Guidehouse

# Gas Optimization Program Impact Evaluation Report

## Energy Efficiency Plan:
## Plan Year 2019
## (1/1/2019-12/31/2019)

## Presented to
## Peoples Gas and North Shore Gas

## Final

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# Gas Optimization Program Impact Evaluation Report

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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) 2019 Gas Optimization programs. It presents a summary of the energy impacts for the total program and broken out by relevant measure and program structure details. The appendix details the impact analysis methodology. Program year 2019 covers January 1, 2019 through December 31, 2019.

# 2. Program Description

The Gas Optimization Program provides a technical assessment service where energy advisors and contracted engineering firms review commercial, industrial or public sector 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, HVAC setbacks and other energy saving measures.

The PGL program had seven participants in 2019 and completed 16 projects as shown in the following table.

**Table 2-1. 2019 Volumetric Summary for PGL**

| Participation | Total |
|---|---|
| Participants * | 7 |
| Completed Projects | 16 |

* Participants are defined as unique customer names
*Source: Peoples Gas tracking data and Guidehouse team analysis.*

The NSG program had one participant who completed two projects in 2019 as shown in the following table.

**Table 2-2. 2019 Volumetric Summary for NSG**

| Participation | Total |
|---|---|
| Participants * | 1 |
| Completed Projects | 2 |

* Participants are defined as unique customer names
*Source: North Shore Gas tracking data and Guidehouse team analysis.*

## 3. Savings Summary

Table 3-1 summarizes the energy savings the PGL Gas Optimization program achieved in 2019.

**Table 3-1. 2019 Annual Energy Savings Summary for PGL**

| Program Path | Ex Ante Gross Savings (Therms) | Verified Gross RR* | Verified Gross Savings (Therms) | NTG† | Verified Net Savings (Therms) |
|---|---|---|---|---|---|
| PGL Gas Optimization | 294,590 | 102% | 300,940 | 0.91 | 273,855 |
| **PGL Total** | **294,590** | **102%** | **300,940** | **0.91** | **273,855** |

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_Faucet_Aerator_Showerhead_Correction_2019-04-12.xlsx, which is to be found on the Illinois SAG web site: https://www.ilsag.info/ntg_2019/
*Source: Peoples Gas tracking data and Guidehouse team analysis.*

Table 3-2 summarizes the energy savings the NSG Gas Optimization program achieved in 2019.

**Table 3-2. 2019 Annual Energy Savings Summary for NSG**

| Program Path | Ex Ante Gross Savings (Therms) | Verified Gross RR* | Verified Gross Savings (Therms) | NTG† | Verified Net Savings (Therms) |
|---|---|---|---|---|---|
| NSG Gas Optimization | 24,286 | 100% | 24,286 | 0.91 | 22,100 |
| **NSG Total** | **24,286** | **100%** | **24,286** | **0.91** | **22,100** |

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_Faucet_Aerator_Showerhead_Correction_2019-04-12.xlsx, which is to be found on the Illinois SAG web site: https://www.ilsag.info/ntg_2019/
*Source: North Shore Gas tracking data and Guidehouse team analysis.*

## 4. Program Savings by Measure Category

The PGL Gas Optimization Program was sampled in three strata as shown in the following table. The strata were designed to contain roughly the same amount of savings.

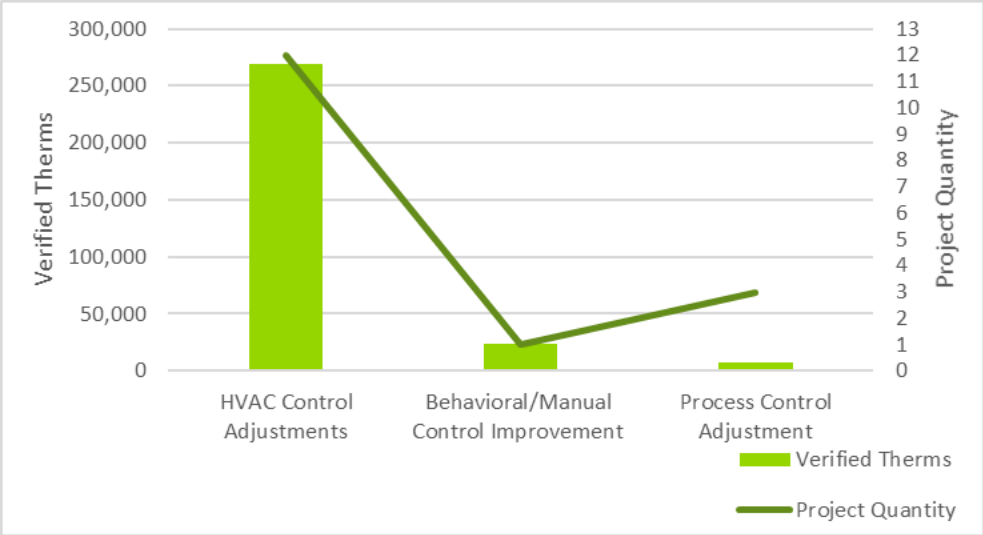
**Table 4-1. 2019 Annual Energy Savings by Strata for PGL**

| Measure Category | Ex Ante Gross Savings (Therms) | Verified Gross RR* | Verified Gross Savings (Therms) | NTG† | Verified Net Savings (Therms) |
|---|---|---|---|---|---|
| Strata 1 | 104,294 | 105% | 109,523 | 0.91 | 99,666 |
| Strata 2 | 90,794 | 103% | 93,535 | 0.91 | 85,117 |
| Strata 3 | 99,502 | 98% | 97,882 | 0.91 | 89,072 |
| **Total** | **294,590** | **102%** | **300,940** | **0.91** | **273,855** |

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_Faucet_Aerator_Showerhead_Correction_2019-04-12.xlsx, which is to be found on the Illinois SAG web site: https://www.ilsag.info/ntg_2019/
*Source: Peoples Gas tracking data and Guidehouse team analysis.*

Figure 4-1 shows the verified savings by the various measure categories by PGL.

