



# ComEd Home Energy Assessment Impact Evaluation Report

Energy Efficiency / Demand Response Plan:  
Plan Year 9 (PY9)

Presented to  
ComEd

DRAFT

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***Prepared by:***

Christine Zook  
Navigant

Jennifer Ma  
Navigant

[www.navigant.com](http://www.navigant.com)

**Submitted to:**

ComEd  
Three Lincoln Centre  
Oakbrook Terrace, IL 60181

**Submitted by:**

Navigant Consulting, Inc.  
150 N. Riverside, Suite 2100  
Chicago, IL 60606

**Contact:**

Randy Gunn, Managing Director  
312.583.5714  
Randy.Gunn@Navigant.com

Jeff Erickson, Director  
608.497.2322  
Jeff.Erickson@Navigant.Com

Patricia Plympton, Associate Director  
202.253.9356  
Patricia.Plympton@Navigant.com

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## 1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's PY9 Home Energy Assessments (HEA) Program. It presents a summary of the energy and demand impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis method. PY9 covers June 1, 2016 through December 31, 2017.

## 2. PROGRAM DESCRIPTION

The HEA program is an assessment and direct install program jointly implemented by ComEd and Peoples Gas and North Shore Gas (PGL/NSG) with Franklin Energy Services implementing the program in the PGL/NSG territory. The program is also jointly implemented by ComEd and Nicor Gas with CLEAResult implementing the program in the Nicor Gas territory. This report focuses solely on the electric savings from the program. Savings from natural gas measures are included in separate evaluation reports. The primary objective of this residential direct install program was to secure energy savings through direct installation of low-cost efficiency measures such as: water efficient showerheads and faucet aerators, pipe insulation, programmable thermostats, reprogramming programmable thermostats, co-pay smart thermostats, advanced power strips, compact florescent lamps (CFLs), and LEDs at eligible single-family residences.

The secondary objective of this program was to function as the “gateway” for homeowners to participate in other residential programs. HEA performs a brief assessment of the major retrofit opportunities (e.g., furnace, boiler, air conditioning, insulation, and air sealing) and brings heightened awareness to the homeowners about efficiency programs offered by ComEd, Peoples Gas, North Shore Gas, and Nicor Gas.

In PY9, the program had 22,566 participants, performed 23,150 unique projects, performed 23,736 assessments and installed 664,371 measures as shown in the following table and graph.

**Table 2-1. PY9 Volumetric Findings Detail**

Participation	Franklin Energy in PGL NSG Territory	CLEAR Result in Nicor Gas Territory	Program Overall
Participants*	12,572	9,994	22,566
Unique Projects†	13,000	10,150	23,150
Assessments	13,194	10,542	23,736
Total Measures	383,733	280,638	664,371
Number of Units/Project	29.5	27.6	57.2
Direct Install Measures (non-CFLs or LEDs)	22,055	10,969	33,024
CFL Installations	56,165	33,269	89,434
LED Installations	305,513	236,400	541,913
Bathroom Faucet Aerator	133	357	490
Kitchen Faucet Aerator	56	101	157
Pipe Insulation	262	396	658
Programmable Thermostats	2,673	1,108	3,781
Reprogramming Thermostats	2,682	0	2,682
Showerheads	171	409	580
Advanced Power Strips	14,995	6,485	21,480
Smart Thermostats	1,083	1,138	2,221
Thermostat Education	0	975	975

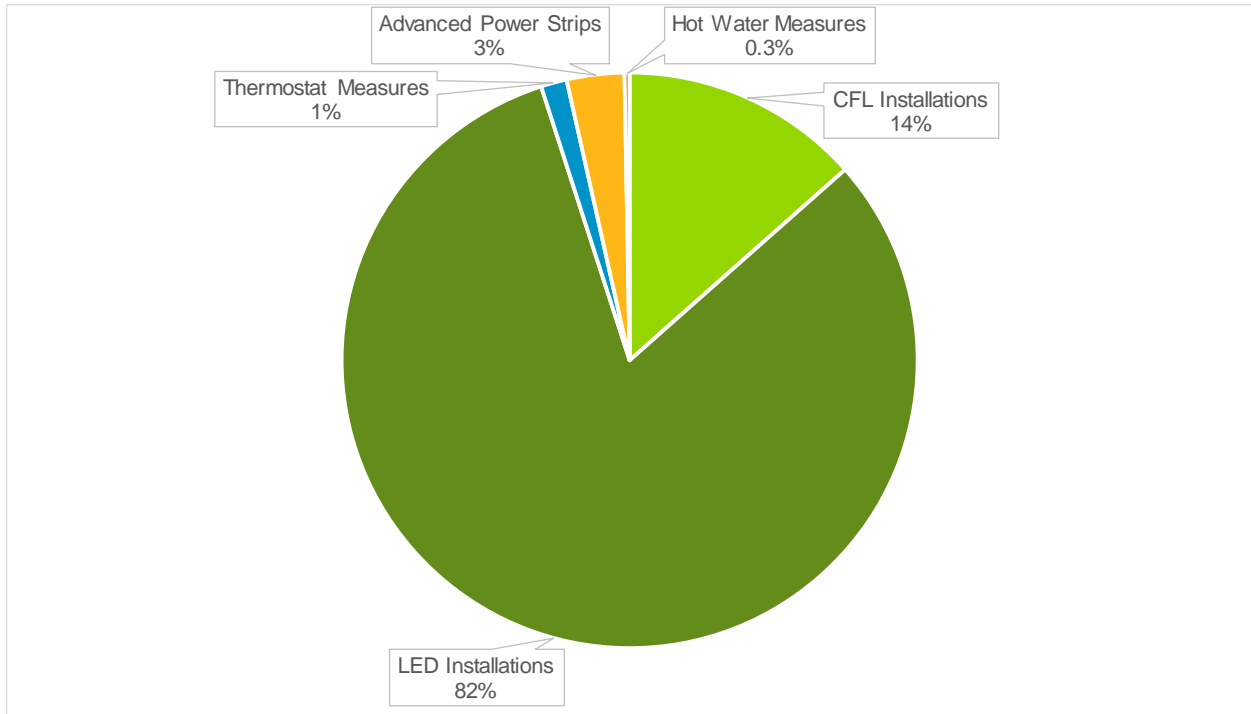
Source: ComEd tracking data and Navigant team analysis.

