



Home Energy Rebates

FINAL

Energy Efficiency/Demand Response Plan:
Plan Year 7
(6/1/2014-5/31/2015)

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E. Executive Summary

This report presents a summary of the findings and results from the impact and process evaluation of the PY7¹ Home Energy Rebates program. Under the Home Energy Rebates program, Commonwealth Edison (ComEd) offers cash incentives to encourage its customers to purchase high efficiency air-conditioning systems and to install weatherization measures. ComEd implemented the weatherization portion of the program in coordination with Nicor Gas. To receive a central air-conditioner rebate, customers are required to also install a high efficiency furnace. This report focuses solely on the electric savings from the program. Savings from natural gas measures are included in separate reports.

E.1. Program Savings

Table E-1. summarizes the electric savings from the Home Energy Rebates program.

Table E-1. PY7 Total Program Electric Savings

Savings Category	Energy Savings (MWh)	Demand Savings (MW)	Peak Demand Savings (MW)
Ex Ante Gross Savings	3,970	2.09	N/A
Verified Gross Savings	4,718	4.40	3.02
Verified Net Savings	4,697	4.37	3.00

Source: ComEd tracking data and Navigant team analysis.

E.2. Program Savings by Measure Type

Table E-2. PY7 Program Results by Measure Type

Research Category	Ex Ante Gross Savings (MWh)	Ex-Ante Gross Demand Reduction (MW)	Verified Gross Savings (MWh)	Verified Gross Demand Reduction (MW)	Verified Gross Realization Rate	NTGR	Verified Net Savings (MWh)	Verified Net Demand Reduction (MW)
Central Air Conditioners	3,081	1.58	3,828	3.89	124%	0.99†	3,790	3.85
Weatherization	889	0.51	889	0.51	100%	1.02†	907	0.52
Total	3,970	2.09	4,718	4.40	119%		4,697	4.37

Source: ComEd tracking data and Navigant team analysis.

† A deemed value. Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

¹ The PY7 program year began June 1, 2014 and ended May 31, 2015.

E.3. Program Volumetric Detail

The Home Energy Rebates program had 6,961 participants in PY7 and distributed rebates for 6 measures through 8,541 projects, as shown in Table E-3. Navigant made evaluation adjustments to the ex-ante existing SEER values from the tracking database. These are discussed in Section 3 of the report. Evaluation adjustments resulted in a program level realization rate of 119 percent.

Table E-3. PY7 Volumetric Findings Detail

Participation	ComEd
Participants	6,961
Total Measures	6
Installed Projects	8,541

Source: ComEd tracking data and Navigant team analysis.

E.4. Results Summary

The following table summarizes the key metrics from PY7.

Table E-4. PY7 Results Summary

Participation	Units	PY7
Net Savings	MWh	4,697
Net Demand Reduction	MW	4.37
Gross Savings	MWh	4,718
Gross Demand Reduction	MW	4.40
Gross PJM Peak Demand Reduction	MW	3.02
Program Realization Rate	%	119%
Central Air Conditioner NTG Ratio †	#	0.99
Weatherization NTG Ratio †	#	1.02
Early Replacement Units	#	4,708
Early Replacement Gross Savings	MWh	3,419
Replace on Burnout Units	#	1,938
Replace on Burnout Gross Savings	MWh	410
Customers Touched	#	6,961

Source: ComEd tracking data and Navigant team analysis.

† A deemed value. Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

E.5. Findings and Recommendations

The following provides insight into key program findings and recommendations.² The program had 6,961 program participants that received 8,541 rebates and achieved verified net savings of 4,697 MWh, exceeding its net energy savings target of 1,339 MWh.

Tracking Database

Finding 1. Overall, program tracking has greatly improved from PY6. In PY6, the majority of central air-conditioning projects either did not list a new system capacity or listed a new system capacity that was out of the accepted range (greater than 15,000 and less than 65,000 Btu/hour). In PY7, all projects listed a new system capacity with only one project being out of range.

