



ComEd HVAC SAVE Pilot Impact Evaluation Report

**Energy Efficiency / Demand Response Plan:
Program Year 2018 (CY2018)
(1/1/2018-12/31/2018)**

**Presented to
ComEd**

DRAFT

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TABLE OF CONTENTS

1. Introduction 1

2. Program Description 1

3. Program Savings Detail 1

4. Cumulative Persisting Annual Savings 2

5. Program Savings by Measure 4

6. Impact Analysis Findings and Recommendations 5

 6.1 Impact Parameter Estimates 5

 6.2 Other Impact Findings and Recommendations 6

7. Appendix 1. Impact Analysis Methodology 6

8. Appendix 2. Impact Analysis Detail 6

 8.1 Central Air Conditioning 6

9. Appendix 3. Total Resource Cost Detail 7

LIST OF TABLES AND FIGURES

Figure 4-1. Cumulative Persisting Annual Savings 4

Table 3-1. CY2018 Total Annual Incremental Electric Savings 2

Table 4-1. Cumulative Persisting Annual Savings (CPAS) 3

Table 5-1. CY2018 Energy Savings – Electric 4

Table 5-2. CY2018 Summer Peak Demand Savings 4

Table 6-1. Navigant Algorithm Inputs for Central Air Conditioning as per Illinois TRM v.7 5

Table 8-1. Central Air Conditioning Measure Impact Detail 7

Table 9-1. Total Resource Cost Savings Summary 7

1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's CY2018 HVAC SAVE Pilot Program. It presents a summary of the energy and demand impacts. The appendix presents the impact analysis methodology. CY2018 covers the period from January 1, 2018 to December 31, 2018.

2. PROGRAM DESCRIPTION

The HVAC SAVE Pilot Program provided incentives for quality installations of replacement residential central air conditioning (CAC) systems. The program achieved energy savings associated with specially-trained Energy Efficiency Service Providers (EESPs) installing qualified CAC units in ComEd customers' homes. ComEd provided training (via the Midwest Energy Efficiency Alliance (MEEA) and CLEARresult) to EESPs in CY2018 via this HVAC SAVE Pilot Program and CLEARresult provided the quality assurance and quality control support for the program.

Navigant's evaluated savings related to the quality installation (QI) process associated with the HVAC SAVE Pilot Program.

3. PROGRAM SAVINGS DETAIL

Table 3-1 summarizes the incremental energy and demand savings the HVAC SAVE Pilot Program achieved in CY2018. The implementation contractor did not report demand savings, but they reported peak demand savings.

Table 3-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	14,373	NA	14.75
Program Gross Realization Rate	1.32	NA	6.30
Verified Gross Savings	18,952	NA	92.93
Program Net-to-Gross Ratio (NTG)	1.00	NA	1.00
Verified Net Savings	18,952	NA	92.93
Converted from Gas			
Ex Ante Gross Savings	0	NA	NA
Program Gross Realization Rate	0.00	NA	NA
Verified Gross Savings	0	NA	NA
Program Net-to-Gross Ratio (NTG)	1.00	NA	NA
Verified Net Savings	0	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	14,373	NA	14.75
Program Gross Realization Rate	1.32	NA	6.30
Verified Gross Savings	18,952	NA	92.93
Program Net-to-Gross Ratio (NTG)	1.00	NA	1.00
Verified Net Savings	18,952	NA	92.93

NA = Not available

Note: The coincident Summer Peak period is defined as 1:00-5:00 P.M. Central Prevailing Time on non-holiday weekdays, June through August.

Source: ComEd tracking data and Navigant team analysis.

4. CUMULATIVE PERSISTING ANNUAL SAVINGS

The total ex ante gross savings for the HVAC SAVE Pilot Program and the cumulative persisting annual savings (CPAS) are shown in the following table and figure. The total CPAS is 18,952 kWh. There were no calculated gas savings.

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

End Use Type	Research Category	EUL	Verified Gross Savings	NTGR†	Lifetime Net Savings†	Verified Net kWh Savings												
						2018	2019	2020	2021	2022	2023	2024	2025	2026				
HVAC	CAC- Quality Install	18.0	18,952	1.00	341,136	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952			
CY2018 Program Total Electric CPAS						18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952			
CY2018 Program Expiring Electric Savings§																		
End Use Type	Research Category												2038					
		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037						
HVAC	CAC- Quality Install	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952							
CY2018 Program Total Electric CPAS		18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	-	-	-				
CY2018 Program Expiring Electric Savings§		-	-	-	-	-	-	-	-	-	-	18,952	18,952	18,952				
End Use Type	Research Category												2050					
		2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049						
HVAC	CAC- Quality Install																	
CY2018 Program Total Electric CPAS		-	-	-	-	-	-	-	-	-	-	-	-	-				
CY2018 Program Expiring Electric Savings§		18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952	18,952				

Note: The green highlighted cell shows program total first year electric savings.