\* Participants are defined as unique ComEd account numbers

† Unique Projects are defined as unique Project ID's

Figure 2-1 shows measure installations by type.

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



Source: Evaluation Analysis

### 3. PROGRAM SAVINGS

Table 3-1 summarizes the incremental energy and demand savings the HEA Program achieved in PY9.

**Table 3-1. PY9 Total Annual Incremental Savings**

Savings Category	Energy Savings (MWh)	Demand Savings (MW)	Peak Demand Savings (MW)
Ex Ante Gross Savings	30,798	NA	4.284
Program Gross Realization Rate	100%	NA	83%
Verified Gross Savings	30,676	31.312	3.575
Program Net-to-Gross Ratio (NTGR)	Varies	Varies	Varies
Verified Net Savings	25,211	25.292	2.977

Source: ComEd tracking data and Navigant team analysis.

### 4. PROGRAM SAVINGS BY MEASURE

The following tables show energy savings, demand savings, and coincidence peak demand savings by measure group. In PY9, the program included 11 measures with savings. LED and CFL installations had 21 individual measures with distinct baseline fixtures, retrofit fixtures, and installation locations. LED installations contributed most of the savings at 77 percent, followed by advanced power strips at 11 percent, and CFL installations at eight percent. The total technical measure life, persistence, and effective

useful life (EUL) for the program is a weighted average of the measures based on the verified gross savings.

**Table 4-1. PY9 Energy Savings by Measure**

End Use Type	Research Category	Ex Ante Gross Savings (MWh)	Verified Gross Realization Rate	Verified Gross Savings (MWh)	NTGR *	Verified Net Savings (MWh)	Technical Measure Life	Persistence	Effective Useful Life (EUL)†
Lighting	CFL Installations	2,322	100%	2,316	0.80	1,853	5		5
Lighting	LED Installations	23,707	100%	23,649	0.80	18,919	10		10
HVAC	Programmable Thermostats	271	91%	246	0.90	222	10	5	5
HVAC	Reprogramming Thermostats	165	94%	155	0.90	140	10	8	2
HVAC	Thermostat Education	89	92%	82	0.90	73	10		10
HVAC	Smart Thermostats	496	96%	475	NA‡	475	10	8	2
Hot Water	Bathroom Faucet Aerator	8	118%	9	0.80	7	9		9
Hot Water	Kitchen Faucet Aerator	21	90%	18	0.80	15	9		9
Hot Water	Pipe Insulation	18	87%	16	0.80	12	15		15
Hot Water	Showerheads	190	104%	198	0.80	158	10		10
Electronics	Advanced Power Strips	3,511	100%	3,511	0.95	3,335	8		8
<b>Total</b>		<b>30,798</b>	<b>100%</b>	<b>30,676§</b>	<b>Varies</b>	<b>25,211§</b>	<b>9</b>		<b>9</b>

Source: ComEd tracking data and Navigant team analysis.

\* A deemed value. Source: ComEd\_NTG\_History\_and\_PY9\_Recommendations\_2016-02-26\_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

‡ The IL TRM algorithm calculates net savings for smart thermostats.

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

§ Values do not add due to rounding.

**Table 4-2. PY9 Demand Savings by Measure**

End Use Type	Research Category	Ex Ante Gross Demand Reduction (MW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (MW)	NTGR†	Verified Net Demand Reduction (MW)
Lighting	CFL Installations	NA*	NA	3.051	0.80	2.440
Lighting	LED Installations	NA	NA	25.387	0.80	20.309
HVAC	Programmable Thermostats	NA	NA	NA	0.90	NA
HVAC	Reprogramming Thermostats	NA	NA	0.000	0.90	0.000
HVAC	Thermostat Education	NA	NA	0.000	0.90	0.000
HVAC	Smart Thermostats	NA	NA	0.670	NA‡	0.670
Hot Water	Bathroom Faucet Aerator	NA	NA	0.554	0.80	0.443
Hot Water	Kitchen Faucet Aerator	NA	NA	0.214	0.80	0.171
Hot Water	Pipe Insulation	NA	NA	0.002	0.80	0.001
Hot Water	Showerheads	NA	NA	0.718	0.80	0.574
Electronics	Advanced Power Strips	NA	NA	0.717	0.95	0.681
<b>Total</b>		<b>NA</b>	<b>NA</b>	<b>31.312§</b>	<b>Varies</b>	<b>25.292§</b>

Source: ComEd tracking data and Navigant team analysis.