Finding 2. Approximately half of central air-conditioning projects in PY7 did not list an existing SEER value or were far out of the accepted range, which ComEd communicated to Navigant in PY6 as greater than six and less than 25.

Recommendation 1. Navigant recommends recording existing SEER values where possible in order to accurately capture all possible savings.

Gross Savings Estimates

Finding 3. Navigant found that existing SEER values of “NULL” were incorrectly assigned in the ex-ante estimates. Instead of using the age of the unit to determine an existing SEER, the tracking system showed a SEER of 13 regardless of their age. According to the methodology provided by ComEd in PY6, many of the units should have been assigned an existing SEER of 10, which results in higher unit savings. This discrepancy resulted in a measure level energy realization rate of 124 percent, and a program level energy realization rate of 119 percent.

Recommendation 2. Navigant recommends following the methodology provided by ComEd in PY6 to assign unknown existing SEER values. This will result in more accurate measure level savings and consequently, more accurate program level savings.

² Numbered findings and recommendations in this section are the same as those found in the Findings and Recommendations section of the evaluation report for ease of reference between each section.

1 Introduction

1.1 Program Description

Previously known as the Complete System Replacement Program for ComEd, in PY7 the program underwent a name change to the “Home Energy Rebates Program.” The program offers rebates for high efficiency Central Air Conditioning (CAC) units with a SEER of 14.5 or higher. ComEd implemented the weatherization portion of the program in coordination with Nicor Gas. Previously, customers were required to participate in one of the Nicor Gas and Peoples Gas/North Shore Gas (PG and NSG) furnace rebate programs in order to receive a rebate for their qualifying CAC unit. In PY7, the program no longer required that a participant also receive a furnace rebate from Nicor Gas or PG and NSG, but participants were required to replace their furnace with a unit that met the qualifications for a rebate from either the Nicor Gas or PG and NSG program at the same time in order to receive a rebate for their qualifying CAC unit. Also in PY7, the Home Energy Rebates program introduced several weatherization measures offered in conjunction with Nicor Gas.

ComEd designed the Home Energy Rebates program to conserve electricity and to lower participants’ monthly energy bills. Both rental and owner-occupied dwellings are eligible for rebates for air-conditioning systems and weatherization measures. In order to receive these rebates, customers must be active residential customers of ComEd, and they must use premises in existing buildings for residential purposes.

This evaluation covers the Home Energy Rebates program year that ran from June 1, 2014, through May 31, 2015.

1.2 Evaluation Objectives

The Evaluation Team’s main objectives for the PY7 Home Energy Rebates program were to determine the program’s verified gross and net savings. Process and net-to-gross evaluation efforts will occur in PY8 and PY9, after additional planned program changes are implemented.

2 Evaluation Approach

Navigant calculated the ex-ante gross savings estimates by totaling all paid Home Energy Rebates projects installed during PY7 from the tracking database. To determine verified gross savings for CAC systems, the evaluation team applied the algorithms from the Illinois TRM v3.0 listed in Section 2.2. The evaluation compared ex ante to ex post savings to find the measure- and program-level realization rates for the Home Energy Rebates program. The net-to-gross ratio (NTGR) for this program year was approved through the Illinois Stakeholder Advisory Group (IL SAG) stakeholder consensus process.

2.1 Overview of Data Collection Activities

The core data collection activities included an engineering analysis of the program data. The full set of data collection activities is shown in the following tables.

