



Prescriptive 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 Peoples Gas (PGL) and North Shore Gas (NSG) PY6 Prescriptive 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. PY6 covers June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

The PGL and NSG comprehensive Business Program bundles existing programs into paths, and allows all eligible customers to access any of the five paths¹ as a one-stop-shop based on the customer's needs.² This report covers evaluation activities for measures installed and natural gas savings realized through the Standard Incentives path³, referred to as the C&I Prescriptive Program in this report. The Standard Incentives path provides standardized incentives for existing customers and new construction. Standard incentives are based on approximately 50 percent of incremental costs. These incentives focus on heating systems, water heating systems, pipe insulation, steam traps, various boiler controls, food service equipment, and other new construction energy efficient measures. Franklin Energy Services LLC., (Franklin Energy) is the implementation contractor for the PGL and NSG Business Program, with trade ally engagement and technical support for program delivery and marketing.

The PGL program had 66 participants in PY6 and completed 85 projects as shown in the following table.

Table 2-1. PY6 Volumetric Summary for PGL

Participation	Standard Incentive	Prescriptive New Construction	Total
Participants †	65	1	66
Installed Projects ‡	84	1	85
Measure Types Installed	12	3	15

Source: Peoples Gas tracking data and Navigant team analysis.

† Participants are defined as number of unique gas account numbers

‡ Installed Projects are defined as number of unique project IDs

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

¹ The comprehensive business program paths include – Direct Install, Engineering Assistance, Standard Incentives, Custom Incentives, and Gas Optimization. Only measures that received standard incentives were implemented in PY6. The PY6 program did not realize savings from the Direct Install path. The custom and gas optimization projects are evaluated and reported separately.

² Second Triennial EEP Compliance Filing.pdf

³ Delivered as the C&I Prescriptive Rebate Program and New Construction Prescriptive Program.

Table 2-2. PY6 Installed Measure Quantities for PGL

Measure ⁴	Quantity Unit	Installed Quantity
Boiler Tune Up – Process	MBH	206,796
Boiler Tune Up – Space Heating	MBH	662,390
DCV – Kitchen	HP	42.5
Direct Fired Heaters	MBH	8,800
Dock Door Seals	Each	1
Energy Star Dishwasher	Each	1
High Efficiency Boiler	MBH	17,549
Pipe Insulation	Ln Ft.	224
Programmable Thermostat	Each	11
Steam Traps – HVAC Repair / Replacement	Each	1,356
Steam Traps – Industrial Replacement	Projects	30
Energy Star Fryer	Each	4
Energy Star Convection Oven	Each	8
Showerhead	Each	64
Other (prescriptive change)	Projects	2

Source: Peoples Gas tracking data and Navigant team analysis.

The NSG program had two participants in PY6 and completed two projects as shown in the following table.

Table 2-3. PY6 Volumetric Summary for NSG

Participation	Standard Incentive
Participants †	2
Installed Projects ‡	2
Measure Types Installed	2

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

† Participants are defined as number of unique gas account numbers

‡ Installed Projects are defined as number of unique project IDs

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

Table 2-4. PY6 Installed Measure Quantities for NSG

Measure	Quantity Unit	Installed Quantity
Boiler Tune Up – Space Heating	MBH	17,105
Steam Traps – Industrial Replacement	Projects	1

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

⁴ Prescriptive New Construction measures included showerheads, Energy Star fryers and convection ovens, and two efficient boilers with 6,000 MBH capacity each (12,000 MBH total capacity).

3. PROGRAM SAVINGS SUMMARY

Table 3-1 summarizes the energy savings the PGL Prescriptive Program achieved in PY6.

Table 3-1. PY6 Annual Energy Savings Summary for PGL

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Standard Incentive	2,239,305	100%	2,242,911	0.79	1,771,900
Prescriptive New Construction	19,194	100%	19,194	0.79	15,163
Total	2,258,499	100%	2,262,105	0.79	1,787,063

Source: Peoples Gas tracking data and Navigant team analysis.

† 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>.

Table 3-2 summarizes the energy savings the NSG Prescriptive Program achieved in PY6.

Table 3-2. PY6 Annual Energy Savings Summary for NSG

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Standard Incentive	27,179	100%	27,265	0.79	21,539

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

† 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>.

