Commercial & Industrial (C&I) Custom Rebate & Gas Optimization Services Programs GPY3 Evaluation Report

Final

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

Presented to
Peoples Gas and North Shore Gas

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E. Executive Summary

This report presents a summary of the findings and results from the impact and process evaluation of the GPY3 Peoples Gas and North Shore Gas (PGL/NSG)[1] Commercial & Industrial Custom Rebate (C&I Custom) Program. The C&I Custom Program provides C&I customers with financial incentives for the installation of natural gas-related energy efficiency improvements that are not specified for a prescriptive rebate under the C&I Prescriptive Rebate Program. The C&I Custom Program is targeted to active customers of Peoples Gas and North Shore Gas. These customers are served under rates S.C. No. 2 and S.C. No. 3 (NSG) and S.C. No. 4 (PGL).

The C&I Custom Program provides a mechanism for a range of customers in various market sectors to install a wide variety of natural gas savings technologies. To enable as many customers as possible to participate in any one year, the program caps each customer's total maximum rebate at $500,000 per customer per program year.[2] The program may waive the maximum rebate limitation based on projects in the program's queue.

This report also includes findings and results from the impact evaluation of the C&I Gas Optimization Services Program (Gas Optimization). The Gas Optimization Program is a new offering that evolved from within the C&I Custom Program in GPY2 (with launch and technical studies), and achieved energy savings beginning in GPY3. The program has its own application forms and its own program delivery structure separate from the C&I Custom Program and the joint Retro-Commissioning Program (Retro-Cx). The program is designed to be a separate path within the GPY4 Business programs for existing facilities. In Gas Optimization, retro-commissioning contractors review a C&I facility for operation and maintenance issues and the customer implements a minimum set of measures in return for receiving the study and receives incentives for measures beyond the minimum. The program targets only gas measures with lower minimum implementation requirements to "repay" the study cost.

E.1. Program Savings and Results Summary

The PGL/NSG C&I Custom Programs achieved 96 percent research finding gross realization rate, and the Gas Optimization Program achieved 100 percent research finding gross realization rate. The verified net savings for the PGL/NSG Custom Programs is based on 0.78 net-to-gross (NTG) ratio deemed by consensus of the Illinois Statewide Advisory Group (SAG).[3] The verified net savings for

[1] The GPY3 program year began June 1, 2013 and ended May 31, 2014.
[2] Based on one of the following calculations: (i) $1.00 per therm saved in the first year; (ii) buy down to one-year payback; (iii) full incremental project cost or 50% of total project cost (*source: Integrys EEP Operating Plan*).
[3] *(http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls)*

the PGL/NSG Gas Optimization Program is based on a NTG value of 1.02, adopted from the GPY2 joint Retro-commissioning Program for this evaluation cycle.[4]

Table E-1 summarizes the natural gas savings from the GPY3 Peoples Gas C&I Custom Program and Gas Optimization Program. The C&I Custom Program achieved a verified net savings of 832,895 therms, and the Gas Optimization Program achieved a verified net savings of 152,169 therms, making a combined verified net savings of 985,064 therms. The Custom savings is 41 percent of the PGL GPY3 planned goal, but the combined net savings from Custom and Gas Optimization Programs is 48 percent of the planned goal.[5]

[4] Navigant recommended using the joint Retro-Commissioning GPY2 NTG value for the Gas Optimization Program due to similarities in the 2 programs offerings and upon guidance from the Illinois NTG Framework (www.ilsag.info/**net**-to-**gross-framework**.html). We referenced the Framework rule #3 as applicable in this case.
[5] Source: PGL NSG Final July 29 PPT for SAG_for_circulation.pdf

Table E-1. Peoples Gas GPY3 Total Program Natural Gas Savings

Program Delivery	Sample	Energy Savings (Therms)	90/10 Significance?
C&I Custom			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		728,664	
Research Findings Gross Realization Rate‡	15	96%	Yes
Research Findings Gross Savings‡		1,067,815	
Net-to-Gross Ratio (NTGR)†		0.78	
Research Findings Net Savings		832,895	
C&I Gas Optimization Services			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		152,169	
Research Findings Gross Realization Rate‡	8	100%	Yes
Research Findings Gross Savings‡		149,185	
Net-to-Gross Ratio (NTGR)†		1.02	
Research Findings Net Savings		152,169	
GPY3 Program Total			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		880,833	
Research Findings Gross Realization Rate‡	23	NA	Yes
Research Findings Gross Savings‡		1,217,000	
Net-to-Gross Ratio (NTGR)†	NA	NA	Yes
Research Findings Net Savings		985,064	

[1] Ex ante gross savings are reported at the project level, but not the program level.
‡ Based on evaluation research on a sample drawn from a population that combined Peoples Gas and North Shore Gas.
Note: Gross realization rate is rounded to two digits. Direct application may produce rounding differences.
† Deemed values. Source: Approved by the SAG (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls)
* When converting ex ante gross to ex ante net savings for tracking and reporting, Franklin Energy combines an additional adjustment factor with the deemed net-to-gross ratio. The additional factor accounts for potential gross realization rate adjustments, and is based on the GPY2 realization rate. The equation is:

GPY3 Ex Ante Net = GPY3 Ex Ante Gross * GPY2 Gross RR * GPY3 NTG.

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

Table E-2 summarizes the natural gas savings from the GPY3 North Shore Gas C&I Custom Program and Gas Optimization Program. The C&I Custom Program achieved a verified net savings of 207,673 therms, and the Gas Optimization Program achieved a verified net savings of 478,078 therms, making a combined verified net savings of 685,751 therms. The Custom savings is 34 percent of the NSG

GPY3 planned goal, but the combined net savings from Custom and Gas Optimization Programs is 113 percent of the planned goal.[6]

Table E-2. North Shore Gas GPY3 Total Program Natural Gas Savings

Program Delivery	Sample	Energy Savings (Therms)	90/10 Significance?
C&I Custom			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		176,824	
Research Findings Gross Realization Rate‡	15	96%	Yes
Research Findings Gross Savings‡		266,247	
Net-to-Gross Ratio (NTGR)†	NA	0.78	Yes
Research Findings Net Savings		207,673	
C&I Gas Optimization			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		478,079	
Research Findings Gross Realization Rate‡	8	100%	Yes
Research Findings Gross Savings‡		468,704	
Net-to-Gross Ratio (NTGR)†	NA	1.02	Yes
Research Findings Net Savings		478,078	
GPY3 Program Total			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		654,903	
Research Findings Gross Realization Rate‡	23	NA	Yes
Research Findings Gross Savings‡		734,951	
Net-to-Gross Ratio (NTGR)†	NA	NA	Yes
Research Findings Net Savings		685,751	

[1] Ex ante gross savings are reported at the project level, but not the program level.
‡ Based on evaluation research on a sample drawn from a population that combined Peoples Gas and North Shore Gas.
Note: Gross realization rate is rounded to two digits. Direct application may produce rounding differences.
† Deemed values. Source: Approved by the SAG (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls)
* When converting ex ante gross to ex ante net savings for tracking and reporting, Franklin Energy combines an additional adjustment factor with the deemed net-to-gross ratio. The additional factor accounts for potential gross realization rate adjustments, and is based on the GPY2 realization rate. The equation is:

GPY3 Ex Ante Net = GPY3 Ex Ante Gross * GPY2 Gross RR * GPY3 NTG.