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When
Program Tracking Database	Participants	Census	Census	September – October 2015
In Depth Interviews	Program Manager/Implementer Staff	2	2	March 2015

Table 2-2. Additional Resources

Reference Source	Application	Gross Impacts	Process
Illinois Statewide Technical Reference Manual for Energy Efficiency Version 3.0	Engineering Analysis	X	N/A

2.2 Verified Savings Parameters

Navigant calculated the verified gross and net savings (energy and coincident peak demand) resulting from the PY7 Home Energy Rebates program using the following algorithms as defined by the Illinois TRM v3.0.³

Equation 2-1. Time of Sale Energy Savings

$$kWh\ Savings = \left(FLH_{cool} \times Btu/hr \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}} \right) \right) / 1000$$

Equation 2-2. Time of Sale Demand Savings

$$kW\ Savings = \left(Btu/hr \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}} \right) \right) / 1000 \times CF$$

³ Available here: <http://www.ilsag.info/technical-reference-manual.html>

Equation 2-3. Time of Sale Demand Savings⁴

$$kW Savings = \left(Btu/hr \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}} \right) \right) / 1000 \times CF_{PJM}$$

Equation 2-4. Early Replacement Energy Savings

$$kWh Savings = \left(FLH_{cool} \times Btu/hr \times \left(\frac{1}{SEER_{exist}} - \frac{1}{SEER_{ee}} \right) \right) / 1000$$

Equation 2-5. Early Replacement Demand Savings

$$kW Savings = \left(\frac{Btu}{hr} \times \left(\frac{1}{EER_{exist}} - \frac{1}{EER_{ee}} \right) \right) / 1000 \times CF$$

Equation 2-6. Early Replacement Demand Savings⁴

$$kW Savings = \left(\frac{Btu}{hr} \times \left(\frac{1}{EER_{exist}} - \frac{1}{EER_{ee}} \right) \right) / 1000 \times CF_{PJM}$$

Where:

- FLH = Full load hours for cooling; based on location and dwelling type
- Btu/hr = Air-conditioner unit capacity, use actual; if “NULL”, < 15,000, or > 65,000, assume 33,600
- SEER_{base} = Seasonal energy efficiency ratio (SEER) rating of base air-conditioner unit; 13
- SEER_{ee} = SEER rating of energy efficient air-conditioner unit, use actual; if “NULL”, < 14.25, or > 25, assume 14.5
- EER_{base} = EER rating of base air-conditioner unit, calculated based on SEER_{base}; see Equation 2-7
- EER_{ee} = EER rating of energy efficient air-conditioner unit, calculated based on SEER_{ee}; see Equation 2-7
- CF = Summer system peak coincidence factor (during system peak hour); 0.915
- CF_{PJM} = PJM summer peak specific coincidence factor (average during PJM peak period); 0.466
- SEER_{exist} = SEER rating of existing air-conditioner unit, see Figure 2-1; logic provided by ComEd in PY6
- EER_{exist} = EER rating of existing air-conditioner unit, calculated based on SEER_{exist}; see Equation 2-7

