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Residential Education and Outreach Programs Evaluation Report

Elementary Energy Education Joint Program

FINAL

Energy Efficiency Plan:
Gas Plan Year 4
(6/1/2014-5/31/2015)

Presented to
Peoples Gas and North Shore Gas

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E. Executive Summary

This report presents a summary of the findings and recommendations from the impact and process evaluation of the joint Commonwealth Edison Company (ComEd) Plan Year 7, Peoples Gas (PG), and North Shore Gas (NSG) Plan Year 4 (GPY4/EPY7) [1] Elementary Energy Education (EEE) program. The EEE Program's primary focus is to produce natural gas and electricity savings in the residential sector by motivating fifth grade students and their families to reduce energy consumption from water heating and lighting in their home. Additionally, the EEE Program aims to increase participation in other PG and NSG programs via cross-marketing and increased customer awareness of energy efficiency issues. The program underwent several changes in GPY4/EPY7. This is the first year that Peoples Gas and North Shore Gas began offering the program jointly with ComEd and Nicor Gas. The program had a new implementation contractor, Resource Action Programs (RAP) and was re-branded as "SUPER SAVERS", and implemented a "teacher-lead instruction" program model.

E.1. Program Savings

Table E-1 summarizes the natural gas and electricity savings from the GPY4/EPY7 Peoples Gas EEE Program.

Table E-1. GPY4/EPY7 Peoples Gas EEE Program Energy Savings

Program/Path	Energy Savings (Therms)	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)
Ex-Ante Gross Savings	58,878	N/A	N/A	N/A
Verified Gross Realization Rate	1.10	N/A	N/A	N/A
Verified Gross Savings	64,719	793,960	2,325	73.85
Net to Gross Ratio	0.79	0.76	0.76	0.76
Verified Net Savings	51,128	603,409	1,767	56.12

Source: Evaluation analysis of GPY4 program tracking data (June 12, 2015 data extract) and Illinois Statewide Technical Reference Manuals.[2]

Table E-2 summarizes the natural gas savings and electricity from the GPY4/EPY7 North Shore Gas EEE Program.

Table E-2. GPY4/EPY7 North Shore Gas EEE Program Energy Savings

Program/Path	Energy Savings (Therms)	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)
Ex-Ante Gross Savings	9,563	N/A	N/A	N/A
Verified Gross Realization Rate	1.00	N/A	N/A	N/A
Verified Gross Savings	9,577	97,489	314	10.59
Net to Gross Ratio	0.79	0.76	0.76	0.76
Verified Net Savings	7,566	74,092	238	8.05

Source: Evaluation analysis of GPY4 program tracking data (June 12, 2015 data extract) and Illinois Statewide Technical Reference Manuals.

[1] The GPY4/EPY7 program year began June 1, 2014 and ended May 31, 2015.

[2] Illinois Statewide Technical Reference Manual for Energy Efficiency (TRM).
Illinois_Statewide_TRM_Effective_060114_Version_3.0_022414_Clean.pdf;
Illinois_Statewide_TRM_Effective_060115_Final_02-24-15_Clean.pdf (Version 4.0 for measure errata corrections).
Available at the Illinois Commerce Commission (ICC): http://www.icc.illinois.gov/electricity/TRM.aspx

The main source of discrepancy between the ex-ante and verified savings are the custom inputs used for the unit savings. These custom inputs (e.g., household size, ISR, percent DHW, single- vs multi-family housing type) are calculated from the parent take home survey. The implementer used the entire dataset (including survey responses from Nicor Gas territory) to calculate these inputs. Navigant used only data from Peoples Gas and North Shore Gas territory, which resulted in some adjustments. Most notably, the multifamily versus single family population split is different in PG and NSG territories when compared to the overall dataset.

E.2 Program Savings by Measure

Table E-3 summarizes the natural gas and electricity savings from the Peoples Gas EEE Program by measure.

Table E-3. GPY4/EPY7 Peoples Gas EEE Program Energy Savings

Savings Type	Measure	Ex-Ante Gross Savings	Verified Gross RR	Verified Gross Savings	NTGR	Verified Net Savings
Therms	Low Flow Showerhead	36,113	0.97	34,983	0.79	27,637
	Kitchen Faucet Aerators	15,020	1.09	16,309	0.79	12,884
	Bathroom Faucet Aerator	3,206	1.03	3,287	0.79	2,596
	Water Heater Set-Back	4,539	0.52	2,380	0.79	1,880
	Shower Timer	N/A	N/A	7,760	0.79	6,130
	Total	**58,878**	**1.10**	**64,719**		**51,128**
kWh	Low Flow Showerhead	N/A	N/A	262,709	0.76	199,659
	Kitchen Faucet Aerators	N/A	N/A	98,887	0.76	75,154
	Bathroom Faucet Aerator	N/A	N/A	25,221	0.76	19,168
	Water Heater Set-Back	N/A	N/A	8,019	0.76	6,094
	CFLs	N/A	N/A	206,149	0.76	156,673
	Shower Timer	N/A	N/A	192,976	0.76	146,661
	Total	**-**		**793,960**		**603,409**
Peak kW	Low Flow Showerhead	N/A	N/A	14.03	0.76	10.66
	Kitchen Faucet Aerators	N/A	N/A	11.86	0.76	9.02
	Bathroom Faucet Aerator	N/A	N/A	14.46	0.76	10.99
	Water Heater Set-Back	N/A	N/A	0.91	0.76	0.70
	CFLs	N/A	N/A	21.72	0.76	16.50
	Shower Timer		N/A	10.86	0.76	8.25
	Total	**-**		**73.85**		**56.12**

Source: Evaluation analysis of GPY4 program tracking data (June 12, 2015 data extract).

Table E-4 summarizes the natural gas and electricity savings from the GPY4/EPY7 North Shore Gas EEE by measure.

Table E-4. GPY4 North Shore Gas EEE Program Energy Savings

Savings Type	Measure	Ex-Ante Gross Savings	Verified Gross RR	Verified Gross Savings	NTGR	Verified Net Savings
Therms	Low Flow Showerhead	5,865	0.81	4,765	0.79	3,764
	Kitchen Faucet Aerators	2,439	0.73	1,791	0.79	1,415
	Bathroom Faucet Aerator	521	0.63	328	0.79	259
	Water Heater Set-Back	737	0.39	288	0.79	227
	Shower Timer	N/A	N/A	2,405	0.79	1,900
	Total	**9,563**	**1.00**	**9,577**		**7,566**
kWh	Bathroom Faucet Aerators	N/A	N/A	32,697	0.76	24,850
	Kitchen Faucet Aerators	N/A	N/A	12,229	0.76	9,294
	Low Flow Showerhead	N/A	N/A	3,039	0.76	2,310
	Water Heater Set-Back	N/A	N/A	79	0.76	60
	CFLs	N/A	N/A	39,248	0.76	29,829
	Shower Timer	N/A	N/A	10,198	0.76	7,751
	Total			**97,489**		**74,092**
Peak kW	Bathroom Faucet Aerators	N/A	N/A	1.91	0.76	1.45
	Kitchen Faucet Aerators	N/A	N/A	1.61	0.76	1.22
	Low Flow Showerhead	N/A	N/A	2.36	0.76	1.79
	Water Heater Set-Back	N/A	N/A	0.01	0.76	0.01
	CFLs	N/A	N/A	4.13	0.76	3.14
	Shower Timer	N/A	N/A	0.57	0.76	0.44
	Total			**10.59**		**8.05**

Source: Evaluation analysis of GPY4 program tracking data (June 12, 2015 data extract).

E.3 Impact Estimate Parameters for Future Use

In the course of our GPY4/EPY7 evaluation, Navigant used a variety of parameters in its impact calculations. Navigant sourced the Illinois TRM Version 3.0[3] for all deemed parameters for gross savings algorithms and sourced the parent-guardian take-home student survey for the following TRM-allowed custom parameters: installation rates, percent with gas water heating, housing type, and household size. The net-to-gross (NTG) value for gas savings was deemed in this program year, based on the Illinois Stakeholder Advisory Group's (IL SAG) consensus process and from previous evaluation research. The GPY4/EPY7 evaluation included a participant survey to estimate NTG values that can be used for deeming in the future. Those values are presented in the following table.

Table E-5. Impact Estimate Parameters for Future Use

Parameter	Description	Value	Data Source
NTGR	Showerhead	0.82	Participant "take-home" survey
	Bathroom Faucet Aerator	0.92	
	Kitchen Faucet Aerator	0.89	

Source: Evaluation Analysis.

[3] www.ilsag.info/technical-reference-manual.html

E.4. Program Volumetric Detail

The program distributed 4,471 kits in the PG territory and 770 kits in the NSG territory, as shown in Table E-6 and Table E-7 below.

Table E-6. GPY4/EPY7 Peoples Gas EEE Program Primary Participation Detail

Metric	Measures Distributed
Number of Total Kits Distributed	4,741
Number of Measures/Kit	7
Number of Showerheads Distributed	4,741
Number of CFLs Distributed	14,223
Number of Bathroom Aerators Distributed	9,482
Water Heater Set Back Instructions Distributed	4,741
Number of Shower Timers Distributed	4,741
Number of Kitchen Aerators Distributed	4,741
Number of Total Measures Distributed	42,669

Source: Navigant analysis of GPY4 program tracking data (June 12, 2015 data extract).

Table E-7. GPY4/EPY7 North Shore Gas EEE Program Primary Participation Detail

Metric	Measures Distributed
Number of Total Kits Distributed	770
Number of Measures/Kit	7
Number of Showerheads Distributed	770
Number of CFLs Distributed	2,310
Number of Bathroom Aerators Distributed	1,540
Water Heater Set Back Instructions Distributed	770
Number of Shower Timers Distributed	770
Number of Kitchen Aerators Distributed	770
Number of Total Measures Distributed	6,930

Source: Navigant analysis of GPY4 program tracking data (June 12, 2015 data extract).

E.5. Findings and Recommendations

The following provides insight into key program findings and recommendations.[4] The program performed well in GPY4/EPY7, exceeding participation targets for the year.

Program Participation

Finding 1. The program distributed 4,741 kits in the Peoples Gas service area and 770 kits in the North Shore Gas service area, exceeding the original participation targets of 4,250 and 700 kits for Peoples Gas and North Shore Gas, respectively.

Verified Gross Program Savings and Realization Rate

Finding 3. Navigant's review of the ex-ante calculations for the GPY4 Elementary Energy Education Program resulted in verified gross energy savings of 64,719 therms in Peoples Gas territory, a gross realization rate of 110 percent, and 9,577 therms in North Shore Gas territory, reflecting a gross realization rate of 100 percent for NSG.

Finding 4. Navigant calculated different ex-post values for custom inputs used to calculate in unit savings (calculated from the parent-guardian take-home survey responses - including in the number of people per household and in-service rates). A comparison of the custom inputs is provided in Appendix 7.1. The number of people per household and measure in-service rates differed significantly between multi-family and single family, and between PG and NSG. In particular, the custom input differences resulted in a much lower gross realization rate for NSG.

Recommendation 1. If the program desires a higher degree of accuracy in ex-ante savings estimates, the program could provide Navigant additional detail on how the ex-ante custom inputs were derived so that evaluation recommendations and common approaches could be developed, where feasible.

Finding 5. The implementation contractor did calculate savings separately for single-family and multi-family housing types and correctly utilized the applicable deemed inputs from the TRM. However, the implementer did not calculate the custom inputs separately for single-family and multi-family housing types, and for PG and NSG separately from all gas installations.

Recommendation 2. The program should calculate custom inputs for CFLs, aerators, and showerheads for single family homes separately from multi-family homes to increase the degree of accuracy of its ex-ante savings estimates. Additionally, the implementer should calculate custom inputs separately for Peoples Gas and North Shore Gas given differences in housing stock and in-service rates.

Finding 6. The ex-ante estimate for the water heater setback measure was 6.4 therms for any household which reported lowering their water heater temperature. This ex-ante number assumes the participant lowered the water heater temperature by 15 degrees. However, the temperature differential reported by participants was 6.5 degrees, resulting in lower than expected savings and a realization rate of 53 percent for this measure. Additionally, the program reported a savings penalty for those who reported raising their water heater temperature after participating; Navigant does not count a penalty because those participants become ineligible for consideration within the methodology of the TRM.

[4] The Executive Summary presents the most important of the Section 6 Findings and Recommendations. Findings and Recommendations in the Executive Summary are numbered to match Section 6 for consistent reference to individual findings and recommendations. Therefore, gaps in numbering may occur in the Executive Summary.

Recommendation 3. The implementer should update savings estimates for the water heater setback measure using the pre- and post-temperature inputs (Tpre and Tpost) from the parent-guardian take-home survey.

Finding 7. The EEE Program does not currently claim savings from programmable thermostat measures. Approximately 1.1 percent of participants reported programming their programmable thermostat based on the educational materials provided in the kits (11% reported not having a programmable thermostat). Within the written program materials, there are directions to set the thermostat to 78F in warm weather and 68F in cool weather. The TRM energy savings methodology is specified for programmable thermostats which were previously set to override mode.

Recommendation 4. In the future, if the program chooses to claim savings for this measure, it should include instructions on how to properly use a programmable thermostat (that is, how to use four programmed settings for daytime, night time, summer, and winter), in order to qualify under the TRM. There are significant savings associated with this measure; a programmable thermostat installed in a single family home in Chicago results in savings of 62.3 therms, using the methodology from the TRM v4.0.

1 Introduction

1.1 Program Description

This report includes Navigant Consulting Inc.'s (Navigant's) findings and recommendations from the impact and process evaluation of the joint Commonwealth Edison Company (ComEd) Plan Year 7 and Nicor Gas, Peoples Gas (PG), and North Shore Gas (NSG) Plan Year 4 (GPY4/EPY7)[5] Elementary Energy Education (EEE) program. The EEE Program is implemented by Resource Action Programs (RAP) and is branded "SUPER SAVERS." In GPY4/EPY7, the program targeted fifth grade students in public and private schools that are customers of Nicor Gas or jointly ComEd and Nicor Gas, ComEd and Peoples Gas, and ComEd and North Shore Gas. Schools received an invitation to participate and register to schedule the interactive presentations; alternatively, schools could register on the program website to join a waiting list if the program was fully-enrolled when they registered. Schools that had participated in the GPY3/EPY6 program were also invited to participate.

The EEE Program's primary focus is to produce natural gas and electricity savings in the residential sector by motivating students and their families to take steps through reducing energy consumption for water heating and lighting in their home; a secondary goal of the program is to reduce residential use of water. Additionally, the EEE Program aims to increase participation in other PG, NSG, ComEd, and Nicor Gas programs via cross-marketing and increased customer awareness of energy efficiency issues.

This was the first year that PG and NSG offered the program jointly with ComEd. New to GPY4/EPY7 was the "teacher-lead instruction" program model, as opposed to the previous model that incorporated a single, contractor-led presentation. The teacher can choose to teach the curriculum over five or ten days and focus on one kit measure per day. After the lessons, students took home a kit that includes water conservation measures. Kits included instruments to measure water and ambient temperature, as well as water flow rates, CFLs, and a student survey form where participants used the form to report details of their family's participation. Students and teachers are incentivized to return the student survey forms with a $50 mini-grant for each class that completes and returns 80 percent of their cards. RAP based the program's savings on the installation rate of implemented measures reported in the student survey form against the number of kits that were reported taken home.

1.2 Evaluation Objectives

Navigant identified the following key researchable questions for GPY4/EPY7.

1.2.1 Impact Questions

1. What is the program's verified gross savings?
2. What is the program's verified net savings?
3. Did the program meet its savings targets? If not, why?

1.2.2 Process Questions

1. Has the program changed since GPY3/EPY6? If so, why and how?

[5] The EPY7/GPY4 program year began June 1, 2014 and ended May 31, 2015.

2 Evaluation Approach

This section provides an overview of the data collection methods, gross and net impact evaluation approaches, and process evaluation approaches that occurred for the GPY4/EPY7 evaluation. For this impact evaluation, gross savings were evaluated by (1) reviewing the implementer-submitted work papers to assure that savings are calculated correctly and in adherence with Illinois TRM v3.0 and (2) cross-checking totals with the tracking system. Navigant calculated verified net savings using a net-to-gross ratio (NTGR) based on previous evaluation research and approved through the Illinois Stakeholder Advisory Group (IL SAG) consensus process.[6] Navigant conducted a limited process review that included in-depth interviews with program staff and analysis of parent and teacher survey responses collected by RAP.