\*Implementation contractors did not report ex ante gross demand reduction.

†A deemed value. Source: ComEd\_NTG\_History\_and\_PY9\_Recommendations\_2016-02-26\_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

‡ The IL TRM algorithm calculates net savings for smart thermostats.

§ Values do not add due to rounding.

**Table 4-3. PY9 Peak Demand Savings by Measure**

End Use Type	Research Category	Ex Ante Gross Demand Reduction (MW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (MW)	NTGR*	Verified Net Demand Reduction (MW)
Lighting	CFL Installations	0.228	99%	0.226	0.80	0.181
Lighting	LED Installations	2.562	101%	2.581	0.80	2.065
HVAC	Programmable Thermostats	0.691	NA	NA	0.90	NA
HVAC	Reprogramming Thermostats	0.000	NA	0.000	0.90	0.000
HVAC	Thermostat Education	0.000	NA	0.000	0.90	0.000
HVAC	Smart Thermostats	0.199	78%	0.156	NA†	0.156
Hot Water	Bathroom Faucet Aerator	0.012	98%	0.012	0.80	0.010
Hot Water	Kitchen Faucet Aerator	0.005	98%	0.005	0.80	0.004
Hot Water	Pipe Insulation	0.002	86%	0.002	0.80	0.001
Hot Water	Showerheads	0.017	115%	0.020	0.80	0.016
Electronics	Advanced Power Strips	0.567	101%	0.573	0.95	0.545
<b>Total</b>		<b>4.284‡</b>	<b>83%</b>	<b>3.575‡</b>	<b>Varies</b>	<b>2.977‡</b>

Source: ComEd tracking data and Navigant team analysis.

\* A deemed value. Source: ComEd\_NTG\_History\_and\_PY9\_Recommendations\_2016-02-26\_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† The IL TRM algorithm calculates net savings for smart thermostats.

‡ Values do not add due to rounding.

## 5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

### Impact Parameter Estimates

Table 5-1 summarizes the parameters and references used in verified gross and net savings calculation. Navigant calculated savings for each measure following algorithms defined by the Illinois TRM version 5.0 which can be found in Appendix 1. Impact Analysis Methodology.



**Table 5-1. Verified Gross Savings Parameters**

Research Category	Ex Ante and Verified Gross Savings (kWh/unit)	Deemed or Evaluated?	Source
Quantity	Varies	Evaluated	Program Tracking Data
NTGR	Varies		IL SAG Consensus*
CFL Installations	Varies		IL TRM v5.0 - Section 5.5†
LED Installations	Varies		IL TRM v5.0 - Section 5.5†
Programmable Thermostats	Varies		IL TRM v5.0 - Section 5.3.11†
Reprogramming Thermostats	Varies		IL TRM v5.0 - Section 5.3.11†
Thermostat Education	Varies		IL TRM v5.0 - Section 5.3.11†
Smart Thermostats	Varies		IL TRM v5.0 - Section 5.3.16†
Bathroom Faucet Aerator	Varies		IL TRM v5.0 - Section 5.4.4†
Kitchen Faucet Aerator	Varies		IL TRM v5.0 - Section 5.4.4†
Pipe Insulation	Varies		IL TRM v5.0 - Section 5.4.1†
Showerheads	Varies		IL TRM v5.0 - Section 5.4.5†
Advanced Power Strip	Varies		IL TRM v5.0 - Section 5.2†

\* ComEd\_NTG\_History\_and\_PY9\_Recommendations\_2016-02-26\_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

† State of Illinois Technical Reference Manual version 5.0 from <http://www.ilsag.info/technical-reference-manual.html>.

## Other Impact Findings and Recommendations

The following provides insight into key program findings and recommendations.

### Program Participation

**Finding 1.** In PY9, the program had 22,566 participants, performed 23,150 unique projects, performed 23,736 assessments and installed 664,371 measures. Navigant found that 586 participants who had assessments (2% of the assessments) did not have any of the recommended measures installed in the home.

**Recommendation 1.** Navigant recommends interviewing participants in CY2018 to better understand the reasons why some request the assessment but do not follow through with installing measures to better understand customers’ decision-making and decrease the number of home with assessments but no installed measures.

### Tracking System Review

**Finding 2.** The TRM does not give a concrete definition to distinguish single-family homes from smaller multi-family homes such as duplex, tri-plex, quadplex and households when selecting TRM assumptions for several measures. In the tracking database’s measure description, the implementers included identifiers for home types such as two-unit, condo, and triplex. However, the implementers applied single-family input parameters to all home types. To increase the accuracy of the savings associated with these measures, Navigant applied multi-family parameters to home types defined as multi-family, as detailed in Table 7-1.<sup>1</sup> This home type discrepancy affected savings for CFL installations, LED installations,

<sup>1</sup> Per email from Navigant to ComEd “RE: Navigant Request: Res Building Types”, 1/29/2018.

programmable thermostats, re-programming thermostats, thermostat education, smart thermostats, aerators, and showerheads.

