



Elementary Energy Education Impact Evaluation Report

Energy Efficiency Plan: Plan Year 6 (PY6)
(6/1/2016-12/31/2017)

Presented to
Peoples Gas and North Shore Gas

FINAL

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1. INTRODUCTION

This report presents the results of the impact evaluation of the joint Peoples Gas (PGL), North Shore Gas (NSG), and Commonwealth Edison (ComEd) GPY6/EPY9 Elementary Energy Education (EEE) program. It presents a summary of the energy impacts for the total program and broken out by relevant measure and program structure details, for each utility. The appendix presents the impact analysis methodology. GPY6/EPY9 covers June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

This program is offered to schools served by PGL, NSG and ComEd. The program is also offered to schools served jointly by Nicor Gas and ComEd, however savings from those kits are not included in this report. The EEE program is implemented by Resource Action Programs (RAP) and is branded “SUPER SAVERS.” In GPY6/EPY9, the program targeted fifth grade students in public and private schools that are customers of PGL, NSG and ComEd. Schools received an invitation to participate and register to receive program materials; alternatively, schools could register on the program website to join a waiting list if the program was fully-enrolled when they registered. Schools that previously participated in the program were also invited to participate. The program used a “teacher-lead instruction” program model where the teacher could choose to teach the curriculum over five or ten days and focus on one kit measure per day. After the lesson, students took home a kit that included water conservation measures; instruments to measure water and ambient temperature, as well as water flow rates; CFLs; LEDs; shower timers; and a student survey form where participants reported details of their family’s participation. Teachers were incentivized to have students return the student survey forms with a \$50 mini-grant for each class that completed and returned 80 percent of the forms. 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.

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 PGL and NSG programs via cross-marketing and increased customer awareness of energy efficiency issues.

The PGL program had 22,145 participants in GPY6/EPY9 and distributed a total of 199,305 measures (132,870 non-lighting measures and 66,435 lighting measures) as shown in the following tables. Since this is a joint program between PGL and ComEd, PGL did not claim any savings from the lighting measures and the therm savings from the non-lighting measures was determined using the electric and gas water heating split deemed in the IL TRM v5.

Table 2-1. GPY6/EPY9 Volumetric Summary for PGL

Participation	Total
Participants †	22,145
Measures Distributed	199,305

Source: Peoples Gas tracking data and Navigant team analysis.

† Participants are defined as anyone who received a kit through the program

Table 2-2 summarizes the distributed measure quantities that are the basis for PGL verified energy savings.

Table 2-2. GPY6/EPY9 Distributed Measure Quantities for PGL

Measure	Quantity Unit	Distributed Quantity
Showerheads	Each	22,145
Kitchen Aerators	Each	22,145
Bathroom Aerators	Each	44,290
CFLs*	Each	13,366
LEDs*	Each	53,069
Water Heater Temperature Setbacks	Each	22,145
Shower Timers	Each	22,145

* Savings for these measures not claimed by PGL

Source: Peoples Gas tracking data and Navigant team analysis.

The NSG program had 5,879 participants in GPY6/EPY9 and distributed a total of 52,911 measures (35,274 non-lighting measures and 17,637 lighting measures) as shown in the following tables. Since this is a joint program between NSG and ComEd, NSG did not claim any savings from the lighting measures and the therm savings from the non-lighting measures was determined using the electric and gas water heating split deemed in the IL TRM v5.

Table 2-3. GPY6/EPY9 Volumetric Summary for NSG

Participation	Total
Participants †	5,879
Measures Distributed	52,911

† Participants are defined as anyone who received a kit through the program

Source: North Shore Gas tracking data and Navigant team analysis.

Table 2-4 summarizes the distributed measure quantities that are the basis for NSG verified energy savings.

Table 2-4. GPY6/EPY9 Distributed Measure Quantities for NSG

Measure	Quantity Unit	Distributed Quantity
Showerheads	Each	5,879
Kitchen Aerators	Each	5,879
Bathroom Aerators	Each	11,758
CFLs*	Each	3,728
LEDs*	Each	13,909
Water Heater Temperature Setbacks	Each	5,879
Shower Timers	Each	5,879

* Savings for these measures not claimed by NSG

Source: North Shore Gas tracking data and Navigant team analysis.

3. PROGRAM SAVINGS SUMMARY

Table 3-1 summarizes the energy savings the PGL EEE program achieved in GPY6/EPY9.

Table 3-1. GPY6/EPY9 Annual Energy Savings Summary for PGL

Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
272,826	149%	407,717	1.00	407,717

† Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.

‡ Net-to-Gross Ratio (NTGR) is the ratio of verified net savings to verified gross savings. The NTGR is a deemed value.