2.1 Overview of Data Collection Activities

The core data collection activities used in this evaluation included in depth interviews with program staff and review of the program tracking database. Participant surveys were used to conduct net-to-gross (NTG) research to inform NTG recommendations for the future. The full set of data collection activities are shown in Table 2-1 and Table 2-2 below.

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When	Comments
Program Tracking Database	Participants	All	All	July – August 2015	Source of information for verified gross analysis
In Depth Interviews	Program Manager/Implementer Staff	4	4	June and September 2015	Included staff from ComEd, Nicor Gas, Peoples Gas, North Shore Gas, and RAP.
Participant Survey	Participating Customers	258	191	May – June 2015	NTG research conducted to be considered for future use.

Source: Navigant.

Table 2-2. Additional Resources

Reference Source	Author	Application	Gross Impacts	Process
Illinois Technical Reference Manual	Illinois Energy Efficiency Stakeholder Advisory Group (SAG)	EEE Measure Impact Analysis	X	
Parent-Guardian Survey Responses	From RAP	Process and Impact Analysis	X	X
Teacher Survey Responses	From RAP	Process Analysis		X
Student Survey Form	From RAP	Impact Analysis	X	

Source: Navigant.

[6] Illinois Stakeholder Advisory Group, ilsag.org/net

2.2 *Verified Savings Parameters*

Navigant calculated verified gross and net program impacts for five measures with deemed savings values: low-flow showerheads, kitchen and bathroom faucet aerators, CFLs, and water heater setback. These measures account for all quantifiable GPY4/EPY7 gas and electric savings.

2.2.1 Verified Gross Program Savings Analysis Approach

Verified gross and net savings resulting from the GPY4/EPY7 program were calculated by multiplying the total quantity of kits by the measure level unit savings.

Unit savings are calculated using the algorithms from the Illinois TRM v3.0 and total quantity is the number of each type of measure distributed. The Illinois TRM deems most input parameters for showerheads, faucet aerators, water heater setback, and CFLs (for detailed description of engineering algorithms and inputs used, see Appendix 7.1).

Table 2-3 lists the source of the measures that Navigant used from the Illinois TRM. The Illinois TRM v3.0 allows for custom values to be used for household size, in-service rate, single- vs multi-family housing type split, and % domestic hot water, and Navigant based these values on student survey form data. Navigant also calculated savings for single family homes separately from multi-family homes given the different values for household size and showers per household.

Table 2-3. GPY4 Verified Gross Savings Parameter Data Sources

Measure	Deemed Input Data Source
Showerheads	Illinois TRM v3.0 – Section 5.4.5
Kitchen Aerators	Illinois TRM v3.0 – Section 5.4.4
Faucet Aerators	
CFLs	Illinois TRM v3.0 – Section 5.5.1
Hot Water Heater Temperature Setback	Illinois TRM v3.0 – Section 5.4.6

Source: http://www.ilsag.info/technical-reference-manual.html

2.2.2 Verified Net Program Savings Analysis Approach

Verified net energy savings were calculated by multiplying the verified gross savings estimates by a deemed NTGR of 0.79 for natural gas measures and 0.76 for electric. In GPY4/EPY7, the NTGR estimates used to calculate the Verified Net Savings were based on past evaluation research and approved through a consensus process managed through the Illinois Energy Efficiency Stakeholders Advisory Group (SAG)[7].

Navigant conducted NTG research in GPY4/EPY7 to inform NTG recommendations for the future. The NTG research methods include participant survey results. The research uses a self-report method where participants answer questions about the program. The participant survey instrument asks about awareness of the measures identified and their inclination to pursue corrective actions for those measures absent the program. The results from the NTG research will be forthcoming in a 2015 memo.

[7] Source: Deemed NTGR values are available on the Illinois SAG web site. http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/Peoples_Gas_and_North_Shore_Gas_NTG_Summary_GPY1-5_2015-03-01_Final.pdf

2.3 *Process Evaluation*

The process evaluation for GPY4/EPY7 was based on interviews with program staff and the implementation contractor and analysis of parent and teacher survey responses collected by RAP, and analysis of parent and teacher survey responses collected by Navigant.

Navigant conducted interviews with the ComEd, Nicor Gas, Peoples Gas and North Shore Gas program managers as well as with the RAP implementation staff in the summer of 2015. These interviews discussed the program's energy savings and participation, as well as changes implemented in GPY4/EPY7.

Around 50 teachers in the PG and NSG service territories responded to the educator evaluation questions asked by RAP. Around 30 parents in the PG and NSG service territories responded to the questions on a parent comment card included in the kit box.

3 Gross Impact Evaluation

Navigant's review of the ex-ante calculations for the PG and NSG GPY4/EPY7 EEE Program resulted in verified gross energy savings of 64,719 therms in Peoples Gas territory, a gross realization rate of 110 percent, and 9,577 therms in North Shore Gas territory, reflecting the program's gross realization rate of 100 percent for NSG.

3.1 Program Tracking Data Review

RAP's tracking system and savings documentation for GPY4/EPY7 consisted of (1) a spreadsheet containing energy savings estimates, including custom inputs, (2) the parent survey data which included contact information and select responses to process questions from parent/guardians, (3) the raw survey data, including all the responses from the parent-guardian take-home survey (additionally the implementer provided a copy of the survey which included a data map for these responses), and (4) the teacher survey data which included responses to process questions provided by teachers. The algorithms and inputs for unit savings calculations were contained in the energy savings spreadsheet.

Key findings include:

1. Overall, Navigant received all applicable data needed in order to conduct the gross impact analysis. Navigant found the spreadsheets well-labeled and easy to follow.
2. The energy savings spreadsheet, which included algorithms and inputs to derive each of the unit savings, was a useful piece of documentation.
3. There were some discrepancies in the custom inputs for each of the calculations between what the implementer provided and what Navigant calculated using the raw survey data, including number of people per household and in-service rates. A comparison of the custom inputs for the unit savings is provided in Appendix 7.1.
4. RAP did calculate savings for single-family homes separately from multi-family homes and correctly used the deemed values from the TRM for these two housing types. However, RAP did not calculate the custom inputs separately for single-family homes and multi-family homes (e.g., number of people per household, in-service rates). This resulted in differences between ex-ante gross savings and verified gross savings.

3.2 Program Volumetric Findings

As shown in Table 3-1 and Table 3-2, the Peoples Gas EEE Program distributed 4,471 kits and 42,669 total measures. The North Shore Gas EEE Program distributed 770 kits and 6,930 total measures.

Table 3-1. GPY4 Peoples Gas EEE Program Primary Participation Detail

Metric	Measures Distributed
Number of Total Kits Distributed	4,741
Number of Measures/Kit	9
Showerheads	4,741
CFLs	14,223
Bathroom Aerators	9,482
Kitchen Aerators	4,741
Water Heater Set Back	4,741
Shower Timers	4,741
Number of Total Measures Distributed	42,669

Source: Navigant analysis of GPY4 program tracking data (June 12, 2015 data extract).

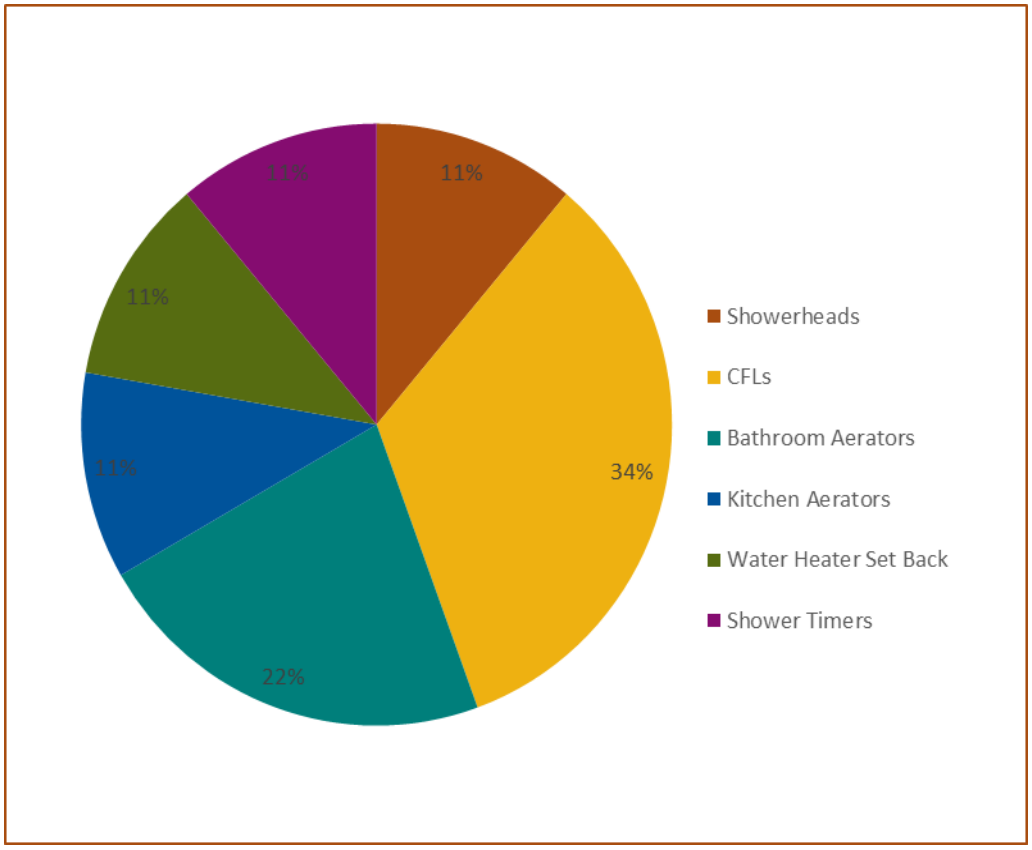
Table 3-2. GPY4 North Shore Gas EEE Program Primary Participation Detail

Metric	Measures Distributed
Number of Total Kits Distributed	770
Number of Measures/Kit	9
Showerheads	770
CFLs	2,310
Bathroom Aerators	1,540
Kitchen Aerators	770
Water Heater Set Back	770
Shower Timers	770
Number of Total Measures Distributed	6,930

Source: Navigant analysis of GPY4 program tracking data (June 12, 2015 data extract).

Figure 3-1 disaggregates the measure mix by type. Measures are distributed in the same proportion for both Peoples Gas and North Shore Gas.

Figure 3-1. Peoples Gas and North Shore Gas: % of Measures Distributed by Type



Source: Navigant Analysis

3.3 Gross Program Impact Parameter Estimates

As described in Section 2.2.1, energy and demand savings were estimated using Illinois TRM v3.0. The Illinois TRM deems most input parameters for showerheads, faucet aerators, and hot water heater setback. Navigant used the student survey form data to calculate or adjust several input parameters. Appendix 7.1 includes tables that show each input variables by measure, values used by Navigant and the implementer, and whether that variable was deemed by the TRM or if a custom input was allowed.

3.4 Verified Gross Program Impact Results

As shown in Table 3-3 and Table 3-4, the GPY4/EPY7 Peoples Gas EEE Program reported ex-ante gross energy savings of 58,878 therms in Peoples Gas territory and 9,563 therms in North Shore Gas territory. Evaluation adjustments resulted in verified gross energy savings of 64,719 therms in Peoples Gas territory, a gross realization rate of 110 percent, and 9,577 therms in North Shore Gas territory, reflecting the program's gross realization rate of 100 percent for NSG.

Table 3-3. GPY4/EPY7 Peoples Gas EEE Program Impact Results

Measure Category	Quantity Unit	Verified Measures Distributed	Ex-Ante Gross Savings (therms)	Verified Gross Realization Rate	Verified Gross Savings (therms)
Kit Measures					
Showerhead	Each	4,741	36,113	0.97	34,983
Kitchen Aerator	Each	4,741	15,020	1.09	16,309
Bathroom Aerator	Each	9,482	3,206	1.03	3,287
Water Heater Temperature Setback	Each	4,741	4,539	0.52	2,380
Shower Timer	Each	4,741	N/A	N/A	6,130
PG Total			**58,878**	**1.10**	**64,719**

Sources: Program tracking data and Navigant analysis

Table 3-4. GPY4/EPY7 North Shore Gas EEE Program Impact Results

Measure Category	Quantity Unit	Verified Measure Quantity	Ex-Ante Gross Savings (therms)	Verified Gross Realization Rate	Verified Gross Savings (therms)
Kit Measures					
Showerhead	Each	770	5,865	0.81	4,765
Kitchen Aerator	Each	770	2,439	0.73	1,791
Bathroom Aerator	Each	1,540	521	0.63	328
Water Heater Temperature Setback	Each	770	737	0.39	288
Shower Timer	Each	770	N/A	N/A	2,405
NSG Total			**9,563**	**1.00**	**9,577**

Source: Program tracking data and Navigant analysis

The reason for variation in savings is some difference in the custom inputs calculated by Navigant and the custom inputs provided by the implementer. The implementer did not calculate custom inputs for PG and NSG separately from Nicor Gas, which resulted in some variation, particularly in the multi-family versus single family split. The ex-ante savings were calculated using 5.2 people per household and the ex-post savings were calculated using 5.02 (Peoples Gas) and 4.47 (North Share Gas) for multifamily and 5.00 (Peoples Gas) and 4.60 (North Shore Gas) for single family people per household. Additionally, variation from Navigant's inputs and the implementer's inputs for the in-service rates calculated for the program ranged from one percent to 14 percent. For additional detail on the custom inputs, see tables in Appendix 7.1.

Table 3-5 below shows the unit savings by measure as well as the total kit savings. These unit savings values contain in-service rate and are multiplied by the single family to multi-family proportion.

Table 3-5. Measure Level Unit Savings

Measure	Energy Unit Savings PG (Therms)	Energy Unit Savings NSG (Therms)
Showerhead (1.5 GPM) - Single Family	3.41	4.69
Showerhead (1.5 GPM) - Multi Family	3.97	1.50
Kitchen Aerator (1.5 GPM) - Single Family	1.77	2.03
Kitchen Aerator (1.5 GPM) - Multi Family	1.67	0.29
Bathroom Aerator (1.0 GPM) Installed one - Single Family	0.13	0.19
Bathroom Aerator (1.0 GPM) Installed one - Multi Family	0.24	0.06
Bathroom Aerator (1.0 GPM) Installed Both - Single Family	0.15	0.16
Bathroom Aerator (1.0 GPM) Installed Both - Multi Family	0.17	0.02
Water Heater Temperature Set Back (Lowered)	0.50	0.37
Shower Timers	1.64	3.12
Total Kit Savings	13.65	12.43
Number of Kits	4,741	770
Total Gross Savings	56,959	7,172

Sources: Program tracking data and Navigant analysis

3.5 Shower Timer Measure Energy Savings

Each energy savings kit contained a shower timer; the shower timer encourages participants to save energy by limiting their shower time length to 5 minutes. Navigant included questions in the net-to-gross survey in order to estimate energy savings achieved by the shower timer. The proposed engineering algorithm and the custom inputs/variables for this measure are shown below.

