



C&I Gas Optimization 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 impact evaluation results of the Peoples Gas (PGL) and North Shore Gas (NSG) Program Year 6 (PY6) C&I Gas Optimization Program. For each utility, the report includes summaries of the energy impacts by relevant measure, program structure, and for the total program. The appendix contains the impact analysis methodology. PY6 covers June 1, 2016 through December 31, 2017. Franklin Energy Services LLC, (Franklin Energy) is the implementation contractor for the PGL and NSG Gas Optimization Program, with trade ally engagement and technical support for program delivery and marketing.

2. PROGRAM DESCRIPTION

The C&I Gas Optimization Program provides a technical assessment service where energy advisors and contracted engineering firms review commercial or industrial facilities for operation and maintenance issues that, if corrected, often provide short payback projects. In addition to identifying low-cost and no-cost measures that can be implemented by the customer, Gas Optimization studies also identify capital improvement projects. Incentives to complete recommended improvements include reimbursement for the cost of the technical assessment, rebates, and program implementation support. Capital projects that can be identified through the Gas Optimization Program include steam pipe insulation, boiler upgrades and economizers, and HVAC setbacks.

The PGL program had seven participants in PY6 and completed 14 projects as shown in the following table.

Table 2-1. PY6 Volumetric Summary for PGL

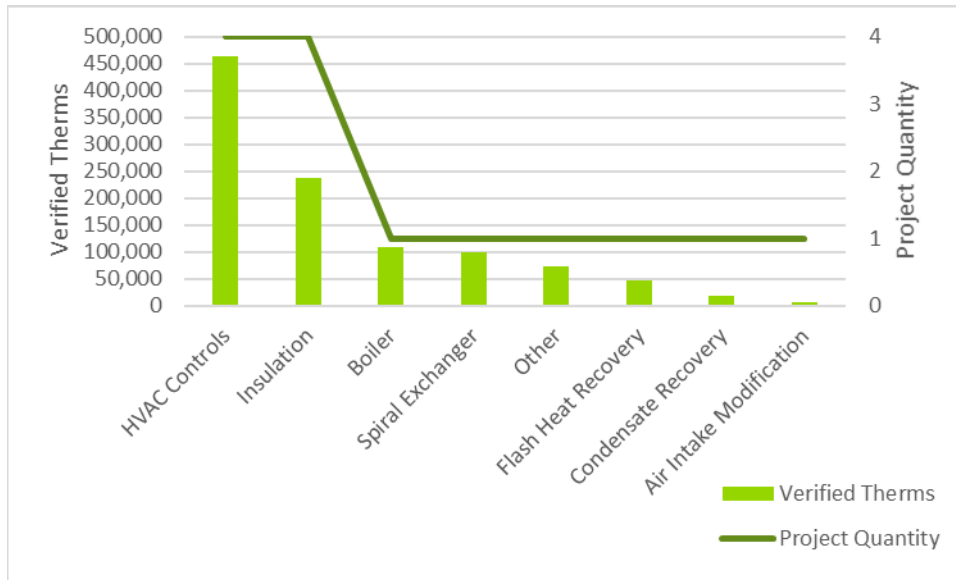
Participation	Total
Participants †	7
Installed Projects ‡	14
Sampled Projects	11

Source: Peoples Gas tracking data and Navigant team analysis.

† Participants are defined as unique accounts which participated in the C&I Gas Optimization Program
‡ Installed Projects are defined as the total number of incentivized C&I Gas Optimization Program projects that were implemented in PY6. Projects can include low- and no-cost measures, capital improvement projects, or a combination of them.

Figure 2-1 shows the verified savings by the various project types received by PGL.

Figure 2-1. Program Verified Savings by Project Type for PGL



Source: Navigant team analysis.