Source: PG-NSG_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is to be found on the Illinois SAG web site: <http://ilsag.info/net-to-gross-framework.html>.

For PGL, 22,145 kits were distributed that saved 407,717 verified gross therms, an average of 18.4 gross therms per kit distributed.

Table 3-2 summarizes the energy savings the NSG EEE program achieved in GPY6/EPY9.

Table 3-2. GPY6/EPY9 Annual Energy Savings Summary for NSG

Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
53,029	139%	73,469	1.00	73,469

† Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.

‡ Net-to-Gross Ratio (NTGR) is the ratio of verified net savings to verified gross savings. The NTGR is a deemed value. Source: PG-NSG_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is to be found on the Illinois SAG web site: <http://ilsag.info/net-to-gross-framework.html>.

Source: North Shore Gas tracking data and Navigant team analysis.

For NSG, 5,879 kits were distributed that saved 73,469 verified gross therms, an average of 12.5 gross therms per kit distributed.

The verified gross savings for both PGL and NSG are calculated using GPY6/EPY9 student survey responses received from PGL and NSG territories, respectively. The large difference between the verified gross realization rates (RR) for PGL and NSG is largely due to the differences in the student survey responses for each utility, including responses from GPY6/EPY9, and comparing GPY6/EPY9 responses with the GPY5/EPY8 responses that were used for the ex ante savings estimates. Further discussion is provided in Section 5. A detailed comparison of the student survey findings used in the impact calculations for both PGL and NSG territories can be found in Appendix 1. Impact Analysis Methodology

4. PROGRAM SAVINGS BY MEASURE

The PGL EEE kits include six measure types overall (not including CFLs and LEDs) and since the measures are distributed in both single and multi-family buildings, the table below shows the verified savings for each measure broken down by building type of the install. Showerheads and kitchen aerators contributed the most verified savings, 67 and 25 percent of total savings respectively.

Table 4-1. GPY6/EPY9 Annual Energy Savings by Measure for PGL

Measure	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Showerhead (1.5 GPM) - Single Family	50,048	188%	94,320	1.00	94,320
Showerhead (1.5 GPM) - Multi-family	98,988	173%	170,802	1.00	170,802
Kitchen Aerator (1.5 GPM) - Single Family	28,124	147%	41,372	1.00	41,372
Kitchen Aerator (1.5 GPM) - Multi-family	34,103	167%	56,843	1.00	56,843
Bathroom Aerator (1.0 GPM) Installed one - Single Family	2,215	157%	3,483	1.00	3,483
Bathroom Aerator (1.0 GPM) Installed one - Multi-family	4,208	214%	8,986	1.00	8,986
Bathroom Aerator (1.0 GPM) Installed Both - Single Family	2,215	187%	4,133	1.00	4,133
Bathroom Aerator (1.0 GPM) Installed Both - Multi-family	4,650	180%	8,375	1.00	8,375
Water Heater Temperature Setback Gas – Single			3,299	1.00	3,299
Water Heater Temperature Setback Gas - Multi-family	11,958	56%	3,444	1.00	3,444
Shower Timer Install - Single Family			6,732	1.00	6,732
Shower Timer Install - Multi-family	36,318	35%	5,927	1.00	5,927
Total*	272,826	149%	407,717	1.00	407,717

† Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings

‡ Net-to-Gross Ratio (NTGR) is the ratio of verified net savings to verified gross savings. The NTGR is a deemed value. Source: PG-NSG_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is to be found on the Illinois SAG web site: <http://ilsag.info/net-to-gross-framework.html>.

*Totals may not sum due to rounding

Source: Peoples Gas tracking data and Navigant team analysis.

The NSG EEE kits also include six measure types overall (not including CFLs and LEDs) and since the measures are distributed in both single and multi-family buildings, the table below shows the verified savings for each measure broken down by building type of the install. As with the PGL program, showerheads and kitchen aerators contributed the most verified savings, 64 and 23 percent of total savings respectively.