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

[6] Source: PGL/NSG presentation to the IL SAG: PGL NSG Final July 29 PPT for SAG_for_circulation.pdf

E.2. Impact Estimate Parameters

In the course of estimating research finding gross savings and verified net savings, the evaluation team used a variety of parameters in its calculations. Some of these parameters were derived based on evaluation Measurement and Verification (M&V), engineering analysis or through deemed NTG values approved through consensus by the SAG. The key parameters used in the analysis are shown in Table E-3.

Table E-3. Verified Gross and Net Savings Parameter Data Sources for GPY3

Parameter	Data Source	Deemed or Evaluated?
Measure Quantity Installed	Program tracking system	Evaluated
Custom Net-to-Gross Ratio (NTGR)	Illinois SAG Process †	Deemed
Gas Optimization Net-to-Gross Ratio (NTGR)	Value from Retro-Cx Program‡	Deemed
Custom Research Finding Gross Realization Rate	Evaluation Research	Evaluated
Gas Optimization Research Finding Gross Realization Rate	Evaluation Research	Evaluated
Custom Analysis and Measures	Project File Review and On-site M&V	Evaluated
Gas Optimization Analysis and Measures	Project File Review	Evaluated

† Deemed values. Source: Approved by the SAG (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls).
‡ Source: Joint RCx Report EPY5-GPY2 2014-03-27 Final.docx

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

E.3. Participation Information

As shown in Table E-4, the Peoples Gas program implemented 36 Custom projects and 3 Gas Optimization projects.[7] The North Shore Gas program implemented 8 Custom projects and 5 Gas Optimization projects. Both PGL and NSG installed fewer Custom projects in GPY3 compared to GPY2 (completed 89 and 10 Custom projects respectively in GPY2), but the NSG program achieved more savings in GPY3, while PGL had less savings compared to GPY2 (see discussion in the findings section).

Custom measures installed in GPY3 included specialty faucet aerators and showerheads with custom savings assumptions, boiler replacements and controls, burner upgrades, pipe and tank insulation, process systems and energy management systems. The Gas Optimization measures included process and steam optimization projects, air make-up units and air handling units control optimizations, pipe and tank insulations.

[7] The PGL C&I Custom Program included project 85581 paid in GPY2 but claimed savings in GPY3 due to M&V findings which were addressed in GPY3.

Table E-4. GPY3 Peoples Gas & North Shore Gas Programs Primary Participation Detail

	Installed Measures	Implemented Projects	Participants
Peoples Gas			
C&I Custom	316*	36	33
C&I Gas Optimization	8	3	2
North Shore Gas			
C&I Custom	8*	8	8
C&I Gas Optimization	8*	5	3

*- PGL Custom measures include 128 feet of pipe insulation (counted as one measure, for simplicity) and 280 special HVAC aerators and showerheads, and other measures. NSG Custom measures included 871 feet of pipe insulation (counted as one measures). NSG Gas Optimization included 536 feet of pipe insulation (counted as one measure).

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

E.4. Conclusions and Recommendations

The following provides key program findings and recommendations

Savings Verification Process

Finding 1. Actions taken by the implementation contractor to minimize evaluation adjustments to reported savings led to improvements in verified gross realization rates from GPY2 to GPY3. The Parallel Path baseline early review process initiated in GPY2 and continued into GPY3 appears to have benefited the implementation contractor's pre-approval savings review process. Franklin Energy employs three criteria to select a project for early review a) has a rebate greater than $75,000, b) deviates from established process, or c) is a new technology to program staff. The involvement of Navigant and its third party contractor (Michaels Energy) in that process helped the implementation contractor to make the necessary adjustments to the final ex-ante project savings estimates and thus minimized evaluation adjustments to savings assumptions at the end of the GPY3 evaluation cycle. Out of the 23 sampled projects, 20 had 100 percent verified gross realization rates compared to the previous year where several adjustments were made during the evaluation process. The Parallel Path process also helped Navigant to minimize the number of sample points selected to achieve a 90/10 precision and confidence level on the research gross realization rates. One type of savings adjustment observed in this evaluation and other jurisdictions occurs when the claimed project savings is the sum from multiple like-units. Downward savings adjustment occurs when evaluation finds that some verified units have reduced or zero savings because they are redundant, they have not had a key control strategy implemented, or they did not fit a generalized operating assumption made for the group.

Recommendation 1. Unless a project is so large that the site must be sampled, evaluation will attempt to verify savings for 100 percent of installed units individually, and then sum to the total. Recognizing the cost and customer burden from two full inspections, Franklin Energy

should consider whether a joint or coordinated post-inspection procedure with evaluation could be worked out to minimize this risk.

Finding 2. The tracking system for the PGL and NSG C&I Custom Programs tracks ex ante net savings and does not directly track the ex ante gross savings. In that approach, the ex ante net savings recorded in the tracking system should be based on a combined NTG ratio and ex ante gross realization rate adjustment factor[8] equal to 63.18%, applied to the Custom project gross savings estimated by the implementation contractor engineer. Navigant found discrepancies after using the 63.18% factor to convert the ex ante net therms to gross therms for some projects when comparing results with the claimed gross savings in the project documentation. For example, Project #131657 was tracked with 126,034 net therms, but applying the combined gross-NTG factor of 63.18% to back-out gross therms produced 199,484 ex ante gross therms compared to 170,354 therms we found documented in project files as claimed gross savings. Similar cases were found for Projects #389952 and #319342. Navigant used the documented gross therms for the sampled projects when presenting the gross realization rate findings for the sample group, which reflects project-level evaluation gross savings adjustments.

Recommendation 2. To avoid such discrepancies in the future, the implementation contractor should track and make available for evaluation the project-level ex ante net and ex ante gross savings.[9]

Verified Gross Realization Rates

Finding 3. Navigant estimated a research finding gross realization rate of 96 percent (up from 81 percent in GPY2) and applied that to calculate the verified gross savings for both PGL and NSG C&I Custom Programs. The Gas Optimization Program achieved a research finding gross realization rate of 100 percent for the verified savings. The programs' gross realization rates were estimated with an overall relative precision of ±3% at 90 percent confidence level.