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

Table 2-2. PY6 Volumetric Summary for NSG

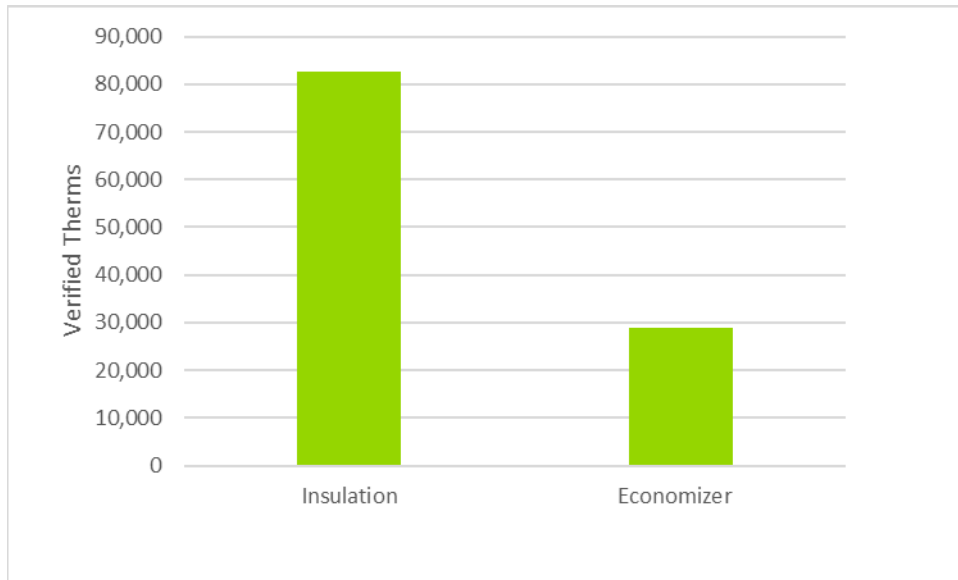
Participation	Total
Participants †	2
Installed Projects ‡	2
Sampled Projects	1

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

† Participants are defined as unique accounts which participated in the C&I Gas Optimization Program
 ‡ Installed Projects are defined as the total number of incentivized C&I Gas Optimization Program projects that were implemented in PY6

Figure 2-2 shows the verified savings by the various project types received by NSG. There were two projects in the NSG program, one of each type.

Figure 2-2. Program Verified Savings by Project Type for NSG



Source: Navigant team analysis.

3. PROGRAM SAVINGS SUMMARY

Table 3-1 summarizes the energy savings of the PGL Gas Optimization Program 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)
PGL Gas Optimization Projects	1,056,303	100%	1,052,062	1.02	1,073,103

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 of the NSG Gas Optimization 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)
NSG Gas Optimization Projects	109,603	102%	111,403	1.02	113,631

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 includes projects in all three project size strata as shown in the following table. Details on strata boundaries, project counts, and sampling approach are discussed in Appendix 1 in Section 6.

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

Project Size	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Strata 1 – Large Size	340,722	100%	340,722	1.02	347,536
Strata 2 – Medium Size	418,191	98%	409,068	1.02	417,249
Strata 3 – Small Size	297,390	102%	302,272	1.02	308,318
Total	1,056,303	100%	1,052,062	1.02	1,073,103

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>.

The NSG program consisted entirely of Strata 3 projects, which consist of the smaller-sized third of the combined project population of PGL and NSG.

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

Project Size	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Strata 1 – Large Size	0	NA	0	1.02	0
Strata 2 – Medium Size	0	NA	0	1.02	0
Strata 3 – Small Size	109,603	102%	111,403	1.02	113,631
Total	109,603	102%	111,403	1.02	113,631

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 that the unit therm savings for custom measures vary, and the overall realization rate for custom measures implemented through the C&I Gas Optimization Program was 100 percent for PGL, and 102 percent for NSG. The realization rate is the ratio of the verified gross savings to the ex ante gross savings. Appendix 1 provides a description of the impact analysis methodology we used to estimate verified gross savings. Appendix 2 describes the sampled projects and includes discussion of evaluation adjustments on projects with realization rates above or below 100 percent. Below are findings and recommendations from our verification effort.

Table 5-1. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Custom Measures	Vary	Vary	Vary	100% (PGL) 102% (NSG)	Project File Review, Monthly Billing Data, On-Site Measurement and Verification*

* Project files and monthly billing data provided by Peoples Gas and North Shore Gas. On-site data collected by Navigant.

Project 1066673 involved implementing an outdoor air setback control strategy at the facility. Navigant was unable to obtain updated air handler unit operational data during an on-site visit and subsequent follow-up with the site contact. Verification was based on file review.

Recommendation 1. Navigant recommends that the implementer provide energy management system (EMS) operational data for any applicable HVAC controls project. Generally, this information includes scheduling, flow rates, damper positions and temperatures. This information can typically be obtained during post-inspections by collecting screenshots or reports of the EMS system operation. Photographs of temperature setpoints, screenshots of the EMS system, or any other resources which would help verify HVAC controls assumptions are recommended to be included in the project files.