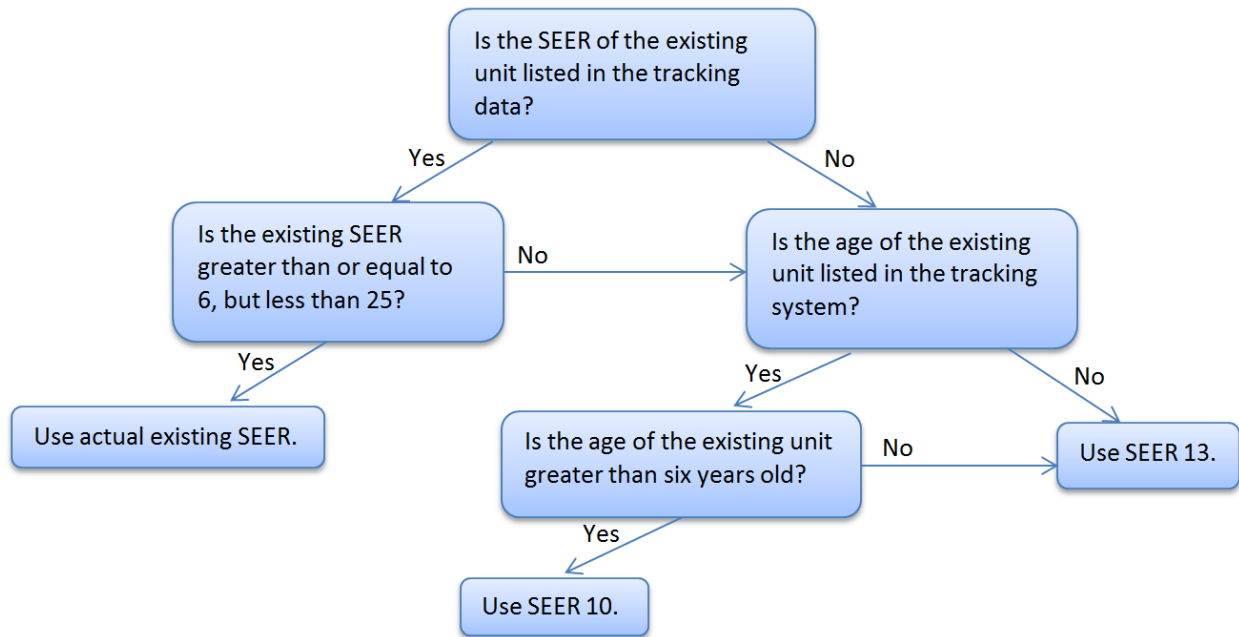
Equation 2-7. SEER to EER Conversion

$$EER = -0.02 \times SEER^2 + 1.12 \times SEER$$

Figure 2-1 below presents the logic used to determine the existing SEER value to be assigned to each air conditioning project. ComEd supplied this logic to Navigant in PY6 and it follows the logic presented in the Illinois TRM v3.0.

⁴ The summer system peak coincidence factor is used to determine verified peak demand reduction, while the PJM summer peak coincidence factor is used to calculate PJM peak demand reduction.

Figure 2-1. SEER_{exist} Logic Tree



Source: Navigant based on logic provided by ComEd in PY6

Table 2-3 presents the parameters that Navigant used in the verified gross and net savings calculations and indicates which were examined through evaluation activities and which were deemed.

Table 2-3. Verified Savings Parameter Data Sources

Gross Savings Input Parameters	Data Source	Deemed or Evaluated
ΔkWh	PY7 EM&V Program Tracking Data Analysis	Evaluated
FLH_{cool}	Illinois TRM v3.0	Deemed from Illinois TRM v3.0
Capacity	PY7 EM&V Program Tracking Data Analysis	Evaluated
$SEER_{base}$	PY7 EM&V Program Tracking Data Analysis	Evaluated
$SEER_{exist}$	PY7 EM&V Program Tracking Data Analysis	Evaluated
$SEER_{ee}$	PY7 EM&V Program Tracking Data Analysis	Evaluated
ΔkW	PY7 EM&V Program Tracking Data Analysis	Evaluated
EER_{base}	PY7 EM&V Program Tracking Data Analysis	Evaluated
EER_{exist}	PY7 EM&V Program Tracking Data Analysis	Evaluated
EER_{ee}	PY7 EM&V Program Tracking Data Analysis	Evaluated
CF	Illinois TRM v3.0	Deemed from Illinois TRM v3.0

Source: Navigant analysis

2.2.1 Verified Gross Program Savings Analysis Approach

Navigant performed a tracking system review to determine if the system provided all necessary information for evaluation purposes. For some of the CAC units, there were fields marked as “NULL” in the tracking system. Navigant used savings algorithms and assumptions provided by ComEd to calculate savings for these units. To review ex ante gross savings estimates, Navigant totaled the energy savings listed for all paid projects in PY7. Navigant calculated the verified gross savings using algorithms from the Illinois TRM v3.0, using assumptions provided by ComEd, as well as actual values taken from the tracking database. In cases where projects were missing information in the ComEd tracking system, Navigant used default values provided by ComEd. The verified gross realization rate is the ratio of the verified gross savings estimates divided by the ex-ante gross savings estimate.

