NAVIGANT

Elementary Energy Education
GPY3 Evaluation Report

Final

Energy Efficiency Plan:
Nicor Gas Plan Year 3
(6/1/2013-5/31/2014)

Presented to

Nicor Gas Company

August 24, 2015

Prepared by:

Christy Zook
Navigant Consulting

Chelsea Lamar
Navigant Consulting

www.navigant.com

© 2015 Navigant Consulting, Inc.

NAVIGANT

Submitted to:

Nicor Gas Company
1844 Ferry Road
Naperville, IL 60563

Submitted by:

Navigant Consulting, Inc.
30 S. Wacker Drive, Suite 3100
Chicago, IL 60606
Phone 312.583.5700
Fax 312.583.5701

Contact:

Randy Gunn, Managing Director
312.583.5714
randy.gunn@navigant.com

Charley Budd, Director
312.583.4135
charley.budd@navigant.com

Laura Agapay-Read, Managing Consultant
312.583.4178
laura.agapay.read@navigant.com

Disclaimer: This report was prepared by Navigant Consulting, Inc. ("Navigant") for Nicor Gas and ComEd based upon information provided by Nicor Gas, ComEd and from other sources. Use of this report by any other party for whatever purpose should not, and does not, absolve such party from using due diligence in verifying the report's contents. Neither Navigant nor any of its subsidiaries or affiliates assumes any liability or duty of care to such parties, and hereby disclaims any such liability.

NAVIGANT

Table of Contents

E. Executive Summary 1

E.1. Program Savings 1
E.2. Program Savings by Measure Type 2
E.3. Impact Estimate Parameters 4
E.4. Program Volumetric Detail 4
E.5. Results Summary 4
E.5. Conclusions and Recommendations 5

1. Introduction 7

1.1 Program Description 7
1.2 Evaluation Objectives 8
1.2.1 Impact Questions 8
1.2.2 Process Questions 8

2. Evaluation Approach 9

2.1 Data Collection 9
2.1.1 Overview of Data Collection Activities 9
2.2 Verified Savings Parameters 10
2.2.1 Verified Gross Program Savings Analysis Approach 10
2.2.2 Verified Net Program Savings Analysis Approach 10
2.3 Process Evaluation 11
2.3.1 Program Staff Interviews 11

3. Gross Impact Evaluation 12

3.1 Tracking System Review 12
3.2 Program Volumetric Findings 12
3.3 Gross Program Impact Parameter Verification 13
3.4 Verified Gross Program Impact Results 18

4. Net Impact Evaluation 21

5. Process Evaluation 22

5.1 Program Changes since GPY2 22
5.1.1 Participation 22
5.1.2 Measures in Kits 22
5.2 Participant Feedback 22
5.3 Planned Changes for GPY4/EPY7 23
5.3.1 New Implementation Contractor 23
5.3.2 Participation 23

6. Conclusions and Recommendations 24

List of Figures and Tables

Tables

Table E-1. GPY3 Energy Savings 2
Table E-2. GPY3 Energy Savings 3
Table E-3. Impact Estimate Parameters for Future Use 4
Table E-4. GPY3 Primary Participation Detail 4
Table E-5. GPY3 Results Summary 5

Table 1-1. Items Included in the Take Home Kit 8
Table 2-1. Primary Data Collection Activities 9
Table 2-2. Additional Resources 9
Table 2-3. Verified Gross Savings Parameters, Source of Deemed Inputs 10
Table 3-1. GPY3 Volumetric Findings Detail 12
Table 3-2. Showerhead Impact Parameters 14
Table 3-3. Kitchen Aerator Impact Parameters 15
Table 3-4. Bathroom Aerators Impact Parameters 16
Table 3-5. Water Heater Setback Impact Parameters 17
Table 3-6. GPY3 Verified Gross Impact Savings Estimates by Measure Type 18
Table 4-1. GPY3 Verified Net Impact Savings Estimates (Therms) by Measure Type 21

E. Executive Summary

This report presents a summary of Navigant Consulting Inc.'s (Navigant's) findings and results from the impact and process evaluation of the joint Nicor Gas Plan Year 3 (GPY3) and Commonwealth Edison Company (ComEd) Plan Year 6 (EPY6)[1] Elementary Energy Education (EEE) program. The EEE program is implemented by National Energy Foundation (NEF) and is branded "THINK! ENERGY" in GPY3. In GPY4, the implementation contractor will be switched to Resource Action Program (RAP). The EEE program's primary focus is to produce electricity and natural gas 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 through energy efficiency education and a free take home kit of energy efficiency equipment (including a high efficiency showerhead and faucet aerators). Additionally, the EEE program aims to increase participation in other ComEd and Nicor Gas programs via cross-marketing and increased customer awareness of energy efficiency issues. The program underwent several changes in GPY3. The participation targets (defined in the Scope of Work) of 21,000 joint kits and 1,500 Nicor Gas only kits were then increased to 26,000 joint kits and 4,500 Nicor Gas only kits. The program also allowed certain 6th grade classrooms to participate in the program. Finally, the program included a second bathroom aerator in the take-home kit.