Project 1072832 involved improving the facility’s condensate recovery to achieve energy savings. A safety factor of 60 percent was incorporated into the savings calculation for this project. Although the project provided information on how the savings factor was calculated, the explanation was not thorough.

Recommendation 2. Navigant recommends that any savings factors, like the safety factor in Project 1072832, should have a clear explanation of how the factor was calculated. Any references necessary to validate the factor should be included in the explanation as well.

The ex ante savings calculations provided by the implementer are frequently in the form of an Excel 97-2003 file. Due to the vintage of this file type, all formatting and some data and workbook functionality is lost.

Recommendation 3. Navigant recommends saving all energy savings workbooks as the “Excel Workbook (*.xlsx)” file type. This should resolve the issue of lost formatting, data, and workbook functionality.

Project 1812156 involved the installation of steam pipe insulation at a chocolate factory. There were steam pipe temperature discrepancies between the project’s pre-inspection form values and the project

engineer's values. The project files included references and screenshots to validate the pre-inspection form values in the project. However, the project engineer's values were used in the energy savings calculation, and had no references. Navigant had a thorough discussion with Franklin Energy regarding these values, and determined that it was justified to use the project engineer's values.

Recommendation 4. Navigant recommends that the implementation contractor ensure references are provided for all calculation input values. If no documentation or reference is provided, it is difficult to verify the accuracy of the calculation input values and assumptions.

Recommendation 5. Additionally, Navigant recommends that an explanation be provided in instances where one documented assumption or value is used over another. For example, if a trade ally provides an efficiency and a customer provides an efficiency, explain why one was selected over the other. This will help clarify the reasons for considering one value of superior quality.

In two projects (917726 and 1773002), the existing boiler efficiency values did not agree with the boiler efficiency values from previous projects at the same facilities.

Recommendation 6. Navigant recommends that documentation from past projects be leveraged to support the documentation and assumptions of related projects, where appropriate.

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

The PY6 Gas Optimization Program evaluation involved sampling of the projects and retrospectively adjusting ex ante gross savings on custom measure variables. Franklin Energy provided documentation of project applications and savings, and Navigant verified project eligibility and savings based on engineering review, billing data review, and/or on-site verification of all sampled program measures. Navigant calculated PY6 verified net impact savings using the net-to-gross ratio (NTGR) deemed through Illinois Energy Efficiency Stakeholder Advisory Group consensus.¹ Navigant's PY6 process evaluation was limited to interviews with the program implementer to learn of any program changes and to collect project data to conduct the impact research.

The evaluation team conducted site-specific research to verify project savings. Projects were randomly selected through a stratified sample design at the tracking record level using the combined PGL and NSG population gross therm savings determined from program tracking data. Strata were defined by project size, based on gross energy savings boundaries that placed about one-third of program-level savings into each stratum. Table 6-1 shows a profile of the sample selection.

Table 6-1. Profile of Gross Impact Sample for Gas Optimization Projects

Program	Population Summary			Sample Summary		
	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (Therms)	Ex Ante Gross Savings N	Ex Ante Gross Savings (Therms)	Sampled % of Population (% Therms)
C&I Gas Optimization	1	2	340,722	2	340,722	100%
	2	4	418,191	4	418,191	100%
	3	10	406,993	6	182,494	45%
TOTAL		16	1,165,906	12	941,407	81%

Source: Navigant analysis

Engineering Review of Project Files

For each selected project, an in-depth application review is performed to assess the engineering methods, parameters and assumptions used to generate all ex ante impact estimates. For each measure in the sampled project, engineers estimated ex post gross savings based on their review of documentation and engineering analysis.

To support this review, the implementation contractor provided project documentation in electronic format for each sampled project. Documentation included some or all scanned files of hardcopy application forms and supporting documentation from the applicant (invoices, measure specification sheets, and vendor proposals), pre-inspection reports and photos (when required), post inspection reports and photos (when conducted), and calculation spreadsheets.

On-Site Data Collection

On-site visits and surveys were completed for a subset of three of the 12 customer applications sampled. The on-site visits included installation verification of the measure and an in-depth interview with the site contact. Following the on-site visits, the site contacts often supplied supplemental data and information to verify the measure savings.