For weatherization projects, in PY4 Navigant performed a thorough literature review to compare evaluated savings values for projects with weatherization offerings similar to those found in the current Home Energy Rebates program. Based on the findings from the literature review, Navigant determined that the savings values from CLEAResult’s EnergyMeasure® HOME (EM HOME) model compare favorably with evaluated savings for similar programs and climates. Navigant accepted CLEAResult’s weatherization measure savings assumptions for PY7. Further detail on Navigant’s weatherization literature review can be found in the PY4 Home Energy Saving Report.⁵

2.2.2 Verified Net Program Savings Analysis Approach

Verified net energy and demand (coincident peak and overall) savings were calculated by multiplying the Verified Gross Savings estimates by a predetermined net-to-gross ratio (NTGR). In PY7, the NTGR estimates used to calculate the Net Verified Savings were based on past evaluation research and approved through a consensus process by the Illinois Stakeholder Advisory Group.⁶

2.3 Process Evaluation

Navigant’s process evaluation is planned for PY8 and PY9, after the planned program changes are implemented and the new program processes can be effectively evaluated.

⁵ Energy Efficiency ComEd Plan Year 4, Nicor Gas Plan Year 1 (6/1/2011-5/31/2012) evaluation Report: Home Energy Savings Program. May 2013.

⁶ Source: ComEd ComEd_NTG_History_and_PY7_Recommendation_2014-02-8_Final_EMV_Recommendations.xlsx which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

3 Gross Impact Evaluation

This section discusses Navigant’s gross impact evaluation results. The tracking system review uncovered one discrepancy. Navigant used the tracking system data to review the ex-ante gross savings, and to calculate the verified gross savings. Navigant calculated the verified gross realization rate using the ex-ante gross savings and the verified gross savings.

3.1 Tracking System Review

Navigant performed a tracking system review to determine if the system provided all necessary evaluation information. All the necessary fields for calculating energy and demand savings are present, but not all fields held values. In these cases, Navigant assumed default values.

The key findings of the tracking system review include the following:

1. Approximately half of central air-conditioning projects in PY7 did not list an existing SEER value or were far out of the accepted range, which ComEd communicated to Navigant in PY6 as greater than six and less than 25. In these cases, Navigant used default existing SEER values of 10 for early replacement projects, or 13 for time-of-sale projects.
2. In general, program tracking has greatly improved from PY6. In PY6, the majority of central air-conditioning projects either did not list a new system capacity or listed a new system capacity that was out of the accepted range (greater than 15,000 and less than 65,000 Btu/hour). In PY7, all projects listed a new system capacity with only one project being out of range.

3.2 Program Volumetric Findings

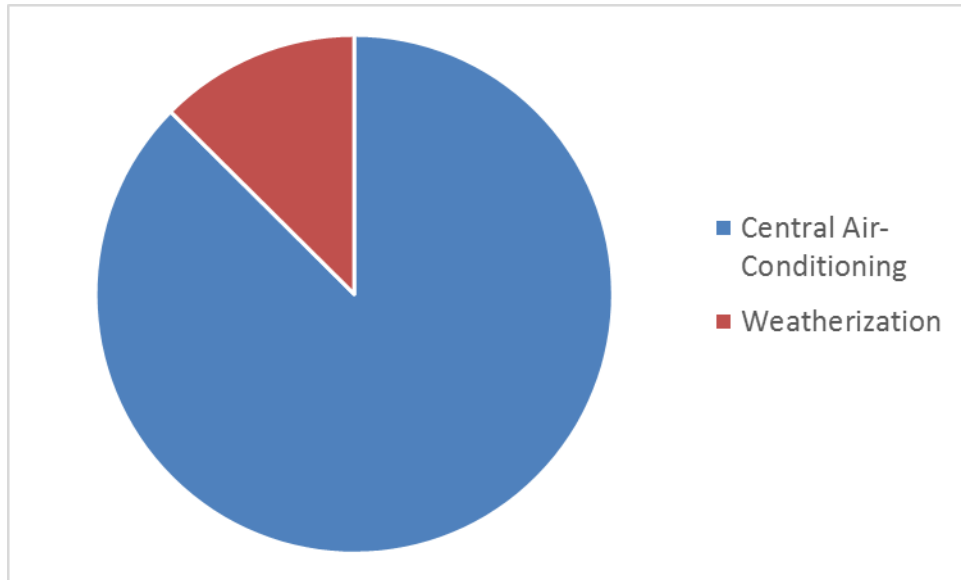
The Home Energy Rebates program had 6,961 participants in PY7 and distributed rebates for six measures through 8,541 projects, as shown in Table 3-1. This is 20 percent less than the number of projects in PY6 (10,706 total projects).