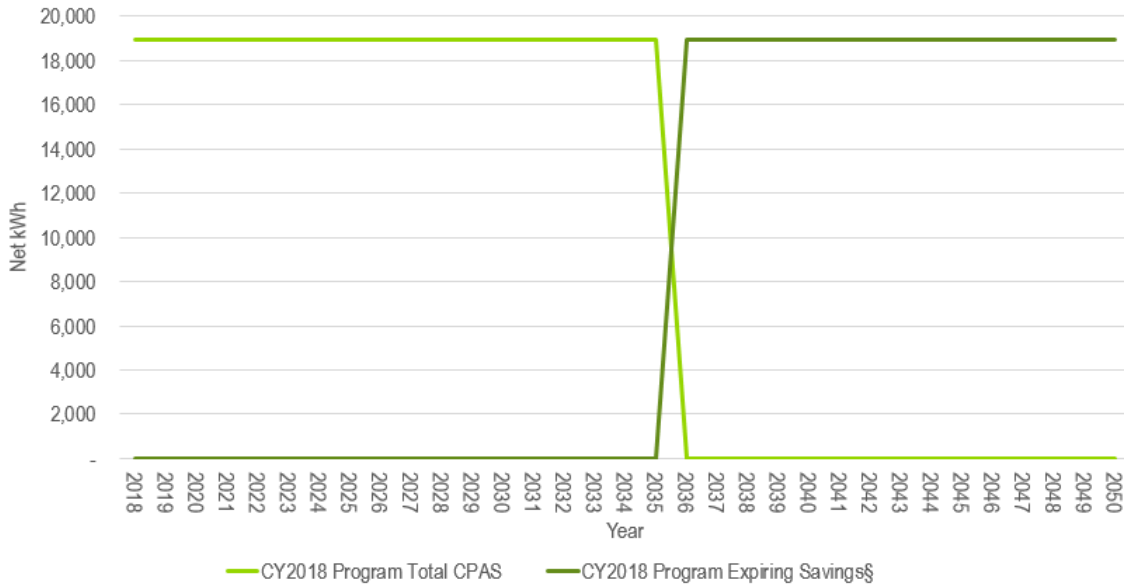
* A deemed value. Source: Memo, March 2019, forthcoming, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

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

§ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

Figure 4-1. Cumulative Persisting Annual Savings



§ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
 Source: Navigant analysis

5. PROGRAM SAVINGS BY MEASURE

The evaluation analyzed savings for the HVAC SAVE Pilot Program for the CAC QI measure as shown in following tables. There were no calculated gas savings.

Table 5-1. CY2018 Energy Savings – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	Effective Useful Life
HVAC	CAC- Quality Install	14,373	1.32	18,952	1.00	18,952	18
Total		14,373	1.32	18,952	1.00	18,952	18

* A deemed value. Source: Memo, March 2019, forthcoming, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

Source: ComEd tracking data and Navigant team analysis

Table 5-2. CY2018 Summer Peak Demand Savings

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	CAC- Quality Install	14.75	6.29	92.93	1.00	92.93
Total		14.75	6.29	92.93	1.00	92.93

* A deemed value. Source: Memo, March 2019, forthcoming, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

Source: ComEd tracking data and Navigant team analysis.

6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

6.1 Impact Parameter Estimates

Navigant calculated verified gross and peak demand savings for the CAC QI measure using the algorithms in the Illinois Technical Reference Manual (TRM), v7 as follows:

Equation 1 Central Air Conditioning Electric Energy Savings: Time of Sale

$$\Delta kWh_{quality\ install} = (FLH_{cooling} * Capacity_{cooling} * \left(\frac{1}{(SEER_{base} * (1 - Derating\ Cool_{base}))} - \frac{1}{(SEER_{ee} * SEER_{adj})} \right) - (FLH_{cooling} * Capacity_{cooling} * \left(\frac{1}{(SEER_{base} * (1 - Derating\ Cool_{base}))} - \frac{1}{(SEER_{ee} * SEER_{adj} * (1 - Derating\ Cool_{ee}))} \right))$$