4. PROGRAM SAVINGS BY MEASURE

The PGL program results included twelve Standard Incentive measure categories and Prescriptive New Construction as shown in the following table. Steam Traps and Boiler Tune Ups contributed the most savings.

Table 4-1. PY6 Annual Energy Savings by Measure for PGL

Measure Category	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Boiler Tune Up – Process	172,766	100%	173,295	0.79	136,903
Boiler Tune Up – Space Heating	234,771	101%	237,798	0.79	187,860
DCV – Kitchen	32,895	100%	32,895	0.79	25,987
Direct Fired Heaters	20,273	100%	20,328	0.79	16,059
Dock Door Seals	235	100%	235	0.79	186
Energy Star Dishwasher	545	100%	546	0.79	431
High Efficiency Boiler	4,918	100%	4,921	0.79	3,887
Pipe Insulation	2,805	100%	2,800	0.79	2,212
Programmable Thermostat	1,387	100%	1,385	0.79	1,094
Steam Traps – HVAC Repair / Replacement	420,560	100%	420,559	0.79	332,242
Steam Traps – Industrial Repair	1,297,162	100%	1,297,162	0.79	1,024,758
Prescriptive New Construction	19,194	100%	19,194	0.79	15,163
Other (prescriptive change)*	50,988	100%	50,988	0.79	40,281
Total**	2,258,499	100%	2,262,105	0.79	1,787,063

Source: Peoples Gas tracking data and Navigant team analysis.

† 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>.

* Comprised of guest room energy management systems (GREM) and steam traps with custom savings inputs.

** Total does not sum due to rounding.

The NSG program results included two measures as shown in the following table.

Table 4-2. PY6 Annual Energy Savings by Measure for NSG

Measure Category	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Boiler Tune Up – Space Heating	6,063	101%	6,148	0.79	4,857
Steam Traps – Industrial Repair	21,117	100%	21,117	0.79	16,682
Total	27,179	100%	27,265	0.79	21,539

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

† 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>.

5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

Impact Parameter Estimates

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

Table 5-1. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (Therms/unit)	Verified Gross (Therms/unit)	Realization Rate	Data Source(s)
Boiler Tune Up - Process	MBH	0.835	0.838	100%	IL TRM v5.0*, Section 4.4.3
Boiler Tune Up - Space Heating	MBH	0.354	0.359	101%	IL TRM v5.0, Section 4.4.2
DCV - Kitchen	HP	774	774	100%	IL TRM v5.0, Section 4.2.16
Direct Fired Heaters	MBH	2.304	2.310	100%	IL TRM v6.0†, Section 4.4.39
Dock Door Seals	Each	235	235	100%	MMDB‡
Energy Star Dishwasher	Each	545	546	100%	IL TRM v5.0, Section 4.2.6
Boiler HW <=300MBtu, >=88% AFUE	MBH	1.127	1.126	100%	IL TRM v5.0, Section 4.4.10
Boiler Steam >=300MBH, >=82% TE	MBH	0.582	0.584	100%	IL TRM v5.0, Section 4.4.10
Pipe Insulation - Steam - Med 2.1" to 5"	Ln Ft.	13.15	13.15	100%	IL TRM v5.0, Section 4.4.14
Pipe Insulation - Steam - Small 1" to 2"	Ln Ft.	3.19	3.19	100%	IL TRM v5.0, Section 4.4.14
Pipe Insulation - Steam Med Fitting	Ln Ft.	12.52	12.21	98%	IL TRM v5.0, Section 4.4.14
Programmable Thermostat	Each	126.08	125.91	100%	IL TRM v5.0, Section 4.4.18
Steam Traps - HVAC Repair/Rep	Each	327.61	327.61	100%	IL TRM v5.0, Section 4.4.16
Steam Traps - Industrial Rep	Projects	Varies	Verified as acceptable	100%	IL TRM v5.0, Section 4.4.16
Energy Star Fryer	Each	505	505.16	100%	IL TRM v5.0, Section 4.2.7
Energy Star Convection Oven	Each	306	306	100%	IL TRM v5.0, Section 4.2.5
Showerhead	Each	18.95	18.95	100%	IL TRM v5.0, Section 4.3.3
Other (prescriptive change)	Projects	Varies	Verified as acceptable	100%	Evaluated

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated January 30, 2018.

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

† State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>.