Table 3-1. PY7 Volumetric Findings Detail

Participation	ComEd
Participants	6,961
Total Measures	6
Installed Projects	8,541

Source: ComEd tracking data and Navigant team analysis.

Figure 3-1. Number Of Participants by Measure Type



Source: Evaluation Analysis

3.3 Gross Program Impact Parameter Estimates

The evaluation team conducted research to validate the parameters that the Illinois TRM v3.0 did not specify. Table 3-2 shows the results.

Table 3-2. Verified Gross Savings Parameters

Input Parameters	Value	Default*	Source
FLH _{cool}	Chicago, Single Family	570	Illinois TRM v3.0
	Chicago, Multi-Family	506	
	Rockford, Single Family	512	
	Rockford, Multi-Family	467	
Capacity	Actual if within the range of greater than 15,000 Btuh and less than 65,000 Btuh	33,600	Evaluated*
SEER _{base}	Actual if within the range of greater than 6 and less than 25	13	Evaluated*
SEER _{exist}	Actual if within the range of greater than 6 and less than 25	10	Evaluated*
SEER _{ee}	Actual if within the range of greater than 14.25 and less than 25	14.5	Evaluated*
EER _{base}	Actual based on SEER _{base} ; calculated	11.18	Evaluated*
EER _{exist}	Actual based on SEER _{exist} ; calculated	9.2	Evaluated*
EER _{ee}	Actual based on SEER _{ee} ; calculated	12.0	Evaluated*
CF	68%	91.5%	Illinois TRM v3.0
CF _{PJM}	46.6%	46.6%	Illinois TRM v3.0

*Navigant used default values if actual data was not available in the tracking system. The source of the default values was the Illinois TRM v3.0.

Source: Navigant analysis

In PY4 Navigant performed a thorough literature review to compare evaluated savings values for projects with weatherization offerings similar to those found in the current Home Energy Rebates program. Based on the findings from the literature review, Navigant determined that the savings values from CLEAResult's EnergyMeasure® HOME (EM HOME) model compare favorably with evaluated savings for similar programs and climates. Navigant accepts CLEAResult's weatherization measure savings assumptions for PY7. Further detail on Navigant's weatherization literature review can be found in the PY4 Home Energy Saving Report.⁷

⁷ Energy Efficiency ComEd Plan Year 4, Nicor Gas Plan Year 1 (6/1/2011-5/31/2012) Evaluation Report: Home Energy Savings Program. May 2013.

3.4 Verified Gross Program Impact Results

To determine the verified gross savings, Navigant calculated savings for each project using the Illinois TRM v3.0 algorithm and assumptions shown in Section 2.2. As Table 3-3 below illustrates, the resulting total program verified gross savings was 4,718 megawatt-hours (MWh) and 4.40 megawatts (MW).

Navigant found that existing SEER values of “NULL” were under estimated in the ex-ante estimates. The tracking system showed a SEER of 13 regardless of their age, instead of using the age of the unit to determine an existing SEER. Many of the units should have been assigned an existing SEER of 10, which would result in higher unit savings, according to the methodology provided by ComEd in PY6. Adjusting for the existing SEER resulted in a measure level energy realization rate of 124 percent, and a program level energy realization rate of 119 percent.