Equation 1. Shower Timer Energy Savings Equation

$$\Delta therms = \%Fossil\ DHW \times Water\ Flow\ (GPM) \times (Baseline\ Shower\ Time - EEM\ Shower\ Time) \times Household\ Users \times Days\ per\ year \times SPCD \times Usage\ Factor \times EPG\_Gas$$

Table 3-6. Shower Timer Inputs and Variables – Peoples Gas

Value, Navigant	Variable	Notes on values
2.01	GPM Water Flow	Average for sample calculated using base case GPM (from the TRM) and efficient case (GPM from the low-flow shower head in the kit) multiplied by the participant reported in-service rate (ISR) of the efficient showerhead supplied in the kit
7.80	Baseline shower time, minutes	Assumed value from TRM v3.0
2.18	Household Users	Calculated from Q10B, how many family members use the shower timer?
0.47	%FossilDHW (natural gas)	Calculated from reported values on the NTG survey, this factor adjusts for shower timers that were distributed to houses with electric water heaters.
0.60	SPCD	Showers Per Capita per Day. Assumed value from TRM v3.0
0.34	Usage Factor	Calculated from survey question Q10, provides the percent of time shower timers were used by the sample of respondents. A response of "Always" is assigned a Usage Factor of 100%, or 1.00. Other responses: "Often" (0.50), "Occasionally" (0.15); "Never" (0.00).
5.65	EEM Shower time, minutes	Calculated based on shower timer specifications and reported usage calculated from NTG survey question Q10C. For this sample of users, the shower timer saves 2.15 minutes (7.80 – 5.65)
365.25	days/year	Assumed value from TRM v3.0
0.005	EPG_gas	Assumed value from TRM v3.0

Sources: Survey responses, Illinois TRM v3.0, and Navigant analysis

Table 3-7. Shower Timer Inputs and Variables – North Shore Gas

Value, Navigant	Variable	Notes on values
1.77	GPM Water Flow	Calculated using base case GPM (from the TRM) and efficient case (GPM from the low-flow shower head in the kit) multiplied by the participant reported ISR of the efficient showerhead supplied in the kit
7.8	Baseline shower time, minutes	Assumed value from TRM v3.0
2.71	Household Users	Calculated from Q10B, how many family members use the shower timer?
0.77	%FossilDHW (natural gas)	Calculated from reported values on the NTG survey, this factor adjusts for shower timers that were distributed to houses with electric water heaters.
0.60	SPCD	Showers Per Capita per Day. Assumed value from TRM v3.0
0.35	Usage Factor	Calculated from survey question Q10, provides the percent of time shower timers were used by the sample of respondents. A response of "Always" is assigned a Usage Factor of 100%, or 1.00. Other responses: "Often" (0.50), "Occasionally" (0.15); "Never" (0.00).
5.61	EEM Shower time, minutes	Calculated based on shower timer specifications and reported usage calculated from NTG survey question Q10C. For this sample of users, the shower timer saves 2.19 minutes (7.80 – 5.61)
365.25	days/year	Assumed value from TRM v3.0
0.005	EPG_gas	Assumed value from TRM v3.0

Sources: Survey responses, Illinois TRM v3.0, and Navigant analysis

Assuming the above variables for participants with gas water heaters, the unit savings per household for the shower timer measure for Peoples Gas is 3.5 therms, and 4.1 therms for North Shore Gas. These savings values reflect Usage Factors of 0.34 for PG and 0.35 for NSG, reflecting some households with partial or no use. If gas water heating participants "Always" used the timer, the average user would save 10.3 therms and 11.6 therms, respectively for PG and NSG. When we include all adjustment factors, including Usage Factor and the finding that some shower timers distributed in PG and NSG territories went to households with electric water heating, the resulting unit savings is 1.64 therms per kit for all kits distributed through the EEE program for Peoples Gas, and 3.12 therms for North Shore Gas.

The total per kit unit savings multiplied by the total kits distributed through the program (4,741 for Peoples Gas and 770 for North Shore Gas) in GPY4 results in gross savings of 7,760 and 2,405 therms for Peoples Gas and North Shore Gas, respectively.

Navigant identified several limitations when using the survey data to estimate the behavioral savings for shower timers:

1. The assumed shower length in the TRM includes an unknown amount of "shower warm up" time (i.e., the time it takes for water to come to a comfortable temperature before the user begins showering) – it is unclear from the instructions in the kit if participants should start timer before or after shower warm up time.
2. The actual savings could be over- or under-estimated because baseline shower length was assumed to be 7.80 minutes, based on the TRM value, not survey responses. Individual household baseline shower lengths may be more or less than 7.80 minutes (although presumably if the baseline shower length was shorter than 7.80 minutes they would be unlikely to use the timer.)
3. Navigant could not find the shower time measure in any other state TRM including Pennsylvania, Indiana, and Michigan. Navigant could not find an instance of any utility claiming savings for this measure using survey data.
4. Navigant found some studies which used metering to evaluate a measure similar to this one, described below. In all cases, the measure evaluated had a more active auditory or visual element to the timer and two of the three found fewer savings than the engineering algorithms in this report.
    a. A study in New York State involved the installation of a shower orb (this illuminated globe provides feedback to user on length of shower by change color) and metering of 16 showers. This study found an increase in water usage after installing the shower orb.[8]
    b. A study in Australia compared the water consumption of 151 showers before and after the installation of a shower monitor with alarm. The study found a reduction in shower time of 1.20 minutes.[9]
    c. A SDG&E study installed 8 shower monitors (auditory and visual alarms) in university dormitories found water volume savings of 11%. This study then used this data to extrapolate savings for a single family home at 9 therms/year.[10]

[8] "Saving Water with a Shower Orb" https://www.rit.edu/affiliate/nysp2i/sites/rit.edu.affiliate.nysp2i/files/team_orb_-_competition_report_0.pdf

[9] "Shower Alarms reduce water and energy consumption" http://ec.europa.eu/environment/integration/research/newsalert/pdf/213na3_en.pdf

[10] "SHOWER MONITOR AND ALARM SYSTEM FINAL REPORT", http://www.etcc-ca.com/sites/default/files/reports/et12sdge0004_shower_monitor_and_alarm_system_final_report.pdf

Overall, Navigant concludes savings are occurring because of the shower timer measure, however the customer survey data may not provide an accurate estimation of energy savings due the combined uncertainties of the multiple self-reported variables in the savings algorithm. In order to deem a savings number for this measure to include in a future version of the TRM, Navigant recommends the TRM Technical Advisory Committee consider collecting data from a before-and-after metering study for the type of shower timer contained in the kit.

4 Net Impact Evaluation

Verified net energy savings were calculated by multiplying the verified gross savings estimates by a NTGR of 0.79 for natural gas measures and 0.76 for electric. As noted in Section 2.2.2, the NTGR used to calculate the net verified savings for the GPY4 EEE Program was deemed through a consensus process managed by the Illinois SAG. Navigant conducted NTG evaluation research jointly with the ComEd and the gas utilities as part of the GPY4/EPY7 evaluation, and have reported these results in a separate memo, provided as Appendix 7.3.

Table 4-1 summarizes the net natural gas savings from the GPY4/EPY7 Peoples Gas EEE Program by measure.

Table 4-1. GPY4/EPY7 Peoples Gas EEE Program Energy Savings

Savings Type	Measure	Ex-Ante Gross Savings	Verified Gross RR	Verified Gross Savings	NTGR	Verified Net Savings
Therms	Low Flow Showerhead	36,113	0.97	34,983	0.79	27,637
	Kitchen Faucet Aerators	15,020	1.09	16,309	0.79	12,884
	Bathroom Faucet Aerator	3,206	1.03	3,287	0.79	2,596
	Water Heater Set-Back	4,539	0.52	2,380	0.79	1,880
	Shower Timer	N/A	N/A	7,760	0.79	6,130
	Total	**58,878**	**1.10**	**64,719**		**51,128**
kWh	Low Flow Showerhead	N/A	N/A	262,709	0.76	199,659
	Kitchen Faucet Aerators	N/A	N/A	98,887	0.76	75,154
	Bathroom Faucet Aerator	N/A	N/A	25,221	0.76	19,168
	Water Heater Set-Back	N/A	N/A	8,019	0.76	6,094
	CFLs	N/A	N/A	206,149	0.76	156,673
	Shower Timer	N/A	N/A	192,976	0.76	146,661
	Total	**-**		**793,960**		**603,409**
kW	Low Flow Showerhead	N/A	N/A	14.03	0.76	10.66
	Kitchen Faucet Aerators	N/A	N/A	11.86	0.76	9.02
	Bathroom Faucet Aerator	N/A	N/A	14.46	0.76	10.99
	Water Heater Set-Back	N/A	N/A	0.91	0.76	0.70
	CFLs	N/A	N/A	21.72	0.76	16.50
	Shower Timer		N/A	10.86	0.76	8.25
	Total	**-**		**73.85**		**56.12**

Source: Evaluation analysis of GPY4 program tracking data (June 12, 2015 data extract).

Table 4-2 summarizes the net natural gas savings from the GPY4/EPY7 North Shore Gas EEE Program by measure.

Table 4-2. GPY4/EY7 North Shore Gas EEE Program Energy Savings

Savings Type	Measure	Ex-Ante Gross Savings	Verified Gross RR	Verified Gross Savings	NTGR	Verified Net Savings
Therms	Low Flow Showerhead	5,865	0.81	4,765	0.79	3,764
	Kitchen Faucet Aerators	2,439	0.73	1,791	0.79	1,415
	Bathroom Faucet Aerator	521	0.63	328	0.79	259
	Water Heater Set-Back	737	0.39	288	0.79	227
	Shower Timer	N/A	N/A	2,405	0.79	1,900
	Total	**9,563**	**1.00**	**9,577**		**7,566**
kWh	Bathroom Faucet Aerators	N/A	N/A	32,697	0.76	24,850
	Kitchen Faucet Aerators	N/A	N/A	12,229	0.76	9,294
	Low Flow Showerhead	N/A	N/A	3,039	0.76	2,310
	Water Heater Set-Back	N/A	N/A	79	0.76	60
	CFLs	N/A	N/A	39,248	0.76	29,829
	Shower Timer	N/A	N/A	10,198	0.76	7,751
	Total			**97,489**		**74,092**
Peak kW	Bathroom Faucet Aerators	N/A	N/A	1.91	0.76	1.45
	Kitchen Faucet Aerators	N/A	N/A	1.61	0.76	1.22
	Low Flow Showerhead	N/A	N/A	2.36	0.76	1.79
	Water Heater Set-Back	N/A	N/A	0.01	0.76	0.01
	CFLs	N/A	N/A	4.13	0.76	3.14
	Shower Timer	N/A	N/A	0.57	0.76	0.44
	Total			**10.59**		**8.05**

Source: Evaluation analysis of GPY4 program tracking data (June 12, 2015 data extract).

5 Process Evaluation

This section includes changes made to the EEE Program in GPY4/EPY7 as well changes planned for GPY5/EPY8.

5.1 Program Changes since GPY3/EPY6

The GPY4/EPY7 program has changed in several ways since GPY3/EPY6 as described below. Together these changes lead to an opportunity for savings by running the program more efficiently and with greater outreach using the same resources.

5.1.1 Participation

A major change to the program in GPY4/EPY7 was the addition of PG and NSG to the program. PG and NSG partnered with ComEd to jointly offer the program in their service territories.

Interest in this program exceeded participation targets. Several teachers who learned about the program from participating teachers contacted RAP to participate in the program and had to be put on a waitlist. RAP began marketing and outreach for the program in the middle of October 2014, and by early December 2014 the program was fully enrolled.

5.1.2 Program Delivery Method

A second major change in GPY4/EPY7 was the use of a new implementation contractor, RAP, and the delivery method of the education component of the program. The change in implementation contractor was due to the utilities' desire to test a "teacher-led instruction" program model, as opposed to the previous model that incorporated a single, contractor-led presentation, which served as the totality of the instruction provided to the students.

This model was also of special interest to Nicor Gas, which experienced significantly reduced program budgets in GPY4. The "teacher-led instruction" model provides the same type of quality materials and measures, but at a cost reduction, which will assist Nicor Gas in maximizing the program budget, while maintaining a robust program. The cost reduction is due to the elimination of the contractor-led presentation, which required travel and accommodations for contractor personnel.

The utilities and RAP worked together to completely overhaul the program. They spent a significant amount of time and effort rebranding the program from "Think! Energy" to "Super Savers". The energy efficiency kits have a different look and feel to them with the utilities' names more in the foreground than they were before. The delivery method of the education component of the program changed significantly. Teachers notified RAP when they wanted to begin teaching the program materials and RAP delivered the materials by that timeframe. The teachers then had the option of teaching the materials to their students over five or ten days, unlike in EPY6/GPY3, when the education component was taught to students during a single, contractor-led presentation.

After the presentation of the educational materials, the students take home an energy efficiency kit that includes water conservation measures; instruments to measure water and ambient temperature, as well as water flow rates; CFLs, and a student workbook where participants used the pages to report details of their family's participation. Once the workbooks were completely filled out and brought back to class,

teachers asked students to transfer their answers from the workbook onto a student survey form. These are the forms that teachers are incentivized to return back to RAP.

5.1.3 Teacher Incentives

Teachers were incentivized with a $50 mini grant for their classroom if they returned 80 percent of the completed survey forms by the middle of March 2015. This is incentive is different than what was offered in GPY3/EPY6, where teachers were incentivized with a $100 mini grant for returning 80 percent of the completed survey forms as well as being entered into a drawing to win an iPad.

5.1.4 Devices and Materials in Kits

No changes were made to number or type of measures included in the kits, but there were changes made to the make and model of high efficiency showerhead and CFLs included in the kits as shown in Table 5-1 below. There were also more print materials included in the kits detailing how to save energy and the utilities' other energy efficiency program offerings.

Table 5-1. GPY3/EPY6 and GPY4/EPY7 Devices Included in Kits

Measure	Make and Model for GPY3/EPY6	Make and Model for GPY4/EPY7
Showerhead	Niagara Power 1.5 gpm	Intellishower 1.5 gpm
Kitchen Aerators	Niagara 1.5 gpm	Niagara 1.5 gpm
Bathroom Aerators	Niagara 1.0 gpm	Niagara 1.0 gpm
CFLs	14-watt	13-watt

5.2 *Participant Feedback*

According to respondents of RAP's teacher and parent surveys and Navigant's NTG survey, the program performed well in GPY4/EPY7. The sections below detail the results from these surveys.

5.2.1 Teacher and Parent Feedback from RAP Surveys

RAP sent an educator evaluation survey to every teacher who participated in GPY4/EPY7. The evaluation team analyzed the raw results from these questions and found that 50 teachers in the PG and NSG service territories (about 32 percent of participating teachers) responded to the survey. About 96 percent of respondents said they would participate in the program again and 94 percent said they would recommend this program to other colleagues. All teachers indicated the materials were clearly written and well-organized and 96 percent of teachers indicated the products in the kit were easy to use.

Teachers reported the curriculum/lesson plans, the home school connection resulting from the kits, and the exposure to energy efficiency as the best program elements. Additionally, the majority of teachers (90 percent) reported the self-installation aspect of the kits was the best program element for students. When asked to provide possible changes to the program, many teachers had no response or responded "none". Those who did respond with a change noted that some of the materials were too difficult for their students' current reading levels and that it was difficult to complete all the program material within the time constraints of the academic year.

Table 5-2 below shows how many teachers in the PG/NSG territory participated in the EEE program, the percentage of those that returned 80 percent or more of the student survey forms as well as the percentage of those that returned the RAP teacher evaluation survey.

Table 5-2. Participating Teachers in PG/NSG Territory

Total Participating Teachers in PG/NSG Schools	Teachers who Returned 80% of Student Survey Forms		Teachers who Returned Educator Evaluation Survey	
158	73	46%	50	32%

Sources: Survey data and Navigant analysis

Thirty parents in the PG and NSG service territories responded to the parent comment card included in the kit box (less than one percent of participating parents). About 89 percent of respondents said they would continue to use the contents in the kit and 93 percent said the materials were easy for their child to use. Bar charts that summarize this participant feedback information are provided in Appendix 7.2.

5.2.2 Parent and Teacher Feedback from Navigant NTG Survey

Navigant conducted NTG research as part of our GPY4/EPY7 evaluation. To estimate free-ridership and spillover effects of the program, Navigant sent a sample of participants a paper-based survey. The survey also included questions on program satisfaction. Participants were asked on a scale of 0 to 10, with 0 meaning "I was not at all satisfied" and 10 meaning "I was very satisfied", how satisfied they were with the Super Savers program. Of the 88 parents that responded to the satisfaction questions, 64 percent said they were satisfied with the program (score of 7 or above). Thirty-two percent of parents rated the program with a five or lower with almost half of them explaining this was because they could not or did not use the equipment provided in the kit.

Teachers were also given a brief teacher survey which asked how the Super Savers program could be improved. Of the 15 teachers who returned the teacher survey return form, four said they would like to see the speaker/presenter aspect of the program from last year brought back. One teacher suggested having a letter included with the kit because some parents were confused as to why they needed to fill out the student survey form.

5.3 Program Improvement

The evaluation team learned through the satisfaction questions asked in their NTG survey that a handful of parents have interest in LEDs. In the upcoming program years, the utilities could consider offering LED lamps in place of the CFLs in the energy efficiency kit.

5.4 Planned Changes for GPY5/EPY8

Because the utilities and RAP invested a significant amount of resources in overhauling the program in GPY4/EPY7 and the participation targets were met, there are no major changes planned for GPY5/EPY8. There is a minor update planned for the kit box which includes an update on the cross promotion of the utilities' other energy efficiency programs.

