

**To:** Vincent Gutierrez, ComEd  
**CC:** Jennifer Morris, ICC Staff; Randy Gunn, Jeff Erickson, Nishant Mehta, Navigant  
**From:** Jane Hummer, Christy Zook, Sagar Deo, Laura Agapay-Read  
**Date:** August 25, 2018  
**Re:** Net-to-Gross Research Results from PY8 and PY9 for the ComEd Home Energy Assessment Program

## INTRODUCTION

This memo presents our free ridership and spillover research results for the PY8 and PY9 ComEd Home Energy Assessment (HEA) Program using the Illinois TRM version 6.0 methodologies.<sup>1</sup> While the program is coordinated with Nicor Gas and with Peoples Gas and North Shore Gas, this memo focuses solely on the free ridership and electric spillover of ComEd program participants. The net-to-gross (NTG) research was conducted in December 2016 with PY8 and PY9 participants and again in Fall 2017 with PY9 participants. Navigant conducted telephone surveys with 80 PY8 participants to assess spillover as well as 150 PY9 participants to assess free ridership of specific measures: smart thermostats, smart power strips, and LEDs all of which were new in PY8. The PY8 participant spillover and PY9 free ridership results provide updated findings relative to the previous NTG research conducted in PY4 for this program as well as the use of secondary research conducted in 2010.

Table 1 below provides a summary of the HEA Program PY9 participant free ridership and PY8 spillover research findings. Navigant estimated free ridership for four measure categories: smart thermostats, smart power strips, copay LEDs, and free LEDs. Together, these four categories comprise 90 percent of the PY9 evaluated program savings.<sup>2</sup> Smart thermostat free ridership was investigated for informational purposes only and will not factor into program-level NTG estimates because the savings for smart thermostats in the TRM, and thus used in our analysis, are already net savings; this has little effect on the program-level NTG because smart thermostats comprise less than two percent of total program savings. To estimate the program-level free ridership, Navigant weighted each measure category's free ridership estimate by the category's share of total program energy savings.

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<sup>1</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 6.0, Volume 4: Cross-Cutting Measures and Attachments, effective January 1<sup>st</sup>, 2018.

<sup>2</sup> Measures not included in the free ridership analysis include CFLs, programmable thermostats, water saving measures (aerators, shower heads, etc.), and pipe insulation.

**Table 1. Participant Free Ridership and Spillover Results (PY8 and PY9 Participants)**

End-use	Participant Free Ridership	Weight (% of Program Savings)	Participant Spillover	Relative Precision @ 90% CI
Advanced Power Strips	0.19	0.12		3%
Copay LEDs	0.12	0.003		7%
Free LEDs	0.20	0.88		3%
<i>Smart Thermostats*</i>	<i>0.19</i>	<i>n/a</i>		3%
<b>Population Roll-up</b>	<b>0.20</b>		<b>0.04</b>	

\*Free ridership for smart thermostats is provided for informational purposes only and will not be used to calculate net savings or the population roll-up number because the TRM calculation for this measure yields net savings.

Source: Navigant analysis of data from a telephone survey conducted by the evaluation team with PY8 and PY9 Home Energy Assessment Program participants.

## FREE RIDERSHIP AND SPILLOVER COMPARISON

For comparison, the free ridership and spillover values and NTG ratios that were deemed by SAG for PY9 are presented in the table below.

**Table 2. PY9 Deemed NTG Ratios**

Measure Category	Free Ridership	Spillover	NTG Ratio
Lighting Measures*	0.23	0.03	0.80
Hot Water Measures*	0.23	0.03	0.80
Programmable Thermostat†			0.90
Advanced Power Strip‡	0.05	0.00	0.95

\* Based on Navigant PY4 evaluation research

† Based on secondary Massachusetts and Vermont research in 2010

‡ Based on MF Elevate and PY6 Desktop Power Management

Source: ComEd Programs NTG Approach for EPY10. March 1, 2017

The values for the direct install measures (lighting and hot water) are based on evaluation research conducted in PY4 and PY5 and have been the SAG-approved NTG ratio and component values for the Home Energy Assessment Program since PY7. The value for programmable thermostats is based on secondary 2010 MA and VT research and the value for advanced power strips is based on the Multi-family Elevate and PY6 Desktop Power Management programs and have been the SAG-approved NTG ratio and component values for the Program since PY8.