Table 4-2. GPY6/EPY9 Annual Energy Savings by Measure for NSG

Measure	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Showerhead (1.5 GPM) - Single Family	13,757	217%	29,842	1.00	29,842
Showerhead (1.5 GPM) - Multi-family	10,523	163%	17,175	1.00	17,175
Kitchen Aerator (1.5 GPM) - Single Family	5,938	197%	11,680	1.00	11,680
Kitchen Aerator (1.5 GPM) - Multi-family	2,998	181%	5,420	1.00	5,420
Bathroom Aerator (1.0 GPM) Installed one - Single Family	412	250%	1,028	1.00	1,028
Bathroom Aerator (1.0 GPM) Installed one - Multi-family	353	263%	928	1.00	928
Bathroom Aerator (1.0 GPM) Installed Both - Single Family	470	286%	1,343	1.00	1,343
Bathroom Aerator (1.0 GPM) Installed Both - Multi-family	118	638%	750	1.00	750
Water Heater Temperature Setback Gas – Single			969	1.00	969
Water Heater Temperature Setback Gas - Multi-family	118	1160%	395	1.00	395
Shower Timer Install - Single Family			3,939	1.00	3,939
Shower Timer Install - Multi-family	18,342	29%	1,331	1.00	1,331
Total*	53,029	139%	73,469	1.00	73,469

† Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.

‡ Net-to-Gross Ratio (NTGR) is the ratio of verified net savings to verified gross savings. The NTGR is a deemed value. Source: PG-NSG_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is to be found on the Illinois SAG web site: <http://ilsag.info/net-to-gross-framework.html>.

*Totals may not sum due to rounding

Source: North Shore Gas tracking data and Navigant team analysis.

5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

Impact Parameter Estimates

The verified savings calculation for each measure is based on custom inputs calculated using the student survey responses for PGL and NSG separately. Therefore, the unit therm savings for each utility is different.

Table 5-1 and Table 5-2 show the verified unit therm savings and realization rate findings by measure for PGL and NSG respectively. The realization rate is the ratio of the verified savings to the ex ante savings. Following the table, we provide findings and recommendations, including discussion for realization rates above or below 100 percent. Appendix 1 provides a description of the impact analysis methodology.

Table 5-1. PGL Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit) [†]	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Showerhead (1.5 GPM) - Single Family	Each	2.26	4.26	188%	IL TRM v5.0 Section 5.4.5* and
Showerhead (1.5 GPM) - Multi-family	Each	4.47	7.71	173%	Student Survey data provided by RAP
Kitchen Aerator (1.5 GPM) - Single Family	Each	1.27	1.87	147%	IL TRM v5.0 Section 5.4.4 and
Kitchen Aerator (1.5 GPM) - Multi-family	Each	1.54	2.57	167%	Student Survey data provided by RAP
Bathroom Aerator (1.0 GPM) Installed one - Single Family	Each	0.10	0.16	157%	
Bathroom Aerator (1.0 GPM) Installed one - Multi-family	Each	0.19	0.41	214%	IL TRM v5.0 Section 5.4.4 and
Bathroom Aerator (1.0 GPM) Installed Both - Single Family	Each	0.10	0.19	187%	Student Survey data provided by RAP
Bathroom Aerator (1.0 GPM) Installed Both - Multi-family	Each	0.21	0.38	180%	
Water Heater Temperature Setback Gas - Single	Each	0.54	0.15	56%	IL TRM v5.0 Section 5.4.6 and
Water Heater Temperature Setback Gas - Multi-family	Each		0.16		Student Survey data provided by RAP
Shower Timer Install - Single Family	Each	1.64	0.30	35%	IL TRM v6.0 Section 5.4.9 and
Shower Timer Install - Multi-family	Each		0.27		Student Survey data provided by RAP
Total Kit Savings	Each	12.32	18.41	149%	

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

† The ex ante numbers were provided to Navigant by RAP in the spreadsheet titled "FINAL_PY9_PY6 EI Ed Reporting Template_2018-01-10"

Table 5-2. NSG Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit) [†]	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Showerhead (1.5 GPM) - Single Family	Each	2.34	5.08	217%	IL TRM v5.0 Section 5.4.5* and Student Survey data provided by RAP
Showerhead (1.5 GPM) - Multi-family	Each	1.79	2.92	163%	
Kitchen Aerator (1.5 GPM) - Single Family	Each	1.01	1.99	197%	IL TRM v5.0 Section 5.4.4 and Student Survey data provided by RAP
Kitchen Aerator (1.5 GPM) - Multi-family	Each	0.51	0.92	181%	
Bathroom Aerator (1.0 GPM) Installed one - Single Family	Each	0.07	0.17	250%	IL TRM v5.0 Section 5.4.4 and Student Survey data provided by RAP
Bathroom Aerator (1.0 GPM) Installed one - Multi-family	Each	0.06	0.16	263%	
Bathroom Aerator (1.0 GPM) Installed Both - Single Family	Each	0.08	0.23	286%	
Bathroom Aerator (1.0 GPM) Installed Both - Multi-family	Each	0.02	0.13	638%	
Water Heater Temperature Setback Gas - Single	Each	0.02	0.16	1160%	IL TRM v5.0 Section 5.4.6 and Student Survey data provided by RAP
Water Heater Temperature Setback Gas - Multi-family	Each		0.07		
Shower Timer Install - Single Family	Each	3.12	0.67	29%	IL TRM v6.0 Section 5.4.9 and Student Survey data provided by RAP
Shower Timer Install - Multi-family	Each		0.23		
Total Kit Savings	Each	9.02	12.50	139%	