E.1. Program Savings

Table E-1 and Table E-2 summarize the verified natural gas savings from the EEE Program. This program is offered to schools served by Nicor Gas and an electricity delivery provider other than ComEd (Nicor Gas only) and to schools served by both Nicor Gas and ComEd ("Joint" refers to the utilities' joint service territory). This report focuses on natural gas savings achieved from kits delivered to schools regardless of the electricity delivery provider. Verified gross savings were calculated using the Illinois TRM Version 2.0[2] algorithms and parameters.

[1] The GPY3/EPY6 program year began June 1, 2013 and ended May 31, 2014.

[2] State of Illinois Energy Efficiency Technical Reference Manual, effective June 1, 2013, which is to be found at http://www.ilsag.info/technical-reference-manual.html

Table E-1. GPY3 Energy Savings

Savings Category	Energy Savings (Therms)	Energy Savings – Joint Kits (kWh)	Demand Savings – Joint Kits (kW)	Energy Savings – Nicor Only Kits (kWh)	Demand Savings – Nicor Only Kits (kW)
Ex Ante Gross Savings[3]	432,746	4,172,174	N/A	N/A	N/A
Verified Gross Realization Rate	1.00	1.00	N/A	N/A	N/A
Verified Gross Savings	432,549	4,162,033	483	188,450	33
Net to gross ratio (NTG)	0.79†	0.76†	0.76†	0.79†	0.79†
Verified Net Savings	341,714	3,163,145	367	148,876	26

Source: Utility tracking data and Navigant analysis.
†A deemed value

E.2. Program Savings by Measure Type

Table E-2 summarizes the natural gas program savings by measure type.

[3] From the Nicor Gas Database Extract, EEEPY3ParticipationgData03092015.xlsx and NEF database extract, Nicor ComEd 2014 Data Tracking Upload.xlsx

Table E-2. GPY3 Energy Savings

Savings Type	Measure	Ex Ante Gross Savings	Verified Gross Realization Rate	Verified Gross Savings	NTGR	Verified Net Savings
Therms	Bathroom Faucet Aerator	25,201	1.08	27,094	0.79†	21,404
	Kitchen Faucet Aerator	94,519	1.02	96,524	0.79†	76,254
	Low Flow Showerhead	269,927	1.03	278,289	0.79†	219,848
	Water Heater Set-Back	43,098	0.62	32,669	0.79†	25,809
	Total	**432,746**	**0.99**	**432,549**		**341,714**
kWh, Joint Kits	Low Flow Showerhead	1,100,436	99%	1,085,887	0.76†	825,267
	Kitchen Faucet Aerator	381,255	98%	374,621	0.76†	284,712
	Bathroom Faucet Aerator	97,931	109%	106,294	0.76†	80,783
	CFLs	2,592,552	100%	2,595,232	0.76†	1,972,376
	Total	**4,172,174**	**1.00**	**4,162,033**		**3,163,145**
kW, Joint Kits	Low Flow Showerhead	N/A	N/A	70	0.76†	53
	Kitchen Faucet Aerator	N/A	N/A	76	0.76†	58
	Bathroom Faucet Aerator	N/A	N/A	96	0.76†	73
	CFLs	N/A	N/A	241	0.76†	183
	Total			**483**		**367**
kWh, Nicor Only Kits	Low Flow Showerhead	N/A	N/A	121,233	0.79†	95,774
	Kitchen Faucet Aerator	N/A	N/A	44,365	0.79†	35,048
	Bathroom Faucet Aerator	N/A	N/A	13,413	0.79†	10,596
	Water Heater Setback	N/A	N/A	9,439	0.79†	7,457
	Total			**188,450**		**148,876**
kW, Nicor Only Kits	Low Flow Showerhead	N/A	N/A	9	0.79†	7
	Kitchen Faucet Aerator	N/A	N/A	8	0.79†	7
	Bathroom Faucet Aerator	N/A	N/A	14	0.79†	11
	Water Heater Setback	N/A	N/A	1.1	0.79†	0.9
	Total			**33**		**26**

Source: Utility tracking data and Navigant analysis.
† *A deemed value.*

E.3. Impact Estimate Parameters

In the course of our GPY3 research, the evaluation team used a variety of parameters in its impact calculations. The evaluation team sourced the Illinois TRM Version 2.0 for all deemed parameters for gross savings algorithms and sourced the Home Energy Worksheets (HEW) for the following TRM-allowed custom parameters: installation rates, household size, number of showerheads per household, and water heater temperature settings. The net-to-gross value for natural gas savings was deemed in this program year, based on the Illinois Stakeholder Advisory Group's consensus process and from previous evaluation research. The gross realization rate was based on the evaluation research.

Table E-3. Impact Estimate Parameters for Future Use

Parameter	Value	Data Source
NTGR	0.79	Deemed*

**A deemed value from the IL SAG consensus process "Nicor Gas Consensus NTG Values; Summary of Nicor Gas NTG Approach and Consensus Values for GPY1 through GPY5" available at http://www.ilsag.info/net-to-gross-framework.html*

E.4. Program Volumetric Detail

The EEE program distributed 31,168 kits in GPY3 as shown in Table E-4.