Net Savings

Finding 4. As mentioned above, the PGL and NSG C&I Custom Programs' ex ante net savings were based on a combined NTG ratio and realization rate adjustment factor equal to 63.18%. The evaluation team used the SAG approved 78% NTG ratio to estimate the Custom program verified net savings – identical to the NTG used by the implementation contractor. The PGL Custom verified net savings is approximately 14 percent greater than ex ante net savings, and the NSG Custom verified net savings is approximately 17 percent greater than ex ante net savings due to a verified gross realization rate that was higher than the built-in ex ante gross realization rate.

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[8] Ex ante NTG values and embedded GPY2 RR adjustments were received from Franklin Energy (file name: Integrys NTG 042914) following a telephone discussion with George Roemer (4-29-2014). GPY3 deemed NTG of 78% was multiplied by the GPY2 RR of 81% to get the 63.18% used to calculate the ex ante net savings.

[9] Program manager indicates this is standard practice for PY4.

Recommendation 4. As the Gas Optimization Program is designed to be a separate path within the GPY4 Business programs, Navigant recommends program level NTG research in GPY4 to establish actual net savings that can be attributed to the program.

1. Introduction

1.1 Program Description

The C&I Custom Program provides C&I customers with financial incentives for the installation of natural gas-related energy efficiency improvements that are not specified for a prescriptive rebate under the C&I Prescriptive Rebate Program. The C&I Custom Program is targeted to active customers of Peoples Gas and North Shore Gas (PGL/NSG). These customers are served under rates S.C. No. 2 and S.C. No. 3 (NSG) and S.C. No. 4 (PGL).

The C&I Custom Program provides a mechanism for a range of customers in various market sectors to install a wide variety of natural gas savings technologies. Typical market sectors for this program include larger customers in light and heavy manufacturing, steel and metal working, plastics compounding and processing, hospitals, food processing, hotels, commercial laundry and other process heating intensive businesses. Large centrally-heated buildings are also target sectors for this program. Eligible projects receive calculated incentives aimed at improving the financial viability of the energy efficiency improvements. Custom rebates are individually determined and analyzed using the Companies' benefit-cost model to ensure that they pass the TRC test. Any measure that is pre-qualified (assessed for cost-effectiveness prior to being installed) must produce a TRC test result of under 1.0, as the program is expected to produce an overall TRC of 1.0. To enable as many customers as possible to participate in any one year, the program caps each customer's total maximum rebate at $500,000 per customer per program year. [10] The program may waive the maximum rebate limitation based on projects in the program's queue.

The GPY3 evaluation included engineering file review and the impact analysis of the C&I Gas Optimization Services Program (Gas Optimization). The Gas Optimization Program is a new offering that evolved from within the Custom Program in GPY2 (with launch and technical studies), and achieved energy savings beginning in GPY3. The program has its own application form and its own program delivery structure separate from the Custom Program and the joint Retro-commissioning Program (Retro-Cx). It designed to be a separate path within GPY4 Business programs for existing facilities.

According to the Program Manager at Franklin Energy[11], Program Staff work with customers to explain the program and explore potential participation. If the customer qualifies and is willing to pay the $7,500 or $10,000 implementation minimum, they complete and sign the application and a Technical Team is assigned to complete the study. The Technical Team spends one- to two-days on site at the facility and then completes a report of identified measures. The report is presented to the customer at which time they choose which measures they will implement to meet their

[10] Based on one of the following calculations: (i) $1.00 per therm saved in the first year; (ii) buy down to one-year payback; (iii) full incremental project cost or 50% of total project cost (*source: Integrys EEP Operating Plan*).
[11] Email correspondence with Program Manager on December 04, 2013.

implementation minimum. The customer has 90 days to complete those measures. Franklin Energy then verifies their completion and meets again with the customer to identify which additional measures they would like to pursue. Any measures installed beyond their implementation minimum are eligible for program rebates.

1.2 Evaluation Objectives

The objectives of the GPY3 evaluation of these two programs were to:

1. Provide a reliable calculation of the gross therm savings and the verified net therm savings of the C&I Custom and Gas Optimization Programs based on analyzing a sample of projects through site-specific interviews, documentation review, and on-site measurement and verification.
2. Determine whether the assumptions and calculations are in compliance with standard engineering practice, and if there is a need to make changes.

2. Evaluation Approach

This section provides an overview of the data collection methods, gross and net impact evaluation approaches, and process evaluation approaches that occurred in GPY3.

2.1 Primary Data Collection

2.1.1 Overview of Data Collection Activities

Navigant's process and impact evaluation activities for GPY3 C&I Custom and Gas Optimization Programs are summarized in Table 2-1.

Table 2-1. Summary of Peoples Gas and North Shore Gas GPY3 Evaluation Activities

Program	Process Evaluation	NTGR Research	Tracking Data Review	Project File Reviews	On-Site M&V*	Billing Analysis	Other
C&I Custom	PM/IC Int.	None	Yes	Yes, 12	Yes, 3 completed	No	≤10 GPY3 Parallel Path Project Reviews
Gas Optimization	PM/IC Int.	None	Yes	Yes, 8	No	No	None

* The onsite M&V and project file reviews were conducted between June and October 2014.

Source: Navigant.

2.1.2 Verified Savings Parameters

Navigant conducted onsite measurement and evaluation (M&V) and engineering project file reviews on a random sample of projects to verify the programs' gross savings and gross realization rates. Net savings were deemed for the C&I Custom Program and a deemed value from the joint utility C&I Retro-Commissioning Program was used for the Gas Optimization Program. The verified gross and net savings parameter data sources are provided in Table 2-2.

Table 2-2. Verified Gross and Net Savings Parameter Data Sources

Parameter	Data Source	Deemed or Evaluated?
Measure Quantity Installed	Program tracking system	Evaluated
Custom Net-to-Gross Ratio (NTGR)	Illinois SAG Process †	Deemed
Gas Optimization Net-to-Gross Ratio (NTGR)	Value from Retro-Cx Program‡	Deemed
Custom Research Finding Gross Realization Rate	Evaluation Research	Evaluated
Gas Optimization Research Finding Gross Realization Rate	Evaluation Research	Evaluated
Custom Analysis and Measures	Project File Review and On-site M&V	Evaluated
Gas Optimization Analysis and Measures	Project File Review	Evaluated

† Deemed values. Source: Approved by the SAG (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls).
‡ Source: Joint RCx Report EPY5-GPY2 2014-03-27 Final.docx

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

2.1.3 Research Finding Gross Program Savings Analysis Approach

The gross impact analysis of the Peoples Gas and North Shore Gas C&I Custom Programs and Gas Optimization Program was based on an engineering estimate of gross therm measure savings from a sample of projects. A total of 23 projects comprising 15 Custom projects and 8 Gas Optimization projects targeting a 90/10 level of confidence and relative precision for program-level verified savings were sampled from the program tracking database population of 52 projects (44 Custom and 8 Gas Optimization). Projects were stratified at the tracking record level using the population gross therms 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. Sampling was done separately for the programs but using the same stratum boundaries. Stratum 1 consisted of large projects with project-level ex-ante savings greater than 107,000 therms, stratum 3 consisted of small projects with ex-ante gross energy savings less than 43,500 therms, and stratum 2 consisted of the medium sized projects in between. A profile of the sample selection is shown below in Table 2-3.