6 Findings and Recommendations

The following provides insight into key program findings and recommendations. The program performed well in GPY4/EPY7, exceeding participation targets for the year.

Program Participation

Finding 1. The program distributed 4,741 kits in the Peoples Gas service area and 770 kits in the North Shore Gas service area, exceeding the original participation targets of 4,250 and 700 kits for Peoples Gas and North Shore Gas, respectively.

Finding 2. The return rate of the student survey forms for the program overall was 43.6 percent exceeding the target of 40 percent.

Verified Gross Program Savings and Realization Rate

Finding 3. Navigant's review of the ex-ante calculations for the GPY4 Elementary Energy Education Program resulted in verified gross energy savings of 64,719 therms in Peoples Gas territory, a gross realization rate of 110 percent, and 9,577 therms in North Shore Gas territory, reflecting the program's gross realization rate of 100 percent for NSG.

Finding 4. Navigant calculated different values from the implementer for many of the custom inputs (calculated from the parent-guardian take-home survey responses) used in unit savings calculations, including in the number of people per household, single- vs multi-family housing type split, and in-service rates. It is unclear to Navigant how the implementer's custom inputs were derived. Additionally the implementer did not calculate custom inputs for only survey responses from PG and NSG territory, but included the entire dataset. A comparison of the custom inputs is provided in Appendix 7.1.

Recommendation 1. If the program desires a higher degree of accuracy in ex-ante savings estimates, the program could provide Navigant additional detail on how the ex-ante custom inputs were derived so that evaluation recommendations and common approaches could be developed, where feasible.

Finding 5. The implementation contractor did calculate savings separately for single-family and multi-family housing types and correctly utilized the applicable deemed inputs from the TRM. However, the implementer did not calculate the custom inputs separately for single-family and multi-family housing types, and for PG and NSG separately from all gas installations.

Recommendation 2. The program should calculate custom inputs for CFLs, aerators, and showerheads for single family homes separately from multi-family homes to increase the degree of accuracy of its ex-ante savings estimates. Additionally, the implementer should calculate custom inputs separately for Peoples Gas and North Shore Gas given differences in housing stock and in-service rates.

Finding 6. The ex-ante estimate for the water heater setback measure was 6.4 therms for any household which reported lowering their water heater temperature. This ex-ante number assumes the participant lowered the water heater temperature by 15 degrees. However, the temperature differential reported by participants was 6.5 degrees, resulting in lower than expected savings and a realization rate of 53 percent for this measure. Additionally, the program reported a savings penalty for those who reported raising their water heater temperature after participating; Navigant does not count a penalty because those participants become ineligible for consideration within the methodology of the TRM.

Recommendation 3. The implementer should update savings estimates for the water heater setback measure using the pre- and post-temperature inputs (Tpre and Tpost) from the parent-guardian take-home survey.

Finding 7. The EEE Program does not currently claim savings from programmable thermostat measures. Approximately 1.1 percent of participants reported programming their programmable thermostat based on the educational materials provided in the kits. Within the written program materials, there are directions to set the thermostat to 78F in warm weather and 68F in cool weather. The TRM energy savings methodology is specified for programmable thermostats which were previously set to override mode.

Recommendation 4. In the future, if the program chooses to claim savings for this measure, it should include instructions on how to properly use a programmable thermostat (that is, how to use four programmed settings for daytime, night time, summer, and winter), in order to qualify under the TRM. To develop these instructions, the implementer could use EPA's EnergyStar program or other resources. The EnergyStar program provides information for consumers on how to program and which settings will save the most energy. EnergyStar has programmable thermostat guidelines (and video) on how to properly set and use a programmable thermostat. Additionally, many thermostat manufacturers (Honeywell, Lux, etc.) and home improvement stores (Lowe's, Home Depot), provide instructions and information on how to program a thermostat. There are significant savings associated with this measure; a programmable thermostat installed in a single family home in Chicago results in savings of 62.3 therms, using the methodology from the TRM v4.0.

Tracking System Review

Finding 8. The implementation contractor provided all applicable materials needed for the impact analysis, including a listing of kits distributed and responses to the take-home survey. Additionally, the implementation contractor provided energy savings calculations with custom inputs where allowed by the Illinois TRM. This streamlined Navigant's identification of variance between ex-ante and ex-post savings.

Verified Net Savings

Finding 9. The program achieved verified net savings of 51,128 therms for Peoples Gas service area and 7,566 therms for the North Shore Gas service area. The net-to-gross ratio for the natural gas program was deemed through the Illinois Stakeholder Advisory Group consensus process at 0.79, while electric impacts are deemed at 0.76.

Process Evaluation

Finding 10. The program is performing well, exceeding participation goals. Comments about the program from parents and teachers are generally uniformly positive. Of the 51 teachers in the PG and NSG service territory who responded to the educator evaluation questions asked by RAP, 94 percent of them said they would participate in the program again.

Finding 11. Through the satisfaction questions asked in Navigant's NTG survey, the evaluation team learned that some parents are interested in LEDs.

7 Appendix

7.1 Gross Program Impact Parameter Estimates

As described in Section 2.2.1, energy and demand savings were estimated using Illinois TRM v3.0. The Illinois TRM deems most input parameters for showerheads, faucet aerators, and hot water heater setback.

Navigant used the student survey form data to calculate or adjust several input parameters, the tables below show each input variables by measure, values used by Navigant and the implementer, and whether that variable was deemed by the TRM or if a custom input was allowed.

Equation 2. Showerhead Savings Equation and Inputs, IL TRM v3.0 Section 5.4.5

$$\Delta Therms = \%FossilDHW * ((GPM\_base * L\_base - GPM\_low * L\_low) * Household * SPCD * 365.25 / SPH) * EPG\_gas * ISR$$

Where:

%FossilDHW	*= proportion of water heating supplied by Natural Gas heating*
GPM_base	*= Flow rate of the baseline showerhead*
GPM_low	*= As-used flow rate of the low-flow showerhead*
L_base	*= Shower length in minutes with baseline showerhead*
Household	*= Average number of people per household*
SPCD	*= Showers Per Capita Per Day*
365.25	*= Days per year, on average.*
SPH	*= Showerheads Per Household so that per-showerhead savings fractions can be determined*
EPG_gas	*= Energy per gallon of hot water supplied by gas fuel*
ISR	*= In service rate of showerhead*

Table 7-1. Showerhead Inputs and Variables

Value, Navigant NSG	Value, Navigant PG	Value, Implementer	Variable	Source	Deemed/ Custom	Discrepancy?
0.68	0.63	0.67	%FossilDHW	Survey - HCU6	Custom	Yes
2.35	2.35	2.35	GPM_base	IL TRM 5.4.5	Deemed	No
1.50	1.50	1.50	GPM_low	Specifications	Actual	No
7.80	7.80	7.80	L_base	IL TRM 5.4.5	Deemed	No
7.80	7.80	7.80	L_low	IL TRM 5.4.5	Deemed	No
365.25	365.25	365.25	days/year	IL TRM 5.4.5	Deemed	No
4.60	4.99	5.22	Household SF	Survey - HCU2	Custom	Yes
4.48	5.02	5.22	Household MF	Survey - HCU2	Custom	Yes
0.60	0.60	0.60	SPCD	IL TRM 5.4.5	Deemed	No
1.79	1.79	1.79	SPH SF	IL TRM 5.4.5	Deemed	No
1.30	1.30	1.30	SPH MF	IL TRM 5.4.5	Deemed	No
0.01	0.01	0.01	EPG_Gas_SF	IL TRM 5.4.5	Deemed	No
0.01	0.01	0.01	EPG_Gas_MF	IL TRM 5.4.5	Deemed	No
0.46	0.46	0.46	ISR SF	Survey - HA1	Custom	No
0.39	0.45	0.46	ISR MF	Survey - HA1	Custom	Yes
0.81	0.57	0.73	%SF	Survey - HCU1	Custom	Yes
0.19	0.43	0.27	%MF	Survey - HCU1	Custom	Yes

Source: 2014_MASTER_Super_Savers_Raw Survey Data, 2014_ComEd_Nicor_PG_NS_Energy_Savings Estimates, IL TRM v3.0 and Navigant Analysis

Equation 3. Aerator Savings Equation and Inputs, IL TRM v3.0 Section 5.4.4

$$\Delta Therms = \%FossilDHW * ((GPM\_base * L\_base - GPM\_low * L\_low) * Household * 365.25 * DF / FPH) * EPG\_gas * ISR$$

Where:

%FossilDHW	*= proportion of water heating supplied by Natural Gas heating*
GPM_base	*= Flow rate of the baseline aerator*
GPM_low	*= As-used flow rate of the low-flow aerator*
L_low	*= Average retrofit length faucet use per capita for all faucets in minutes*
L_base	*= Average baseline length faucet use per capita for all faucets in minutes*
Household	*= Average number of people per household*
365.25	*= Days per year, on average.*
DF	*= Drain Factor*
FPH	*= Faucets Per Household*
EPG_gas	*= Energy per gallon of Hot water supplied by gas*
ISR	*= In service rate of aerator*

Table 7-2. Kitchen Aerator Inputs and Variables

Value, Navigant NSG	Value, Navigant PG	Value, Implementer	Variable	Source	Deemed/ Custom	Discrepancy
0.68	0.63	0.67	%FossilDHW	Survey - HCU6	Custom	Yes
1.39	1.39	1.39	GPM_base	IL TRM 5.4.4	Deemed	No
0.94	0.94	0.94	GPM_low	Specifications	Deemed	No
4.50	4.50	4.50	L_base	IL TRM 5.4.4	Deemed	No
4.50	4.50	4.50	L_low	IL TRM 5.4.4	Deemed	No
365.25	365.25	365.25	days/year	IL TRM 5.4.4	Deemed	No
4.60	4.99	5.22	Household SF	Survey - HCU2	Custom	Yes
4.48	5.02	5.22	Household MF	Survey - HCU2	Custom	Yes
0.75	0.75	0.75	DF	IL TRM 5.4.4	Deemed	No
1.00	1.00	1.00	KFPH	IL TRM 5.4.4	Deemed	No
0.004	0.004	0.004	EPG_gas_SF	IL TRM 5.4.4	Deemed	No
0.005	0.005	0.005	EPG_gas_MF	IL TRM 5.4.5	Deemed	No
0.35	0.42	0.38	ISR SF	Survey - HA2	Custom	Yes
0.19	0.46	0.38	ISR MF	Survey - HA2	Custom	Yes
0.81	0.57	0.73	%SF	Survey - HCU1	Custom	Yes
0.19	0.43	0.27	%MF	Survey - HCU1	Custom	Yes

Source: 2014_MASTER_Super_Savers_Raw Survey Data, 2014_ComEd_Nicor_PG_NS_Energy_Savings Estimates, IL TRM v3.0 and Navigant Analysis

Table 7-3. Bathroom Aerator Inputs and Variables

Value, Navigant NSG	Value, Navigant PG	Value, Implementer	Variable	Source	Deemed/ Custom	Discrepancy
0.68	0.63	0.67	%GasDHW	Survey - HCU6	Custom	Yes
1.39	1.39	1.39	GPM_base	IL TRM 5.4.4	Deemed	No
0.94	0.94	0.94	GPM_low	Specifications	Deemed	No
1.60	1.60	1.60	L_base	IL TRM 5.4.4	Deemed	No
1.60	1.60	1.60	L_low	IL TRM 5.4.4	Deemed	No
365.25	365.25	365.25	days/year	IL TRM 5.4.4	Deemed	No
4.60	4.99	5.22	Household SF	Survey - HCU2	Custom	Yes
4.48	5.02	5.22	Household MF	Survey - HCU2	Custom	Yes
0.90	0.90	0.90	DF	IL TRM 5.4.4	Deemed	No
2.83	2.83	2.83	BFPH - SF	IL TRM 5.4.4	Deemed	No
1.50	1.50	1.50	BFPH - MF	IL TRM 5.4.4	Deemed	No
0.003	0.003	0.003	EPG_gas_SF	IL TRM 5.4.4	Deemed	No
0.004	0.004	0.004	EPG_gas_MF	IL TRM 5.4.5	Deemed	No
0.26	0.26	0.27	ISR SF, installed one	Survey - HA2	Custom	Yes
0.19	0.33	0.27	ISR MF, installed one	Survey - HA2	Custom	Yes
0.11	0.14	0.13	ISR SF, installed both	Survey - HA2	Custom	Yes
0.03	0.12	0.13	ISR MF, installed both	Survey - HA2	Custom	Yes
0.81	0.57	0.73	%SF	Survey - HCU1	Custom	Yes
0.19	0.43	0.27	%MF	Survey - HCU1	Custom	Yes

Source: 2014_MASTER_Super_Savers_Raw Survey Data, 2014_ComEd_Nicor_PG_NS_Energy_Savings Estimates, IL TRM v3.0 and Navigant Analysis

Equation 4. Hot Water Temperature Setback Savings Equation and Inputs, IL TRM v3.0 Section 5.4.6

$$\Delta Therms = 6.4\ therms^{*}\ (Tpre - Tpost) / 15$$

Where:

6.4 Therms	*= Estimate of savings derived in UL and CLP Program Savings Documentation, 2010.*
Tpre	*= Actual hot water setpoint prior to adjustment*
Tpost	*= Actual new hot water setpoint, which may not be lower than 120 degrees*
15	*= Delta watts used to derive the UL and CLP Program Savings Documentation estimate.*

Table 7-4. Hot Water Temperature Setback Inputs and Variables

Value, Navigant NSG	Value, Navigant PG	Value, Implementer	Variable	Source	Deemed/ Custom	Discrepancy
6.4	6.4	6.4	UL/CLP Savings	IL TRM 5.4.6	Deemed	No
6.4	6.6	15	(Tpre-Tpost)	Survey - HA8/HA9	Custom	Yes
15	15	15	Delta Watts UL/CLP Savings	IL TRM 5.4.6	Deemed	No
0.20	0.28	0.22	ISR	Survey - HA7	Custom	Yes
0.68	0.63	0.67	%FossilDHW	Survey - HCU6	Custom	Yes

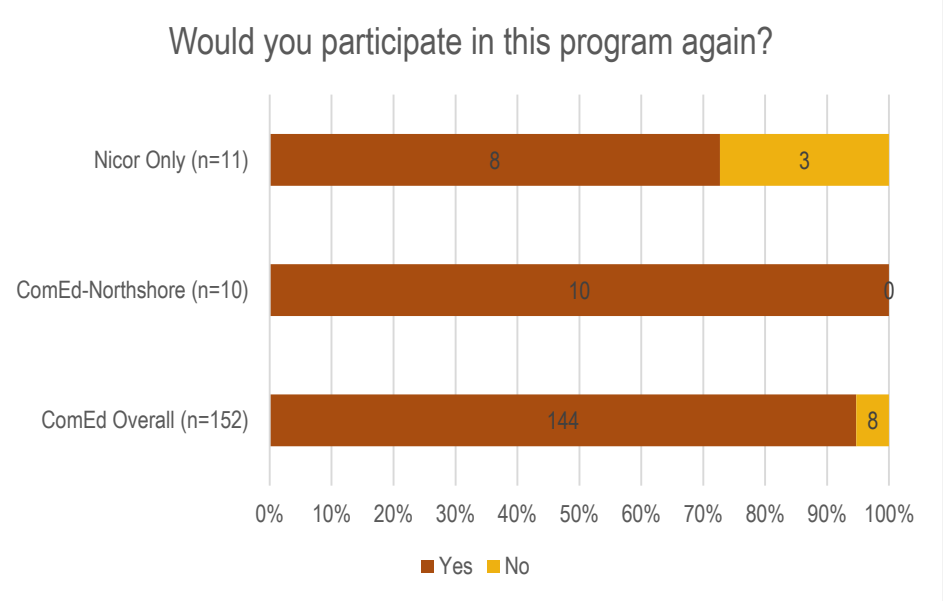
Source: 2014_MASTER_Super_Savers_Raw Survey Data, 2014_ComEd_Nicor_PG_NS_Energy_Savings Estimates, IL TRM v3.0 and Navigant Analysis

7.2 *Participant Feedback*

This section details the participant feedback provided in Section 5.2 graphically.

Around 50 teachers in the PG and NSG service territories responded to the educator evaluation questions asked by RAP, and about 96 percent of respondents said they would participate in the program again (Figure 7-1).