Table E-4. GPY3 Primary Participation Detail

Volumetric Parameter	Nicor Gas Total Participants or Measures Installed
Number of Total Kits Distributed	31,168
Number of Measures/Kit	4
Number of Total Measures Distributed	124,672

Source: Utility tracking data and Navigant analysis.

E.5. Results Summary

The following table summarizes the key metrics from GPY3.

Table E-5. GPY3 Results Summary

Participation	Units	GPY3
Verified Net Savings	Therm	341,714
Verified Gross Savings	Therm	432,549
Program Realization Rate	%	1.00
Program NTG Ratio*	#	0.79
Showerheads Distributed	#	31,168
Bathroom Faucet Aerators Distributed	#	62,336
Kitchen Aerators Distributed	#	31,168
Total Kits Distributed	#	31,168

Source: Utility tracking data and Navigant analysis.
**A deemed value*

E.5. Conclusions and Recommendations

The following section provides insight into key program findings and recommendations.[4] Overall, the program performed well in GPY3, exceeding energy savings and participation targets for the year. School teachers are pleased with the program: of the 348 schools enrolled in the program in GPY3, 146 of them have previously participated.

Program Participation

Finding 1. The program distributed 31,168 kits to schools in the Nicor Gas service area, exceeding the original participation target of 22,500 kits as well as the revised participation target of 30,500 kits.

Finding 2. The return rate of the HEW was 65.4% or 20,401 worksheets returned out of 31,168.

Verified Gross Program Savings and Realization Rate

Finding 3. To calculate savings for the hot water heater setback measure, Navigant used the water heater temperature setback deemed unit savings of 6.4 therms from the IL TRM v2.0. The implementer calculated water heater temperature setback savings using the pre- and post- temperatures as reported by the participants, though the implementer did not transform the 1 to 10 scale given on the parent/guardian survey to the correct corresponding degrees as defined in the survey. The implementer assumed the difference between a 7 and 8 on the scale corresponded to a change of 10 degrees; however using an average of the water heater setting range defined in the survey, the difference is approximately 5 degrees.

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

Recommendation for Finding 3. The program should calculate savings for water heater setback using the degree settings defined in the parent/guardian survey. The IL TRM does move to an algorithm which takes into account temperature before and after water heater temperature adjustment. Actual temperature adjustments should be used in years subsequent to GPY3.

Tracking System Review

Finding 4. The implementation contractor (NEF) provided algorithms and values for per unit savings for low-flow showerheads, CFLs, and kitchen and bathroom aerators in the final report. The tracking system contained the number of kits distributed as well as unit savings by measure as defined in the final report.

Finding 5. The implementer did not calculate savings for single family homes separately from multi-family homes for any measures; within the TRM there is a distinction between water usage, waste heat factors, and energy per gallon of water for single-family homes and multi-family homes. This accounts for the differences in the ex-ante savings and the verified gross savings for aerators and showerheads; often the deemed multi-family variables result in higher unit savings numbers.

Recommendation for Finding 5. The program should calculate savings for aerators and showerheads for single family homes separately from multi-family homes. Calculating savings separately resulted in a 3% increase in savings for aerators and showerheads (approximately, 12,260 gross therms).

Verified Net Savings

Finding 6. The program achieved verified net savings of 341,714 therms exceeding the net planning target of 277,200 therms.

Process Evaluation

Finding 7. The program is performing well, exceeding participation and savings goals. Comments about the program from parents and teachers are generally uniformly positive. Of the 730 teachers who responded to the educator evaluation questions asked by NEF, 81 percent of them said their impression of the program overall is excellent.

1. Introduction

1.1 Program Description

This report presents a summary of Navigant Consulting Inc.'s (Navigant's) findings and results from the Impact and Process Evaluation of the joint Nicor Gas Plan Year 3 (GPY3) and Commonwealth Edison Company (ComEd) Plan Year 6 (EPY6)[5] Elementary Energy Education (EEE) program. The EEE program is implemented by National Energy Foundation (NEF) and is branded "THINK! ENERGY." In GPY3, the program targeted fifth grade students in public and private schools that are customers of Nicor Gas or jointly Nicor Gas and ComEd. 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 GPY2 program were also invited to participate. New to GPY3 was the participation of some sixth grade students due to smaller schools participating or schools with split classrooms. After the presentation, students took home a kit that included water conservation measures; instruments to measure water temperature, ambient temperature, and water flow rates; and a home energy worksheet ("HEW") where participants reported details of their family's participation in Scantron form (see Table 1-1 below). Students and teachers are incentivized to return the home energy worksheets with a $100 mini-grant for each class that completes and returns 80 percent of their HEWs. Students are also incentivized to receive a program wristband if they complete and return a card. In addition, teachers that returned 80 percent of the HEWs were entered into a raffle to win an iPad. NEF based the program's savings on the installation rate of implemented measures reported in the HEW against the number of kits that were reported taken home.

The EEE program's primary focus is to produce electricity and natural gas 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 Nicor Gas and ComEd programs via cross-marketing and increased customer awareness of energy efficiency issues.