‡ Franklin Energy's Master Measure Database spreadsheet, PGNSG MMDB PY6-Navigant013017

Navigant found that the tracking ex ante gross therm savings for efficient boilers and boiler tune ups are slightly different than values in Franklin Energy's Master Measure Database document (MMDB)⁵ of default measure assumptions and savings. The differences are mostly due to rounding of values in the

⁵ File name: PGNSG MMDB PY6-Navigant013017, produced by Franklin Energy.

tracking system, which have not been updated since GPY5 evaluation findings. The verified savings match the MMDB values.

Recommendation 1. Ensure that the tracking system savings inputs for boilers and tune up measures are consistent with the default values in the MMDB file.

The program assumes an unknown building type for assigning heating equivalent full load hours (EFLH) of 1,539 hours for HVAC measures, but could use tracked building types to set building-specific deemed EFLH values to improve accuracy. Navigant presented this finding and recommendation in an “early impact memo”⁶ during the PY6 program year. Franklin Energy⁷ indicated that complying with that recommendation would require adding approximately 1,400 components to the tracking systems, slowing application processing and potentially introducing inadvertent tracking system errors. Instead, Franklin Energy noted that Building Type is tracked for each project in Efficiency Manager, and they have six years of data that links Building Type to therm savings for specific measures. Franklin Energy’s proposed alternative is to report percent of projects for each Building Type, for each measure, and use that to calculate a weighted average EFLH to estimate future savings. Navigant agreed that the weighted average approach is an acceptable resolution.

Recommendation 2. Implement a weighted average heating EFLH to represent the different building types based on previous participation for HVAC measures.

The ex ante gross therms savings per unit capacity for direct fired heaters was 2.304 therms/MBH, which is different than the value in the MMDB (2.310 therms/MBH). Navigant calculated verified savings using a value of 2.310 therms/MBH.

Recommendation 3. Ensure that the tracking system savings inputs for direct fired heaters are consistent with the default values in the MMDB file and verified results.

Navigant conducted engineering file reviews on two projects described as “prescriptive savings” to ensure that custom-calculated project savings were reasonable or did not exceed allowable deemed savings using TRM algorithms. One project was a guest room energy management system (GREM) that used TRM inputs and other custom assumptions. Claimed savings were not capped as described but were verified as acceptable. For the second project (involving steam traps), the tracking data did not report customer gas usage information that was the claimed basis for capping savings at 20 percent of usage, but claimed savings did not exceed TRM-derived values.

Recommendation 4: Provide calculation files and algorithm inputs in “prescriptive savings” project files to present how the ex ante savings were calculated.

The ex ante per unit savings for programmable thermostats is 126.07 therms, which is an average estimate that includes all eight building types included in the TRM for this measure, but drawn only from conditions in the “Proposed” scenario. Correct application of the TRM algorithm factors in the baseline energy use scenario:

$$\Delta \text{Therms} = \frac{[\text{Baseline Energy Use (Therms/kBtuh)} - \text{Proposed Energy Use (Therms/kBtuh)}]}{\text{Output Heating Capacity (kBtuh)}} *$$

The MMDB file notes the error and provides a revision to the calculations using an average of continuous and intermittent fan use baseline scenarios, and a proposed scenario of intermittent fan use during unoccupied times. This produced a slightly lower average savings of 125.91 therms that the program

⁶ “Early Impact Memo” produced by Charles Ampong, Emma van Beuningen, and Nick Beaman; Navigant. *PGL-NSG GPY6 C&I Prescriptive Program Interim Savings Review Memo*. Email sent August 22, 2017 by Kevin Grabner.

⁷ Adam Roche, Franklin Energy. October 10, 2017.

would apply to all building types, including others not listed among the eight select small business building types included in the TRM. Franklin Energy has indicated the following recommendations presented in the early impact memo will be considered for the 2018 program.

Recommendation 5: Where the participating building type can be matched to a small business building type in the TRM thermostat measure, we recommend the ex ante savings calculation be based on the participating building type, rather than a simple average value across all building types. Franklin Energy's proposal to use a weighted average of building types is an acceptable alternative approach.

Recommendation 6: The program should consider tracking the project-specific baseline and proposed conditions for this measure, whether there is a continuous or intermittent fan mode operation, and then apply the building-type-specific TRM algorithm accordingly. While this may not be possible for prescriptive rebate measures, for contractor installed measures collecting this information will provide better savings estimates.