**Recommendation 2.** Navigant recommends the implementers follow the Energy Information Administration (EIA)'s definition of single-family and multi-family homes for building types<sup>2</sup>. In 2015, the EIA defined single-detached, single-family and duplex as single-family and two-unit, condo, triplex, quadplex, and five or more units as multi-family.

### Verified Gross Impacts and Realization Rate

**Finding 3.** The PY9 HEA program achieved 30,676 MWh of verified gross energy savings. The overall gross program realization rate for energy savings is 100 percent. Although the overall program realization rate is 100 percent, there was some variability in realization rates at the measure level. Recommendations three through 11 summarize the recommendations at the measure level from Appendix 2. Impact Analysis Detail.

**Recommendation 3.** Navigant recommends the implementers verify that the coincidence factors (CF) for LED candelabra bulbs match the install locations to prevent the use of interior CF values for bulbs installed in exterior locations.

**Recommendation 4.** Navigant recommends the implementers update their tracking data savings for LED 15W bulbs to accurately represent the retrofit wattage as 15W instead of 19W.

**Recommendation 5.** Navigant recommends the implementers update their tracking data savings for LED 5W Globe bulbs to accurately represent the baseline wattage as 40W instead of 45W.

**Recommendation 6.** Navigant recommends the implementers cap thermostat quantities at one per project for single family homes and the number of units for multi-family buildings to accurately follow thermostat saving guidelines outlined in the IL TRM.

**Recommendation 7.** Navigant recommends the implementers do not claim peak demand savings for programmable thermostats. Guidelines in the IL TRM state that summer coincident peak demand savings are not applicable due to there being no savings from cooling during the summer peak period.

**Recommendation 8.** Navigant recommends the implementers make sure that the baseline shown in the measure name and in the "Baseline" field are consistent for smart thermostat installations to avoid calculating baseline energy using an incorrect baseline thermostat.

**Recommendation 9.** Navigant recommends the implementers do not claim peak demand savings for smart thermostats in buildings without cooling systems to properly follow the algorithm for smart thermostat energy savings outlined in the IL TRM.

**Recommendation 10.** Navigant recommends both implementers use  $CF_{PJM}$  to calculate smart thermostat peak demand savings to support ComEd's PJM compliance requirements.

**Recommendation 11.** Navigant recommends the implementers make sure that R\_new values for "Pipe Insulation – Electric" measures are recorded as 3.8 and not 38.

**Finding 4.** The PY9 HEA program achieved 31.312 MW of verified gross demand reduction and 3.575 MW of verified gross peak demand reduction. We cannot calculate the gross program realization rate for demand savings as the implementers did not track gross demand reduction. The gross program realization rate for peak demand savings is 83 percent. The reason for this discrepancy is because the implementers claimed peak demand savings for programmable thermostats where the evaluation did not, using the guidelines in the IL TRM for this measure. See Recommendation 7 above.

### Verified Net Impacts

**Finding 5.** The evaluation used varying deemed net-to-gross (NTG) values depending on the measure to calculate verified net savings of 25,211 MWh, verified net demand reduction of

<sup>2</sup> <https://www.eia.gov/consumption/residential/terminology.php#s>

25.292 MW and verified net peak demand reduction of 2.977 MW. In PY9, the HEA program exceeded its net savings forecast of 24,490 MWh by 721 MWh.

## 6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant calculated verified gross and net savings using the following algorithms as defined by the IL TRM v5.0 in PY9.

### CFL and LED Replacement

Verified Gross Annual kWh Savings = Program Bulb Quantity \* ΔWatts/1000 \* ISR \* HOU \* WHF<sub>energy</sub>

**Where:**

- ΔWatts = Difference between Baseline Wattage and Efficient (LED) Wattage, Evaluated
- HOU = Annual Hours of Use, Deemed
- WHF<sub>energy</sub> = Energy Waste Heat Factor, Deemed

Verified Gross Annual kW Savings = Program Bulb Quantity \* ΔWatts/1000

Verified Gross Annual Peak kW Savings = Gross Annual kW Savings \* Peak Load Coincidence Factor \* WHF<sub>demand</sub>

**Where:**

- Peak Load Coincidence Factor is calculated as the percentage of program bulbs turned on during peak hours (weekdays from 1 to 5 p.m.) throughout the summer.
- WHF<sub>demand</sub> = Demand Waste Heat Factor

### Low Flow Faucet Aerators

Verified Gross Annual kWh Savings = ((GPM<sub>base</sub> \* L<sub>base</sub> – GPM<sub>low</sub> \* L<sub>low</sub>) \* Household \* 365.25 \* DF / FPH) \* EPG<sub>electric</sub> \* ISR

**Where:**

- GPM<sub>base</sub> = Average baseline flowrate, Gallons per minute, Deemed
- L<sub>base</sub> = Average baseline daily faucet use per capita, Deemed
- GPM<sub>low</sub> = Average low flowrate, Gallons per minute, Deemed
- L<sub>low</sub> = Average baseline daily faucet use per capita, Deemed
- Household = Average number of people per household, Deemed
- 365.25 = Number of days per year
- DF = Drain Factor, Deemed
- FPH = Faucets per household, Deemed
- EPG<sub>electric</sub> = Energy per gallon of water used supplied by electric water heater, Deemed
- ISR = In Service Rate, Deemed

Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU

Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU \* CF

## Low Flow Showerheads

Verified Gross Annual kWh Savings =  $((\text{GPM}_{\text{base}} * L_{\text{base}} - \text{GPM}_{\text{low}} * L_{\text{low}}) * \text{Household} * \text{SPCD} * 365.25 \text{ SPH}) * \text{EPG}_{\text{electric}} * \text{ISR}$

**Where:**

- SPCD = Showers per capita per day, Deemed
- SPH = Showers per household, Deemed

Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU  
 Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU \* CF

## Advanced Power Strips

**Tier 1:**

Verified Gross Annual kWh savings = Deemed Energy Savings Per Unit  
 Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU  
 Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU \* CF

**Tier 2:**

Verified Gross Annual kWh savings = Energy Reduction Percentage (ERP) \* Baseline Energy \* ISR  
 Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU  
 Verified Gross Annual Peak kW Savings = Gross Annual Energy Savings / HOU \* CF

## Programmable Thermostats, Reprogramming Thermostats, Thermostat Education

Verified Gross Annual kWh Savings = Electric Heating Consumption \* Heating Reduction \* HF \* ISR +  $(\Delta\text{Therms} * F_e * 29.3)$

**Where:**

- Heating Reduction = Assumed percentage reduction in total household heating energy consumption due to programmable thermostat, Deemed
- HF = Household Factor, Deemed
- ISR = In Service Rate, Deemed
- $F_e$  = Furnace fan energy consumption as a percentage of annual fuel consumption, Deemed
- 29.3 = kWh per therm conversion
- $\Delta\text{Therms}$  is calculated as follows

$\Delta\text{Therms} = \% \text{Fossil Heat} * \text{Gas Heating Consumption} * \text{Heating Reduction} * \text{HF} * \text{ISR}$

## Water Heater Pipe Insulation

Verified Gross Annual kWh Savings =  $((1/R_{\text{exist}} - 1/R_{\text{new}}) * \text{Length of Insulation} * \text{Circumference of Pipe} * \Delta T * 8,766) / (\text{Water Heater Efficiency} * 3,413)$

**Where:**

- $R_{\text{exist}}$  = Existing pipe thermal resistance, Deemed
- $R_{\text{new}}$  = Total pipe thermal resistance after adding insulation, claimed based on pipe insulation used

- $\Delta T$  = Temperature difference between the water in the pipe and the surrounding air, Deemed
- 3,413 = Conversion from BTU to kWh

## Deemed Values

Navigant calculated verified gross direct install savings for the PY9 HEA program using algorithms, assumptions, and input parameters defined in the Illinois TRM v5.0. Table 6-1 shows the deemed input values used in these algorithms and calculations

**Table 6-1. TRM Deemed Savings Input Parameters Used in Ex Post Analysis**

Verified Gross and Net Input Parameters	Value	Data Source
CFL In-Service Rate (ISR)	0.969	IL TRM v5.0, Section 5.5.1
CFL HOU (Interior / Exterior)	793 / 2,475	IL TRM v5.0, Section 5.5.1
CFL WHF <sub>energy</sub> (SF Interior / MF Interior / Exterior)	1.06 / 1.04 / 1.00	IL TRM v5.0, Section 5.5.1
CFL WHF <sub>demand</sub> (SF Interior / MF Interior / Exterior)	1.11 / 1.07 / 1.00	IL TRM v5.0, Section 5.5.1
CFL CF	0.074	IL TRM v5.0, Section 5.5.1
LED ISR	0.969	IL TRM v5.0, Section 5.5.8
LED HOU (Interior / Exterior)	759 / 2,475	IL TRM v5.0, Section 5.5.8
LED WHF <sub>energy</sub> (SF Interior / MF Interior / Exterior)	1.06 / 1.04 / 1.00	IL TRM v5.0, Section 5.5.8
LED WHF <sub>demand</sub> (SF Interior / MF Interior / Exterior)	1.11 / 1.07 / 1.00	IL TRM v5.0, Section 5.5.8
LED CF	0.071	IL TRM v5.0, Section 5.5.8
Faucet Aerator GPM <sub>base</sub>	1.39	IL TRM v5.0, Section 5.4.4
Faucet Aerator L <sub>base</sub> (Kitchen / Bathroom)	4.5 / 1.6	IL TRM v5.0, Section 5.4.4
Faucet Aerator GPM <sub>low</sub>	0.94	IL TRM v5.0, Section 5.4.4
Faucet Aerator L <sub>low</sub> (Kitchen / Bathroom)	4.5 / 1.6	IL TRM v5.0, Section 5.4.4
Faucet Aerator Household (Single Family / Multi Family)	2.56 / 2.1	IL TRM v5.0, Section 5.4.4
Faucet Aerator DF (Kitchen / Bathroom)	0.75 / 0.90	IL TRM v5.0, Section 5.4.4
Faucet Aerator FPH (Kitchen / SF Bath / MF Bath)	1 / 2.83 / 1.5	IL TRM v5.0, Section 5.4.4
Faucet Aerator EPG <sub>electric</sub> (Kitchen / Bath)	0.0969 / 0.0795	IL TRM v5.0, Section 5.4.4
Faucet Aerator ISR (SF / MF Kitchen / MF Bath)	0.95 / 0.91 / 0.95	IL TRM v5.0, Section 5.4.4
Faucet Aerator HOU (SF K / SF B / MF K / MF B)	94 / 14 / 77 / 22	IL TRM v5.0, Section 5.4.4
Faucet Aerator CF	0.022	IL TRM v5.0, Section 5.4.4
Shower GPM <sub>base</sub>	2.67	IL TRM v5.0, Section 5.4.5
Shower L <sub>base</sub>	7.8	IL TRM v5.0, Section 5.4.5
Shower GPM <sub>low</sub>	1.5	IL TRM v5.0, Section 5.4.5
Shower L <sub>low</sub>	7.8	IL TRM v5.0, Section 5.4.5
Shower Household (Single Family / Multi Family)	2.56 / 2.1	IL TRM v5.0, Section 5.4.5
Shower SPCD	0.6	IL TRM v5.0, Section 5.4.5
SPH (Single Family / Multi Family)	1.79 / 1.3	IL TRM v5.0, Section 5.4.5
Shower EPG <sub>electric</sub>	0.117	IL TRM v5.0, Section 5.4.5
Shower ISR (SF / MF)	0.98 / 0.95	IL TRM v5.0, Section 5.4.5
Shower HOU (SF / MF)	302 / 248	IL TRM v5.0, Section 5.4.5
Shower CF	0.0278	IL TRM v5.0, Section 5.4.5
Advanced Power Strip Energy Savings (Tier 1)	103	IL TRM v5.0, Section 5.2.1
Advanced Power Strip Energy ERP	0.5	IL TRM v5.0, Section 5.2.2
Advanced Power Strip Baseline Energy	600	IL TRM v5.0, Section 5.2.2
Advanced Power Strip ISR	0.7	IL TRM v5.0, Section 5.2.2
Advanced Power Strip CF	0.80	IL TRM v5.0, Section 5.2.1/5.2.2
Advanced Power Strip HOU (Tier 1 / Tier 2)	7129 / 4380	IL TRM v5.0, Section 5.2.1/5.2.2
Programmable Thermostat Electric Heating Consumption (Electric Resistance / Heat Pump / Gas)	20,771 / 12,218 / 0	IL TRM v5.0, Section 5.3.11