[5] The GPY3/EPY6 program year began June 1, 2013 and ended May 31, 2014.

Table 1-1. Items Included in the Take Home Kit

Items
Niagara Power showerhead (1.5 gpm)
Niagara kitchen aerator (1.5 gpm)
Two Niagara bathroom aerators (1.0 gpm)
Three 14- watt CFLs (Joint kits only)
Shower timer
Flow rate test bag
Digital water and ambient temperature thermometer
Scratch n. sniff mercaptan (natural gas odorant) stickers
Home Energy Worksheet
Nicor Gas promotional brochure
ComEd Smart Ideas® for Your Home pamphlet (Joint kits only)

1.2 Evaluation Objectives

The evaluation team identified the following key researchable questions for GPY3:

1.2.1 Impact Questions

1. What is the program's net and gross savings?
2. Did the program meet its energy and demand savings goals? If not, why not?

1.2.2 Process Questions

1. Has the program changed since GPY2/EPY5? If so, why and how?

2. Evaluation Approach

This evaluation of the EEE Program reflects the fourth year of program operation for Nicor Gas. 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 v2.0 and (2) cross-checking totals with the tracking system. The evaluation team calculated verified net savings using a NTGR from 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.

2.1 *Data Collection*

2.1.1 Overview of Data Collection Activities

The core data collection activities included in-depth interviews with program staff and review of the program tracking database. The full set of data collection activities are shown in Table 2-1 and Table 2-2.

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When	Comments
Program Tracking Database	Participants	All	All	September – October 2014	Source of information for verified gross analysis.
In Depth Interviews	Program Manager/Implementer Staff	3	3	March & August 2014	Included staff from Nicor Gas, ComEd, and NEF.

Source: Navigant

Table 2-2. Additional Resources

Reference Source	Author	Application	Impacts	Process
Illinois Technical Reference Manual Version 2.0	Illinois Energy Efficiency Stakeholder Advisory Group (SAG)	EEE Measure Impact Analysis	X	
Home Energy Worksheets	National Energy Foundation	Impact Analysis	X	
NEF 2013 Think! Energy with Nicor Gas and ComEd Program Reports	National Energy Foundation	Impact Analysis Process Analysis	X	X

Source: Navigant

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

2.2 *Verified Savings Parameters*

In the course of estimating verified gross and net savings, the evaluation team used a variety of parameters in its calculations. Verified gross and net savings resulting from the GPY3 program were calculated using the following algorithm.

*Total Registered Quantity * Unit Savings*

Unit savings are calculated using the algorithms from the Illinois TRM v2.0 and total registered quantity is the number of each type of measure distributed. The Illinois TRM deems most input parameters for showerheads and faucet aerators (for detailed description of engineering algorithms and inputs used, see Section 3.3).

Table 2-3 lists the source of the measures that Navigant used. The Illinois TRM v2.0 allows for custom values to be used for household size, showerheads-per-household, and faucets-per-household, and Navigant based these values on HEW data. Navigant also calculated savings for single family homes separately from multi-family homes given the different values for household size, showers per household, and other constants.

Table 2-3. Verified Gross Savings Parameters, Source of Deemed Inputs

Measure	Deemed Input Parameter Source
Showerheads	Illinois TRM v2.0 - Section 5.4.5
Kitchen Aerators	Illinois TRM v2.0 - Section 5.4.4
Bathroom Aerators	
Water Heater Temperature Setback	Illinois TRM v2.0 - Section 5.4.6

Source: Navigant

2.2.1 Verified Gross Program Savings Analysis Approach

Navigant calculated verified gross program impacts for four measures with deemed savings values: low-flow showerheads, kitchen and bathroom faucet aerators, and water heater setback. These measures account for all quantifiable GPY3 savings.

2.2.2 Verified Net Program Savings Analysis Approach

Verified net energy savings were calculated by multiplying the verified gross savings estimates by a net-to-gross ratio (NTGR) of 0.79. In GPY3, the NTGR estimates used to calculate the net verified savings were based on past evaluation research and approved through the IL SAG consensus process. [7]

[7] A deemed value from the IL SAG consensus process "Nicor Gas Consensus NTG Values; Summary of Nicor Gas NTG Approach and Consensus Values for GPY1 through GPY5" available at http://www.ilsag.info/net-to-gross-framework.html

2.3 *Process Evaluation*

The process evaluation for GPY3 was based on the in-depth interviews as mentioned above.

2.3.1 Program Staff Interviews

Navigant conducted interviews with the Nicor Gas and ComEd program managers as well as with the NEF implementation staff in the spring and summer of 2014. These interviews discussed the program's energy savings and participation, as well as changes implemented in GPY3 or planned for GPY4.

3. Gross Impact Evaluation

In GPY3, the EEE program achieved a verified gross savings realization rate of 1.00. The resulting gross savings are 432,549 therms.

