



To: Vincent Gutierrez, ComEd

CC: Jennifer Morris, ICC Staff; Jeff Erickson, Nishant Mehta, and Laura Agapay-Read, Guidehouse

From: Christy Zook and Daniel Talero, Guidehouse

Date: August 20, 2021

Re: Net-to-Gross Research Results for Single Family Assessment Program

Executive Summary

This memo presents the evaluation team’s results of the net-to-gross (NTG) research during 2021 on ComEd’s Single Family Assessment (SFA, also known as Home Energy Assessment) Program using the Illinois Technical Reference Manual version 9.0 (TRM v9.0) methodologies.¹ The evaluation team fielded participant free ridership and spillover surveys online in Spring 2021. The free ridership research was conducted with 252 participants who had program energy advisors install LEDs in their home between August and December 2020 while the spillover research was conducted with 126 customers that participated in the program between January and July 2020.

These results will inform Guidehouse’s September 2021 recommendations to the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) of NTG values to be used for this program in 2022 (as detailed at the end of this memo in Table 3).

Table 1 summarizes the SFA Program free ridership and spillover research findings. Guidehouse estimated free ridership for only free LEDs as they composed 96% of CY2020 evaluated program savings.

Table 1. Net-to-Gross Research Results for ComEd SFA LEDs CY2021

Measure	Free Ridership	Relative Precision @90% CI	Participant Spillover*
LEDs	0.26	3%	
Total Program			0.03

*Spillover is calculated at the program level for this program

Source: Guidehouse analysis of data from online surveys conducted with 2020 ComEd SFA Program participants

¹ Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 9.0, Volume 4: Cross-Cutting Measures and Attachments.

Free Ridership and Spillover Research Representation

The evaluation team conducted participant free ridership research using a customer self-report approach through an online survey. Respondents accessed the survey through a link in an email invitation from Guidehouse. The evaluation team fielded the free ridership surveys in Spring 2021. From the 3,404 who participated between August and December 2020, 252 participants responded (a 7.4% response rate) to the free ridership survey. The evaluation team also completed an online spillover survey using a customer-self approach with 126 participants from a census of 3,197 who participated between January and July 2020.

Guidehouse excluded from the analysis 21 free ridership surveys from respondents who could not recall participating in the program (12) or who did not install the bulbs (9). We estimated free ridership from 231 responses. All 126 completed spillover surveys were included in the spillover analysis. Table 2 presents the participant free ridership and spillover research representation.

Table 2. Participant Free Ridership and Spillover Research Representation

NTG Component	Usable Contacts*	Target Completes	Actual Completes	Analyzed Completes†
Free Ridership: LEDs	3,404	80	252	231
Spillover	3,197	100	126	126

*Usable Contacts provides the number of participants with viable email addresses that were included in the free ridership and spillover samples.

†Analyzed Completes provides the count used to develop the free ridership and spillover estimates. Analyzed Completes excludes responses that failed consistency checks or lacked required data (discussed in the Appendix).

Source: Guidehouse analysis of data from online survey conducted with 2020 ComEd SFA Program participants

Free Ridership and Spillover Protocols

The following diagram describes the TRM v9.0 free ridership algorithm for the residential single family home energy audit for free direct install measures (protocol 4.5.1.1) that Guidehouse used to calculate the free ridership for the SFA Program. This protocol calculates free ridership by calculating a timing score, efficiency score, and quantity score for each respondent. These are in the form of likelihood questions scored 0-10. For each respondent, the minimum value of the three is divided by 10 to produce the final free ridership score.

The Participant Free Ridership Estimation section and the Final NTG Results and Recommendations section detail the free ridership algorithm and the overall equation for determining the NTG ratio.

Participant Free Ridership Estimation

Figure 1 describes the TRM v9.0 algorithm for No-Cost, Direct Install Measures (protocol 4.5.1.1) that Guidehouse used to calculate free ridership for the ComEd SFA Program.