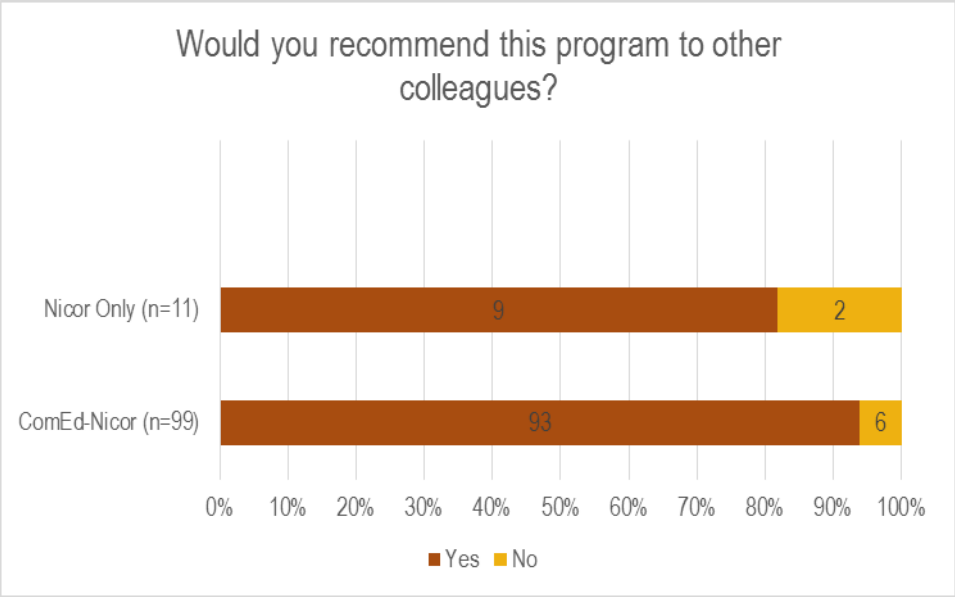
Figure 7-1. Would you participate in this program again (%)?



Source: Navigant Analysis

Ninety-four percent of teacher respondents said they would recommend this program to other colleagues (Figure 7-2).

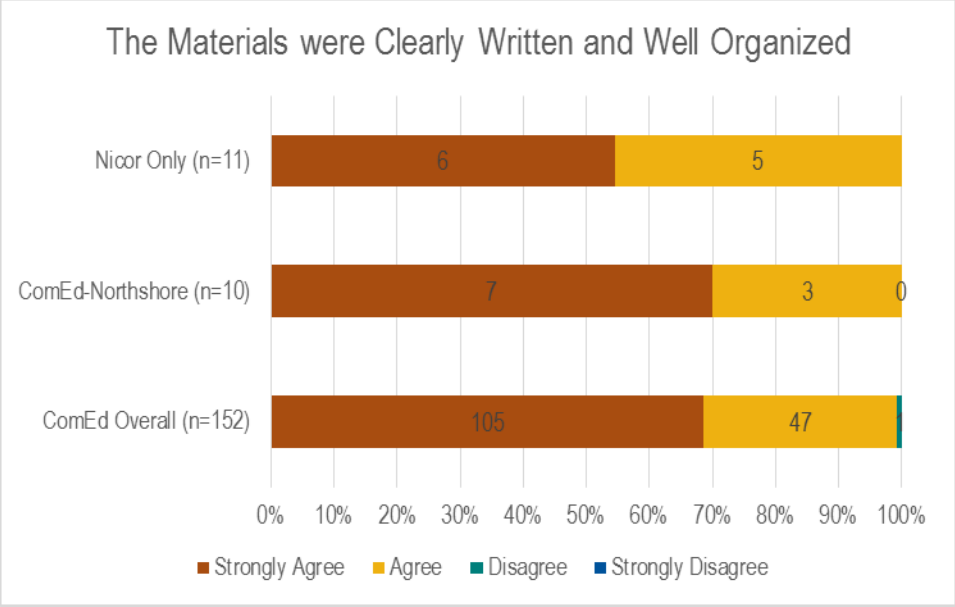
Figure 7-2. Would you recommend this program to other colleagues (%)?



Source: Navigant Analysis

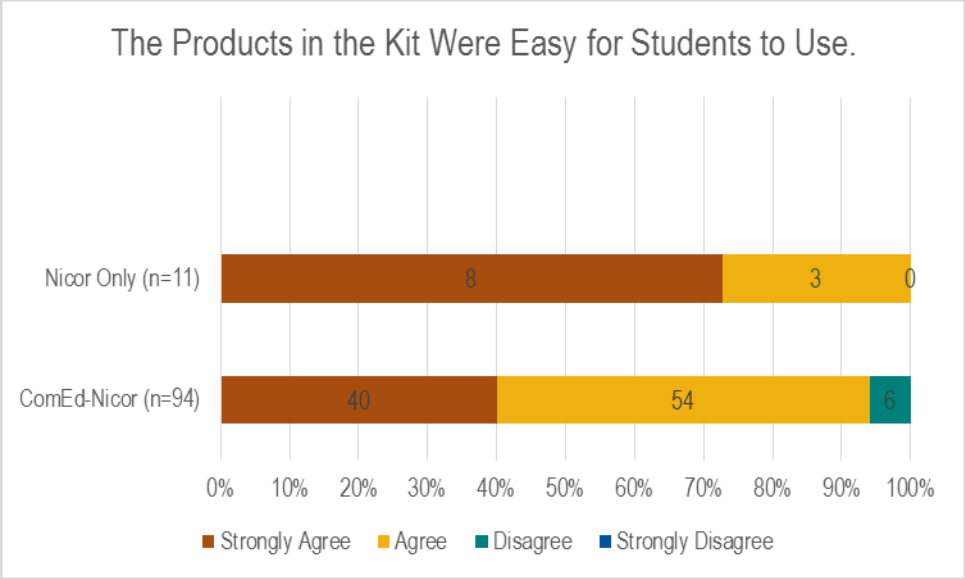
Additionally, all the teachers indicated the materials were clearly written and well-organized and 96 percent of teachers indicated the products in the kit were easy to use (Figure 7-3, Figure 7-4).

Figure 7-3. The Materials were Clearly Written and Well-Organized



Source: Navigant Analysis

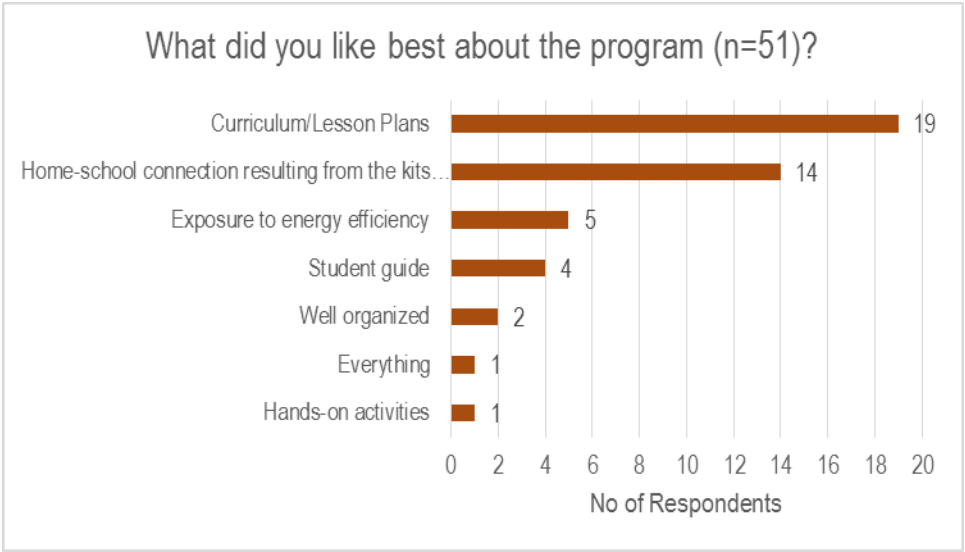
Figure 7-4. The Products in the Kits were Easy for Students to Use



Source: Navigant Analysis

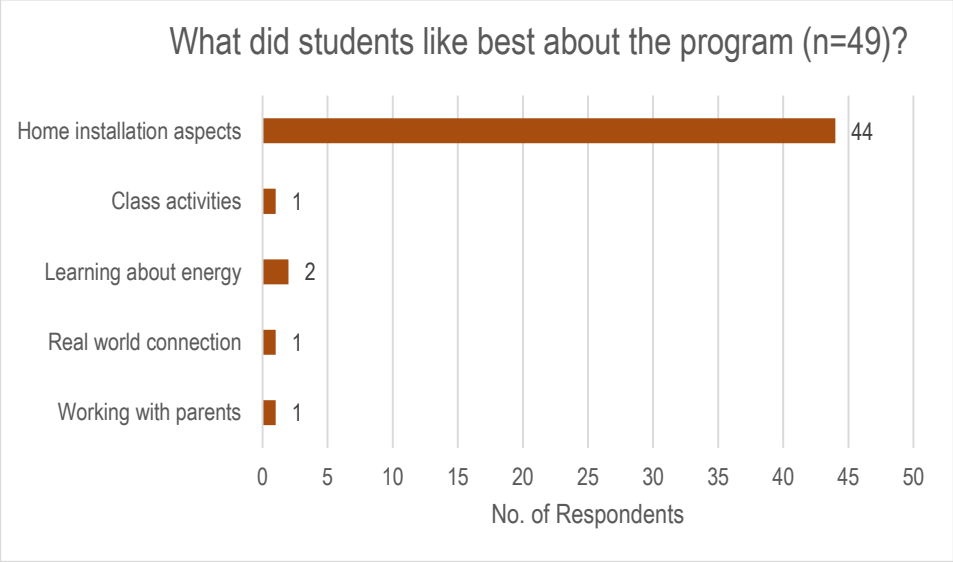
Teachers reported the curriculum/lesson plans, the home school connection resulting from the kits, and the exposure to energy efficiency as the best program elements. Additionally, the majority of teachers (90 percent) reported the self-installation aspect of the kits was the best program element for students (Figure 7-5, Figure 7-6).

Figure 7-5. What did you like best about the program?



Source: Navigant Analysis

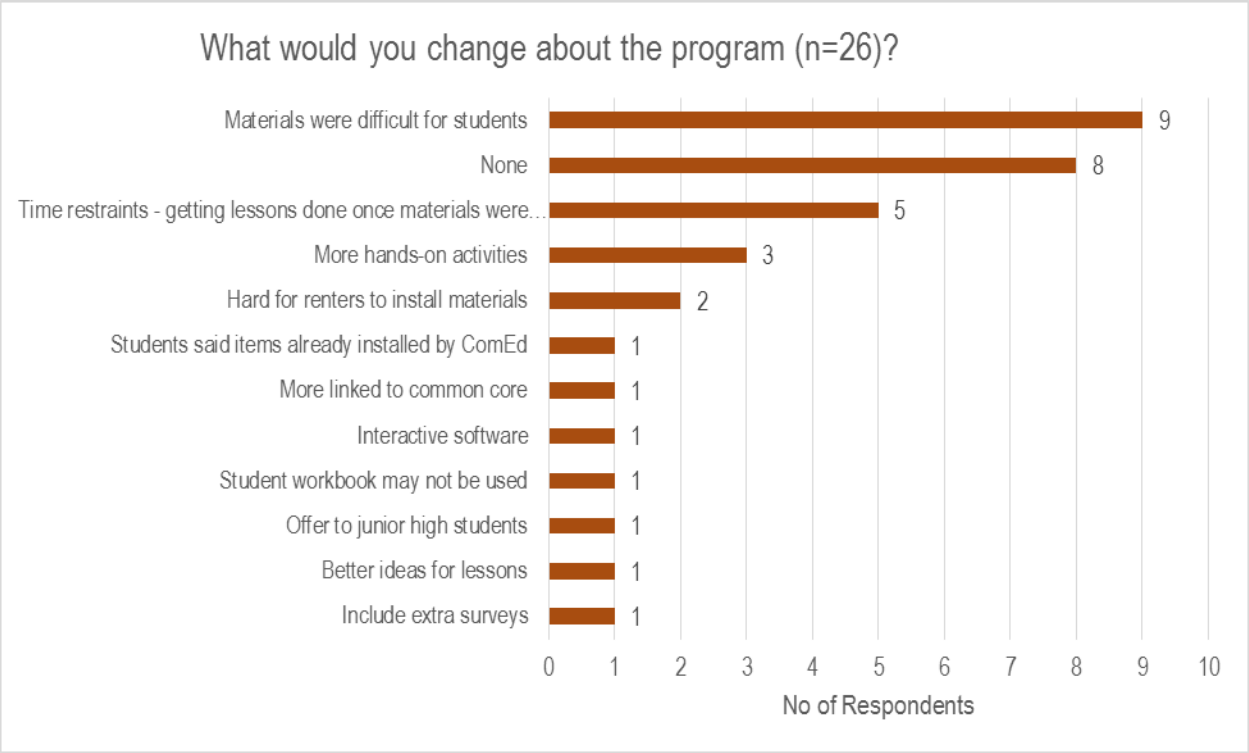
Figure 7-6. What did students like best about the program?



Source: Navigant Analysis

When asked to provide possible changes to the program, many teachers had no response or responded "none". Those who did respond with a change noted that some of the materials were too difficult for their students' current reading levels and that it was difficult to complete all the program material within the time constraints of the academic year (Figure 7-7).

Figure 7-7. What would you change about the program?



Source: Navigant Analysis

7.3 Net-to-Gross Research Results

This Appendix section presents results from Navigant's GPY4/EPY7 evaluation activities to provide research-based net-to-gross (NTG) values that may be used prospectively for the Elementary Energy Education (EEE) program. The results were presented in the February 16, 2016 memo below.

To: Jim Jerozal, John Madziarczyk, Bridgid Lutz, Steve Grzenia, Nicor Gas; Scott Dimetrosky, Apex Analytics; Ted Weaver, First Tracks Consulting; Vincent Gutierrez, ComEd; Patrick Michalkiewicz, Peoples Gas; Susan Nathan, Applied Energy Group; Paige Knutsen, Laura Pavlot, Franklin Energy; Jennifer Hinman Morris, David Brightwell, ICC Staff; Celia Johnson, Future Energy Enterprises

From: Christy Zook and Chelsea Lamar, Navigant

CC: Randy Gunn, Charley Budd, Jeff Erickson, Laura Agapay-Read, Kevin Grabner, Rob Neumann, Josh Arnold, Katherine Wolf, Meghan Sposato, Navigant

Date: February 16, 2016

Re: GPY4/EPY7 Net-to-Gross Ratio Estimates for Future Use for the Nicor Gas, ComEd, Peoples Gas, and North Shore Gas Elementary Energy Education Program

This memo presents results from Navigant's GPY4/EPY7 evaluation activities that will support our January 7, 2016 delivery of net-to-gross (NTG) values that will be used prospectively in GPY6/EPY9 for the Elementary Energy Education (EEE) program[11]. Navigant calculated net-to-gross values using two algorithms: one from the draft Illinois TRM statewide approach[12] and the other from the approach Navigant used in GPY1/EPY4. We will provide additional results from our GPY4/EPY7 evaluation in separate evaluation reports for each utility.

ELEMENTARY ENERGY EDUCATION

In GPY4/EPY7, the EEE program was jointly offered by Nicor Gas, ComEd, Peoples Gas (PG), and North Shore Gas (NSG). The program's primary focus is to produce natural gas and electricity savings in the residential sector by motivating 5th grade students and their families to reduce energy consumption from water heating and lighting in their home. Students take home a free energy saving kit that includes high efficiency showerheads, bathroom and kitchen faucet aerators, and CFLs (only in kits in the ComEd service territory).

NET-TO-GROSS RATIO ESTIMATES

The evaluation team's net-to-gross estimates using the draft Illinois TRM approach (TRM), as well as the GPY1/EPY4 approach (historic) for the program, are shown in Table 5 below. The two approaches produce very similar free ridership results for electric measures on the whole (0.36 vs. 0.34) but the gas

[11] This memo was originally delivered December 18, 2015 and was finalized February 16, 2016.
[12] IL-TRM_Attach A_IL-NTG Methods_10_02_15_DRAFT.docx

measures NTG differs by 0.1 (0.27 TRM, 0.17 historic). This result is mainly driven by a lower TRM CFL NTG value (only electric) and higher TRM NTG values for the other measures (both electric and gas).