Equation 2 Central Air Conditioning Summer Peak Demand Savings: Time of Sale

$$\Delta kW_{quality\ install} = (Capacity_{cooling} * \frac{\left(\frac{1}{(EER_{base} * (1 - Derating\ Cool_{base}))} - \frac{1}{(EER_{ee})} \right)}{1000 * CF} - (Capacity_{cooling} * \frac{\left(\frac{1}{(EER_{base} * (1 - Derating\ Cool_{base}))} - \frac{1}{(EER_{ee} * (1 - Derating\ Cool_{eff}))} \right)}{1000 * CF})$$

The following table presents the input parameter source that Navigant used by measure. The IL TRM v7.0 allows for custom or actual values to be used for some of the input parameters. Navigant based these values on the program tracking database when available.

Table 6-1. Navigant Algorithm Inputs for Central Air Conditioning as per Illinois TRM v.7

Variable	Value
Dwelling_Type	Single-Family Home
FLH_cooling_Zone 1	512
FLH_cooling_Zone 2	570
SEER base	13
SEER ee	15
Derating Cool base	0.1
Derating Cool ee	0% if Quality Installation is performed and 10% if Quality Installation is not performed
EER base	10.5
EER ee	12
CF	PJM Summer Peak Coincidence Factor = 46.6%

Source: IL TRM v.7

6.2 Other Impact Findings and Recommendations

At the time of submitting this draft report, Navigant and the implementer have not yet met to review the savings calculators to attempt to resolve the discrepancies in estimated savings values. The final report will contain the results of those meetings and discussions.

However, the evaluation team developed three recommendations based on the evaluation so far:

Finding 1. Because the CY2018 tracking database file contains hardcoded values, Navigant could not determine the input parameters used to estimate savings.

Recommendation 1. Navigant recommends including the savings calculation equations in the program tracking database file rather than hardcoded values.

Recommendation 2. Navigant recommends using the energy saving algorithms based on IL TRM v.7 for both the energy savings and summer peak demand savings.

Recommendation 3. Navigant recommends the implementer reconcile their input parameter values with Table 6-1 which is based on IL TRM v.7 or provide their inputs to Navigant.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

This section discusses the impact analysis methodology Navigant used for the HVAC SAVE Pilot Program. Navigant determined verified gross savings for the CAC QI measure by:

1. Reviewing the savings algorithm equation and inputs in the measure workbook for agreement with the IL TRM 7.0.
2. Reviewing the savings algorithm calculation in the TRM Savings Calculator provided by the implementer.
3. Determining if the savings algorithm was applied correctly.
4. Cross-checking gross-ex ante energy and peak demand saving values with the verified energy and peak demand saving values.

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

Navigant downloaded the final tracking data for the CY2018 impact evaluation from the ComEd Evaluation Share file site. Navigant relied on the following documents to verify the per-unit savings:

- Final CY2018 tracking database files:
 - HVAC: "HVAC_Save_2018_EOY_Data_Rev0_01152019.xlsx"
- TRM Savings Calculator
- Illinois Technical Reference Manual (IL TRM v7.0) for deemed input parameters or secondary evaluation research to verify any custom inputs used in the ex ante calculations.

The following section provides an outline of the differences between the ex ante and verified savings associated with the HVAC SAVE QI measure as part of the HVAC SAVE Pilot Program.

8.1 Central Air Conditioning

Quality installed CACs had an electric energy realization rate of 132% and peak demand energy savings realization rate of 629%. Verified savings have been calculated for 126 CAC installations via the HVAC SAVE Pilot Program.

Table 8-1. Central Air Conditioning Measure Impact Detail

Measure	Project Type	Quantity	Ex ante Gross Savings (kWh)	Ex ante Gross Peak Demand Savings (kW)	Verified Gross Savings (kWh)	Verified Gross kWh Realization Rate	Verified Gross Peak Demand Savings (kW)	Verified Gross kW Realization Rate
CAC	Time of Sale- New Construction, Quality Install	126	14,373	14.75	18,952	1.32	92.93	6.29

Source: ComEd tracking data and Navigant team analysis.

9. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 9-1, below, shows the Total Resource Cost (TRC) table. It includes only the 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 evaluation later.

Table 9-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Reduction (kW)*	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)
HVAC	CAC- Quality Install	Each	126	18	14,373	14.75	18,952	92.93
	Total		126	18	14,373	14.75	18,952	92.93

† EUL is a combination of technical measure life and persistence.

Source: ComEd tracking data and Navigant team analysis.