Navigant completed 3 onsite visits out of the 15 Custom projects sampled and conducted desk file reviews on the remaining 12 projects.[12] Navigant also conducted desk file reviews for all 8 Gas Optimization projects in the GPY3 population. Navigant collaborated with the program implementation contractor through emails and telephone conversations where clarifications were needed to verify the savings input assumptions of the sampled projects.

[12] The onsite M&V included project 85581paid in PY2 but claimed savings in PY3 due to EM&V findings which were addressed in GPY3.

The total sample of 15 projects from the Custom program accounts for 67 percent of the ex ante gross savings from Peoples Gas and North Shore Gas Custom program population, and 60 percent of the overall sampled projects' gross savings (including Gas Optimization projects). The Custom sample comprised of 12 Peoples Gas projects (82% of Custom sample gross savings) and 3 North Shore Gas projects (18% of Custom sample gross savings). The Gas Optimization projects comprised of 3 Peoples Gas projects (24% of program gross savings) and 5 North Shore Gas projects (76% of program gas savings). Navigant reviewed the sample to verify that there was an accurate representation by measure, technology and business type within the overall sample.

Table 2-3. Profile of GPY3 Gross Impact Sample by Strata

Population Summary					Sample	
Program	Sampling Strata	Number of Project (N)	Ex Ante Gross Savings (Therms)	Therms Weights	n	Ex Ante Therms
Custom	1	3	403,518	0.29	3	403,518
	2	6	472,137	0.34	4	380,648
	3	35	523,732	0.37	8	149,386
Custom Total		***44***	***1,399,387***	***1.00***	***15***	***933,553***
Gas Optimization	1	1	388,195	0.63	1	388,195
	2	2	106,241	0.17	2	106,241
	3	5	123,454	0.20	5	123,454
Optimization Total		***8***	***617,890***	***1.00***	***8***	***617,890***
TOTAL	**TOTAL**	**52**	**2,017,277**	**1.00**	**23**	**1,551,443**

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

The estimated measure-level and project level realization rates were then extrapolated to the program population for Peoples Gas and North Shore Gas, using a ratio estimation method to yield research finding evaluation-adjusted gross energy savings.

Navigant conducted a limited number of Parallel Path early reviews of projects. These are projects that the implementation contractor had identified early in the project application cycle that has a rebate greater than $75,000, deviates from established process, or is a new technology to program staff that required early review and inputs from the evaluation team to determine appropriate savings.

2.1.4 Verified Net Program Savings Analysis Approach

Verified net energy savings were calculated by multiplying the research finding gross savings estimates by a net-to-gross ratio (NTGR). Table 2-4 presents the GPY3 NTGR evaluation approach. The NTGR values used to calculate the net verified savings for GPY3 C&I Custom Program were

deemed through a consensus process by the SAG[13] and no further evaluation research was conducted for GPY3. As indicated above, a deemed NTGR value from the joint utility C&I Retro-Commissioning GPY2 Program was used for the Gas Optimization Program. This value was proposed by Navigant to PGL/NSG and ICC Staff based on the similarities in program services of the two programs and upon reference to the rules in the Illinois NTG Framework[14] approved by the SAG.

Table 2-4. Net-to-Gross Ratios for Evaluation of GPY3 Programs

PGL and NSG Program	GPY3 NTGR Source	GPY3 NTGR Research	GPY3 NTGR Used for Evaluation
C&I Custom	Deemed	None	0.78
Gas Optimization	Value from Retro-Cx	None	1.02

Source: Approved by the SAG for GPY3 evaluation (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls).

2.1.5 Process Evaluation

The GPY3 process evaluation activities for the programs were limited to interview with program implementation contractor staff to verify information about marketing and outreach strategies made in GPY3 that impacted customer and trade ally participation and satisfaction.

[13] Approved by the SAG for GPY3 Evaluation (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls).
[14] www.ilsag.info/**net**-to-**gross-framework**.html

3. Gross Impact Evaluation

The gross impact analysis involved tracking system review and verification of measure savings based on findings from the engineering desk reviews and onsite M&V of the sample of 23 projects. Navigant calculated the sample gross realization rate and applied it to the population using a ratio estimation technique, as explained in Appendix 7.1.1.

3.1 Tracking System Review

Over the course of the GPY3 program year, Navigant and the program implementation contractor maintained close contact regarding the program tracking system (Bensight Data Management platform) updates and follow-up from previous program evaluation recommendations. Franklin Energy provided updated links from the previous year to enable Navigant to download the program's tracking database for the GPY3 impact evaluation. Navigant used the data updates from June through October to complete the M&V onsite and file review tasks.

Navigant observed from the tracking system that when converting ex ante gross to ex ante net savings for tracking and reporting, Franklin Energy combines an additional adjustment factor with the deemed net-to-gross ratio. The additional factor accounts for potential gross realization rate adjustments, and is based on the GPY2 realization rate from the Custom Program and a planning value for the Gas Optimization Program.[15]

Navigant found that in some cases a conversion of the Custom project's ex ante net therms to the gross therms did not produce the project documented claimed gross savings. For example, Project# 131657 was tracked with 126,034 net therms, but applying the adjusted NTG of 63.18% produced 199,484 gross therms compared to 170,354 therms documented as the claimed gross savings. We found similar cases for Projects #389952 and #319342. Navigant used the documented project level gross therms for all sampled projects in the gross realization rates analysis.

To avoid similar issues in the future, Navigant recommends that the program should track the gross therms savings alongside the net therms savings.

3.2 Program Volumetric Findings

The key GPY3 volumetric findings are summarized in Table 3-1. The C&I Custom Program participation decreased in GPY3 for both Peoples Gas and North Shore Gas. Peoples Gas completed 36 projects (down from 89 projects in GPY2), and North Shore Gas completed 8 projects (down from 10 projects in GPY2). Peoples Gas completed 3 projects and North Shore Gas completed 8 Gas Optimization projects with realized savings through the GPY3 program.

[15] GPY3 Ex Ante Net = GPY3 Ex Ante Gross * GPY2 Gross RR * GPY3 NTG.

Table 3-1. GPY3 Peoples Gas & North Shore Gas Programs Primary Participation Detail

	Installed Measures	Implemented Projects	Participants
Peoples Gas			
C&I Custom	316*	36	33
C&I Gas Optimization	8	3	2
North Shore Gas			
C&I Custom	8*	8	8
C&I Gas Optimization	8*	5	5**

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

*- PGL Custom measures include 128 feet of pipe insulation (counted as one measure, for simplicity). NSG Custom measures included 871 feet of pipe insulation (counted as one measure). NSG Gas Optimization included 536 feet of pipe insulation (counted as one measure).
**- Includes 2 projects which completed process optimization but did not report therm savings.