Table 5. Program Net-to-Gross Ratio and Components from Two Approaches

	Free Ridership		Spillover		NTG	
	TRM	GPY1/EPY4	TRM	GPY1/EPY4	TRM	GPY1/EPY4
Showerheads	0.29	0.19	0.11	0.14	0.82	0.95
Bathroom Faucet Aerators	0.20	0.13	0.12	0.15	0.92	1.01
Kitchen Faucet Aerator	0.23	0.13	0.12	0.14	0.89	1.01
CFL	0.51	0.62	0.18	0.10	0.67	0.48
Unlike SO, Electric and Gas			0.02	-		
Electric Measures	**0.36**	**0.34**	**0.16**[13]	**0.12**	**0.80**	**0.78**
Gas Measures	**0.27**	**0.17**	**0.13**[14]	**0.14**	**0.87**	**0.97**

The evaluation team also conducted a free ridership (FR) sensitivity analysis where the evaluators tested an alternative method for combining the non-program, timing, and quantity scores, to report on the sensitivity of results to these changes. The sensitivity analysis only applied to measures that included a quantity component: the CFLs and the bathroom faucet aerators. The results of the alternate FR algorithm can be seen in Table 6 below. The alternative FR methodology resulted in a slightly higher FR for CFLs and no change to the bathroom faucet aerators FR rates.

Table 6. Free-Ridership Estimates Compared to Alternative Method

Measure	Draft IL TRM FR	Alternative FR
CFL	0.51	0.54
Bathroom Faucet Aerator	0.20	0.20

Source: Evaluation Analysis

DATA COLLECTION FOR NET TO GROSS ESTIMATES

Table 7 below summarizes primary data sources that Navigant used to estimate the NTGR for the program. The survey achieved 5.9 percent precision at a 90 percent confidence interval.

[13] This represents unlike SO added to the weighted average of the electric measure level like SO (0.14).
[14] This represents unlike SO added to the weighted average of the gas measure level like SO (0.11).

Table 7. Primary Data Sources

Method	Subject	Combined Target Completes	Combined Actual Completes	Completed	Confidence Precision
Take-Home Survey	GPY4/EPY7 Program Participants	258[15]	191	May 15, 2015	90/6

Source: Evaluation Analysis

TRM AND HISTORIC NET-TO-GROSS METHODOLOGIES

As part of the GPY4/EPY7 NTG analysis, the evaluation team calculated NTG using two methods, the draft Illinois TRM NTG methodology and the GPY1/EPY4 NTG methodology. This was done so that the NTGR for the different program years can be compared using the same algorithm. This section describes the free-ridership and spillover methodologies that were used in the draft Illinois TRM approach as well as in the GPY1/EPY4 approach.

The free-ridership and spillover rates were assessed using the same self-reported data gathered through Navigant's participant survey. The participant survey included questions to identify installations that might have occurred if the utilities had not funded the EEE program. This data allows Navigant to estimate free-rider ratios—a factor that effectively deducts "free-riders" from the gross savings identified via the impact analysis. The survey also included questions to help identify participant spillover effects.

The final NTGRs for each measure are calculated as:

$$NTG = 1 - [Free\ Ridership] + [Spillover]$$

Where,
Free ridership is the energy savings that would have occurred even in the absence of program activities and sponsorship, expressed as a percent of gross impact.

And,
Spillover is the energy savings that occurred as a result of program activities and sponsorships, but was not included in the gross impact accounting, expressed as a percent of gross impact.

Free Ridership – Draft Illinois TRM Approach

Free ridership cannot be measured directly due to absent empirical data regarding the counterfactual situation. Thus, free ridership is assessed as a probability score for each measure. The evaluation relies on self-reported data collected during participant paper-based surveys to assign free ridership probability scores to each measure. More specifically, for each measure, the following questions were posed to each measure recipient[16]:

[15] The sample goal was designed to reach statistical significance for each utility territory
[16] The survey instrument instructions directed an adult to complete the survey.

FR1. On a scale of 0 to 10, with 0 meaning "No, I was not planning to buy this high efficiency item" and 10 meaning "Yes, I was planning to buy this high efficiency item." Were you planning to buy the same items in the kit before you received the kit?

FR2. When were you planning to purchase and install them?

For measures with a quantity of greater than one, the following question was also included:

FR3. Were you planning to purchase the same number of [measures] as in the kit on your own?

The following question was also asked of all participants and used as a consistency check:

CC1. Before you received the [measure] in the kit, was your family already planning to purchase the same high efficiency [measure] from the store?

Free Ridership Scoring—TRM Approach

The free ridership data was assembled into a probability score in a step-by-step fashion, applying the following logic:

If the participant indicated a low likelihood that they had been planning to purchase the item before receiving it in their kit (FR1 <= 3), the participant's response to FR1 divided by 10 is considered the participant's free ridership score. In the IL TRM, the response to FR1 is referred to as the "Non-Program Score".

If the participant gave a response to FR1 greater than 3, the timing score (FR2) and the quantity score (FR3, where applicable) were first averaged, and then the response to FR1 was averaged with the average of the timing and quantity, if the timing and quantity score are less than the response to FR1.

The timing score is 0.5 if the high efficiency measure would have been purchased within 6 months, 0.25 if it would have been purchased within 6 months to a year later, and 0 if it would have been purchased more than a year later.

The corresponding formula for calculating free ridership is shown below:

$$if\ FR1 > 3\ and\ FR2, FR3 < \frac{FR1}{10},$$
$$then\ FR = Average\left[\frac{FR1}{10}, Average(FR2, FR3)\right],$$
$$else\ FR = \ FR1/10$$

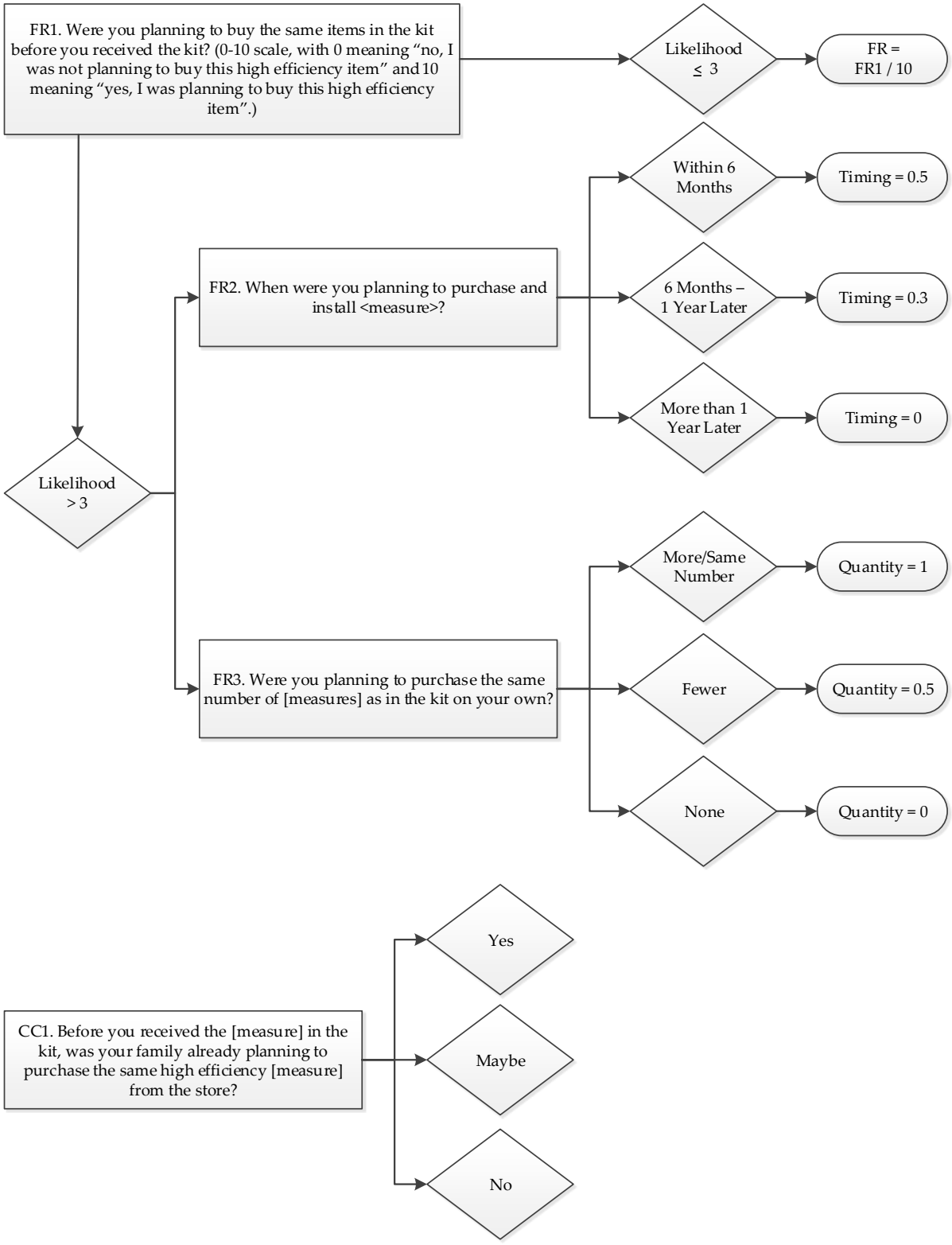
Note that in the above formula, if FR1 is invalid (missing or "don't know"), then the participant's responses for NTG determination are disqualified. Eight participants were removed from the analysis based on their response to FR1. Participants were only removed from the FR calculations for the individual measure(s) where they had an invalid response for FR1 but were included for the other measures.

If a participant 1) replied to the consistency check (CC1) that they were planning on purchasing the measure before they received their kit (a "yes" response, indicating high or full free ridership) and 2) had a calculated FR of less than 0.5, they were removed from the analysis because their responses are not consistent. Likewise, if a participant 1) indicated that they were not planning on purchasing the measure (a "no" response to CC1, indicating low or no free ridership) and 2) had a calculated FR rate of greater than 0.5, they were also removed from the analysis. Participants who responded "maybe" to CC1 were not included in the consistency check. Twenty participants were removed from the analysis based on their FR rates and responses to the consistency check question. Participants were only removed from the FR calculations for the individual measure(s) where they failed the consistency check but were included for the other measures.

This approach is a modification of that used in the Nicor Gas Rider 29 evaluation to add precision and to approximate the free ridership approaches currently proposed by the Illinois TRM working group. The free ridership methodology is presented in Figure 8 below.

The free-ridership rate was calculated for each individual kit component and participant. The individual free-ridership rates were then averaged to calculate the free-ridership rate per component, and weighted by individual savings, for measures where the quantity is greater than one. The program free-ridership rate was calculated using a weighted average by component savings. The component savings were calculated using Illinois TRM deemed values and the specific component values, where appropriate. The free-ridership rates were then weighted by program savings in order to calculated overall free-ridership for each fuel type (gas or electric).

Figure 8. Participant Free-Ridership Algorithm—TRM Approach



Free Ridership - GPY1/EPY4 Historic Approach

The GPY1/EPY4 FR methodology used the same questions as the draft Illinois TRM NTG methodology, with the inclusion of CC1 as part of the algorithm.

> CC1. Before you received the [measure] in the kit, was your family already planning to purchase the same high efficiency [measure] from the store?
>
> FR1. On a scale of 0 to 10, with 0 meaning "No, I was not planning to buy this high efficiency item" and 10 meaning "Yes, I was planning to buy this high efficiency item." Were you planning to buy the same items in the kit before you received the kit?
>
> FR2. When were you planning to purchase and install them?

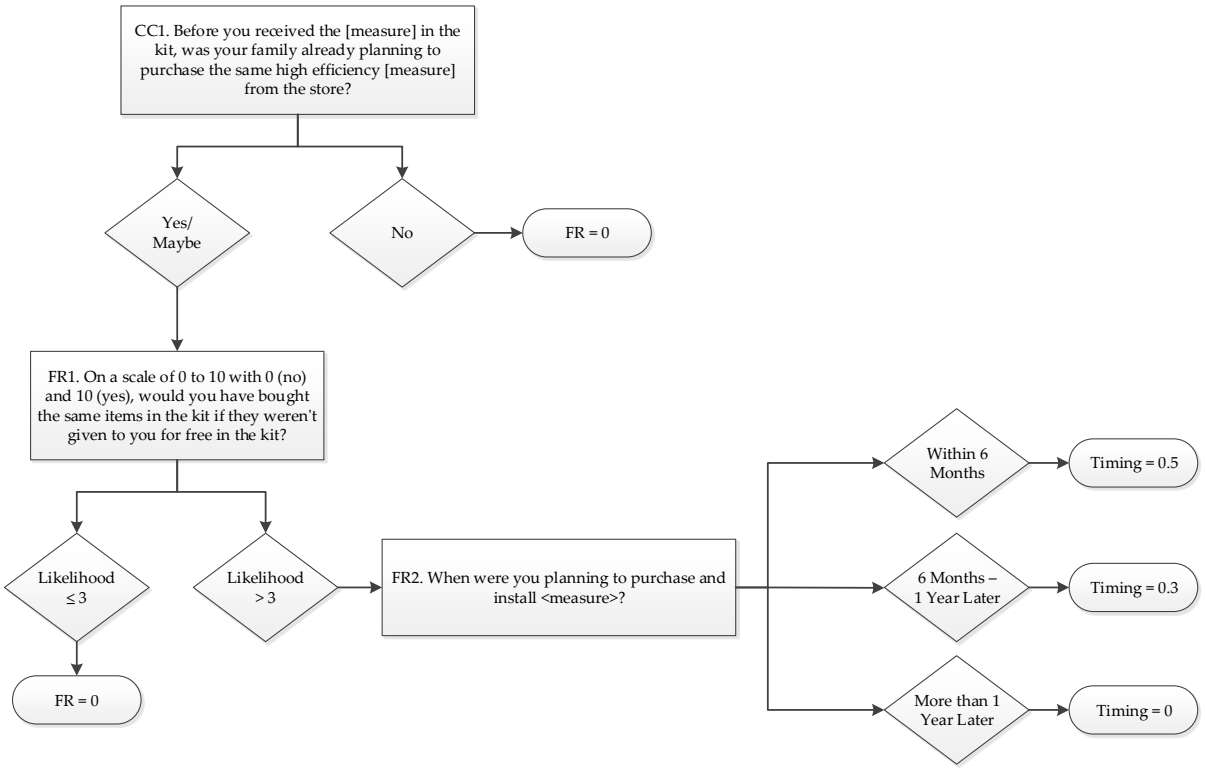
Free Ridership Scoring—Historic Approach

The free ridership data was assembled into a probability score in a step-by-step fashion, applying the following logic:

> If the participant reported that they were not planning on purchasing the measure before they received their kit, then the probability of free ridership for that participant is estimated to be zero (based on CC1 above). Similarly, if the participant reported likelihood of purchasing the same measures as provided in the kit less than or equal to 3 (on a 0-10 scale), then the probability of free ridership is estimated to be zero (based on the response to FR1). If neither of the above criteria holds, then responses to question FR2 (the timing score) and FR1, likelihood of purchasing the measures in the absence of the program (the non-program score), were averaged and divided by 10 to calculate the probability of free ridership. The corresponding formula for calculating free ridership is shown below:
>
> $$if\ CC1 = \text{"}No\text{"}\ or\ FR1 \leq 3, then\ FR = 0,$$
>
> $$else\ FR = \ Average(\frac{FR1}{10}, FR2)$$
>
> Note that in the above formula, if CC1 is invalid (missing or "don't know") then the participant's responses for NTG determination are disqualified.

The free-ridership rate was calculated for each individual kit component and participant. The individual free-ridership rates were then averaged to calculate the free-ridership rate per component and weighted by individual savings, for measures where the quantity is greater than one. The program free-ridership rate was calculated using a weighted average by component savings. The component savings were calculated using Illinois TRM deemed values and the specific component values, where appropriate. The free-ridership rates were then weighted by program savings in order to calculate overall free-ridership for each fuel type (gas or electric).

