWh	Deemed	TRM v7.0 – Section 5.3.4 & 5.6.1 – 5.6.5
Verified Realization Rate on Ex Ante Gross Savings (Non-Lighting)	Varies	%	Evaluated	
Effective Useful Life (EUL)	20	Years	Deemed	TRM v7.0 – Section 5.3.4 & 5.6.1 – 5.6.5

* TRM is the State of Illinois Technical Reference Manual version 7.0 from http://www.ilsag.info/technical-reference-manual.html. The NTG values can be found on the IL SAG web site here: https://www.ilsag.info/ntg_2019.

6.2 Other Impact Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2019 evaluation applicable to all measures in the Weatherization – Market Rate Program. The cross cutting recommendations account for the majority of non-100% realization rates.

Finding 1. Program tracking data only reports total project level ex-ante kWh and kW savings. Per TRM formulas and guidelines, each program measure has up two sources of TRM based savings calculations. The TRM savings components and how they vary by primary heating fuel and central air conditioning are shown in Table 6-2. Furnace fan, cooling, and heating savings each have distinct savings formulas assumptions for each measure. It is challenging to address ex-ante and evaltuated TRM calculation variances without savings broken out by underlying furnace fan, cooling, or heating components.

Table 6-2. TRM Savings Components by Fuel, Central Cooling

Primary Heating Fuel	Central Cooling Present	Furnace Fan Savings	Cooling Savings	Heating Savings (kWh)
Natural Gas	Yes	✓	✓	
Natural Gas	No	✓		
Electric	Yes		✓	✓
Electric	No			✓

Recommendation 1. Guidehouse recommends the implementer provide ex-ante savings broken out by furnace fan, cooling, and electric space heat savings. The evaluation team recommends the program implementer provide TRM based savings calculators broken out by fan, cooling, and electric heating components.

Finding 2. CY2019 gross verified energy savings realization rates vary between 81% (Wall Insulation) and 101% (Basement / Sidewall and Attic Insulation) and peak kW demand reduction realization rates range between 80% (Attic Insulation) and 105% (Basement / Sidewall Insulation). The program tracking database savings calculations are not consistent with TRM v7.0 formulas.

Recommendation 2 The evaluation team recommends that the program implementer update all savings calculators to be consistent with current TRM guidelines and use the program tracking data in all formulas.

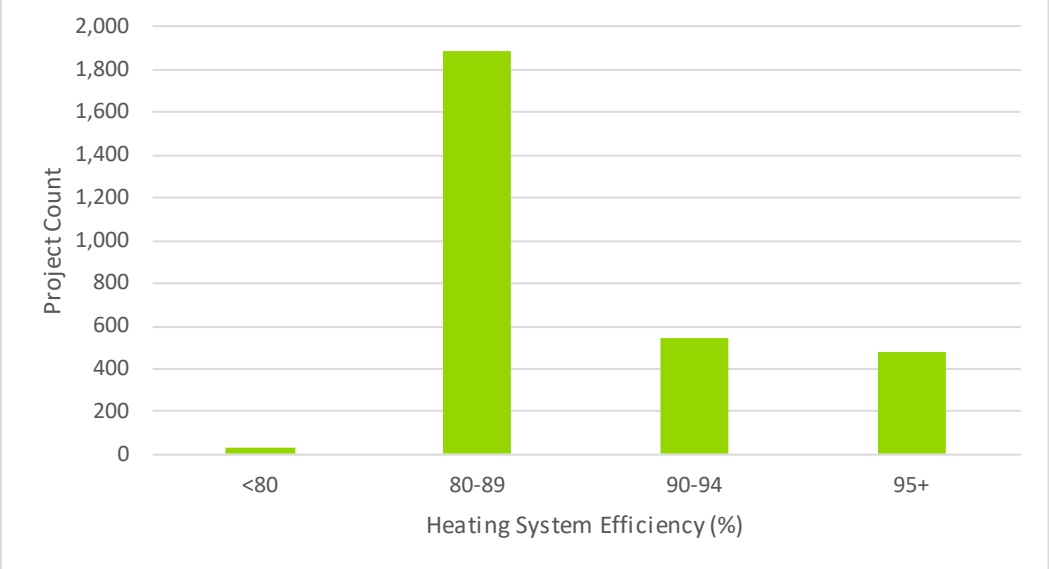
Finding 3. The program tracking data reports peak kW savings for non-central cooling homes (Window, Mini-Splits, None). TRM v7.0 only allows peak kW demand reductions for centrally cooled homes.