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

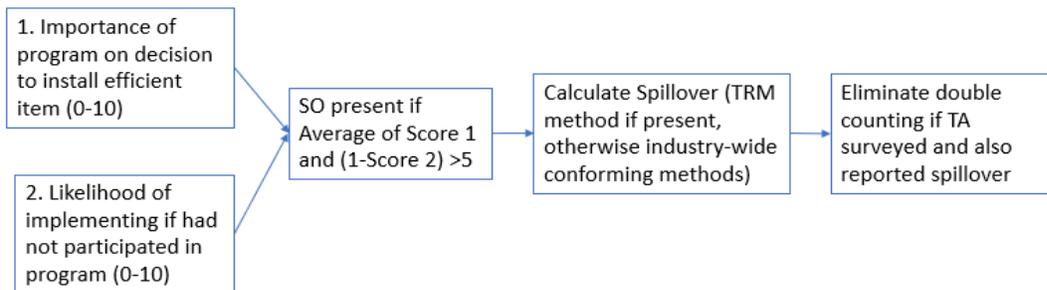


Source: Illinois TRM Version 9, Volume 4: Cross-Cutting Measures and Attachments

Participant Spillover Estimation

Participant spillover is documented by the following process (Figure 2).

Figure 2. Participant Spillover Protocol



Source: Guidehouse Illustration of Illinois TRM Version 9.0

The online participant spillover survey asked respondents if they had installed any additional electric saving measures after participating in the SFA Program. Guidehouse included eight questions² to identify spillover candidates, followed by additional modules to estimate savings from qualifying upgrades.³ These questions addressed three general aspects, paraphrased below:

1. Did you make any other energy efficiency improvements to your home since you participated in the Home Energy Assessment to save electricity that were not rebated by a utility program?
2. How much influence did your participation in the program have on making additional energy efficiency improvements?
 - a. On a 0 to 10 scale where 0 is not at all important and 10 is extremely important, how important was your experience with ComEd's Home Energy Assessment on making additional energy efficiency improvements on your own (Attribution Score 1)?
 - b. If you had not participated in the Home Energy Assessment, how likely is it that you would have made this energy efficiency improvement? Please use a 0 to 10 scale, where 0 means that you definitely would not have made the improvement and 10 means that you definitely would have made the improvement even if you had not had the Home Energy Assessment (Attribution Score 2).
3. What were details of the energy efficiency improvements (equipment, efficiency level, quantity, etc.)?

The evaluation attributed spillover to the SFA Program if the average of Attribution Score 1 and 10 minus Attribution Score 2 exceeded 5.0.⁴

Final NTG Results and Recommendations

Table 3 summarizes Guidehouse's draft recommendations for free LEDs offered through ComEd's SFA Program to be used in CY2022 based on our NTG research.

² Respondents do not answer all eight questions; follow-up questions are skipped depending on earlier responses.

³ The six modules are Lighting and Advanced Power Strips, Water Heating Equipment, HVAC Equipment or Controls, ENERGY STAR Appliances, Weatherization, and Other.

⁴ The spillover methodology is guided by NTG protocols in the Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 9.0, Volume 4: Cross-Cutting Measures and Attachments.

Table 3. Summary of Free Ridership, Spillover, and NTG Research Results for ComEd SFA Program LEDs

Measure	Free Ridership	Spillover	NTG
LEDs	0.26		0.77
Total Program		0.03	NA

NTG = 1 – FR + SO

Source: Guidehouse analysis of data from online surveys conducted with 2020 ComEd SFA Program participants

Appendix A. Spillover Calculation

A.1 Spillover Estimation

Of the 126 survey respondents, 45 reported that they installed additional energy efficient equipment without rebates, and 19 of them indicated that participating in the SFA Program influenced them to make these additional purchases. Guidehouse determined that all 19 had averaged spillover attribution scores greater than 5. These participants installed LED lamps, advanced power strips, a central AC unit, an ENERGY STAR freezer, an ENERGY STAR refrigerator, an ENERGY STAR dishwasher, insulation, and a dehumidifier⁵ as Table 6 shows.

Table 4. Reported Energy Savings for Spillover by Measure

Measure Installed	Spillover (kWh)	Number of Instances
LED lamps	1,736	9
Air Source Heat Pump	1,786	1
ENERGY STAR Refrigerator	432	1
Advanced Power Strips	396	7
Central Air Conditioner	176	1
ENERGY STAR Freezer	131	3
Dehumidifier	714	1
Attic Insulation	73	1
ENERGY STAR Dishwasher	20	1
Total Spillover kWh	5,463	
Program Savings by SO Survey Respondents	198,274	
Spillover Rate	0.03	

Source: Guidehouse analysis of data from online spillover surveys conducted with CY2020 SFA Program participants

The electric savings from these measures amounted to 3% of program gross ex ante savings for the 126 respondents. Because the 126 respondents were selected as a simple random sample, their spillover savings rate is representative of the population of CY2020 program participants.