3.1 *Tracking System Review*

NEF's tracking system for GPY3 consisted of the following spreadsheets, (1) spreadsheet which contained the answers to the HEW and (2) spreadsheet which contained number of kits and measures distributed, including unit savings. In addition, Nicor Gas provided a spreadsheet with the final savings numbers. The evaluation team also utilized the engineering work papers contained in the NEF 2013 Think! Energy with Nicor Gas and ComEd Program Report and the NEF 2013 Think! Energy with Nicor Gas Program Report in order to confirm gross verified savings. The algorithms and inputs used to determine ex-ante savings were included in these work papers. Navigant was able to arrive at all the necessary inputs used in the calculations in the work papers.

Key findings include:

1. The implementation contractor (NEF) provided algorithms and values for per unit savings for low-flow showerheads, CFLs, and kitchen and bathroom aerators in the final report. The tracking system contained the number of kits distributed as well as unit savings by measure as defined in the final report.
2. Nicor Gas provided final ex-ante savings numbers for all measures.
3. NEF did not calculate savings for single-family homes separately from multi-family homes. There is a distinction between water usage and savings for single-family homes and multi-family homes, including differences in the waste heat factor.

3.2 *Program Volumetric Findings*

The EEE program distributed 31,168 kits in GPY3 (as illustrated in Table 3-1 below). Of these participants, 4,671 were in the Nicor Gas only group and 26,497 were in the joint group.

Table 3-1. GPY3 Volumetric Findings Detail

Volumetric Parameter	Total Participants or Measures Installed
Number of Total Kits Distributed	31,168
Showerheads Distributed	31,168
Bathroom Faucet Aerators Distributed	62,336
Kitchen Aerators Distributed	31,168
Number of Total Measures Distributed (not including behavioral measures)	124,672

Source: Navigant analysis of Nicor Gas/NEF program tracking data.

3.3 Gross Program Impact Parameter Verification

As described in Section 2, energy and demand savings were estimated using Illinois TRM v2.0. The Illinois TRM deems most input parameters for showerheads, faucet aerators and water heater setback.

Navigant used the HEW data to calculate or adjust several input parameters, including showers per household, faucets per household, and actual water heater temperature setback. The TRM provides housing type-dependent values for many parameters; because the evaluation team knew the distribution of multi-family and single-family households from the HEW data, we used the actual split of housing types in calculating savings.

The calculations for therm savings for showerheads are shown below and the data sources for the engineering inputs are outlined in Table 3-2:

$$\Delta Therms = \%FossilDHW * ((GPM_base * L_base - GPM_low * L_low) * Household * SPCD * 365.25 / SPH) * EPG_gas * ISR$$

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*
ISR	*= In service rate of showerhead*
EPG_gas	*= Energy per gallon of Hot water supplied by gas*

Table 3-2. Showerhead Impact Parameters

Gross Savings Input Parameters	Data Source	Value, Single-Family Joint	Value, Multi-family Joint	Value, Single-Family Nicor Only	Value, Multi-family Nicor Only	Unit	Deemed or Evaluated?
%FossilDHW	HEW	0.85	0.74	0.88	0.74	%	Evaluated
GPM_base	TRM v2.0	2.35	2.35	2.35	2.35	GPM	Deemed
GPM_low	TRM v2.0	1.5	1.5	1.5	1.5	GPM	Deemed
L_base	TRM v2.0	8.2	8.2	8.2	8.2	min	Deemed
L_low	TRM v2.0	8.2	8.2	8.2	8.2	min	Deemed
Household	HEW	4.74	5.28	4.64	4.90	# people	Evaluated
SPCD	TRM v2.0	0.75	0.75	0.75	0.75	Showers/Day	Deemed
SPH	HEW	1.91	1.61	2.10	1.78	Showers/Household	Evaluated
ISR	HEW	0.40	0.41	0.36	0.39	%	Evaluated
EPG_gas	TRM v2.0	0.0054	0.0063	0.0054	0.0063	Therm/Gal	Deemed

The calculations for therm savings for bathroom and kitchen aerators are shown below and the data sources for the engineering inputs are outlined in Table 3-3 and Table 3-4:

*ΔTherms = %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
RE_gas = Recovery efficiency of gas water heater
ISR = In service rate of aerator

Table 3-3. Kitchen Aerator Impact Parameters

Gross Savings Input Parameters	Data Source	Value, Single-Family Joint	Value, Multi-family Joint	Value, Single-Family Nicor Only	Value, Multi-family Nicor Only	Unit	Deemed or Evaluated?
%FossilDHW	HEW	0.85	0.74	0.88	0.74	%	Evaluated
GPM_base	TRM v2.0	1.2	1.2	1.2	1.2	GPM	Deemed
GPM_low	TRM v2.0	0.94	0.94	0.94	0.94	GPM	Deemed
L_base	TRM v2.0	6.9	6.9	6.9	6.9	Min/person /day	Deemed
L_low	TRM v2.0	6.9	6.9	6.9	6.9	Min/person/ day	Deemed
Household	HEW	4.74	5.28	4.64	4.90	# people	Evaluated
DF	TRM v2.0	0.75	0.75	0.75	0.75	%	Deemed
FPH	TRM v2.0	1	1	1	1	#	Deemed
EPG_Gas	TRM v2.0	0.00399	0.00446	0.00399	0.00446	%	Deemed
ISR	HEW	0.39	0.45	0.33	0.44	%	Evaluated