Table 3-3. PY7 Verified Gross Impact Savings Estimates by Measure Type

	Sample Size	Gross Energy Savings (MWh)	Significance 90/10	Gross Peak Demand Savings (MW)	Significance 90/10
Central Air-Conditioners					
Ex-Ante Gross Savings		3,081		1.58	
Verified Gross Realization Rate	Census	124%	NA†	246%	NA†
Verified Gross Savings		3,828		3.89	
Weatherization Measures					
Ex-Ante Gross Savings		889		0.51	
Verified Gross Realization Rate	Census	100%	NA†	100%	NA†
Verified Gross Savings		889		0.51	
Total					
Ex-Ante Gross Savings		3,970		2.09	
Verified Gross Realization Rate	Census	119%	NA†	210%	NA†
Verified Gross Savings		4,718		4.40	

Source: Evaluation Team analysis.

†NA when the TRM determines the gross savings.

4 Net Impact Evaluation

The PY7 program achieved verified net savings of 4,697 MWh and net peak demand reduction of 4.37 MW. The IL SAG determined⁸ that the NTGR for this program should be deemed prospectively and used to calculate verified net savings. The table below shows deemed NTGR and PY7 verified net savings. As the table below demonstrates, central air conditioning units were the largest contributing measure to program savings, accounting for 81 percent of the program savings.

Table 4-1. PY7 Verified Net Impact Savings Estimates by Measure Type

	Energy Savings (MWh)	Coincident Peak Demand Savings (MW)
Central Air Conditioners		
Ex-Ante PY7 Gross Savings	3,081	1.58
Realization Rate	124%	246%
Verified Gross Savings	3,828	3.89
NTG	0.99	0.99
Verified Net Savings	3,790	3.85
Weatherization Measures		
Ex-Ante PY7 Gross Savings	889	0.51
Realization Rate	100%	100%
Verified Gross Savings	889	0.51
NTG	1.02	1.02
Verified Net Savings	907	0.52
Total		
Ex-Ante PY7 Gross Savings	3,970	2.09
Realization Rate	119%	210%
Verified Gross Savings	4,718	4.40
NTG	1.00	0.99
Verified Net Savings	4,697	4.37

Source: Evaluation Team analysis.

⁸ Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

5 Findings and Recommendations

This section summarizes the key impact findings and recommendations.² The program had 6,961 program participants that received 8,541 rebates and achieved verified net savings of 4,697 MWh, exceeding its net energy savings target of 1,339 MWh.

Tracking Database

Finding 1. Overall, program tracking has greatly improved from PY6. In PY6, the majority of central air-conditioning projects either did not list a new system capacity or listed a new system capacity that was out of the accepted range (greater than 15,000 and less than 65,000 Btu/hour). In PY7, all projects listed a new system capacity with only one project being out of range.

Finding 2. Approximately half of central air-conditioning projects in PY7 did not list an existing SEER value or the values listed were far out of the accepted range, which ComEd communicated to Navigant in PY6 as greater than six and less than 25.

Recommendation 1. Navigant recommends recording existing SEER values where possible in order to accurately capture all possible savings.

Gross Savings Estimates

Finding 3. Navigant found that existing SEER values of “NULL” were incorrectly assigned in the ex-ante estimates. Instead of using the age of the unit to determine an existing SEER, the tracking system showed a SEER of 13 regardless of their age. According to the methodology provided by ComEd in PY6, many of the units should have been assigned an existing SEER of 10, which results in higher unit savings. This discrepancy resulted in a measure level energy realization rate of 124 percent, and a program level energy realization rate of 119 percent.

Recommendation 2. Navigant recommends following the methodology provided by ComEd in PY6 to assign unknown existing SEER values. This will result in more accurate measure level savings and consequently, more accurate program level savings.