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

† The ex ante numbers were provided to Navigant by RAP in the spreadsheet titled "FINAL_PY9_PY6 EI Ed Reporting Template_2018-01-10"

The custom inputs that RAP used to calculate the ex ante savings are based on student survey responses collected in GPY5/EPY8. Navigant calculated the custom inputs based on the latest GPY6/EPY9 student survey responses provided by RAP. The custom inputs differed significantly between GPY5/EPY8 and GPY6/EPY9, leading to a realization rate of 149 and 139 percent for PGL and NSG programs respectively.

The difference between the verified gross realization rates for PGL and NSG is largely due to the differences in the student survey responses for each utility, including responses from GPY6/EPY9, and comparing GPY6/EPY9 responses with the GPY5/EPY8 responses that were used for the ex ante savings estimates. In particular, shower timers accounted for 35 percent of the NSG ex ante savings, but only 13 percent of PGL ex ante savings. For both utilities, the verified shower timer savings were significantly less than ex ante in GPY6/EPY9, but the reduction of the overall program realization rate was greater for NSG because of the higher proportion of shower timer savings in the ex ante savings.

A comparison of the custom inputs used in the ex ante and ex post analysis along with the algorithms deemed by the IL TRM v5.0 are highlighted in Appendix 1. Impact Analysis Methodology.

Recommendation 1. To get a more accurate ex ante savings estimate, Franklin Energy should consider using the latest student survey data to calculate the custom inputs used for ex ante

savings calculations,¹ except for the type of water heater fuel for water saving measures. To determine the proportion of water heating supplied by natural gas or electricity (water heater fuel type) Navigant used the applicable TRM values for “Unknown” fuel type rather than the student survey responses². Alternatively, Franklin Energy may base the initial ex ante estimate on the most recent verified evaluation results available when the tracking system is set-up prior to the start of a program year, and then update the ex ante estimate during the program year using interim evaluation results.

However, for verified savings calculations for program year 2018, Navigant will review the findings from the student survey form (received by January 30, 2019). The student survey form for the 2018/19 school year was updated to show students how to identify water heater fuel type and to include a "Can't identify" option. Navigant will also analyze the distribution of participating schools in ComEd's territory before finalizing the gas versus electric DHW fuel split for the 2018 program year verified savings calculations.

¹ Beginning with 2018, the evaluation team will perform custom calculations using available mid-year survey data as part of an interim impact review.

² Navigant has observed that the student self-reported responses, which in GPY6/EPY9 indicated a proportion of natural gas water heating at 64 percent for Nicor Gas, indicate a proportion of natural gas water heating significantly lower than rigorous studies supporting the Illinois TRM and Illinois utility baseline and potential studies. For example, based on a detailed mail survey adjusted with site visit findings, Opinion Dynamics found the proportion of natural gas water heating was 91 percent among all single family and multi-family respondents with valid responses, and found that 15 percent answered: “Don’t know” while 3 percent gave no answer (40 percent of multi-family survey participants answered “Don’t know” or gave no answer), (Opinion Dynamics Corporation, COMED RESIDENTIAL SATURATION/END USE, MARKET PENETRATION & BEHAVIORAL STUDY, April 2013). Thus, Navigant used the TRM version 5.0 statistics for water heating fuel split for the GPY6/EPY9 evaluations: 84 percent gas water heating and 16 percent electric water heating. TRM version 6.0 specifies the same split values as version 5.0.

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the measure workbook for agreement with the TRM or evaluation research for non-deemed measures.
2. Validating that the savings algorithm was applied correctly.
3. Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in Navigant's calculations if the workbook did not agree with the TRM.
4. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

This section highlights the equations used to calculate the ex post therm savings for each measure and a comparison of input values used by Navigant and RAP.