## PY8 AND PY9 FREE RIDERSHIP AND SPILLOVER RESEARCH DATA COLLECTION

The PY8 and PY9 free ridership and spillover research was conducted following a customer self-report approach through a telephone survey with 230 participants (80 participants for the spillover research and 150 participants for the free ridership research) from a randomized sample of 15,132 participants. The counts for the completed participant interviews and sample design are provided in Table 3 below.

**Table 3. Free Ridership and Spillover Research Survey Disposition**

End-use	Number of Usable Contacts	Target Completes	Actual Completes
Smart Thermostat	606	60	48
Copay LEDs	276	40	31
Free LEDs	6,474	45	93
Advanced Power Strips	5,782	45	76
Spillover	1,994	70	80
<b>Overall Population</b>	<b>15,132</b>	<b>260</b>	<b>230*</b>

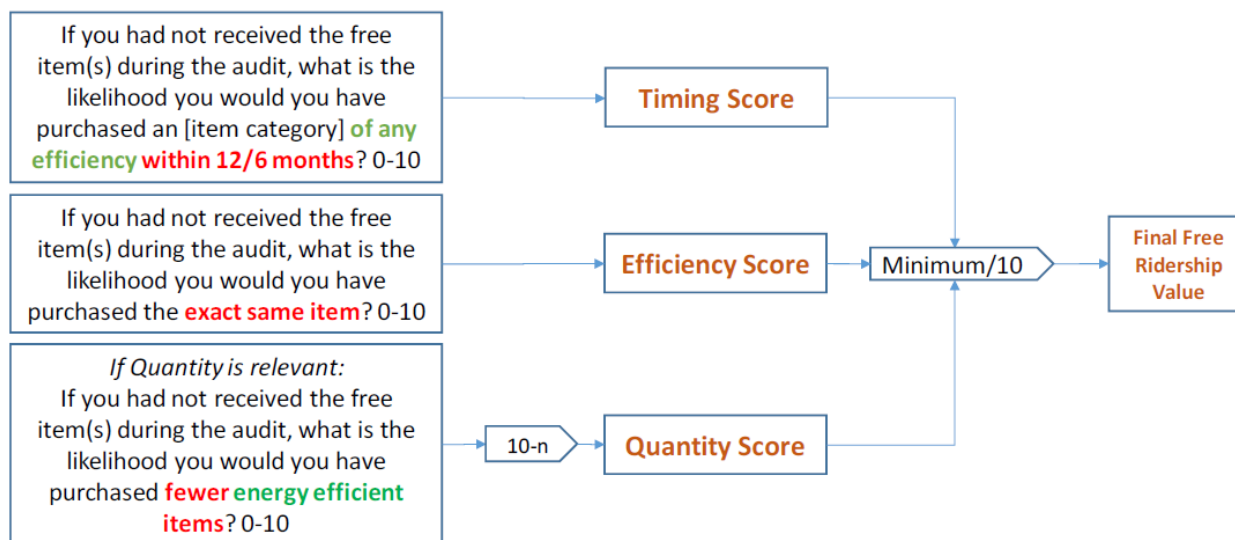
\*Rows do not sum to the total because participants completed free ridership surveys about more than one measure. The total row reflects the number of completed surveys.

Source: Home Energy Assessment Program PY8 and PY9 Tracking Data and evaluation analysis