Table 3-2 and Table 3-3 provide the measure level quantities and the ex ante gross savings in GPY3. Custom measures installed in GPY3 included boiler replacements, burner upgrades, controls, steam pipe insulation and tank insulation, energy management systems (GREM), and specialty faucet aerators and showerheads. The Gas Optimization measures included building, process and steam optimization studies with projects ranging from air handling unit (AHU) controls optimization to pipe and tank insulation.

Table 3-2. Peoples Gas GPY3 Program Participation and Gross Savings by Measure

Measures	Measure Count (units)	Ex Ante Gross Savings (Therms)	% Gross Savings
C&I Custom			
HVAC	14	637,464	57%
Burner Retrofit/Replacement	4	147,848	13%
Dampers & Controls	3	120,462	11%
Process System	5	82,680	7%
Energy Management System	4	79,909	7%
Steam Boiler Replacement	1	8,123	1%
Pipes, Valves & Tank Insulation	1	7,098	1%
Faucet Aerators & Showerheads	281	7,004	1%
Other	3	28,925	3%
Custom Subtotal	*316*	*1,119,514*	*100%*
Gas Optimization			
Pipes, Valves & Tank Insulation	5	106,241	71%
Boiler & Controls Optimization	3	42,944	29%
Optimization Subtotal	*8*	*149,185*	*100%*
TOTALS	**323**	**1,268,699**	

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

Table 3-3. North Shore Gas GPY3 Program Participation and Gross Savings by Measure

Measures	Measure Count (units)	Ex Ante Gross Savings (Therms)	% Gross Savings
C&I Custom			
HVAC	2	128,430	46%
Pipes, Valves & Tank Insulation	3	99,657	36%
Process System	1	41,644	15%
Industrial Water Heater	1	8,503	3%
Dampers & Controls	1	1,683	1%
Custom Subtotal	*8*	*279,918*	*100%*
Gas Optimization			
Destratification, Dock Seals & Setpoint Reduction	1	35,298	8%
Pipes, Valves & Tank Insulation	1	34,183	7%
Boiler & Controls Optimization	4	9,729	2%
Deaeration Tank Overflow Trap	1	1,300	0%
Make-up Air Unit Energy Upgrade	1	388,195	83%
Optimization Subtotal	*8*	*468,705*	*100%*
TOTALS	**16**	**748,623**	

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

3.3 *Verified Gross Program Impact Results*

From the results of the on-site M&V and engineering project file reviews, the measure-level verified savings were determined for the sampled projects as the research findings gross savings. The research finding gross realization rates for the sample were determined as the ratio of the research finding gross energy savings to ex-ante gross energy savings from project-level savings reported in the project documentation. The result of the sample-based research findings gross realization rates by strata are summarized in Table 3-4 for the Peoples Gas and North Shore Gas combined sample.

Navigant determined a research findings gross realization rate of 96 percent for the C&I Custom Program and 100 percent for the Gas Optimization Program, with an overall relative precision at ±3% at 90 percent confidence level.

Table 3-4. Gross Impact Realization Rate Results for Custom and Gas Optimization Programs

Program	Sampling Strata	Sample-Based Ex Ante Gross Savings (Therms)	Sample-Based Research Findings Gross Realization Rate[16]	Sample-Based Research Findings Gross Savings (Therms)
Custom	1	403,446	99%	397,420
	2	380,648	90%	341,816
	3	149,504	100%	149,516
Custom Total		***933,598***	**96%**	***888,752***
Gas Optimization	1	388,195	100%	388,195
	2	106,241	100%	106,241
	3	123,454	100%	123,454
Gas Optimization Total		***617,890***	**100%**	***617,890***
Overall Confidence Interval and Relative Precision (90/10) on RR			3%	

Source: Navigant analysis

With the exception of three projects, 20 out of the 23 sampled projects had a 100% realization rate. Table 3-5 shows the three projects which savings were adjusted and the resulted realization rates.

[16] These are sample weighted therms realization rate values rounded to 2 digits. Direct application to the ex ante gross savings (to get sample research findings gross savings) will produce rounding differences.

Table 3-5. Summary of Sample EM&V Projects with Adjustments

Project ID#	Utility	Program	EM&V Approach	Research Finding RR	Reason for Adjustment
131657	PGL	Custom	Onsite	95%	Correction to inputs to the radiant losses of the retrofit boilers
85581	PGL	Custom	Onsite	63%	Adjustments to the air changes per hour for each room inspected.
288890	NSG	Custom	Onsite	102%	Adjustments to the operating hours and boiler efficiencies

Source: Navigant analysis

Custom Project 131657 involved the retrofit of a fuel oil storage system and the upgrade of four steam boilers with the installation of several features to improve boiler efficiency. Navigant conducted an engineering file review and a site visit to evaluate the energy savings of this project. The verified savings were lower due to correcting inputs to the radiant losses. The implementation contractor had noted that there were three boilers running during the fall/winter and 2 running during spring/summer. However, the on-site contact noted that because the hospital has a need for 100% redundancy at all times, there are normally two boilers running during the fall/water and one operational during spring/summer. Navigant determined the verified savings to be 162,041 therms, resulting in a realization rate of 95 percent.

Custom Project 85581 installed an air demand control system in two buildings to monitor and reduce the inefficient use of hot air to heat the building. The air quality monitoring (Aircuity system) allows the minimum airflow rate in rooms to be safely decreased to four air changes per hour (ACH), down from eight air changes per hour. Navigant's evaluation included a review of the project files and onsite verification. Navigant verified the installation and operation of the Aircuity units during onsite verification, but determined that many of the rooms in the larger building were found to have no significant reduction in ACH, reducing the overall savings estimate of the project. Navigant determined the verified savings to be 67,445 therms, resulting in a realization rate of 63 percent.

Custom Project 28890 installed two Munters PowerPurge™ units on two existing desiccant wheels in two separate air handling units (AHU). Navigant verified the installation and operation of the measures during onsite verification. Navigant determined that the boiler operating characteristics were properly utilized in the ex-ante savings model; however the implementation contractor did not take into account the five day shutdown in October, so Navigant adjusted the operating hours from 8,760 to 8,640. The ex-ante boiler efficiency of 82% is within range of the measurements recorded onsite; however, there is no project documentation if this value is for one of the boilers or both, so Navigant changed the value to the weighted average spot measurement of 79.6%. Navigant determined the verified savings to be 216,183 therms, resulting in a realization rate of 102 percent.