Equation 1. Low Flow Showerheads Savings Equation and Inputs, IL TRM v5.0 Section 5.4.5

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

Where:

<i>%FossilDHW</i>	= proportion of water heating supplied by Natural Gas heating
<i>GPM_base</i>	= Flow rate of the baseline showerhead
<i>GPM_low</i>	= As-used flow rate of the low-flow showerhead
<i>L_base</i>	= Shower length in minutes with baseline showerhead
<i>L_low</i>	= Shower length in minutes with low-flow showerhead
<i>Household</i>	= Average number of people per household
<i>SPCD</i>	= Showers Per Capita Per Day
<i>365.25</i>	= Days per year, on average.
<i>SPH</i>	= Showerheads Per Household
<i>EPG_gas</i>	= Energy per gallon of Hot water supplied by gas
<i>ISR</i>	= In service rate of showerhead
<i>%SF_MF</i>	= percentage of SF or MF homes in the student survey responses
<i>quantity</i>	= total number of kits distributed in GPY6/EPY9

Table 6-1. Low Flow Showerheads - Custom and Deemed Values Comparison

Value, Navigant PGL	Value, Implementer, PGL	Value, Navigant NSG	Value, Implementer, NSG	Variable	Source	Deemed/Custom	Discrepancy?
0.84	0.612	0.84	0.540	%FossilDHW	Survey - HCU6	Custom	Yes (PGL, NSG)
2.35	2.35	2.35	2.35	GPM_base	IL TRM 5.4.5	Deemed	-
1.5	1.5	1.5	1.5	GPM_low	Specifications	Custom	-
7.8	7.8	7.8	7.8	L_base	IL TRM 5.4.5	Deemed	-
7.8	7.8	7.8	7.8	L_low	IL TRM 5.4.5	Deemed	-
365.25	365.25	365.25	365.25	days/year	IL TRM 5.4.5	Deemed	-
4.982	4.848	4.681	4.747	Household SF	Survey - HCU2	Custom	Yes (PGL, NSG)
5.060	4.997	4.592	4.894	Household MF	Survey - HCU2	Custom	Yes (PGL, NSG)
0.600	0.600	0.600	0.600	SPCD	IL TRM 5.4.5	Deemed	-
1.79	1.79	1.79	1.79	SPH SF	IL TRM 5.4.5	Deemed	-
1.30	1.30	1.30	1.30	S PH MF	IL TRM 5.4.5	Deemed	-
0.005	0.005	0.005	0.005	EPG_Gas_SF	IL TRM 5.4.5	Deemed	-
0.006	0.006	0.006	0.006	EPG_Gas_MF	IL TRM 5.4.5	Deemed	-
0.522	0.333	0.412	0.307	ISR SF	Survey - HA1	Custom	Yes (PGL, NSG)
0.535	0.512	0.505	0.388	ISR MF	Survey - HA1	Custom	Yes (PGL, NSG)
0.479	0.562	0.770	0.732	%SF	Survey - HCU1	Custom	Yes (PGL, NSG)
0.521	0.438	0.230	0.268	%MF	Survey - HCU1	Custom	Yes (PGL, NSG)

Source: PGL and NSG tracking data and Navigant team analysis.

Equation 2. Low Flow Faucet Aerators Savings Equation and Inputs, IL TRM v5.0 Section 5.4.4

$$\Delta \text{Therms} = \% \text{FossilDHW} * ((\text{GPM_base} * \text{L_base} - \text{GPM_low} * \text{L_low}) * \text{Household} * 365.25 * \text{DF} / \text{FPH}) * \text{EPG_gas} * \text{ISR} * \% \text{SF_MF} * \text{quantity}$$

Where:

- %FossilDHW* = proportion of water heating supplied by Natural Gas heating
- GPM_base* = Average flow rate, in gallons per minute, of the baseline faucet
- GPM_low* = Average flow rate, in gallons per minute, of the low-flow faucet aerator
- L_base* = Average baseline daily length faucet use per capita for faucet of interest in minutes
- L_low* = Average retrofit daily length faucet use per capita for faucet of interest 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
- %SF_MF* = percentage of SF or MF homes in the student survey responses
- quantity* = total number of kits in GPY6/EPY9