## FREE RIDERSHIP ESTIMATES USING ALGORITHMS IN THE TRM VERSION 6.0

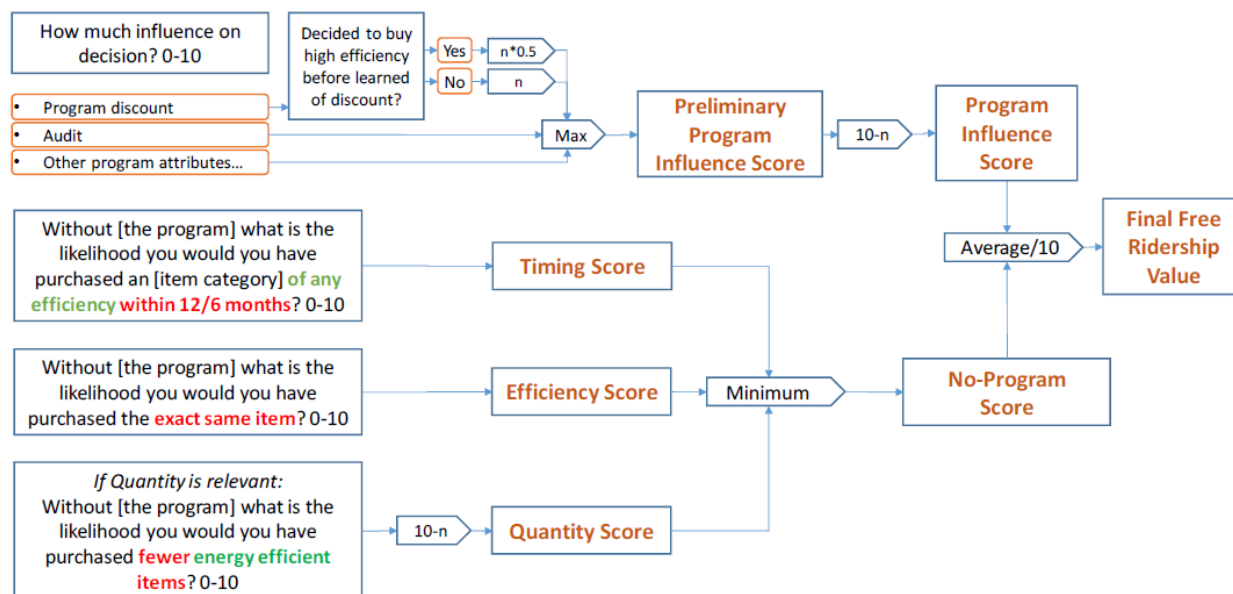
The following diagrams describes the TRM free ridership algorithms for residential single-family home energy audit programs.

**Figure 1. Residential Single-Family Home Energy Audit Free Ridership - No Cost Measures**



Source: Illinois TRM Version 6, Volume 4. Cross-Cutting Measures and Attachments, final February 8, 2017, effective January 1st, 2018.

**Figure 2. Residential Single-Family Home Energy Audit Free Ridership - Discounted Measures**



Source: Illinois TRM Version 6, Volume 4. Cross-Cutting Measures and Attachments, final February 8, 2017, effective January 1st, 2018.

Navigant applied the free ridership algorithm from the Single-Family Home Energy Audit Protocol in the Illinois Statewide Technical Reference Manual- Attachment A: IL-NTG Methodologies v6 document.<sup>3</sup> Free ridership estimates for smart strips and free LEDs were calculated using the algorithm for no cost measures shown in Figure 1 above and free ridership estimates for smart thermostats and copay LEDs were calculated using the algorithm for discounted measures shown in Figure 2 above.

## PARTICIPANT SPILLOVER ESTIMATION

Navigant estimated spillover consistent with the method laid out in the Residential Cross-Cutting Approaches: Participant Spillover section of the IL-TRM. Respondents were asked in the telephone survey if they have made additional energy efficiency improvements to reduce energy consumption since participating in the Program. Navigant included 17 questions to identify spillover candidates and estimate savings. These questions addressed three general aspects, paraphrased below:

1. Since participating in the Home Energy Assessment Program, have you purchased and installed any additional energy efficient measures that you did not receive any rebate for?
2. Did the program influence you in any way to make to make additional energy efficiency improvements?
  - a. On a zero to ten scale, where zero is not at all important and ten is extremely important, how important was your participation in the Home Energy Assessment Program on your decision to make additional energy efficiency improvements outside of utility program? [Attribution Score 1.]
  - b. If you had not participated in the Home Energy Assessment Program, how likely is it that you would have made additional energy efficiency improvements? Please use a zero to ten scale, where zero means that you definitely would not have made additional energy

<sup>3</sup> The referenced TRM document can be accessed here: [http://ilsagfiles.org/SAG\\_files/Technical\\_Reference\\_Manual/Version\\_6/Final/IL-TRM\\_Effective\\_010118\\_v6.0\\_Vol\\_4\\_X-Cutting\\_Measures\\_and\\_Attach\\_020817\\_Final.pdf](http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_6/Final/IL-TRM_Effective_010118_v6.0_Vol_4_X-Cutting_Measures_and_Attach_020817_Final.pdf).

efficiency improvements and ten means that you definitely would have purchased them, even if you had not participated in the program? [Attribution Score 2.]

3. What were details of the energy efficiency improvements (equipment, efficiency level, quantity, etc.)?

Navigant attributed spillover to the Home Energy Assessment Program if the following condition is met: the average of Attribution Score 1 and (10 minus Attribution Score 2) must exceed 5.0.