Table 3-4. Bathroom Aerators Impact Parameters

Gross Savings Input Parameters	Data Source	Value, Single-Family Joint	Value, Multi-family Joint	Value, Single-Family Nicor Only	Value, Multi-family Nicor Only	Unit	Deemed or Evaluated?
%FossilDHW	HEW	0.85	0.74	0.88	0.74	%	Evaluated
GPM_base	TRM v2.0	1.2	1.2	1.2	1.2	GPM	Deemed
GPM_low	TRM v2.0	0.94	0.94	0.94	0.94	GPM	Deemed
L_base	TRM v2.0	2.95	2.95	2.95	2.95	Min/person /day	Deemed
L_low	TRM v2.0	2.95	2.95	2.95	2.95	Min/person/ day	Deemed
Household	HEW	4.74	5.28	4.64	4.90	# people	Evaluated
DF	TRM v2.0	0.9	0.9	0.9	0.9	%	Deemed
FPH	HEW	3.2	3.8	2.7	3.5	#	Evaluated
EPG_Gas	TRM v2.0	0.00399	0.00446	0.00399	0.00446	%	Deemed
ISR Aerator 1, Aerator 2	HEW	0.43, 0.26	0.44, 0.23	0.38, 0.23	0.37, 0.20	%	Evaluated

The calculations for therm savings for water heater temperature setback are shown below and the data sources for the engineering inputs are outlined in Table 3-5. Navigant deemed these savings as directed by the Illinois TRM v2.0 at 6.4 therms.

$$\Delta Therms = 6.4 \text{ therms}$$

Where:

6.4 = Therms saved assuming a 15 degree setback; the Implementer used the actual degree setback reported by participants

Table 3-5. Water Heater Setback Impact Parameters

Gross Savings Input Parameters	Data Source	Value, Single-Family Joint	Value, Multi-family Joint	Value, Single-Family Nicor Only	Value, Multi-family Nicor Only	Unit	Deemed or Evaluated?
%FossilDHW	HEW	0.85	0.74	0.88	0.74	%	Evaluated
Unit Savings	TRM v2.0	6.4	6.4	6.4	6.4	Therms	Deemed
Average degree adjustment	HEW	9.3	10.5	9.0	11.4	Degrees F	Evaluated
ISR	HEW	0.20	0.19	0.17	0.19	%	Evaluated

3.4 *Verified Gross Program Impact Results*

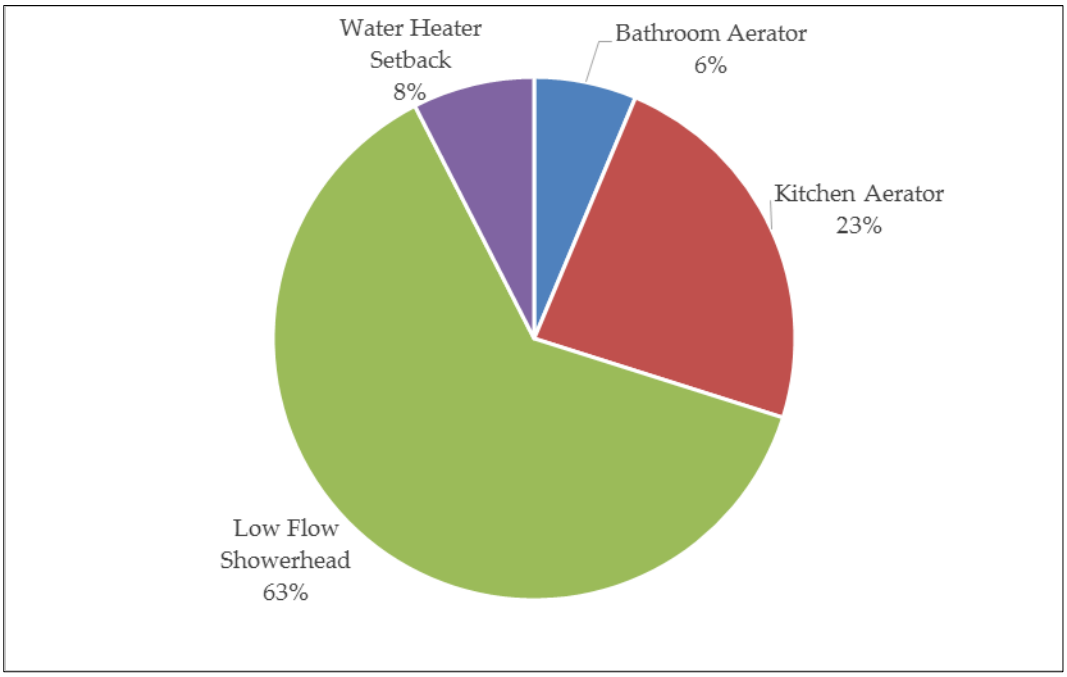
The EEE program achieved verified gross savings of 432,549 therms and a gross savings realization rate of 100 percent in GPY3. Table 3-6 below presents program savings at the measure group level.