Recommendation 3. Guidehouse recommends that the implementer only calculate cooling kWh and kW savings for centrally cooled homes to be consistent with the TRM.

Finding 4. The program implementation contractor during CY2018 and CY2019 Wave 1 analysis requested the evaluation team to not use program tracking database furnace efficiency values for measure savings calculations. The program implementer expressed concern that program tracking database values were not accurate. As a result, the Guidehouse team used default TRM ("nHeat") (72%) heating system efficiency values for verified therm savings calculations (therms savings are used for furnace fan kWh savings estimates). TRM default values were also applied for forced air resistance (1.0) and heat pump heated homes (2.04 for systems installed after 2014, 2.4 for Duct Sealing). The evaluation team identified diverse program tracking database heating system efficiencies (see Figure 6-1) which averaged 84.6% across CY2019 measures. Using the TRM heating system efficiency default values instead of reported program tracking furnace efficiency values increases verified savings calculations for most Weatherization projects.

Recommendation 4. Guidehouse recommends that the program implementer review heating system efficiency on-site data collection methods and calculate heating and furnace fan savings using actual customer system efficiency information where possible.

Figure 6-1. CY2019 Program Tracking Database Heating System Efficiencies



Source: ComEd tracking data and evaluation team analysis

The following recommendations pertain to specific measure-level realization rates and had minor realization rate impacts.

Air Sealing

Finding 5: The "N_cool" and "N_heat" 50 Pascal to natural condition leakage conversion factors matrix (TRM 7.0, page 296) contains both Climate Zone and the number of building stories parameters. The number of building stories is not currently reported in the program tracking data. The verified savings calculations assumes one story for manufactured/mobile homes and 1.5 stories for single-family homes.
Recommendation 5: Guidehouse recommends that the program implementer collect the number of stories for each participant whenever possible.

Finding 6**:** The central air conditioning full load hours ("FLH_cool") lookup table (TRM v7.0, p. 301) does not list Manufactured/Mobile home values. Franklin and Guidehouse both applied single-family full load hours "FLH_cool" lookup table values to calculate both coincident and average summer peak savings for mobile/manufactured centrally cooled homes.
Recommendation 6: Guidehouse and the implementer team should determine if TRM v7.0 single-family home full load hour values for mobile and manufactured home are appropriate and recommend an update to the TRM to include mobile and manufactured homes if needed.

Finding 7. One Air Sealing project was coded as "Air Sealing - Savings - Electric Heat (Electric Only) -SF Wx 19" when it should have been coded as "Air Sealing - Savings - Gas Heat (Joint) -SF Wx 19". The homes primary fuel system is natural gas as per the tracking data.
Recommendation 7. The program implementer should add data entry checks and should correctly document air sealing measure and heating system combinations.

Finding 8. One Air Sealing (with attic insulation) project was coded as "Air Sealing - With Attic Ins - Savings - Gas Heat (Joint) -SF Wx 19" in the program tracking data, where the primary heating fuel is electric. Similarly, three Air Sealing (with attic insulation) projects were coded as electric measures in the program tracking data, when the primary heating fuel was natural gas as per the tracking data.
Recommendation 8. The program implementer should add data entry checks for inconsistent measure type and heating system combinations.

Attic Insulation

Finding 9. One Attic Insulation project was coded as "Attic Insulation - Existing R-1-3 - Final R-49+ (Joint) -SF Wx 19" when the primary heating fuel is electric as per the tracking data.
Recommendation 9. The program implementer should add data entry checks for inconsistent measure type and heating system combinations.