Of the 80 survey respondents, 28 installed additional energy efficient equipment, but only 16 indicated that participating in the Home Energy Assessment Program influenced them to make these additional purchases. Navigant determined that only nine of the 16 potential spillover candidates had spillover averaged attribution scores greater than 5.0 and installed equipment with quantifiable electric savings which included refrigerators, CFL and LED light bulbs, and smart thermostats. Table 1Table 4 below lists the respondents' improvements and savings.

**Table 4. Reported Energy Savings**

End-use Measure	kWh	Qty	Per Unit Savings (kW)
LEDs	709.52	14	50.68
CFLs	341.04	14	24.36
Refrigerators	128.40	2	64.20
Smart Thermostats	466.50	2	233.25
<b>Spillover Total</b>	<b>1,645.46</b>		

*Source: Navigant analysis of data from spillover telephone surveys conducted by Navigant with PY8 Home Energy Assessment Program participants.*

Together, the kWh savings from these improvements amounted to 3.8 percent of program savings for the 80 respondents. Because the 80 were selected as a simple random sample, their spillover savings rate is representative of the population of PY8 program participants

## NTG RESULTS

The NTG research results for the Home Energy Assessments Program are summarized in Table 5 below.

**Table 5. Summary of Free Ridership, Spillover and NTGR Research Results for HEA Program**

End-use	Free Ridership	Participant Spillover	NTGR
Advanced Power Strips	0.19		
Copay LEDs	0.12		
Free LEDs	0.20		
<i>Smart Thermostats*</i>	<i>0.19</i>		
<b>Population Roll-up</b>	<b>0.20</b>	<b>0.04</b>	<b>0.84</b>

\*FR for smart thermostats is provided for informational purposes only and will not be used to calculate net savings because the TRM calculation for this measure yields net savings.

NTGR = 1 – FR + PSO + TSO + NPSO

FR = Participant Free Ridership; PSO = Participant Spillover; TSO = Trade Ally Spillover; NPSO = Nonparticipant Spillover

Source: Navigant analysis of data from telephone surveys conducted by Navigant with PY8 and PY9 Home Energy Assessment Program participants.