Table 3-6. GPY3 Verified Gross Impact Savings Estimates by Measure Type

	Energy Savings (Therms)
Bathroom Aerators	
Ex-Ante Gross Savings	25,201
Verified Gross Realization Rate	1.08
Verified Gross Savings – Joint Kits	22,842
Verified Gross Savings – Nicor Only	4,251
Verified Gross Savings	27,094
Kitchen Aerators	
Ex-Ante Gross Savings	94,519
Verified Gross Realization Rate	1.02
Verified Gross Savings – Joint Kits	83,644
Verified Gross Savings – Nicor Only	12,880
Verified Gross Savings	96,524
Low Flow Showerheads	
Ex-Ante Gross Savings	269,927
Verified Gross Realization Rate	1.03
Verified Gross Savings – Joint Kits	243,706
Verified Gross Savings – Nicor Only	34,583
Verified Gross Savings	278,289
Water Heater Setback	
Ex-Ante Gross Savings	43,098
Verified Gross Realization Rate	0.76
Verified Gross Savings – Joint Kits	28,151
Verified Gross Savings – Nicor Only	4,518
Verified Gross Savings	32,669
Total Ex-Ante Gross Savings	**432,746**
Verified Gross Realization Rate	**1.00**
Total Verified Gross Savings	**432,549**

Figure 3-1 below shows the relative distribution of gross energy savings by measure.

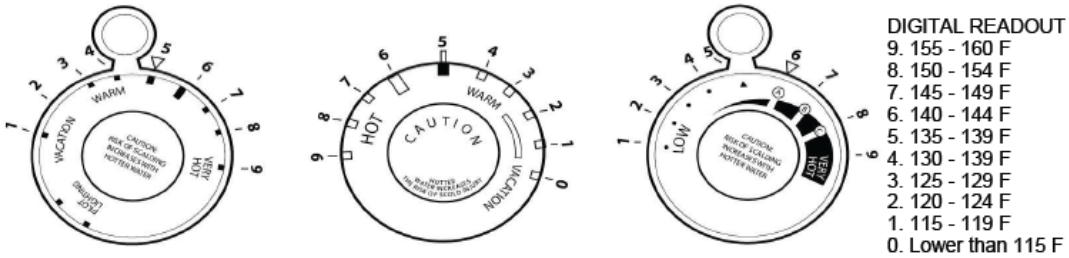
Figure 3-1. Distribution of Gross Therm Savings by Measure



The discrepancy in the realization rate for aerators and showerheads is because the implementer did not calculate savings for single family homes separately from multi-family homes for any measures; within the TRM there is a distinction between water usage, waste heat factors, and energy per gallon of water for single-family homes and multi-family homes. Navigant calculated savings separately for single- and multi-family homes. This accounts for the differences in the ex-ante savings and the verified gross savings for aerators and showerheads; the deemed multi-family variables result in higher unit savings numbers.

Navigant used the water heater temperature setback deemed unit savings of 6.4 therms from the IL TRM v2.0. The implementer calculated water heater temperature setback savings using the pre- and post- temperatures as reported by the participants, though the implementer did not transform the 1 to 10 scale given on the parent/guardian survey to the correct corresponding degrees as defined in the survey (i.e., the implementer assumed the difference between a 7 and 8 on the scale corresponded to a change of 10 degrees, though using an average of the water heater setting range defined in the survey, the difference is 5 degrees (152 to 147 degrees). Figure 3-2 below shows the water heater temperature setting illustration used in the HEW. The reason for discrepancy in realization rate is the in- service rate; Navigant found a lower in-service rate than what NEF used in their savings documentation. Navigant has included the actual average degree adjustment below as a research finding.

Figure 3-2. Water Heater Temperature Settings from the HEW worksheet



Source: NEF parent/guardian survey

4. Net Impact Evaluation

The program achieved verified net savings 341,714 therms. The evaluation team calculated verified net savings using a NTGR of 0.79 from previous evaluation research and approved through the Illinois Stakeholder Advisory Group (IL SAG) consensus process.[8] Table 4-1 below shows the deemed the GPY3 verified net savings.

Table 4-1. GPY3 Verified Net Impact Savings Estimates (Therms) by Measure Type

Savings Type	Measure	Nicor Gas-only Total	Joint Total	Program Total
Therms	Bathroom Aerators	3,310	18,372	21,682
	Kitchen Aerator	10,568	69,905	80,473
	Low Flow Showerhead	26,110	187,640	213,750
	Water Heater Setback	3,569	22,240	25,809
	Total	**43,557**	**298,157**	**341,714**

Source: Navigant Analysis

[8] A deemed value from the IL SAG consensus process "Nicor Gas Consensus NTG Values; Summary of Nicor Gas NTG Approach and Consensus Values for GPY1 through GPY5" available at http://www.ilsag.info/net-to-gross-framework.html

5. Process Evaluation

This section describes changes made to the EEE program in GPY3 as well as changes planned for GPY4 as reported to Navigant via interviews with program managers and the implementation contractor.

5.1 Program Changes since GPY2

The GPY3 program has changed in several ways since GPY2 as described below. Together these changes amount to more savings per kit and more participants.