Figure 9. GPY1/EPY4 Participant Free-Ridership Algorithm—Historic Approach



Free Ridership Sensitivity Analysis of Historic Approach

In addition to reporting results based on the above algorithms, the evaluators tested an alternative method for combining the non-program (FR1), timing (FR2), and quantity scores (FR3), to report on the sensitivity of results to these changes. This information is intended to inform the TRM NTG algorithm development process. The primary difference between the draft IL TRM FR method and the alternative method is how the non-program, timing, and quantity responses are averaged. In the draft IL TRM FR method, the timing and quantity responses are first averaged, then that number is average with the non-program score (divided by 10). In the alternative method, the non-program score (divided by 10), timing score, and quantity score are averaged together. The free ridership alternative method was calculated using the equation below:

$$if\ FR1 > 3\ and\ FR2, FR3 < \frac{FR1}{10},$$
$$then\ FR = Average\left[\frac{FR1}{10}, FR2, FR3\right],$$
$$else\ FR = \ FR1/10$$

where the timing and quantity scores were assigned as they were in the draft Illinois TRM FR analysis.

The sensitivity analysis only applied to measures that included a quantity component: the CFLs and the bathroom faucet aerators. Because there was only one high efficiency showerhead and one kitchen

faucet aerator in the each kit, the free-ridership calculations for these measures did not include the quantity score, and therefore the sensitivity analysis could not be performed on them. The results of the alternate FR algorithm can be seen below. The alternative FR methodology resulted in a slightly higher FR for CFLs and no change to the bathroom faucet aerators FR rates.

Table 8. Free-Ridership Estimates Compared to Alternative Methods

Measure	Draft IL TRM FR	Alternative FR
CFL	0.51	0.54
Bathroom Faucet Aerator	0.20	0.20

Source: Evaluation Analysis

Spillover – Draft Illinois TRM Approach

The objective of the spillover assessment is to estimate the impact arising from efficient measures installed as a result of the program that were not incented by the program. The evaluation relied on self-reported data collected during the paper-based participant survey to identify these measures and assess the role of the program in the decision to install. The spillover methodology approximates the spillover methodology currently proposed by the Illinois TRM working group.[17] Like spillover (spillover from program measures) and unlike spillover (spillover from other efficient measures) were estimated and are defined below.

Like Spillover—TRM Approach

For each measure installed through the program, the following questions are posed to each measure recipient:

> SP1. AFTER the program came to your school, did you BUY and INSTALL any showerheads, faucet aerators, or CFLs like the ones in the kit?
>
> SP2. Please note how many you bought and installed.
>
> SP3. Did you receive a rebate from your gas or electric utility for your purchase?
>
> SP4. If you bought more showerheads, aerators, or CFLs after the program, how likely was it that you bought them because of your experience with the kit? (0-10 scale)

Unlike Spillover—TRM Approach

A similar series of questions were asked to participants regarding unlike spillover:

> USP1: Did you complete any additional energy efficiency upgrades after receiving the kit (for example, purchase LED bulbs, weatherize your home, or purchase a high efficiency appliance)?

[17] IL-TRM_Attach A_IL-NTG Methods_10_02_15_DRAFT.docx

USP2: Did you receive an incentive from your gas or electric utility for your upgrade?

USP3: If you completed energy efficiency upgrades after receiving the kit, how likely was it that you bought them because of the kit?

Spillover Scoring—TRM Approach

The survey data was assembled into an assessment of spillover impact through application of the following method:

> If the customer installed additional units of the measure following their participation, did not receive an incentive from their gas or electric utility for the upgrade, and the program was highly influential in the decision to install those measures, the adoption is considered to be potentially program spillover:
>
> *If SP1=Yes, SP3=No, and SP4 >7,*
>
> *then SO = (SP2*Measure Savings) / Program Measure Savings*

Any savings associated with spillover were weighted against the total savings of the participant sample for the particular measure to establish a measure-specific spillover rate. The spillover methodology is shown in Figure 10 below. The spillover rate was calculated for each individual kit component and participant. The individual spillover rates were then averaged to calculate the spillover rate per component. The spillover rate by fuel type (gas or electric) was calculated using a weighted average by component savings. The component savings were calculated using Illinois TRM deemed values and the specific component values, where appropriate. The participants with spillover had an assigned spillover value based on their influence score, and the fraction of the measure savings out of the total program measure savings.

Unlike Spillover Scoring—TRM Approach

If the customer completed additional energy efficiency upgrades after receiving the kit, did not receive an incentive from their gas or electric utility for the upgrade, and reasoning for completing these upgrades was somewhat related to the customer's experience with the kit, their savings contributed to unlike spillover as calculated below:

If USP1=Yes, USP2=No, and USP3 >7,

then unlike SO = $[\sum Estimated\ Energy\ Savings]$*/ Total Sample Savings*

These percentages were calculated separately for participants using gas and electric heat, with estimated energy savings in units of therms or kWh respectively.

Figure 10. Participant Like Spillover Algorithm—TRM Approach

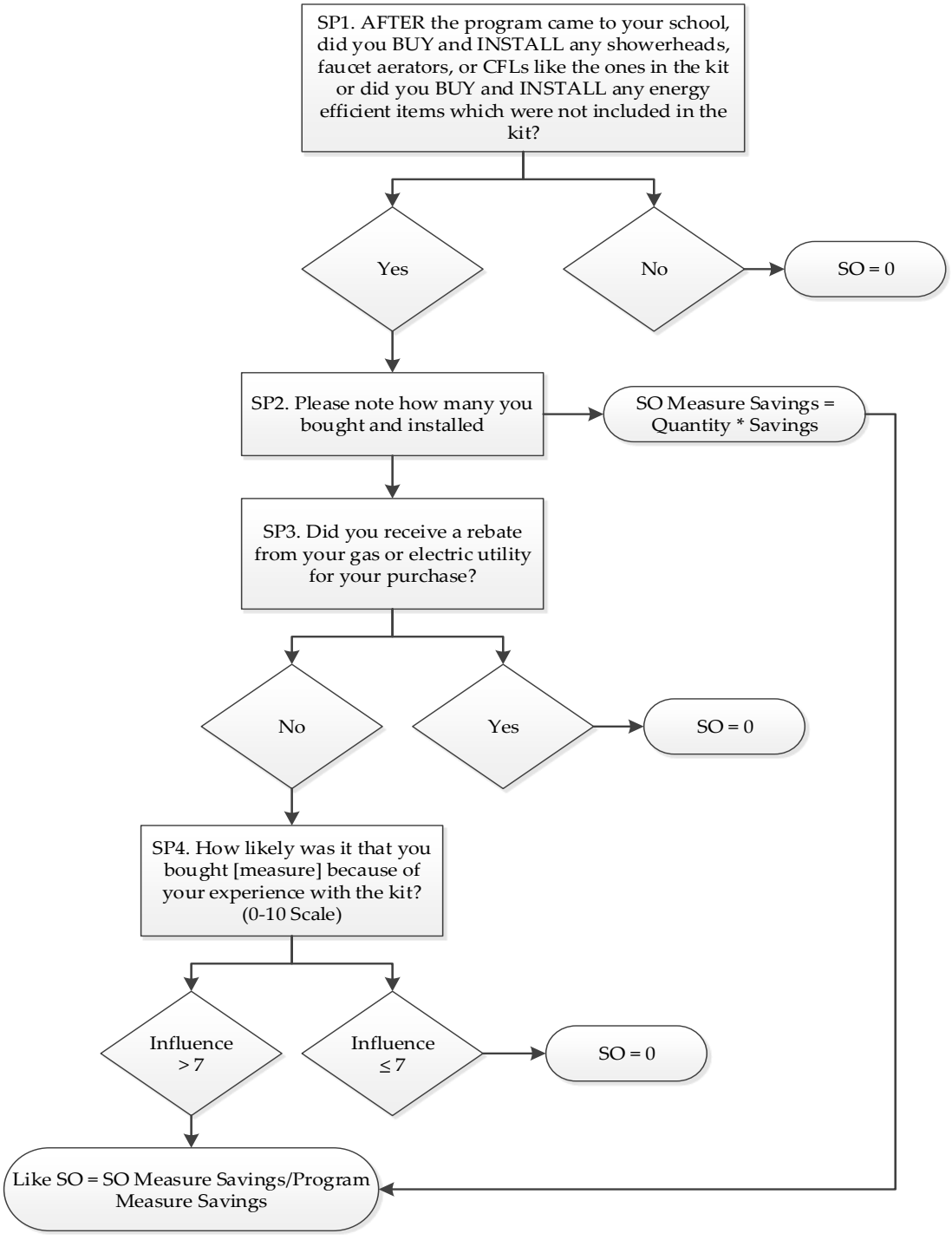
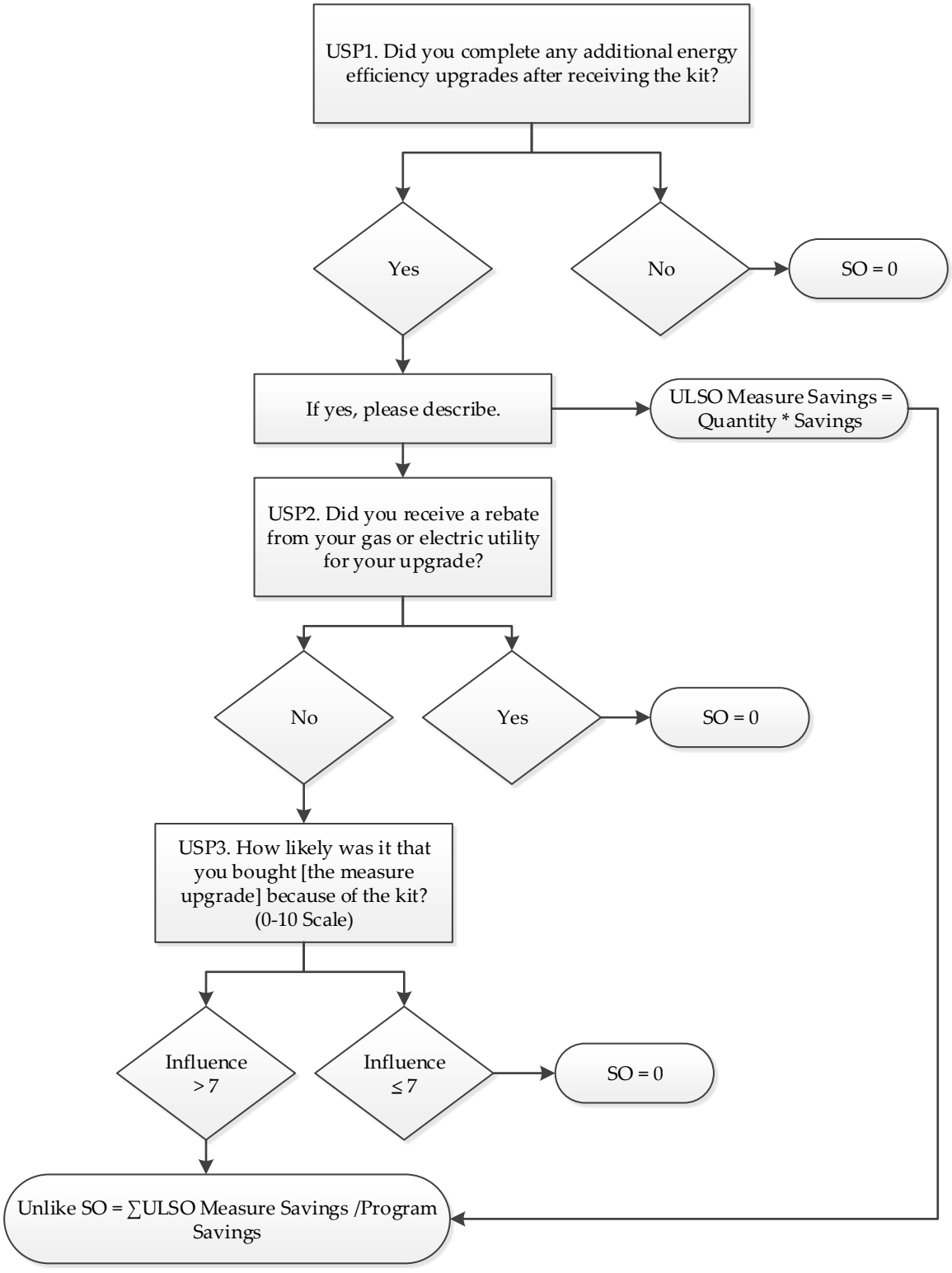


Figure 11. Participant Unlike Spillover Algorithm—TRM Approach



The estimations of both like and unlike spillover by measure are presented in Table 9 and Table 10 below.

Table 9. Like Spillover by Measure Type—TRM Approach

Measure	Measure-level Spillover
Showerhead	0.11
Bathroom Aerator	0.12
Kitchen Aerator	0.12
CFL	0.18

Source: Evaluation Analysis

Table 10. Unlike Spillover Estimates by Heating Type—TRM Approach

	Gas	Electric
Unlike SO	0.02	0.02

Source: Evaluation Analysis

Spillover – GPY1/EPY4 Historic Approach

The objective of the spillover assessment is to estimate the impact arising from efficient measures installed as a result of the program that were not incented by the program. The evaluation relied on self-reported data collected during the paper-based participant survey to identify these measures and assess the role of the program in the decision to install.

For each measure installed through the program, the following questions are posed to each measure recipient:

> SP1. AFTER the program came to your school, did you BUY and INSTALL any showerheads, faucet aerators, or CFLs like the ones in the kit?
> SP2. How many additional measures did you install?
> SP3. If you bought more showerheads, aerators, or CFLs after the program, how likely was it that you bought them because of the program? (0-10 scale)

Spillover Scoring—Historic Approach

The survey data was assembled into an assessment of spillover impact through application of the following method:

> If the customer installed additional units of the measure following their participation, and the program was highly influential in the decision to install those measures, the adoption is considered to be potentially program spillover:
>
> *[If SP1=1 and SP3 is greater than 7, then adoption is spillover]*

Any savings associated with spillover were weighted against the total savings of the participant sample for the particular measure to establish a measure-specific spillover rate. The spillover methodology is shown in Figure 12 below. The spillover rate was calculated for each individual kit component and participant. The individual spillover rates were then averaged to calculate the spillover rate per

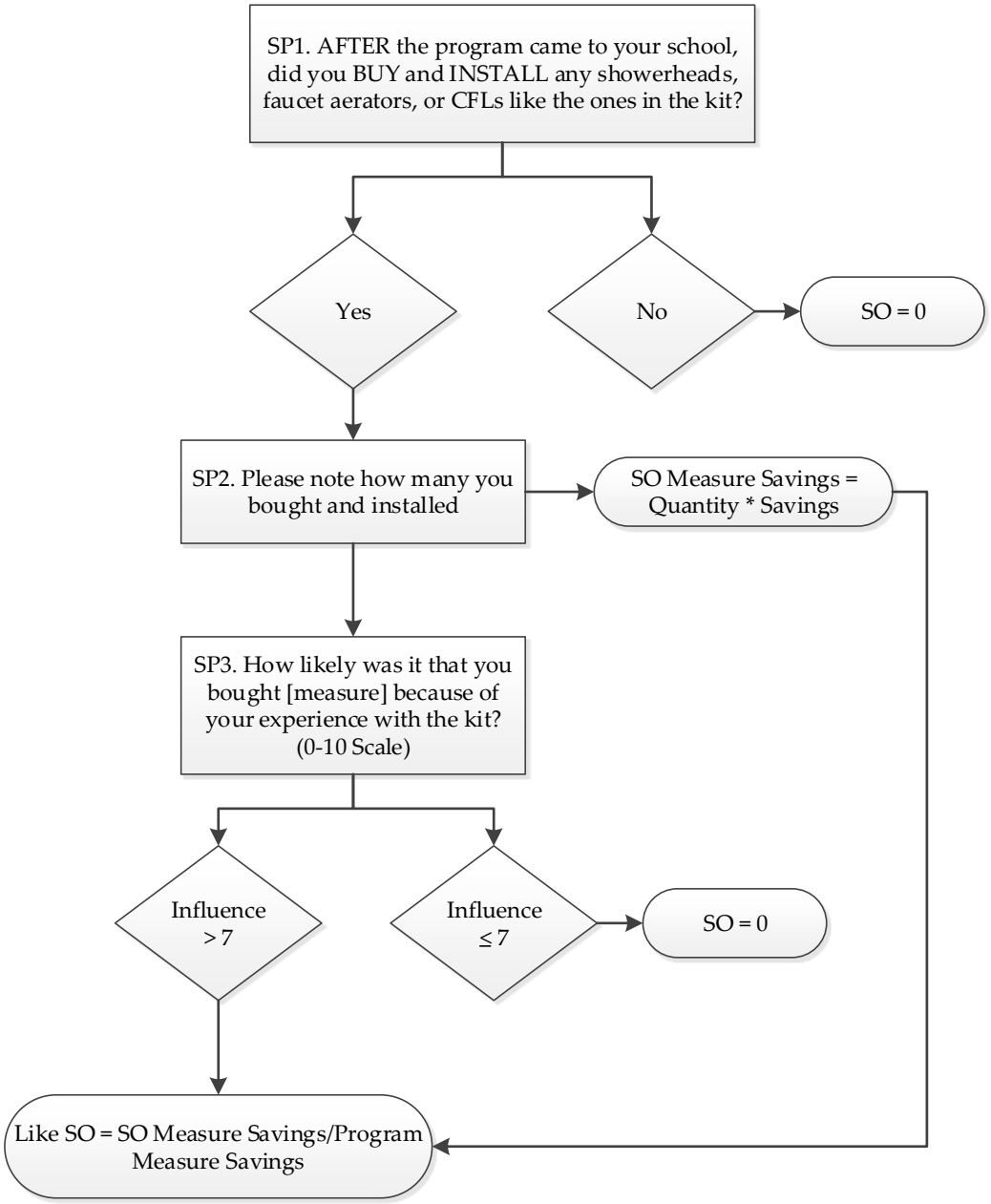
component. The spillover rate by fuel type (gas or electric) was calculated using a weighted average by component savings. The component savings were calculated using Illinois TRM deemed values and the specific component values, where appropriate. The participants with spillover had an assigned spillover value based on their influence score, and the fraction of the measure savings out of the total program measure savings.