Navigant identified duplicate savings calculations in the MMDB for "pipe insulation commercial steam pipe – medium fitting". This measure was reviewed in the GPY5 evaluation report and confirmed with the Franklin Energy team that the savings is 12.21 therms, not 12.52 therms per square feet of pipe insulated. Franklin Energy has indicated the following recommendation presented in the early impact memo will be considered for the 2018 program.

Recommendation 7: Update the MMDB and tracking system savings inputs for "pipe insulation commercial steam pipe – medium fitting" to the verified savings of 12.21 therms per linear feet.

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 TRM⁸ 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.

The deemed savings verification approach was supplemented by engineering file review of two prescriptive projects that were described as "prescriptive change" in the tracking data. Navigant verified the measures installed and the savings reported for these projects as reasonable but recommended adequate information on usage data should be tracked.

For industrial steam traps, the measure description in the tracking system ("Steam Traps - Industrial/Process Audit") does not provide information on the steam trap size (e.g. psig) to enable Navigant to directly verify the per unit savings based on measure description. A blend of steam trap sizes or types were implemented, and the project savings were aggregated in the tracking system. Navigant sampled a list of projects to review the application documentation, and verified the steam trap types/sizes and the claimed savings.

Navigant calculated verified net energy savings by multiplying the verified gross savings estimates by a net-to-gross ratio (NTGR). In PY6, the NTGR estimates used to calculate the net verified savings were based on past evaluation research and defined by a consensus process through SAG, as documented in a spreadsheet.⁹

⁸ Because the Illinois TRM provides multiple options for selecting input assumptions, Franklin Energy produces a "Master Measure Database" spreadsheet that documents their approach to compliance with the Illinois TRM. The spreadsheet is "PGNSG MMDB PY6 update for PS" produced by Franklin Energy.

⁹ 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>.

7. APPENDIX 2. PROGRAM-SPECIFIC INPUTS FOR THE ILLINOIS TRC

Table 7-1 and Table 7-2, the Total Resource Cost (TRC) variable tables, only include cost-effectiveness analysis inputs available at the time of finalizing the PY6 Prescriptive Program impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in the tables and will be provided to evaluation later. Detail in the TRC tables (e.g., EULs), other than final PY6 savings and program data, are subject to change and are not final.

Table 7-1. TRC Test Inputs for PGL

Measure	Units	Quantity	Effective Useful Life*	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Boiler Tune Up – Process	MBH	206,796	3	172,766	173,295	136,903
Boiler Tune Up – Space Heating	MBH	662,390	3	234,771	237,798	187,860
DCV – Kitchen	HP	42.5	15	32,895	32,895	25,987
Direct Fired Heaters	MBH	8,800	15	20,273	20,328	16,059
Dock Door Seals	Each	1	12	235	235	186
Energy Star Dishwasher	Each	1	20	545	546	431
High Efficiency Boiler*	MBH	17,549	20	18,431	18,434	14,563
Pipe Insulation	Ln Ft.	224	15	2,805	2,800	2,212
Programmable Thermostat	Each	11	4	1,387	1,385	1,094
Steam Traps – HVAC Repair / Replacement	Each	1,356	6	420,560	420,559	332,242
Steam Traps – Industrial Replacement	Projects	30	6	1,297,162	1,297,162	1,024,758
Energy Star Fryer	Each	4	15	2,020	2,020	1,596
Energy Star Convection Oven	Each	8	12	2,448	2,448	1,934
Showerhead	Each	64	10	1,213	1,213	958
Other (steam trap)**	Projects	1	6	3,388	3,388	2,677
Other (GREM)	Projects	1	15	47,600	47,600	37,604
Total			6	2,258,499	2,262,105	1,787,063

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated January 30, 2018.

* includes new construction boiler installations.

** Prescriptive change measures (steam traps or GREMs) are broken down for the TRC analysis.

Table 7-2. TRC Test Inputs for NSG

Measure	Units	Quantity	Effective Useful Life*	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Boiler Tune Up – Space Heating	MBH	17,105	3	6,063	6,148	4,857
Steam Traps – Industrial Replacement	Projects	1	6	21,117	21,117	16,682
Total			5	27,179	27,265	21,539

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated January 30, 2018.