5.1.1 Participation

One of the major changes in GPY3 was the increase in the target number of program participants. Originally, the targets for GPY3 were 21,000 joint kits and 1,500 Nicor Gas only kits but were then increased to 26,000 joint kits and 4,500 Nicor Gas only kits. The program met the increased targets in GPY3. Some sixth grade classrooms were allowed to participate because of the increased participation targets and in cases where fifth and sixth grade students were in the same classroom to learn about energy education.

5.1.2 Measures in Kits

There were no changes made to the make and model of the measures included the kits but a second bathroom aerator was added in GPY3. Natural gas savings for the water heater setback were also counted this year (for the first time) due to the enhanced questions on the HEWs. Rather than only asking the parent if they set back the temperature on their water heater, an illustration was included that shows examples of water heater dials with notches ranging from "vacation" to "very hot". Additional questions were included asking about old settings and new settings for the water heater dials.

5.2 Participant Feedback

According to the responses from NEF's teacher and parent program evaluation survey, this program is performing well. The program's increased participation targets were met, which suggests strong interest in the program. Of the overall 348 schools that participated in GPY3, 146 of them have participated in the program before. Around 730 teachers responded to the educator evaluation questions asked by NEF, and about 81 percent of respondents said their impression of this program overall was excellent. Around 520 parents responded to the parent evaluation questions asked by NEF in the parent program evaluation survey, and 94 percent said the kit devices were easy to install and use. About 97 percent of parents surveyed said they would continue to use the kit items after the program ended, and about 96 percent of parents surveyed said they would like to see this program continue in their schools.

5.3 *Planned Changes for GPY4/EPY7*

Nicor Gas and ComEd have changes planned for the GPY4/EPY7 program as discussed below.

5.3.1 New Implementation Contractor

One of the major changes planned for GPY4/EPY7 is the use of a new implementation contractor. This was due to both 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 formal instruction provided to the students.

This model was also of special interest to Nicor Gas, which will experience significantly reduced program budgets in GPY4-GPY6. The "teacher-led instruction" model provides the same type of quality materials and measures, but at a significant 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. Additionally, both utilities perceived minor shortcomings with the previous contractor's program implementation, but this was a distant secondary consideration for making the change.

5.3.2 Participation

Another change in GPY4/EPY7 is the addition of Peoples Gas and North Shore Gas to the program. ComEd will be partnering with Nicor Gas as well as Peoples Gas and North Shore Gas. The participation target for GPY4/EPY7 is scaled back to 9,591kits.

6. Conclusions and Recommendations

The following section provides insight into key program findings and recommendations.[9] Overall, the program performed well in GPY3, exceeding energy savings and participation targets for the year. School teachers are pleased with the program: of the 348 schools enrolled in the program in GPY3, 146 of them have previously participated.

Program Participation

Finding 1. The program distributed 31,168 kits to schools in the Nicor Gas service area, exceeding the original participation target of 22,500 kits as well as the revised participation target of 30,500 kits.

Finding 2. The return rate of the HEW was 65.4% or 20,401 worksheets returned out of 31,168.

Verified Gross Program Savings and Realization Rate

Finding 3. To calculate savings for the hot water heater setback measure, Navigant used the water heater temperature setback deemed unit savings of 6.4 therms from the IL TRM v2.0. The implementer calculated water heater temperature setback savings using the pre- and post- temperatures as reported by the participants, though the implementer did not transform the 1 to 10 scale given on the parent/guardian survey to the correct corresponding degrees as defined in the survey. The implementer assumed the difference between a 7 and 8 on the scale corresponded to a change of 10 degrees; however using an average of the water heater setting range defined in the survey, the difference is approximately 5 degrees.

Recommendation for Finding 3. The program should calculate savings for water heater setback using the degree settings defined in the parent/guardian survey. The IL TRM does move to an algorithm which takes into account temperature before and after water heater temperature adjustment. Actual temperature adjustments should be used in years subsequent to GPY3.

Tracking System Review

Finding 4. The implementation contractor (NEF) provided algorithms and values for per unit savings for low-flow showerheads, CFLs, and kitchen and bathroom aerators in the final report. The tracking system contained the number of kits distributed as well as unit savings by measure as defined in the final report.

Finding 5. The implementer did not calculate savings for single family homes separately from multi-family homes for any measures; within the TRM there is a distinction between water usage, waste heat factors, and energy per gallon of water for single-family homes and multi-family homes. This accounts for the differences in the ex-ante savings and the verified gross savings for aerators and showerheads; often the deemed multi-family variables result in higher unit savings numbers.

Recommendation 2 for Finding 5. The program should calculate savings for aerators and showerheads for single family homes separately from multi-family homes. Calculating

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

savings separately resulted in a 3% increase in savings for aerators and showerheads (approximately, 12,260 gross therms).

Verified Net Savings

Finding 6. The program achieved verified net savings of 341,714 therms exceeding the net planning target of 277,200 therms.

Process Evaluation

Finding 7. The program is performing well, exceeding participation and savings goals. Comments about the program from parents and teachers are generally uniformly positive. Of the 730 teachers who responded to the educator evaluation questions asked by NEF, 81 percent of them said their impression of the program overall is excellent.