Verified Gross and Net Input Parameters	Value	Data Source
Programmable Thermostat Gas Heating Consumption [Therms] (Electric Resistance / Heat Pump / Gas)	0 / 0 / 1,005	IL TRM v5.0, Section 5.3.11
Programmable Thermostat Heating Reduction	0.062	IL TRM v5.0, Section 5.3.11
Programmable Thermostat HF (Single Family / Multi Family)	1 / 0.65	IL TRM v5.0, Section 5.3.11
Programmable Thermostat ISR	1	IL TRM v5.0, Section 5.3.11
Programmable Thermostat F <sub>e</sub>	0.0314	IL TRM v5.0, Section 5.3.11
DHW R <sub>exist</sub>	1	IL TRM v5.0, Section 5.4.1
DHW R <sub>new</sub>	2.8 / 3.8	IL TRM v5.0, Section 5.4.1
DHW ΔT	60	IL TRM v5.0, Section 5.4.1
DHW η <sub>DHW</sub>	.98	IL TRM v5.0, Section 5.4.1
DHW Circumference of Pipe	0.196	IL TRM v5.0, Section 5.4.1

### Smart Thermostats

The savings for smart, or “advanced,” thermostats were calculated using deemed savings values based on application type and heating fuel that were discussed and agreed upon prior to this program year. The calculations done by Navigant used the algorithms presented below from the Illinois TRM v5.0, Section 5.3.16. Navigant also used population data specific to the HEA participants to more accurately represent the target population.

Verified Gross Annual kWh Savings = Electric Heating Consumption \* Heating Reduction \* HF \* ISR + (ΔTherms \* F<sub>e</sub> \* 29.3)

**Where:**

- Heating Reduction = Assumed percentage reduction in total household heating energy consumption due to programmable thermostat, Deemed
- HF = Household Factor, Deemed
- ISR = In Service Rate, Deemed
- F<sub>e</sub> = Furnace fan energy consumption as a percentage of annual fuel consumption, Deemed
- 29.3 = kWh per therm conversion

The deemed input parameters for smart thermostats are summarized in the table below.

**Table 6-2. Deemed Savings Input Parameters and Sources**

Verified Gross and Net Input Parameters	Value	Data Source
Smart Thermostat Electric Heating Consumption (Electric Resistance / Heat Pump / Gas)	20,771 / 12,218 / 0	IL TRM v5.0, Section 5.3.16
Smart Thermostat Heating Reduction (Manual Baseline / Programmable BL / Unknown BL)	0.088 / 0.056 / 0.074	IL TRM v5.0, Section 5.3.16
Smart Thermostat HF (Single Family / Multi Family)	1 / 0.65	IL TRM v5.0, Section 5.3.16
Smart Thermostat ISR	1	IL TRM v5.0, Section 5.3.16
Smart Thermostat F <sub>e</sub>	0.0314	IL TRM v5.0, Section 5.3.16

## 7. APPENDIX 2. IMPACT ANALYSIS DETAIL

This Appendix provides more detail on the impact analysis. The recommendations presented in this appendix are the same as those presented in Section 5. They are repeated here so they can be reviewed in context with the expanded discussion of the issue.