Duct Sealing

Finding 10: Cooling kWh, electric heating kWh, and heating therm TRM v7.0 calculations (p.86) require cooling and heating thermal regain factors ("TRFcool", "TRFheat"). These two variables define what percent of the sealed ducts are in unconditioned vs. semi-conditioned space. The program tracking data does not contain values for "TRFcool" and "TRFheat" so Guidehouse assumed the value of 0.4 for semi-conditioned spaces for CY2019 verified

savings as per TRM v7.0 Section 5.3.4. It is unclear which value the implementer is using for program tracking savings calculations.

Recommendation 10. Guidehouse recommends that the program implenter estimate the percent of ducts in unconditioned vs. semi-conditioned space so that actual "TRFcool" and "TRFheat" values can be used in calculations consistent with TRM v7.0 methods.

Finding 11. Pre duct sealing Heating System Efficiency (Equipment Efficiency*Pre Distribution Efficiency) formula input values were not available because Pre Distribution Efficiency values were not recorded in the tracking database. For verified CY2019 savings estimates, the evaluation team used the default value of 70% for all cases as per TRM v7.0 Section 5.3.4.

Recommendation 11. Guidehouse recommends that the implementer record the Pre Distribution Efficiency value so that Pre duct sealing Heating System Efficiency can be calculated when possible. The default values in TRM v7.0 should be used when actual values cannot be obtained.

7. Appendix 1. Impact Analysis Detail

Guidehouse relied on the following documents to verify program measure per-unit savings;

1. TRM v7.0 savings algorithms to verify program tracking database ex-ante savings
2. Recreate and validate TRM savings algorithms for all CY2019 measures and projects
3. Cross-check per-unit eTrack savings values in the tracking data with the verified TRM measure savings and identify inconsistencies

Guidehouse calculated verified net energy and demand (coincident and peak) savings by multiplying verified gross savings estimated by net-to-gross ratios (NTG) of 1.01 for Duct Sealing, Air Sealing (not in conjuction with Attic Insulation), Wall Insulation, and Basement and Sidewall Insulation. NTG adjustments were not applied to Attic Insulation or Air Sealing with Attic Insulation measures. Net verified savings NTG values are based on past evaluation research and defined through the Stakeholder Advisory Group (SAG) process.

Guidehouse relied on the following documents to verify the program measure per unit savings;

- Final CY2019 eTrack database exports:
  - Wx_CY2019_EOY_Data_Rev0_01102020
- Recent program reports
  - ComEd Weatherization Rebates CY2018 Evaluation Report 2019-04-05 Final
  - ComEd Weatherization Rebates CY2019 Wave 1 Data Review Memo 2019-11-05 Final
- Illinois Technical Reference Manual (TRM v7.0) for savings algorithms and deemed input parameters

8. Appendix 2. Total Resource Cost Detail

Table 8-1 shows the Total Resource Cost (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) are not included in this table and will be provided to the evaluation team later.

Table 8-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Verified Gross Electric Energy Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	Verified Gross Gas Savings (Therms)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Verified Net Electric Energy Savings (kWh)	Verified Net Peak Demand Reduction (kW)	Verified Net Gas Savings (Therms)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Shell	Air Sealing (with attic insulation)	Projects	1,045	20.0	No	238,179	129.90	NA	NA	NA	NA	NA	NA	238,179	129.90	NA	NA	NA
Shell	Attic Insulation	Projects	1,040	20.0	No	140,362	58.68	NA	NA	NA	NA	NA	NA	140,362	58.68	NA	NA	NA
HVAC	Duct Sealing	Projects	314	20.0	No	118,338	40.78	NA	NA	NA	1.01	1.01	NA	119,522	41.19	NA	NA	NA
Shell	Air Sealing	Projects	381	20.0	No	81,670	40.69	NA	NA	NA	1.01	1.01	NA	82,487	41.09	NA	NA	NA
Shell	Wall Insulation	Projects	135	20.0	No	16,514	7.20	NA	NA	NA	1.01	1.01	NA	16,679	7.27	NA	NA	NA
Shell	Basement / Sidewall Insulation	Projects	28	20.0	No	10,398	4.37	NA	NA	NA	1.01	1.01	NA	10,502	4.41	NA	NA	NA
	Total			20.0		605,461	282	NA	NA	NA	NA	NA	NA	607,730	283	NA	NA	NA

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.

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

Source: ComEd tracking data and evaluation team analysis