⁵ Natural gas-saving spillover actions are not credited to the electric spillover.

Appendix B: ComEd SFA NTG History

Home Energy Assessments (Single Family Retrofit)																																
EPY1	<p>NTG 0.80 Free Ridership 0.20 Spillover NA</p> <p>Method: 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>																															
	<p>NTG 0.87 Free Ridership 26% Spillover 3.5%</p> <p>Method: Customer self-reports. 130 surveys completed from a population of 760.</p>																															
EPY2	<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>Total Direct Install</td> <td>0.87</td> <td>26%</td> <td>3.5%</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%	Total Direct Install	0.87	26%	3.5%			
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Pipe Insulation	1.02	7%	9.0%																													
Total Direct Install	0.87	26%	3.5%																													

Home Energy Assessments (Single Family Retrofit)

NTG 0.74

Free Ridership 27%

Spillover 4%

Method: Customer self-reports. 122 full-participant (direct install and weatherization measures) and direct install-only participant surveys completed from a population of 413 full participants and 962 direct install-only participants.

	Measure	NTG	FR	SO
EPY3	Compact Fluorescent Bulbs	0.68	34%	3%
	Air Sealing	0.99	8%	
	Attic Insulation	0.98	9%	
	Floored Attic Insulation	0.98	9%	
	Exterior Wall Insulation	0.96	11%	
	Sloped Insulation	0.96	11%	
	Knee Wall Insulation	0.96	11%	
	Crawl Space Insulation	0.96	11%	7%
	Duct Insulation	0.99	8%	
	Rim Joist Insulation	0.96	11%	
	Seal and Repair Ducts	0.93	-	
	Overall	0.74	27%	4%

Home Energy Assessments (Single Family Retrofit)

Retroactive application of NTG* 0.83 (Preliminary)

Overall Free Ridership* 18% (Preliminary)

Overall Spillover* 1% (Preliminary)

*A final draft of the report has not been submitted yet, thus these values may change.

Method: Customer self-reports. 54 full-participant (direct install and weatherization measures) surveys completed from a population of 1,081 audits and 320 full participants.

		Measure	NTG*	Free Ridership*	Spillover*
EPY4	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	-	-
		Attic Insulation	0.75	0.27	0.02
	Wall Insulation	0.78	0.22	0.00	
	Retrofit Measures	Floor Insulation (Other)	0.76	0.24	0.00
	Duct Insulation & Sealing	0.80	-	-	
	Air Sealing	0.84	0.16	0.00	
	Overall Program			0.83	0.18

**A final draft of the report has not been submitted yet, thus these values may change.*

Illinois SAG Consensus:

		EPY5	EPY6
EPY5	Lighting	0.89	0.79
	Single Family with Gas _ Showerhead	0.94	0.75
	Single Family with Gas _ Kitchen Aerator	0.94	
	Single Family with Gas _ Bath Aerator	0.94	
	Single Family with Gas _ Water Heater Temp Setback	0.94	
EPY6	Single Family with Gas _ Pipe Insulation	0.94	
	Weatherization Measures	0.80	0.80
	Attic Insulation	0.80	
	Wall Insulation	0.80	
	Floor Insulation (other)	0.80	
	Duct Sealing	0.80	
	Air Sealing	0.80	

Home Energy Assessments (Single Family Retrofit)

Direct Install NTG: 0.80

Weatherization NTG: 1.02

Source: Participant surveys in EPY4 and EPY5, trade ally surveys in EPY5. For weatherization free ridership, the trade ally value was weighted 75% and the participants value was weighted 25%.

EPY7

Supporting Information

	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

Recommendation (based upon PY7 NTG recommended values):

NTG CFL: 0.79 (used in PY6 report based upon PY4 research)

NTG Hot Water Measures with Gas: 0.75 (used in PY6 report based upon PY4 research)

NTG Direct Install Measures: 0.80 (from PY7 recommendation based upon PY5 research)

NTG Weatherization Measures: 1.02 (from PY7 recommendation based upon PY5 research)

NTG Thermostat: 0.90 – (secondary 2010 MA and VT research)

FR CFL: NA

FR Hot Water: NA

FR Direct Install: 0.23

EPY8

FR Weatherization: 0.10

FR Thermostat: NA MA/VT secondary research

SO CFL: NA

SO Hot Water: NA

SO Direct Install: 0.03

SO Weatherization: 0.11

SO Thermostat: NA MA/VT secondary research

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.