CFL-Specific Adjustments to Spillover—Historic Approach

The impact credit granted for CFL spillover adoptions must avoid double counting the impact credit accrued already through the ComEd midstream residential lighting program. Navigant uses the approach established in the ComEd Single Family PY3 evaluation that assumes that 1) the market share of program bulbs is not a readily available number and 2) the residential lighting program PY3 evaluation results indicated a substantial amount of free ridership (41percent), and there is no reason that one program's free ridership cannot be another program's net impact. Thus, it is not necessary that bulbs be un-incented for them to legitimately qualify for credit under the Single Family Program.[18] Due to the uncertainty in this area, the evaluation team takes the conservative approach used in the PY3 Single Family evaluation and assumes that only 50 percent of the impact arising from CFL spillover adoptions is creditable to the program. Again, even if these customers purchased a discounted bulb, the purchase decision was either influenced by both programs (making the 50 percent assumption reasonable) or influenced by only the EEE program (making the 50 percent assumption conservative).

[18] There is some available evidence regarding the CFL market share of residential lighting program bulbs. The PY3 residential lighting general population survey revealed that 87 percent of CFLs are purchased at stores participating in the ComEd lighting program. Among program stores, the shelf space dedicated to ComEd program CFL bulbs is 53 percent of the overall shelf space dedicated to CFLs (for standard bulbs), and 62 percent for specialty bulbs. If we assume shelf space relates directly to sales share, then 46 percent of standard CFLs and 54 percent of specialty bulbs are Residential Lighting program bulbs.

Figure 12. Participant Spillover Algorithm—Historic Approach



Navigant conducted a paper survey with a stratified random sample with a goal of 258 participating customers from GPY4/EPY7. The actual number of surveys returned from participating customers was 191 providing a 6 percent precision at a 90 percent confidence interval at the program level.

APPENDIX

Net-to-Gross research instrument referenced in the February 16, 2016 memo is included as Appendix 7.4.

7.4 Net-to-Gross Research Survey Instrument

This Appendix section presents the survey instrument used to collect data from parents and guardians.

Super Savers Program Survey

Dear Parents and Guardians: Earlier this school year, your child participated in the Super Savers program, which included a take-home kit to help your child teach the family about energy and energy efficiency. The purpose of this survey is to help the sponsors (Nicor Gas, ComEd, Peoples Gas, and North Shore Gas) improve this program. **Please complete this form** and have your child return it to their classroom teacher. **Your child's classroom will receive a $100 check if at least 10 students return this form.**

Name	Date
School	Teacher

Please check the box next to your answer or write your answer on the blank line.

1. **I am the person most familiar with the Super Savers program and items in the kit.**
   - ☐ Yes

2. **Do you have your own water heater that heats water for just your home?**
   - ☐ Yes ☐ No ☐ Not Sure

3. **How is your water heated?**
   - ☐ Electricity
   - ☐ Natural Gas
   - ☐ Propane
   - ☐ Don't Know
   - ☐ Other: _____

4. **Did your child receive a Super Savers energy efficiency kit through the Super Saver program?**
   - ☐ Yes ☐ No

5. **Did the kit include 3 CFLs?**
   - ☐ Yes ☐ No

IF YOU ANSWERED "NO" TO QUESTION 4, YOU ARE DONE WITH THE SURVEY. PLEASE RETURN THIS SURVEY TO YOUR CHILD'S TEACHER. THANK YOU!!

6. **Did you fill out and return a survey (the "Student Survey Form") to your child's teacher?**

☐ Yes ☐ No ☐ Not Sure

7. **Did you successfully install the 1.5 gallons per minute (GPM) *High Efficiency Showerhead* like the one in this picture?**

☐ Yes ☐ No

IF YOU ANSWERED "NO": Fill in the main reasons why not:

- ☐ It did not fit
- ☐ Already had an efficient showerhead
- ☐ Landlord won't allow
- ☐ Haven't gotten around to it
- ☐ Didn't have tools
- ☐ Didn't know how to install
- ☐ We liked our showerhead
- ☐ Other: _____

IF YOU ANSWERED "YES":

a) **Are you still using the efficient showerhead?**

☐ Yes, still using it ☐ No, no longer using it

i. **If you answered "No, no longer using it," fill in the one main reason why not:**

- ☐ Water pressure was too weak
- ☐ It leaked
- ☐ I didn't like it
- ☐ Other: _____

8. **Did you successfully install the 1.5 GPM *Kitchen Faucet Aerator* like the one in this picture?**

☐Yes ☐ No

IF YOU ANSWERED "NO": Fill in the main reasons why not:

- ☐ It did not fit
- ☐ Already had a kitchen aerator
- ☐ Landlord won't allow
- ☐ Haven't gotten around to it
- ☐ Didn't have tools
- ☐ Didn't know how to install
- ☐ We liked our own
- ☐ Other: _____

IF YOU ANSWERED "YES":

a) **Are you still using the Kitchen Aerator?**

☐ Yes, still using it ☐ No, no longer using it

i. **If you answered "No, no longer using it," fill in the main reason why not:**

- ☐ Water pressure was too weak
- ☐ I didn't like it
- ☐ It leaked
- ☐ Other: _____

9. **Did you successfully install the 1.0 GPM *Bathroom Faucet Aerators* like the one in this picture?**

☐ Yes, installed both ☐ Yes, installed one ☐ No

IF YOU ANSWERED "NO": Fill in the main reasons why not:

- ☐ It did not fit
- ☐ Already had a bathroom aerator
- ☐ Landlord won't allow
- ☐ Haven't gotten around to it
- ☐ Didn't have tools
- ☐ Didn't know how to install
- ☐ We liked our own
- ☐ Other: _____

IF YOU ANSWERED "YES":

a) Are you still using the Bathroom Aerators?

☐ Yes, still using both ☐ Yes, still using one ☐ No

IF YOU ANSWERED "NO": fill in the main reason why not:

- ☐ Water pressure was too weak
- ☐ I didn't like it
- ☐ It leaked
- ☐ Other:_____

10. Did your family successfully use the *shower timer* like the one in the picture to the right?

☐ Yes, Always ☐ Yes, Often ☐ Yes, Occasionally ☐ No, We don't use it

a) How many family members live in the household? _____

b) If you use it, how many family members use the *shower timer*? _____

c) Do you turn off the shower as soon as five minutes on the timer is up?

☐ Yes ☐ No

IF YOU ANSWERED "NO": Do you extend your showers by: One minute

☐ Two minutes

☐ Three or more minutes

The following questions are about the three CFL light bulbs that may have been included in your kit. If your kit included three CLFs, answer the questions under the bulb you installed. If your kit did not include CFLs, skip to Question 11.

	CFL 1	***CFL 2***	***CFL 3***
Did you install the following CFLs in your kit?	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
If you said "NO", are you ever going to use the CFL?	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
If you won't use it, why not? Write an answer here →			
If you are going to use it, will it replace another CFL, an LED, a regular (non-CFL) light bulb or all three?	☐CFL Bulb ☐LED Bulb ☐Regular Light Bulb ☐All Types	☐CFL Bulb ☐LED Bulb ☐Regular Light Bulb ☐ All Types	☐CFL Bulb ☐LED Bulb ☐Regular Light Bulb ☐ All Types
Was the old bulb you took out and replaced a regular (non-CFL) bulb?	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No
Do you still use the CFL?	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

If you are not still using the CFL, please answer why:	☐Burned out ☐Other _____	☐Burned out ☐Other _____	☐Burned out ☐Other _____
About how many hours a day on average is the light on?	_____ Hours	_____ Hours	_____ Hours

11. <u>Before you received the showerhead in the kit</u>, <u>was your family already planning to purchase the *same high efficiency showerhead* from the store</u>? That is, a showerhead with a flow rate of 1.5 GPM or lower.

☐ Yes ☐ No ☐ Maybe

12. <u>Before you received the bathroom faucet aerators in the kit, was your family already planning to purchase the *same high efficiency* faucet aerators from the store?</u> That is, a bathroom faucet aerator with a flow rate of 1.0 GPM or lower.

☐ Yes ☐ No ☐ Maybe

13. <u>Before you received the kitchen faucet aerator in the kit, was your family already planning to purchase *the same high* efficiency</u> faucet aerator from the store? That is, a kitchen faucet aerator with a flow rate of 1.5 GPM or lower.

☐ Yes ☐ No ☐ Maybe

14. <u>Before you received the CFLs in the kit, was your family planning to purchase the *same CFLs* from the store</u>? That is, a CFL light bulb with a wattage rating of 13 watts or lower.

☐ Yes ☐ No ☐ Maybe

15. <u>Use the scale below to put a check mark under the number the best describes you for each item in the kit-</u>

On a scale of 0 to 10, with 0 meaning "No, I was not planning to buy this high efficiency item" and 10 meaning "Yes, I was planning to buy this high efficiency item."

Were you planning to buy the same items in the kit before you received the kit?

Put a ✓	*No, not planning to buy it*			*Maybe we were planning to buy it*					*Yes, we were planning to buy it*		
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Efficient Showerhead (1.5 GPM)											
Kitchen Faucet Aerator (1.5 GPM)											
Bathroom Faucet Aerators (1.0 GPM)											
CFLs (13 watt)											

i. FOR EACH ITEM RATED 3 OR HIGHER ABOVE, <u>when</u> were you planning to purchase and install them?

Efficient Showerhead (1.5 GPM)	Kitchen Faucet Aerator (1.5 GPM)	Bathroom Faucet Aerators (1.0 GPM)	CFLs (13 watt)
☐Within 6 months	☐Within 6 months	☐Within 6 months	☐Within 6 months
☐ 6 months to 1 year later	☐ 6 months to 1 year later	☐ 6 months to 1 year later	☐ 6 months to 1 year later
☐More than 1 year later	☐More than 1 year later	☐More than 1 year later	☐More than 1 year later

ii. Were you planning to purchase the same number of CFLs as in the kit (3 CFLs) on your own?

- ☐ The Same Number of CFLs
- ☐ More CFLs
- ☐ Fewer CFLs
- ☐ None
- ☐ Don't know

iii. Were you planning to purchase the same number of bathroom aerators as in the kit (2 bathroom aerators) on your own?

- ☐ The Same Number of Bathroom Aerators
- ☐ More Bathroom Aerators
- ☐ Fewer Bathroom Aerators
- ☐ None
- ☐ Don't know

16. BEFORE the Super Savers program came to your school and you received your kit, did you BUY and INSTALL any efficient showerheads, faucet aerators, or CFLs like the ones in the kit?

☐ Yes ☐ No

i. If you answered "Yes" above, please note how many you bought and installed:

Efficient Showerhead (1.5 GPM)	Kitchen Faucet Aerator (1.5 GPM)	Bathroom Faucet Aerators (1.0 GPM)	CFLs (13 watt)
☐ 1	☐ 1	☐ 1	☐ 1 - 3
☐ 2	☐ 2	☐ 2	☐ 4 - 7
☐ 3	☐ 3	☐ 3	☐ 8 - 11
☐ 4 or more	☐ 4 or more	☐ 4 or more	☐ 12 or more
☐ None	☐ None	☐ None	☐ None

17. AFTER the program came to your school and you received your kit, did you BUY and INSTALL any showerheads, faucet aerators, or CFLs like the ones in the kit?

☐ Yes ☐ No

i. If you answered "Yes" above, please note how many you bought and installed:

Efficient Showerhead	Kitchen Faucet Aerator	Bathroom Faucet Aerator	CFLs
☐ 1	☐ 1	☐ 1	☐ 1 - 3
☐ 2	☐ 2	☐ 2	☐ 4 - 7
☐ 3	☐ 3	☐ 3	☐ 8 - 11
☐ 4 or more	☐ 4 or more	☐ 4 or more	☐ 12 or more

☐ None	☐ None	☐ None	☐ None

18. If you bought more showerheads, aerators or CFLs <u>after</u> receiving your kit, did you receive a <u>rebate</u> from your gas or electric utility for your purchase?

Efficient Showerhead (1.5 GPM)	☐ Yes	☐ No	☐ Maybe	☐ N/A
Kitchen Faucet Aerator (1.5 GPM)	☐ Yes	☐ No	☐ Maybe	☐ N/A
Bathroom Faucet Aerator (1.0 GPM)	☐ Yes	☐ No	☐ Maybe	☐ N/A
CFLs (13 watt)	☐ Yes	☐ No	☐ Maybe	☐ N/A

19. <u>Use the scale below to put a check mark under the number that best describes you for each item in the list.</u>

If you bought more showerheads, aerators or CFLs <u>after receiving a kit from</u> the Super Savers program, how likely was it that you bought them because of your experience with the kit? (0 means *not at all due to the kit*, 10 means *very much due to the kit*)

Put a ✓ to indicate program influence	*NOT because of the kit*			*Partly because of the kit*				*Because of the kit*				*Did not buy*
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Efficient Showerhead												
Kitchen Faucet Aerator												
Bathroom Faucet Aerator												
CFLs												

20. Did you complete any additional energy efficiency upgrades after receiving the kit (for example, purchase LED bulbs, weatherize your home, or purchase a high efficiency appliance)?

☐ **Yes**
☐ **No**

a) If yes, please describe here:

_____

b) Did you receive an incentive from your gas or electric utility for your upgrade?

Energy efficiency upgrade:	☐ Yes	☐ No	☐ Don't Know

21. If you completed energy efficiency upgrades <u>after</u> receiving the kit, how likely was it that you bought them because of the kit?

(0 means not at all due to the program, 10 means very much due to the program)

Put a ✓ to indicate program influence	*NOT because of the kit*			*Partly because of the kit*				*Because of the kit*			
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Energy efficiency upgrade											

22. Did you cancel or delay any intended energy efficiency upgrades as a result of your experience with the Super Savers program or kit?

- ☐ **Yes**
- ☐ **No**

a) If yes, please describe here: _____

23. <u>Use the scale below to put a check mark under the number the best describes your satisfaction of the Super Savers kit and educational program-</u>

i. On a scale of 0 to 10, with 0 meaning "I was not at all satisfied" and 10 meaning "I was very satisfied", how satisfied were you with the Super Savers kit and educational program?

Put a ✓ to indicate program influence	*NOT at all satisfied*			*Partly satisfied*				*Very satisfied*			
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Energy efficiency upgrade											

ii. Why did you give it that rating?

24. How can the Super Savers kit and educational program be improved?

Thank you for your input. If you would like more information about other conservation programs available to you, please provide us with your email address or phone number:

Email: _____

Phone: _____

Parents, please sign below to indicate that you filled out or assisted your child in filling out the survey:

PARENT SIGNATURE: _____

THANK YOU FOR YOUR PARTICIPATION!