**APPENDIX: COMED HOME ENERGY ASSESSMENT PROGRAM NTG HISTORY**

	<b>Home Energy Assessment (Single Family Retrofit)</b>																																											
EPY1	<p><b>NTG 0.80</b>  <b>Free-Ridership 0.20</b>  <b>Spillover NA</b>  <b>Method:</b> ComEd Program Assumption. The EPY1 evaluation did not estimate the net to gross ratio. The value of 80% is drawn from the program plan presented in ComEd’s 2008-2010 Energy Efficiency and Demand Response Plan (November 15, 2007). Page D-2 of the ComEd plan provides a footnote stating the net to gross ratio of 80% is drawn from the California Energy Efficiency Policy Manual, version 2 (2003).</p>																																											
EPY2	<p><b>NTG 0.87</b>  <b>Free-Ridership 26%</b>  <b>Spillover 3.5%</b>  <b>Method:</b> Customer self-reports. 130 surveys completed from a population of 760.</p> <table border="1"> <thead> <tr> <th>Measure</th> <th>NTG Ratio</th> <th>FR</th> <th>SO</th> </tr> </thead> <tbody> <tr> <td>CFL</td> <td>0.72</td> <td>34%</td> <td>6.4%</td> </tr> <tr> <td>Kitchen Aerators</td> <td>0.97</td> <td>3%</td> <td>0.0%</td> </tr> <tr> <td>Bathroom Aerators</td> <td>0.97</td> <td>3%</td> <td>0.0%</td> </tr> <tr> <td>Showerheads</td> <td>0.93</td> <td>8%</td> <td>0.5%</td> </tr> <tr> <td>Pipe Insulation</td> <td>1.02</td> <td>7%</td> <td>9.0%</td> </tr> <tr> <td><b>Total Direct Install</b></td> <td><b>0.87</b></td> <td><b>26%</b></td> <td><b>3.5%</b></td> </tr> </tbody> </table>	Measure	NTG Ratio	FR	SO	CFL	0.72	34%	6.4%	Kitchen Aerators	0.97	3%	0.0%	Bathroom Aerators	0.97	3%	0.0%	Showerheads	0.93	8%	0.5%	Pipe Insulation	1.02	7%	9.0%	<b>Total Direct Install</b>	<b>0.87</b>	<b>26%</b>	<b>3.5%</b>															
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EPY4	<p><b>Retroactive application of NTG* 0.83 (Preliminary)</b>  <b>Overall Free-Ridership* 18% (Preliminary)</b>  <b>Overall Spillover* 1% (Preliminary)</b>  <i>*A final draft of the report has not been submitted yet, thus these values may change.</i>  <b>Method:</b> Customer self-reports. 54 full-participant (direct Install and weatherization measures) surveys completed from a population of 1,081 audits and 320 full-participants.</p> <table border="1"> <thead> <tr> <th></th> <th>Measure</th> <th>NTG*</th> <th>Free Ridership*</th> <th>Spillover*</th> </tr> </thead> <tbody> <tr> <td rowspan="14">Direct-Install Measures</td> <td>9 Watt CFL</td> <td>0.79</td> <td>0.25</td> <td>0.04</td> </tr> <tr> <td>14 Watt CFL</td> <td>0.79</td> <td>0.25</td> <td>0.04</td> </tr> <tr> <td>19 Watt CFL</td> <td>0.79</td> <td>0.25</td> <td>0.04</td> </tr> <tr> <td>23 Watt CFL</td> <td>0.79</td> <td>0.25</td> <td>0.04</td> </tr> <tr> <td>9 Watt Globe CFL</td> <td>0.79</td> <td>0.25</td> <td>0.04</td> </tr> <tr> <td>Low Flow Shower Head</td> <td>0.93</td> <td>0.07</td> <td>0.00</td> </tr> <tr> <td>Kitchen Aerator</td> <td>1.00</td> <td>0.01</td> <td>0.01</td> </tr> <tr> <td>Bathroom Aerator</td> <td>1.00</td> <td>0.01</td> <td>0.01</td> </tr> <tr> <td>Hot Water Temperature Setback</td> <td>0.88</td> <td>0.12</td> <td>0.00</td> </tr> <tr> <td>Pipe Insulation</td> <td>0.89</td> <td>0.18</td> <td>0.07</td> </tr> <tr> <td>Programmable Thermostat</td> <td>0.85</td> <td>-</td> <td>-</td> </tr> <tr> <td>Programmable Thermostat Education</td> <td>0.85</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="5">Retrofit Measures</td> <td>Attic Insulation</td> <td>0.75</td> <td>0.27</td> <td>0.02</td> </tr> <tr> <td>Wall Insulation</td> <td>0.78</td> <td>0.22</td> <td>0.00</td> </tr> <tr> <td>Floor Insulation (Other)</td> <td>0.76</td> <td>0.24</td> <td>0.00</td> </tr> <tr> <td>Duct Insulation &amp; Sealing</td> <td>0.80</td> <td>-</td> <td>-</td> </tr> <tr> <td>Air Sealing</td> <td>0.84</td> <td>0.16</td> <td>0.00</td> </tr> <tr> <td><b>Overall Program</b></td> <td></td> <td><b>0.83</b></td> <td><b>0.18</b></td> <td><b>0.01</b></td> </tr> </tbody> </table> <p><i>*A final draft of the report has not been submitted yet, thus these values may change.</i></p>						Measure	NTG*	Free Ridership*	Spillover*	Direct-Install Measures	9 Watt CFL	0.79	0.25	0.04	14 Watt CFL	0.79	0.25	0.04	19 Watt CFL	0.79	0.25	0.04	23 Watt CFL	0.79	0.25	0.04	9 Watt Globe CFL	0.79	0.25	0.04	Low Flow Shower Head	0.93	0.07	0.00	Kitchen Aerator	1.00	0.01	0.01	Bathroom Aerator	1.00	0.01	0.01	Hot Water Temperature Setback	0.88	0.12	0.00	Pipe Insulation	0.89	0.18	0.07	Programmable Thermostat	0.85	-	-	Programmable Thermostat Education	0.85	-	-	Retrofit Measures	Attic Insulation	0.75	0.27	0.02	Wall Insulation	0.78	0.22	0.00	Floor Insulation (Other)	0.76	0.24	0.00	Duct Insulation & Sealing	0.80	-	-	Air Sealing	0.84	0.16	0.00	<b>Overall Program</b>		<b>0.83</b>	<b>0.18</b>	<b>0.01</b>
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EPY7	<p><b>Direct Install NTG: 0.80</b>  <b>Weatherization NTG: 1.02</b>  <b>Source:</b> Participant surveys in EPY4 and EPY5, Trade ally surveys in EPY5. For Weatherization free ridership, trade ally value was weighted 75% and participants 25%.</p> <p><b>Supporting Information</b></p> <table border="1"> <thead> <tr> <th></th> <th>Free Ridership</th> <th>Participant Spillover</th> <th>NTG</th> </tr> </thead> <tbody> <tr> <td>Direct Install</td> <td>0.23</td> <td>0.03</td> <td>0.80</td> </tr> <tr> <td>Weatherization</td> <td>0.10</td> <td>0.11</td> <td>1.02</td> </tr> <tr> <td>Program Wide</td> <td>0.20</td> <td>0.05</td> <td>0.85</td> </tr> </tbody> </table>					Free Ridership	Participant Spillover	NTG	Direct Install	0.23	0.03	0.80	Weatherization	0.10	0.11	1.02	Program Wide	0.20	0.05	0.85
	Free Ridership	Participant Spillover	NTG																	
Direct Install	0.23	0.03	0.80																	
Weatherization	0.10	0.11	1.02																	
Program Wide	0.20	0.05	0.85																	
EPY8	<p>Recommendation (based upon PY7 NTG recommended values):                      NTG CFL: 0.79 – <i>(used in PY6 Report based upon PY4 research)</i>                      NTG Hot Water Measures with gas: 0.75 – <i>(used in PY6 Report based upon PY4 research)</i>                      NTG Direct Install Measures: 0.80 – <i>(from PY7 Recommendation based upon PY5 research)</i>                      NTG Weatherization Measures: 1.02 – <i>(from PY7 Recommendation based upon PY5 research)</i>                      NTG Thermostat: 0.90 – <i>(secondary 2010 MA and VT research)</i></p> <p>FR CFL: NA                      FR Hot Water: NA                      FR Direct Install: 0.23                      FR Weatherization: 0.10                      FR Thermostat: NA MA/VT secondary research</p> <p>SO CFL: na                      SO Hot Water: NA                      SO Direct Install: 0.03                      SO Weatherization: 0.11                      SO Thermostat: NA MA/VT secondary research</p> <p>EPY6 research on thermostat NTG was based on secondary research. There was no EPY6 research for other measures, thus the evaluation team recommends using the EPY7 values – see detail above for EPY7.</p>																			
EPY9	<p>NTG CFL: 0.80 – <i>(used in PY6 Report based upon PY4 research)</i>                      NTG Hot Water Measures with gas: 0.80 – <i>(used in PY6 Report based upon PY4 research)</i>                      NTG Direct Install Measures: 0.80 – <i>(from PY7 Recommendation based upon PY5 research)</i>                      NTG Weatherization Measures: 1.01 – <i>(from PY7 Recommendation based upon PY5 research)</i>                      NTG Thermostat: 0.90 – <i>(secondary 2010 MA and VT research)</i></p> <p>FR CFL: NA</p>																			