Home Energy Assessments (Single Family Retrofit)

NTG Pipe Insulation: 0.80 (*used in PY6 report based upon PY4 research*)

NTG Showerhead and Kitchen and Bathroom Faucet Aerator: 1.04

NTG Other Direct Install Measures: 0.81 (*from PY7 recommendation based upon PY5 research*)

NTG Programmable Thermostat and Programmable Thermostat Education: 0.90 (*secondary 2010 MA and VT research*)

NTG Advanced Power Strips: 0.85 (*based on PY9 participant survey for FR and PY8 participant survey for SO*)

NTG Advanced Thermostat: NA. The savings value in the TRM is based on regression analysis on consumption data and thus is a net savings number.

NTG LEDs – Copay: 0.92

NTG LEDs – Free: 0.84

FR Showerhead and Kitchen and Bathroom Faucet Aerator: 0.00

FR Other Direct Install: 0.23

FR Thermostat: NA

CY2019

FR Advanced Power Strips: 0.19

FR LEDs – Copay: 0.12

FR LEDs – Free: 0.20

SO Showerhead and Kitchen and Bathroom Faucet Aerator: 0.04

SO Other Direct Install: 0.04

SO Thermostat: NA

SO Advanced Power Strips: 0.04

SO LEDs – Copay: 0.04

SO LEDs – Free: 0.04

NTG Source: Showerhead and Kitchen and Bathroom Faucet Aerator FR: TRM version 7.0 specifies that the free ridership for faucet aerators and showerheads be set at zero when estimating gross savings using the TRM-specified baseline average water flow rate. LED and APS FR: PY9 participant survey.

Thermostat: 2010 MA VT Evaluation Research

Other Direct Install FR: PY6 SAG consensus value (no new research)

SO: PY8 participant survey

Home Energy Assessments (Single Family Retrofit)

NTG Pipe Insulation: 0.80 (*used in PY6 Report based upon PY4 research*)

NTG Showerhead and Kitchen and Bathroom Faucet Aerator: 1.04

NTG Other Direct Install Measures: 0.81 (*from PY7 Recommendation based upon PY5 research*)

NTG Programmable Thermostat and Programmable Thermostat Education: 0.90 (*secondary 2010 MA and VT research*)

NTG Advanced Power Strips: 0.85 (*based on PY9 participant survey for FR and PY8 participant survey for SO*)

NTG Advanced Thermostat: NA. The savings value in the TRM is based on regression analysis on consumption data and thus is a net savings number.

NTG LEDs – Copay: 0.92

NTG LEDs – Free: 0.84

FR Showerhead and Kitchen and Bathroom Faucet Aerator: 0.00

FR Other Direct Install: 0.23

FR Thermostat: NA

CY2020

FR Advanced Power Strips: 0.19

FR LEDs – Copay: 0.12

FR LEDs – Free: 0.20

SO Showerhead and Kitchen and Bathroom Faucet Aerator: 0.04

SO Other Direct Install: 0.04

SO Thermostat: NA

SO Advanced Power Strips: 0.04

SO LEDs – Copay: 0.04

SO LEDs – Free: 0.04

NTG Source: Showerhead and Kitchen and Bathroom Faucet Aerator FR: TRM version 7.0 specifies that the free ridership for faucet aerators and showerheads be set at zero when estimating gross savings using the TRM specified baseline average water flow rate. LED and APS FR: PY9 participant survey.

Thermostat: 2010 MA VT Evaluation Research

Other Direct Install FR: PY6 SAG consensus value (no new research)

SO: PY8 participant survey

Home Energy Assessments (Single Family Retrofit)

All but advanced thermostat unchanged from CY2020.