### Home Type Definition

The TRM does not give a concrete definition to distinguish single family from smaller multi-family buildings such as duplex, tri-plex, quadplex and households when selecting TRM assumptions on several measures. Navigant defined building types for this program<sup>3</sup> differently compared to the implementers, which reflects a change from how we analyzed the impacts in the PY9 Wave 1 memo. For this report, Navigant used nationally-recognized definitions in the EIA 2015 Residential Energy Consumption Survey<sup>4</sup>.

The EIA single-family home definition is: “A housing unit either detached from or attached to another housing unit that typically provides living space for one household or family. Housing units that are connected side-by-side by a wall that extends ground to roof are considered single-family attached units (i.e., a townhouse, row house, or duplex.) A mobile home is not classified as a single-family home.”

The EIA multi-family home definition is: “A self-contained housing unit that occupies only part of a multi-family residential building that has two or more housing units. Apartments may be owned by an owner/occupier or rented by tenants. This category includes condominium apartments (i.e. individually owned apartments), basement apartments, or other residential structures where units are stacked vertically. Housing units that are connected side-by-side by a wall that extends ground to roof are considered single-family attached units (i.e., a townhouse, row house, or duplex.) RECS categorizes apartments into those that are in buildings with two to four units—this category also includes houses originally intended for occupancy by one household (or for some other use) that have since been converted to separate dwellings for two to four households—and that are buildings with five or more units.”

The following table details how each building type was categorized for the HEA program in PY9.

**Table 7-1. Home Type Definition**

Identified Building Types	Implementers' Treatment	Navigant's Treatment
Two-Unit	SF	MF
Condo	SF	MF
Duplex	SF	SF
Five or More Units	SF	MF
Quadplex	SF	MF
Single-Detached	SF	SF
Single-Family	SF	SF
Triplex	SF	MF

*Source: ComEd tracking data and Navigant analysis*

The discrepancy between the implementers' treatment and Navigant's treatment of home types affected savings for CFL installations, LED installations, programmable thermostats, re-programming thermostats, thermostat education, and smart thermostats, aerators, and showerheads. For CFL installations, re-

<sup>3</sup> Per email from Navigant to ComEd “RE: Navigant Request: Res Building Types”, 1/29/2018.

<sup>4</sup> <https://www.eia.gov/consumption/residential/terminology.php#s>



programming thermostats, aerators, and showerheads, the home type discrepancy is the sole reason for deviation of the verified gross realization rate from 100 percent.

**Recommendation 2.** Navigant recommends the implementers follow the EIA’s definition of single family and multi-family homes for building types. In 2015, the EIA defined single-detached, single-family and duplex as single-family and two-unit, condo, triplex, quadplex, and five or more units as multi-family.

## CFL Installations

CFL Installations have a realization rate of 100 percent and represent eight percent of overall energy savings. Table 7-2 shows the results from analysis of individual CFL measures.

**Table 7-2. CFL Measure Impact Detail**

Research Category	Measures Installed	Ex Ante Gross Savings (MWh)	Verified Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
CFL 13W	70,909	1,731	100%	1,728	0.80	1,382
CFL 18W	7,465	213	100%	212	0.80	170
CFL 23W	8,370	334	100%	333	0.80	266
CFL 9W	2,690	44	100%	44	0.80	35

Source: ComEd tracking data and Navigant team analysis.

## LED Installations

LED Installations have a realization rate of 100 percent and represent 77 percent of overall energy savings.

Table 7-3 shows the results from analysis of individual LED measures.



**Table 7-3. LED Measure Impact Detail**

Research Category	Measures Installed	Ex Ante Gross Savings (MWh)	Verified Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
LED - 19W PAR38	985	239	100%	239	0.80	191
LED - BR30	42,089	2,107	100%	2,111	0.80	1,689
LED - Globe	31,951	955	100%	952	0.80	762
LED 11W	8,115	344	100%	344	0.80	275
LED 15W	13,302	1,687	103%	1,730	0.80	1,384
LED 16W	1,671	93	100%	93	0.80	75
LED 17W	1,560	231	100%	231	0.80	185
LED 5.5W	5,581	111	100%	110	0.80	88
LED 5W	10,407	274	87%	239	0.80	191
LED 6.5W	3,016	116	100%	116	0.80	93
LED 6W	52,411	1,481	101%	1,489	0.80	1,191
LED 8W	125,289	6,362	100%	6,350	0.80	5,080
LED 9W	101,092	3,056	100%	3,051	0.80	2,441
LED A-Line 13W	4,482	333	100%	333	0.80	266
LED A-Line 7W	972	24	100%	24	0.80	19
LED Candelabra	124,006	5,726	99%	5,671	0.80	4,537
LED Track Light	14,984	569	100%	568	0.80	454

Source: ComEd tracking data and Navigant team analysis.

Navigant observed that while calculating the ex post savings for exterior LED candelabra bulbs that the calculator used a CF of 0.121 for interior installations instead of the 0.273 deemed by the IL TRM v5.0.

**Recommendation 3.** Navigant recommends the implementers verify that the CF for LED candelabra bulbs match the install locations to prevent the use of interior CF values for bulbs installed in exterior locations.

Navigant observed that while calculating the ex post savings for LED 15W that Franklin has been installing 15W LED bulbs instead of 19W bulbs in the ex ante calculation as in previous years. Franklin has noted the change and increase in savings but has not yet update the calculator or tracking savings to reflect the change in retrofit wattage.