	<b>Home Energy Assessment (Single Family Retrofit)</b>
	FR Hot Water: NA FR Direct Install: 0.23 FR Weatherization: 0.10 FR Thermostat: NA  SO CFL: NA SO Hot Water: NA SO Direct Install: 0.03 SO Weatherization: 0.11 SO Thermostat: NA  NTG Source: PY6 SAG consensus value (no new research)
EPY10	NTG Lighting: 0.80 – <i>(used in PY6 Report based upon PY4 research)</i> NTG Hot Water Measures: 0.80 – <i>(used in PY6 Report based upon PY4 research)</i> NTG Other Direct Install Measures: 0.80 – <i>(from PY7 Recommendation based upon PY5 research)</i> NTG Programmable Thermostat and Programmable Thermostat Education: 0.90 – <i>(secondary 2010 MA and VT research)</i> NTG Smart Power Strips: 0.95 – <i>(based on MF Elevate and PY6 Desktop Power Management)</i> NTG Smart Thermostat: NA. The savings value in the IL TRM is based on regression analysis on consumption data and thus is a net savings number.  FR Lighting: NA FR Hot Water: NA FR Other Direct Install: 0.23 FR Thermostat: 0.23 FR Smart Power Strips: NA  SO Lighting: NA SO Hot Water: NA SO Other Direct Install: 0.03 SO Thermostat: 0.03 SO Smart Power Strips: NA  NTG Source: PY6 SAG consensus value (no new research)

Source: [http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.pdf](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.pdf)