Table 6-2. Low Flow Kitchen Aerators - Custom and Deemed Values Comparison

Value, Navigant PGL	Value, Implementer, PGL	Value, Navigant NSG	Value, Implementer, NSG	Variable	Source	Deemed/Custom	Discrepancy?
0.84	0.612	0.84	0.540	%FossilDHW	Survey - HCU6	Custom	Yes (PGL, NSG)
1.39	1.39	1.39	1.39	GPM_base	IL TRM 5.4.4	Deemed	-
0.94	0.94	0.94	0.94	GPM_low	Specifications	Deemed	-
4.5	4.5	4.5	4.5	L_base	IL TRM 5.4.4	Deemed	-
4.5	4.5	4.5	4.5	L_low	IL TRM 5.4.4	Deemed	-
365.25	365.25	365.25	365.25	days/year	IL TRM 5.4.4	Deemed	-
4.982	4.848	4.681	4.747	Household SF	Survey - HCU2	Custom	Yes (PGL, NSG)
5.060	4.997	4.592	4.894	Household MF	Survey - HCU2	Custom	Yes (PGL, NSG)
0.75	0.75	0.75	0.75	DF	IL TRM 5.4.4	Deemed	-
1	1	1	1	KFPH	IL TRM 5.4.4	Deemed	-
0.00415	0.00415	0.00415	0.00415	EPG_gas_SF	IL TRM 5.4.4	Deemed	-
0.005	0.005	0.005	0.005	EPG_gas_MF	IL TRM 5.4.4	Deemed	-
0.405	0.330	0.285	0.233	ISR SF	Survey - HA2	Custom	Yes (PGL, NSG)
0.432	0.430	0.387	0.267	ISR MF	Survey - HA2	Custom	Yes (PGL, NSG)
0.479	0.562	0.770	0.732	%SF	Survey - HCU1	Custom	Yes (PGL, NSG)
0.521	0.438	0.230	0.268	%MF	Survey - HCU1	Custom	Yes (PGL, NSG)

Source: PGL and NSG tracking data and Navigant team analysis.

Table 6-3. Low Flow Bathroom Aerators - Custom and Deemed Values Comparison

Value, Navigant PGL	Value, Implementer, PGL	Value, Navigant NSG	Value, Implementer, NSG	Variable	Source	Deemed/Custom	Discrepancy?
0.84	0.612	0.84	0.540	%FossilDHW	Survey - HCU6	Custom	Yes (PGL, NSG)
1.39	1.39	1.39	1.39	GPM_base	IL TRM 5.4.4	Deemed	-
0.94	0.94	0.94	0.94	GPM_low	Specifications	Deemed	-
1.6	1.6	1.6	1.6	L_base	IL TRM 5.4.4	Deemed	-
1.6	1.6	1.6	1.6	L_low	IL TRM 5.4.4	Deemed	-
365.25	365.25	365.25	365.25	days/year	IL TRM 5.4.4	Deemed	-
4.982	4.848	4.681	4.747	Household SF	Survey - HCU2	Custom	Yes (PGL, NSG)
5.060	4.997	4.592	4.894	Household MF	Survey - HCU2	Custom	Yes (PGL, NSG)
0.90	0.90	0.90	0.9	DF	IL TRM 5.4.4	Deemed	-
2.83	2.83	2.83	2.83	BFPH_SF	IL TRM 5.4.3	Deemed	-
1.50	1.50	1.50	1.50	BFPH_MF	IL TRM 5.4.4	Deemed	-
0.00341	0.00341	0.00341	0.00341	EPG_gas_SF	IL TRM 5.4.4	Deemed	-
0.004	0.004	0.004	0.004	EPG_gas_MF	IL TRM 5.4.4	Deemed	-
0.275	0.217	0.203	0.126	ISR Installed 1 SF	Survey - HA2	Custom	Yes (PGL, NSG)
0.293	0.266	0.284	0.163	ISR Installed 1 SF	Survey - HA2	Custom	Yes (PGL, NSG)
0.163	0.100	0.132	0.074	ISR Installed 2 SF	Survey - HA2	Custom	Yes (PGL, NSG)
0.136	0.140	0.115	0.020	ISR Installed 2 MF	Survey - HA2	Custom	Yes (PGL, NSG)
0.479	0.560	0.770	0.732	%SF	Survey - HCU1	Custom	Yes (PGL, NSG)
0.521	0.440	0.230	0.268	%MF	Survey - HCU1	Custom	Yes (PGL, NSG)

Source: PGL and NSG tracking data and Navigant team analysis.

Equation 3. Ex Ante Water Heater Temperature Setback Savings Equation and Inputs, IL TRM v3.0 Section 5.4.6

$$\Delta Therms = 6.4 \text{ therms} * (T_{pre} - T_{post}) / 15 * \%SF_MF * \text{quantity}$$

Where:

- 6.4 Therms = Estimate of savings derived in UL and CLP Program Savings Documentation, 2010.
- T_{pre} = Actual hot water setpoint prior to adjustment
- T_{post} = 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.