NTG Pipe Insulation: 0.80 (*used in PY6 report based upon PY4 research*)

NTG Showerhead and Kitchen and Bathroom Faucet Aerator: 1.04

NTG Other Direct Install Measures: 0.81 (*from PY7 recommendation based upon PY5 research*)

NTG Programmable Thermostat and Programmable Thermostat Education: 0.90 (*secondary 2010 MA and VT research*)

NTG Advanced Power Strips: 0.85 (*based on PY9 participant survey for FR and PY8 participant survey for SO*)

NTG Advanced Thermostat - cooling: 0.80

NTG Advanced Thermostat - heating: 0.90

NTG LEDs – Copay: 0.92

NTG LEDs – Free: 0.84

FR Showerhead and Kitchen and Bathroom Faucet Aerator: 0.00

FR Other Direct Install: 0.23

NTG Thermostat – Cooling: Policy manual default

CY2021 NTG Thermostat – Heating: SAG decision. TRM savings are between net and gross; therefore, NTG should be between the default value (0.8) and 1.0.

FR Advanced Power Strips: 0.19

FR LEDs – Copay: 0.12

FR LEDs – Free: 0.20

SO Showerhead and Kitchen and Bathroom Faucet Aerator: 0.04

SO Other Direct Install: 0.04

SO Thermostat: See FR.

SO Advanced Power Strips: 0.04

SO LEDs – Copay: 0.04

SO LEDs – Free: 0.04

NTG Source: Showerhead and Kitchen and Bathroom Faucet Aerator FR: TRM version 7.0 specifies that the free ridership for faucet aerators and showerheads be set at zero when estimating gross savings using the TRM-specified baseline average water flow rate. LED and APS FR: PY9 participant survey.

Other Direct Install FR: PY6 SAG consensus value (no new research)

SO: PY8 participant survey

Appendix C: History of SAG Approved NTG for ComEd LEDs

Program Year	Program	Measure	NTG Ratio	FR	PSO	NPSO	
CY2018	Single Family Assessment	Lighting	0.80				
CY2019		LEDs - Free	0.84	0.20	0.04		
CY2020		LEDs - Free	0.84	0.20	0.04		
CY2021		LEDs - Free	0.84	0.20	0.04		
PY4	Lighting Discounts	LED Bulb - Omni-Directional	0.54				
PY5		LED Bulb - Omni-Directional	0.48	0.53	0.02		
PY6		LED Bulb - Omni-Directional	0.73	0.44	0.17		
EPY7		LED Bulb - Omni-Directional	0.75				
EPY8		LED Bulb - Omni-Directional	0.73	0.44	0.17		
EPY9		LED Bulb - Omni-Directional	0.60	0.42	0.01	0.01	
		LED Bulb - Specialty	0.58	0.49	0.01	0.07	
CY2018		LED Bulb - Omni-Directional	0.58	0.45	0.01	0.03	
		LED Bulb - Specialty	0.58	0.49	0.01	0.06	
CY2019		LED Bulb - Directional	0.61	0.47	0.02	0.06	
	LED Bulb - Omni-Directional	0.67	0.41	0.02	0.06		
	LED Bulb - Specialty	0.53	0.55	0.02	0.06		
CY2020	LED Bulb - Directional	0.52	0.55	0.02	0.05		
	LED Bulb - Omni-Directional	0.52	0.55	0.02	0.05		
	LED Bulb - Specialty	0.59	0.48	0.02	0.05		
CY2021	LED Bulb - Directional	0.52	0.55	0.02	0.05		
	LED Bulb - Omni-Directional	0.52	0.55	0.02	0.05		
CY2019	Multi-Family Assessments	LED Exit Sign	0.95	0.05	0.00		
		LED Exit Sign	0.83	0.20	0.03		
CY2020		LED Linear (CA)	0.96	0.07	0.03		
		LED Omnidirectional	0.67	0.36	0.03		
CY2021		LED Specialty	0.82	0.21	0.03		
		LED Exit Sign	0.83	0.20	0.03		
		LED Linear (CA)	0.96	0.07	0.03		
		LED Omnidirectional	0.67	0.36	0.03		
CY2018		Elementary Energy Education	LED Specialty	0.82	0.21	0.03	
			LEDs (traditional kit)	1.00			
CY2019	LEDs (traditional kit)		0.84	0.20	0.04		
CY2020	LEDs (traditional kit)		0.84	0.20	0.04		
	LED Nightlight		1.00				
CY2021	LEDs (traditional kit)		0.84	0.20	0.04		
	LED Nightlight	1.00					