¹ The Net-to-Gross Ratio (NTGR) used for calculating verified net savings is deemed prospectively through a consensus process managed by the Illinois Energy Efficiency Stakeholder Advisory Group (SAG). Deemed NTGRs (as well historical verified gross Realization Rates) are available at: <http://www.ilsag.info/net-to-gross-framework.html>

Due to the relatively large sample in comparison with the population, the mean realization rate was estimated with high precision.

Table 6-2. Gross Therm Realization Rates and Relative Precision at 90% Confidence Level

Program	Strata	Relative Precision +or-%	Mean RR	Standard Error
Gas Optimization	1	0.00%	100%	0.00
	2	0.00%	98%	0.00
	3	1.86%	102%	0.01
Customer Total RR (90/10)		0.48%	100%	0.00

Source: Navigant analysis

7. APPENDIX 2. IMPACT ANALYSIS SUPPLEMENTAL INFORMATION

Table 7-1 provides a summary of the sample selection and M&V approach. Table 7-2 provides a summary of M&V results for the sample.

Table 7-1. Profile of PY6 Gross Impact Sample

Project ID	Utility	Ex Ante Gross	Strata	M&V Approach	Measure
1078843	PGL	177,142	1	File Review	HVAC Controls
1066673	PGL	163,580	1	On-Site	HVAC Controls
1078862	PGL	111,865	2	File Review	HVAC Controls
1603513	PGL	110,773	2	File Review	Boiler
1072797	PGL	101,404	2	On-Site	Spiral Exchanger
1812156	PGL	94,150	2	File Review	Insulation
1159475	PGL	71,664	3	File Review	Other
1072847	PGL	45,603	3	File Review	Flash Heat Recovery
444873	NSG	28,363	3	File Review	Economizer
1072832	PGL	18,276	3	On-Site	Condensate Recovery
917726	PGL	12,378	3	File Review	HVAC Controls
1773002	PGL	6,210	3	File Review	Air Intake Modification

Source: Evaluation analysis of programs data.

Table 7-2. PY6 Summary of Sample Impact Verification Results

Project ID	Measure Description	Gross Realization Rate	Summary of Adjustment
1078843	HVAC Controls	100%	OK
1066673	HVAC Controls	100%	OK
1078862	HVAC Controls	85%	Corrected savings workbook reference errors, updated efficiency value based on past project at same facility (1078843), and updated heat loss formulae.
1603513	Boiler	100%	OK
1072797	Spiral Exchanger	107%	Updated inlet and outlet temperatures, and average flow rate based on facility staff feedback.
1812156	Insulation	100%	OK
1159475	Other	105%	Excluded auxiliary duct heater savings, updated dryer heater control enthalpy values, and updated shop fan louver savings.
1072847	Flash Heat Recovery	100%	OK
444873	Economizer	99%	Updated economizer leaving flue gas temperature, economizer water properties, and steam generation efficiency.
1072832	Condensate Recovery	100%	OK
917726	HVAC Controls	97%	Updated boiler efficiency based on past project at same facility (1078843)
1773002	Air Intake Modification	102%	Updated boiler efficiency based on past project at same facility (1426857)

Source: Evaluation analysis of programs data.

8. APPENDIX 3. PROGRAM-SPECIFIC INPUTS FOR THE ILLINOIS TRC

Table 8-1 and Table 8-2, the Total Resource Cost (TRC) variable tables, only include cost-effectiveness analysis inputs available at the time of finalizing the PY6 Gas Optimization 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 8-1. TRC Test Inputs for PGL

Research Category (e.g., Measure)	Units	Quantity	Effective Useful Life (years)	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Boiler	Project	1	20	110,773	108,356	110,523
Condensate Recovery	Project	1	21	18,276	18,576	18,947
Flash Heat Recovery	Project	1	13	45,603	46,352	47,279
HVAC Controls	Project	4	15	464,964	462,727	471,982
Insulation	Project	4	20	237,409	237,707	242,462
Other	Project	1	13	71,664	72,841	74,298
Spiral Exchanger	Project	1	18	101,404	99,191	101,175
Air Intake Modification	Project	1	21	6,210	6,312	6,438
Total		14	17	1,056,303	1,052,062	1,073,103

Source: Evaluation analysis of programs data.

Table 8-2. TRC Test Inputs for NSG

Research Category (e.g., Measure)	Units	Quantity	Effective Useful Life (years)	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Insulation	Project	1	20	81,240	82,574	84,225
Economizer	Project	1	15	28,363	28,829	29,406
Total		2	19	109,603	111,403	113,631

Source: Evaluation analysis of programs data