Equation 4. Ex Post Water Heater Temperature Setback Savings Equation and Inputs, IL TRM v5.0 Section 5.4.6

$$\Delta Therms = (U * A * (T_{pre} - T_{post}) * \text{Hours}) / (100,000 * RE_gas) * ISR * \%FossilDHW * \%SF_MF * \text{quantity}$$

Where:

- U = Overall heat transfer coefficient of tank (Btu/Hr-°F-ft²)
- A = Surface area of storage tank (square feet)
- T_{pre} = Actual hot water setpoint prior to adjustment

- Tpost* = Actual new hot water setpoint, which may not be lower than 120 degrees
- RE_gas* = Recovery efficiency of gas water heater
- ISR* = In service rate of showerhead
- % FossilDHW* = proportion of water heating supplied by Natural Gas heating
- Quantity* = total number of kits distributed in GPY6/EPY9
- %SF_MF* = percentage of SF or MF homes in the student survey responses
- 100,000* = Converts Btus to Therms (btu/Therm)

Table 6-4. Ex Ante Water Heater Temperature Setback - Custom and Deemed Values Comparison

Value, Implementer, PGL	Value, Implementer, NSG	Variable	Source	Deemed/Custom
6.4	6.4	UL/CLP Savings	IL TRM 5.4.6	Deemed
8.2	1.0	(Tpre-Tpost)	Survey - HA8/HA9	Custom
15	15	UL/CLP Savings	IL TRM 5.4.6	Deemed
0.25	0.11	ISR	Survey - HA7	Custom
0.61	0.54	%GasDHW	Survey - HCU6	Custom

Source: PGL and NSG tracking data and Navigant team analysis.

Table 6-5. Ex Post Water Heater Temperature Setback - Custom and Deemed Values Comparison

Value, Navigant PGL	Value, Navigant NSG	Variable	Source	Deemed/Custom
0.08	0.08	U (Overall heat transfer coefficient of tank)	IL TRM 5.4.6	Actual if known
24.99	24.99	A (Square feet) Surface area of storage tank	IL TRM 5.4.6	Actual if known
5.54	6.01	(Tpre-Tpost)_SF	Survey - HA13and14	Custom
4.85	3.93	(Tpre-Tpost)_MF	Survey - HA13and15	Custom
8766.00	8766.00	Hours	IL TRM 5.4.6	Deemed
0.78	0.78	RE_gas_SF	IL TRM 5.4.6	Deemed
0.67	0.67	RE_gas_MF	IL TRM 5.4.6	Deemed
0.29	0.18	ISR_SF	Survey - HA12	Custom
0.27	0.33	ISR_MF	Survey - HA12	Custom
0.48	0.77	%SF	Survey - HCU1	Custom
0.52	0.23	%MF	Survey - HCU1	Custom
0.84	0.84	%FossilDHW	Survey - HCU6	Custom

Source: PGL and NSG tracking data and Navigant team analysis.

Equation 5. Shower Timer Equation and Inputs, IL TRM v6.0 Section 5.4.9

$$\Delta Therms = \%FossilDHW * GPM * (L_base - L_timer) * Household * Days/yr * SPCD * UsageFactor * EPG_Gas * \%SF_MF * quantity$$

Where:

- % FossilDHW* = Proportion of water heating supplied by Natural Gas heating
- GPM* = Flow rate of showerhead as used
- L_base* = Number of minutes in shower without a shower timer
- L_timer* = Number of minutes in shower after shower timer
- Household* = Number in household using timer
- Days/yr* = 365.25

- SPCD = Showers Per Capita Per Day
- UsageFactor = How often each participant is using shower timer
- EPG_Gas = Energy per gallon of Hot water supplied by gas
- %SF_MF = percentage of SF or MF homes in the student survey responses
- quantity = total number of kits distributed in GPY6/EPY9

The L_timer value is calculated using the responses from the following questions:

- HA9. After the Shower Timer is up, how much longer do you shower?
- HA10. Do you start the shower timer when you turn on the water or when you get into the shower?

To demonstrate the calculation approach, Navigant received the following responses for PGL participants from the two L_timer questions above:

Table 6-6. Shower Timer Question HA9 PGL Student Survey Responses

HA9 Responses	% of responses SF	% of responses MF
Showers is turned off right away	27.48%	26.90%
One minute longer	20.95%	21.12%
Two minutes longer	19.43%	16.66%
Three minutes longer	32.14%	35.32%

Source: Student survey responses and Navigant analysis.

Table 6-7. Shower Timer Question HA10 PGL Student Survey Responses

HA10 Responses	Added Time Adjustment	% of responses SF	% of responses MF
When I turn on the water	0	39.47%	37.08%
When I get into the shower	1.63 ³	60.53%	62.92%

Source: Student survey responses and Navigant analysis.

Therefore, for PGL:

$$L_timer_SF = 5 \text{ minutes} + (0 \times 27.48\% + 1 \times 20.95\% + 2 \times 19.43\% + 3 \times 32.14\%) + (0 \times 39.47\% + 1.63 \times 60.53\%) = 7.55 \text{ minutes}$$

$$L_timer_MF = 5 \text{ minutes} + (0 \times 26.90\% + 1 \times 21.12\% + 2 \times 16.66\% + 3 \times 35.32\%) + (0 \times 37.08\% + 1.63 \times 62.92\%) = 7.63 \text{ minutes}$$

The calculation for NSG followed the same approach, using responses from NSG participants.