**Recommendation 4.** Navigant recommends the implementers update their tracking data savings for LED 15W bulbs to accurately represent the retrofit wattage as 15W instead of 19W.

Navigant observed that while calculating the ex post savings for exterior LED 5W Globe bulbs that the calculator lists 40W as the baseline wattage but the tracking savings correspond to savings from retrofitting a 45W baseline bulb. Navigant used 40W as the baseline wattage according to the calculator.

**Recommendation 5.** Navigant recommends the implementers update their tracking data savings for LED 5W Globe bulbs to accurately represent the baseline wattage as 40W instead of 45W.

All other differences between reported ex ante gross savings and verified gross savings were due to the home type discrepancy.

## All Thermostats

In Section 5.3.11 Programmable Thermostats and Section 5.3.16 Advanced Thermostats, the IL TRM indicates that “installation of multiple programmable thermostats per home does not accrue additional savings.” Therefore, Navigant capped the quantity of thermostats at one per project for single-family homes and the number of units for multi-family buildings (i.e., duplexes were capped at two measures; triplexes at three measures; and quadplexes were capped at four measures) for smart thermostats, programmable thermostats, re-programming thermostats, and thermostat education. The verified quantity of programmable thermostats was 3,624, which was 157 less than the reported quantity of 3,781. The verified quantity of thermostat education measures was 932, which was 43 less than the reported quantity of 975. The verified quantity of smart thermostats was 2,061, which was 160 less than the reported quantity of 2,221. The quantity of re-programmed thermostats was unchanged.

**Recommendation 6.** Navigant recommends the implementers cap thermostat quantities at one per project for single-family homes and the number of units for multi-family buildings to correctly follow thermostat saving guidelines outlined in the IL TRM.

## Programmable Thermostats

Programmable thermostats have a realization rate of 91 percent and represent one percent of overall energy savings. The implementers reported ex ante kW savings for programmable thermostats, but Navigant did not verify any demand savings. Section 5.3.11 of the IL TRM states that summer coincident peak demand savings are not applicable due to there being no savings from cooling during the summer peak period. Additional data would be required to calculate non-peak demand savings. For these reasons the verified gross peak demand savings and realization rate is NA and the peak demand realization rate is NA. This discrepancy in programmable thermostat peak demand savings was the reason why the peak demand realization rate for the HEA program in PY9 is 83 percent.

**Recommendation 7.** Navigant recommends the implementers do not claim peak demand savings for programmable thermostats. Guidelines in the IL TRM state that summer coincident peak demand savings are not applicable due to there being no savings from cooling during the summer peak period.

## Smart Thermostats

Smart thermostats have a realization rate of 96 percent and represent one percent of overall energy savings.

Navigant observed that there were inconsistencies between the “Existing Thermostat Type” information in the “Baseline” field and the “Measure\_Name” field of the tracking data. For instance, despite being named “Gas Tstat - Smart Stat (\$150) Baseline Manual NSG/ComEd SF PY6/9” the “Baseline” field stated that the “Existing Thermostat Type” was “Programmable”. In all cases the value in the “Baseline” field was considered in the analysis. Additionally, the “Baseline” field also indicated that the existing thermostat type for some cases were “None” and “Smart”. Since the IL TRM does not deem any values for these cases, the existing thermostat type was considered “unknown”.

**Recommendation 8.** Navigant recommends the implementers make sure that the baseline shown in the measure name and in the “Baseline” field are consistent for smart thermostat installations to avoid calculating baseline energy using an incorrect baseline thermostat.

No peak demand savings were awarded to projects where the “Cooling\_System\_Type” was “None”. Additionally, unless the “Cooling\_System\_Type” was “None”, we assumed that the cooling system was controlled by the smart thermostat.

**Recommendation 9.** Navigant recommends the implementers do not claim peak demand savings for smart thermostats in buildings without cooling systems to properly follow the algorithm for smart thermostat energy savings outlined in the IL TRM.

Navigant further observed that while CLEAResult used the  $CF_{PJM}$  to calculate the ex ante peak demand savings, Franklin Energy used the  $CF_{SSP}$ . Navigant used the  $CF_{PJM}$  value to calculate the ex post peak demand savings to support ComEd’s PJM compliance requirements, resulting in a gross peak demand realization rate of 78 percent.

**Recommendation 10.** Navigant recommends both implementers use  $CF_{PJM}$  to calculate smart thermostat peak demand savings to support ComEd’s PJM compliance requirements.

## Pipe Insulation

Pipe insulation has a realization rate of 87 percent and represents 0.05 percent of overall energy savings. The low realization rate is attributed to measures labeled “Pipe Insulation – Electric” with  $R_{new} = 3.8$  according to the implementer’s calculator. The realization rate of these measures is 81 percent. Navigant noted that verified savings matched ex ante savings if  $R_{new}$  was inputted as 38. It is possible that the implementer’s calculator accidentally inserted the period in the wrong place, turning  $R_{new} = 3.8$  to  $R_{new} = 38$ .

**Recommendation 11.** Navigant recommends the implementers make sure that  $R_{new}$  values for “Pipe Insulation – Electric” measures are recorded as 3.8 and not 38.

## 8. APPENDIX 3. TRC DETAIL

[We will add this section in the second draft.]