The sample strata research findings gross realization rates were applied to the population strata to achieve the program level research findings gross savings.
Table 3-6 summarizes the savings from the GPY3 PGL C&I Custom Program and Gas Optimization Program. The C&I Custom Program achieved a verified gross savings of 1,067,815 therms, and the

Gas Optimization Program achieved a verified gross savings of 149,185 therms, making a total verified gross savings of 1,217,000 therms.

Table 3-6. Peoples Gas GPY3 Verified Gross Impact Savings Estimates

Program Delivery	Sample	Energy Savings (Therms)	90/10 Significance?
C&I Custom			
Research Findings Gross Realization Rate‡	15	96%	Yes
Research Findings Gross Savings‡		1,067,815	
C&I Gas Optimization Services			
Research Findings Gross Realization Rate‡	8	100%	Yes
Research Findings Gross Savings‡		149,185	
GPY3 Program Total			
Research Findings Gross Realization Rate‡	23	NA	Yes
Research Findings Gross Savings‡		1,217,000	

‡ Based on evaluation research on a sample drawn from a population that combined Peoples Gas and North Shore Gas.
Note: Gross realization rate is rounded to two digits. Direct application may produce rounding differences.
Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

Table 3-7 summarizes the savings from the GPY3 NSG C&I Custom Program and Gas Optimization Program. The C&I Custom Program achieved a verified gross savings of 266,247 therms, and the Gas Optimization Program achieved a verified gross savings of 468,704 therms, making a total verified gross savings of 734,951 therms.

Table 3-7. North Shore Gas GPY3 Verified Gross Impact Savings Estimates

Program Delivery	Sample	Energy Savings (Therms)	90/10 Significance?
C&I Custom			
Research Findings Gross Realization Rate‡	15	96%	Yes
Research Findings Gross Savings‡		266,247	
C&I Gas Optimization			
Research Findings Gross Realization Rate‡	8	100%	Yes
Research Findings Gross Savings‡		468,704	
GPY3 Program Total			
Research Findings Gross Realization Rate‡	23	NA	Yes
Research Findings Gross Savings‡		734,951	

‡ Based on evaluation research on a sample drawn from a population that combined Peoples Gas and North Shore Gas.

Note: Gross realization rate is rounded to two digits. Direct application may produce rounding differences.

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

4. Net Impact Evaluation

As noted in Section 2, the NTGR estimate used to calculate the net verified savings for the GPY3 C&I Custom Program was deemed through a consensus process by the Illinois SAG.[17] No further research was conducted in GPY3. Navigant used a deemed NTG value of 1.02 from the GPY2 joint utility Retro-Commissioning Program (Retro-Cx) and applied that to the Gas Optimization Program.[18] Table 4-1 below details the NTG values used to calculate the program-level net savings. Verified net energy savings were calculated by multiplying the verified gross savings estimates by a net-to-gross ratio.

Table 4-1. Peoples Gas and North Shore Gas GPY3 Programs NTG Values

Program	Franklin's Embedded GPY2 RR Adjustment Factors	GPY3 Ex Ante NTG (GPY2 RR x GPY3 NTGR)	GPY3 Ex Post NTG	Ex Post NTG Source
C&I Custom	0.81 (PGL/NSG)	0.6138 (PGL/NSG)	0.78† (PGL/NSG)	SAG
C&I Gas Optimization	1.00 (PGL/NSG)	1.02 (PGL/NSG)	1.02 (PGL/NSG)	Planning value from Retro-Cx

Source: † A deemed value. Approved by the Illinois Energy Efficiency SAG

As shown in Table 4-2 and

Table 4-3, the PGL Custom Program achieved a verified net savings of 832,895 therms, and the Gas Optimization Program achieved a verified net savings of 152,169 therms, making a total verified net savings of 985,064 therms. The NSG Custom Program achieved a verified net savings of 207,673 therms, and the Gas Optimization Program achieved a verified net savings of 478,078 therms, making a total verified net savings of 685,751 therms.

[17] *SAG (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls.*

[18] Navigant recommended using the joint Retro-Commissioning GPY2 NTG value for the Gas Optimization Program due to similarities in the 2 program offerings and upon guidance from the Illinois NTG Framework (www.ilsag.info/**net**-to-**gross-framework**.html). We referenced the Framework rule #3 as applicable in this case.

Table 4-2. Peoples Gas GPY3 Verified Net Impact Savings Estimates by Program

Program Delivery	Sample	Energy Savings (Therms)	90/10 Significance?
C&I Custom			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		728,664	
Research Findings Gross Realization Rate‡	15	96%	Yes
Research Findings Gross Savings‡		1,067,815	
Net-to-Gross Ratio (NTGR)†		0.78	
Research Findings Net Savings		832,895	
C&I Gas Optimization Services			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		152,169	
Research Findings Gross Realization Rate‡	8	100%	Yes
Research Findings Gross Savings‡		149,185	
Net-to-Gross Ratio (NTGR)†		1.02	
Research Findings Net Savings		152,169	
GPY3 Program Total			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		880,833	
Research Findings Gross Realization Rate‡	23	NA	Yes
Research Findings Gross Savings‡		1,217,000	
Net-to-Gross Ratio (NTGR)†	NA	NA	Yes
Research Findings Net Savings		985,064	

[1] Ex ante gross savings are reported at the project level, but not the program level.
‡ Based on evaluation research on a sample drawn from a population that combined Peoples Gas and North Shore Gas.
Note: Gross realization rate is rounded to two digits. Direct application may produce rounding differences.
† Deemed values. Source: Approved by the SAG (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls)
* When converting ex ante gross to ex ante net savings for tracking and reporting, Franklin Energy combines an additional adjustment factor with the deemed net-to-gross ratio. The additional factor accounts for potential gross realization rate adjustments, and is based on the GPY2 realization rate. The equation is:

GPY3 Ex Ante Net = GPY3 Ex Ante Gross * GPY2 Gross RR * GPY3 NTG.

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

Table 4-3. North Shore Gas GPY3 Verified Net Impact Savings Estimates by Program

Program Delivery	Sample	Energy Savings (Therms)	90/10 Significance?
C&I Custom			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		176,824	
Research Findings Gross Realization Rate‡	15	96%	Yes
Research Findings Gross Savings‡		266,247	
Net-to-Gross Ratio (NTGR)†	NA	0.78	Yes
Research Findings Net Savings		207,673	
C&I Gas Optimization			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		478,079	
Research Findings Gross Realization Rate‡	8	100%	Yes
Research Findings Gross Savings‡		468,704	
Net-to-Gross Ratio (NTGR)†	NA	1.02	Yes
Research Findings Net Savings		478,078	
GPY3 Program Total			
Ex Ante Gross Savings		[1]	
Ex Ante Net Savings*		654,903	
Research Findings Gross Realization Rate‡	23	NA	Yes
Research Findings Gross Savings‡		734,951	
Net-to-Gross Ratio (NTGR)†	NA	NA	Yes
Research Findings Net Savings		685,751	

[1] Ex ante gross savings are reported at the project level, but not the program level.
‡ Based on evaluation research on a sample drawn from a population that combined Peoples Gas and North Shore Gas.
Note: Gross realization rate is rounded to two digits. Direct application may produce rounding differences.
† Deemed values. Source: Approved by the SAG (http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls)
* When converting ex ante gross to ex ante net savings for tracking and reporting, Franklin Energy combines an additional adjustment factor with the deemed net-to-gross ratio. The additional factor accounts for potential gross realization rate adjustments, and is based on the GPY2 realization rate. The equation is:

GPY3 Ex Ante Net = GPY3 Ex Ante Gross * GPY2 Gross RR * GPY3 NTG.