³ Sum of the following sources: Hot water waste time (0.89 minutes); "IL TRM v 5.0 section 5.4.8", and time taken for hot water to arrive at the shower (0.74 minutes); "PG&E Work Paper PGECODHW113".

Table 6-8. Shower Timer Custom and Deemed Values Comparison

Value, Navigant PGL	Value, Implementer, PGL	Value, Navigant NSG	Value, Implementer, NSG	Variable	Source	Deemed/Custom	Discrepancy?
0.84	0.47	0.84	0.47	%FossilDHW	Survey - HCU6	Custom	Yes (PGL, NSG)
1.91		2.00	2.01	GPM_SF	Survey - HA1	Custom	Yes (PGL, NSG)
1.90	2.01	1.92		GPM_MF	Survey - HA1	Custom	Yes (PGL, NSG)
7.80	7.8	7.80	7.8	L_base	IL TRM 5.4.9 (v6)	Deemed	-
1.63	NA	1.63	NA	Shower Start Time Adjustment	Navigant, See Table 6-7	Custom	Yes (PGL, NSG)
7.55		7.38	5.65	L_timer_SF	Survey - HA9, HA10	Custom	Yes (PGL, NSG)
7.63	5.65	7.42		L_timer_MF	Survey - HA9, HA10	Custom	Yes (PGL, NSG)
3.28		2.70	2.18	Household_SF	Survey - HA8	Custom	Yes (PGL, NSG)
3.28	2.18	2.96		Household_MF	Survey - HA8	Custom	Yes (PGL, NSG)
0.44		0.41	0.34	UsageFactor_SF	Survey - HA7	Custom	Yes (PGL, NSG)
0.45	0.34	0.42		UsageFactor_MF	Survey - HA7	Custom	Yes (PGL, NSG)
0.48	NA	0.77	NA	%SF	Survey - HCU3	Custom	Yes (PGL, NSG)
0.52	NA	0.23	NA	%MF	Survey - HCU4	Custom	Yes (PGL, NSG)
365.25	365.25	365.25	365.25	Days/yr	IL TRM 5.4.9 (v6)	Deemed	-
0.60	0.60	0.60	0.60	SPCD	IL TRM 5.4.9 (v6)	Deemed	-
0.01		0.01	0.01	EPG_gas_SF	IL TRM 5.4.9 (v6)	Deemed	-
0.01	0.01	0.01		EPG_gas_MF	IL TRM 5.4.9 (v6)	Deemed	-

Source: PGL and NSG tracking data and Navigant team analysis.

7. APPENDIX 2. TOTAL RESOURCE COST DETAIL

Table 7-1, the Total Resource Cost (TRC) variable table, only includes cost-effectiveness analysis inputs available at the time of finalizing the GPY6/EPY9 EEE impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to the evaluation later. Detail in this table (e.g., EULs), other than final GPY6/EPY9 savings and program data, are subject to change and are not final.

Table 7-1. Total Resource Cost Savings Summary for PGL

Measure/Project	Units	Distributed Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Showerheads	Each	22,145	10	149,036	265,122	265,122
Kitchen Aerator (1.5 GPM)	Each	22,145	9	62,227	98,215	98,215
Bathroom Aerator (1.0 GPM)	Each	44,290	9	13,287	24,978	24,978
13-watt CFL	Each	13,366	4	NA	NA	NA
9.0-watt LED	Each	53,069	10	NA	NA	NA
Water Heater Temperature Setback	Each	22,145	2	11,958	6,743	6,743
Shower Timer Install	Each	22,145	2	36,318	12,659	12,659

Source: PGL tracking data and Navigant team analysis.

Table 7-2. Total Resource Cost Savings Summary for NSG

Measure/Project	Units	Distributed Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Showerheads	Each	5,879	10	24,280	47,017	47,017
Kitchen Aerator (1.5 GPM)	Each	5,879	9	8,936	17,100	17,100
Bathroom Aerator (1.0 GPM)	Each	11,758	9	1,352	4,050	4,050
13-watt CFL	Each	3,728	4	NA	NA	NA
9.0-watt LED	Each	13,909	10	NA	NA	NA
Water Heater Temperature Setback	Each	5,879	2	118	1,363	1,363
Shower Timer Install	Each	5,879	2	18,342	5,269	5,269

Source: NSG tracking data and Navigant team analysis.