Source: Navigant analysis of GPY3 programs tracking data (October 20, 2014 data extract)

Table 4-4 provides the year-over-year comparison of the Peoples Gas and North Shore Gas C&I Custom Program findings, including comparison of the GPY3 program's detail versus GPY2 program's detail. The GPY3 findings exclude the results from the Gas Optimization Program for accurate comparison with the previous years' Custom program findings.

Table 4-4. Peoples Gas and North Shore Gas C&I Custom Program Yearly Comparison

Program	GPY1 Verified Net Savings (therms)	GPY2 Verified Net Savings (therms)	GPY3 Verified Net Savings (therms)	GPY1-GPY3 Portfolio Total (therms)	Year-Over- Year Difference (GPY3/GPY2)
Peoples Gas C&I Custom	171,610	1,644,924	832,895	2,649,429	51% (-49%)
North Shore Gas C&I Custom	26,975	194,360	207,673	429,008	107% (+7%)

Sources: Navigant analysis of GPY3 Program tracking data (October 20, 2014 data extract)
PGL/NSG C&I Custom Program PY1 Report _Final
PGL/NSG C&I Custom Program PY2 Report _Final

5. Process Evaluation

The GPY3 process evaluation activities for the programs were limited to interviews with program and implementation contractor staff to verify information about marketing and outreach strategies made in GPY3 that impacted customer and trade ally participation and satisfaction.

Information gathered through interviews and other communications did not raise concerns by the evaluation team that merited follow-up process research in GPY3. The observations will be considered when planning GPY4 evaluation activities.

6. Conclusions and Recommendations

This section summarizes key impact findings and recommendations. This section is repeated in entirety in the Executive Summary.

Savings Verification Process

Finding 1. Actions taken by the implementation contractor to minimize evaluation adjustments to reported savings led to improvements in verified gross realization rates from GPY2 to GPY3. The Parallel Path baseline early review process initiated in GPY2 and continued into GPY3 appears to have benefited the implementation contractor's pre-approval savings review process. The involvement of Navigant and its third party contractor (Michaels Energy) in that process helped the implementation contractor to make the necessary adjustments to the final ex-ante project savings estimates and thus minimized evaluation adjustments to savings assumptions at the end of the GPY3 evaluation cycle. Out of the 23 sampled projects, 20 had 100 percent verified gross realization rates compared to the previous year where several adjustments were made during the evaluation process. The Parallel Path process also helped Navigant to minimize the number of sample points selected to achieve a 90/10 precision and confidence level on the research gross realization rates. One type of savings adjustment observed in this evaluation and other jurisdictions occurs when the claimed project savings is the sum from multiple like-units. Downward savings adjustment occurs when evaluation finds that some verified units have reduced or zero savings because they are redundant, they have not had a key control strategy implemented, or they did not fit a generalized operating assumption made for the group.

Recommendation 1. Unless a project is so large that the site must be sampled, evaluation will attempt to verify savings for 100 percent of installed units individually, and then sum to the total. Recognizing the cost and customer burden from two full inspections, Franklin Energy should consider whether a joint or coordinated post-inspection procedure with evaluation could be worked out to minimize this risk.

Finding 2. The tracking system for the PGL and NSG C&I Custom Programs tracks ex ante net savings and does not directly track the ex ante gross savings. In that approach, the ex ante net savings recorded in the tracking system should be based on a combined NTG ratio and ex ante gross realization rate adjustment factor[19] equal to 63.18%, applied to the Custom project gross savings estimated by the implementation contractor engineer. Navigant found discrepancies after using the 63.18% factor to convert the ex ante net therms to gross therms for some projects when comparing results with the claimed gross savings in the project documentation. For example, Project# 131657 was tracked with 126,034 net therms, but

[19] Ex ante NTG values and embedded GPY2 RR adjustments were received from Franklin Energy (file name: Integrys NTG 042914) following a telephone discussion with George Roemer (4-29-2014). GPY3 deemed NTG of 78% was multiplied by the GPY2 RR of 81% to get the 63.18% used to calculate the ex ante net savings.

applying the combined gross-NTG factor of 63.18% to back-out gross therms produced 199,484 ex ante gross therms compared to 170,354 therms we found documented in project files as claimed gross savings. Similar cases were found for Projects #389952 and #319342. Navigant used the documented gross therms for the sampled projects when presenting the gross realization rate findings for the sample group, which reflects project-level evaluation gross savings adjustments.

Recommendation 2. To avoid such discrepancies in the future, the implementation contractor should track and make available for evaluation the project-level ex ante net and ex ante gross savings. [20]

Verified Gross Realization Rates

Finding 3. Navigant estimated a research finding gross realization rate of 96 percent (up from 81 percent in GPY2) and applied that to calculate the verified gross savings for both PGL and NSG C&I Custom Programs. The Gas Optimization Program achieved a research finding gross realization rate of 100 percent for the verified savings. The programs' gross realization rates were estimated with an overall relative precision of ±3% at 90 percent confidence level.

Net Savings

Finding 4. As mentioned above, the PGL and NSG C&I Custom Programs' ex ante net savings were based on a combined NTG ratio and realization rate adjustment factor equal to 63.18%. The evaluation team used the SAG approved 78% NTG ratio to estimate the Custom program verified net savings – identical to the NTG used by the implementation contractor. The PGL Custom verified net savings is approximately 14 percent greater than ex ante net savings, and the NSG Custom verified net savings is approximately 17 percent greater than ex ante net savings due to a verified gross realization rate that was higher than the built-in ex ante gross realization rate.

Recommendation 4. As the Gas Optimization Program is designed to be a separate path within the GPY4 Business programs, Navigant recommends program level NTG research in GPY4 to establish actual net savings that can be attributed to the program.

[20] Program manager indicates this is standard practice for PY4.

7. Appendix

7.1 *Detailed Impact Research Findings and Approaches*

7.1.1 Gross Impact Results

Gross Impact Sampling

A sample of 23 projects (15 PGL/NSG Custom and 8 Gas Optimization projects) based on a planned target of 90/10 confidence and precision level for program-level verified gross savings was drawn from the PGL and NSG program tracking database of a population of 52 (44 Custom and eight Gas Optimization) projects to determine verified gross realization rates. Sampling was done separately for the two programs although with the same defined strata boundary. The engineering review of the algorithms used by the program to calculate energy savings and the assumptions that feed into those algorithms were assessed and the savings evaluation approach were classified into one of two categories, 1) reasonable and acceptable, or 2) needs revision based on evaluation findings. On-site measurement and verification (M&V) based on IPMVP protocols were conducted for three out of the 23 selected sites including spot measurements. A profile of the sample selection is shown below in Table 7-1. Navigant reviewed the sample to verify that there is an accurate representation by measure technology and business type within the overall sample.

Table 7-1. Profile of GPY3 Gross Impact Sample by Measure Category

Program	Utility	Ex Ante Gross	Sample Strata	Measure
Custom	NSG	125,415	1	HVAC
Custom	PG	170,354	1	HVAC
Custom	PG	107,677	1	HVAC
Custom	PG	106,308	2	HVAC
Custom	PG	96,743	2	Burner Replacement
Custom	PG	89,519	2	Dampers
Custom	PG	88,079	2	HVAC
Custom	PG	39,603	3	Process
Custom	PG	19,716	3	GREM
Custom	PG	15,810	3	Process
Custom	PG	13,922	3	HVAC
Custom	PG	10,890	3	Burner Retrofit
Custom	PG	6,236	3	Process
Custom	NSG	1,683	3	Controls
Custom	NSG	41,644	3	WMA System
Optimize	NSG	388,195	1	MAU Energy Upgrade
Optimize	PG	60,308	2	Pipe Insulation, Valves & Fittings Insulation, Condensate Tanks insulation
Optimize	PG	45,933	2	Pipe Insulation
Optimize	PG	42,944	3	Raise Boiler Conductivity, Run Boilers #1 and #2 Preferentially, Optimize Standy Boiler Operation
Optimize	NSG	35,298	3	Destratification, Dock Seals & Setpoint Reduction
Optimize	NSG	34,183	3	Steam Pipe Insulation
Optimize	NSG	9,729	3	AHU-1a-b Controls Optimization, Office HW System Scheduling, Warehouse HW System OA reset confirmation
Optimize	NSG	1,300	3	Deaeration Tank Overflow Trap

Source: Utility tracking data and project files, and Navigant analysis. Ex ante gross based on project documentation.

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, Franklin Energy provided project documentation in electronic format for each sampled project. Documentation included some or all of 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), calculation spreadsheets, and a project summary report.

On-Site Data Collection

On-site surveys were completed for a subset of three of the 23 customer applications sampled. For most projects on-site sources include interviews that are completed at the time of the on-site, visual inspection of the systems and equipment, spot measurements, and short-term monitoring (e.g., less than four weeks). An analysis plan is developed for each project selected for on-site data collection. Each plan explains the general gross impact approach used (including monitoring plans), provides an analysis of the current inputs (based on the application and other available sources at that time), and identifies sources that will be used to verify data or obtain newly identified inputs for the ex post gross impact approach.

The engineer assigned to each project first calls to set up an appointment with the customer. During the on-site audit, data identified in the analysis plan is collected, including monitoring records such as measured temperatures, data from equipment logs, equipment nameplate data, system operation sequences and operating schedules, and, of course, a careful description of site conditions that might contribute to baseline selection.

All engineers who conduct audits are trained and experienced in completing inspections for related types of projects. Each carries properly calibrated equipment required to conduct the planned activities. They check in with the site contact upon arrival at the business, and check out with that same site contact, or a designated alternate, on departure. The on-site audit consists of a combination of interviewing and taking measurements. During the interview, the engineer meets with a business representative who is knowledgeable about the facility's equipment and operation, and asks a series of questions regarding operating schedules, location of equipment, and equipment operating practices. Following this interview, the engineer makes a series of detailed observations and measurements of the business and equipment. All information is recorded and checked for completeness before leaving the site.

Research Findings for the Gross Impact Sample

In Table 7-2 below we present the research findings results for the 23 sampled projects. A total of 20 projects out of the 23 sample achieved 100 percent realization rates, while three projects received some adjustments that affected their realization rates.

Table 7-2. GPY2 Summary of Sample EM&V Results

Project ID	Measure Description	Gross Realization Rate	Summary of Adjustment
131657	HVAC Boiler Retrofit	95%	Onsite M&V. Correction to inputs to the radiant losses of the retrofit boilers
289721	HVAC	100%	OK
85581	HVAC (air demand control system)	63%	Onsite M&V Adjustments to the air changes per hour for each room inspected.
288890	HVAC	102%	Onsite M&V. Adjustments to the operating hours and boiler efficiencies
389952	Process	100%	OK
488929	WMA System	100%	OK
383970	Dampers	100%	OK
324758	Burner Replacement	100%	OK
441944	HVAC	100%	OK
385341	Process	100%	OK
466620	GREM	100%	OK
319342	Process	100%	OK
350571	Burner Retrofit	100%	OK
252071	HVAC	100%	OK
209913	Controls	100%	OK
380472	Pipe Insulation, Valves & Fittings Insulation, Condensate Tanks insulation	100%	OK
387477	Pipe Insulation	100%	OK
461431	Deaeration Tank Overflow Trap	100%	OK
394258	Make-up Air Unit Energy Upgrade	100%	OK
256921	Raise Boiler Conductivity, Run Boilers #1 and #2 Preferentially, Optimize Standy Boiler Operation	100%	OK
488314	Destratification, Dock Seals & Setpoint Reduction	100%	OK
497568	Steam Pipe Insulation	100%	OK
249447	HVAC	100%	OK

Source: Utility tracking data and Navigant analysis.

The relative precision at 90% level of confidence for the sample is provided in Table 7-3. The mean research findings gross realization rate for the Custom sample was 96 percent at a relative precision of ±4% at 90% confidence level (overall precision was ±3% at 90% confidence level).

Table 7-3. Gross Therms Realization Rates and Relative Precision at 90% Confidence Level

	Strata	Relative Precision +or-%	Low RR	Mean RR	High RR	Std Error
Custom	1	0.00%	0.99	0.99	0.99	-
	2	15.45%	0.76	0.90	1.04	0.06
	3	0.01%	1.00	1.00	1.00	0.00
Custom Total RR		**3.79%**	**0.92**	**0.96**	**1.00**	**0.02**
Optimization	1	-	-	1.00	-	-
	2	0.00%	1.00	1.00	1.00	-
	3	0.00%	1.00	1.00	1.00	-
Gas Optimization Total RR		**0.00%**	**1.00**	**1.00**	**1.00**	**-**
Overall Programs (90/10)		**2.65%**				

Source: Navigant analysis