**Figure 4-1. 2019 Annual Energy Savings by Measure Category for PGL**




The NSG Gas Optimization Program was sampled as a census as shown in the following table.

**Table 4-2. 2019 Annual Energy Savings for NSG**

| Measure Category | Ex Ante Gross Savings (Therms) | Verified Gross RR* | Verified Gross Savings (Therms) | NTG† | Verified Net Savings (Therms) |
|---|---|---|---|---|---|
| Census | 24,286 | 100% | 24,286 | 0.91 | 22,100 |
| **Total** | **24,286** | **100%** | **24,286** | **0.91** | **22,100** |

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_Faucet_Aerator_Showerhead_Correction_2019-04-12.xlsx, which is to be found on the Illinois SAG web site: https://www.ilsag.info/ntg_2019/
*Source: North Shore Gas tracking data and Guidehouse team analysis.*

# 5. Impact Analysis Findings and Recommendations

## 5.1 Impact Parameter Estimates

Table 5-1 shows that the unit therm savings for gas optimization measures vary, and the overall realization rate for the PGL C&I Gas Optimization projects is 102 percent. The overall realization rate for NSG C&I Gas Optimization projects is 100 percent. Following the table, we provide findings and recommendations, including discussion of projects with realization rates above or below 100 percent. Appendix 1 provides a description of the impact analysis methodology. Appendix 2 provides project level realization rates and a summary of adjustments to the ex ante savings.

**Table 5-1. Verified Gross Savings Parameters**

| Measure | Unit Basis | Ex Ante Gross Savings (therms/unit) | Verified Gross Savings (therms/unit) | Realization Rate | Data Source(s) |
|---|---|---|---|---|---|
| Gas Optimization | Vary | Vary | Vary | 102% (PGL)<br>100% (NSG) | Project File Review |

* Project files and monthly billing data provided by Peoples Gas and North Shore Gas.

## 5.2 Findings and Recommendations

The following section provides insight into key program findings and recommendations.

The majority of program savings in 2019 are attributed to HVAC control adjustments. To determine savings for these types of projects the implementer selected the conservative value from different savings calculators referred to as “FE” and “GBA”. The fundamental difference between the two is that the FE calculator relies on bin weather data and the GBA calculator uses hourly data. Guidehouse reviewed both savings estimates throughout program evaluation and considers both to be reasonable methods. Guidehouse defaulted to the FE calculator for all projects that presented either the FE or GBA savings methods for consistency given more projects reported savings using this approach.

Project 4050808 involved updates to schedules for two AHUs at the facility. The two units operated in normal occupied mode seven days a week for 19 hours a day. The updated schedule would reduce those hours significantly. The ex ante savings were calculated from one of the AHU savings calculators presented in the savings file. The conservative estimate was taken as the ex ante savings. The verified savings used the “FE” calculator to be consistent with savings claimed for other projects in 2019. This adjustment increased the project realization rate to 108%.

**Recommendation 1.** Guidehouse recommends the implementer use a consistent savings calculator for determining savings. The implementer currently chooses the most conservative option between two different calculators. However the same approach should be used for consistency.

Project 3880469 involved four different targeted energy efficiency upgrades including adjusting supply air cubic feet per minute (cfm), revising the AHU start-up protocol, adjusting outside air damper control, and decreasing toilet exhaust fan cfm. The ex ante savings defaulted to a heating efficiency of 80% for each of the four upgrades. The verified savings calculation updated the heating efficiency to 84% based on prior data from the project. This adjustment reduced the project realization rate to 95%.

Project 3945255 involved utilizing the heat recovery coil to save natural gas for outside air heating. An AHU savings calculator developed by the implementer was used for this project. The ex ante savings included a heat recovery efficiency of 55%. The verified savings calculation updated the heat recovery efficiency to 50% based on supporting project documentation. This adjustment reduced the project realization rate to 98%.

**Recommendation 2.** Guidehouse recommends that the implementer provide supporting documentation that accurately describes the project and assumptions in the calculation files and that the calculation inputs agree with the documentation.

**Recommendation 3.** Guidehouse recommends the implementer note any exceptions to project documentation such as work orders that deviate from assumptions made in savings calculations to ensure that an accurate final savings calculation is presented.

Project 3806478 involved updating the schedules for two air handling units (AHU) that operated 24/7. The proposed measure adjusted the schedule to shut off during unoccupied periods. The ex ante savings were generated from the implementer's calculator for AHU upgrades. The calculator considers the heat gains from occupants and incorporates setpoints and schedules from inspections. The verified savings calculation included an adjustment that removed internal heat gain during unoccupied periods. This adjustment reduced the project realization rate to 97%. This finding also affected Project 3945259 and Project 4244061. These projects also had other adjustments as noted in their respective project specific findings below.

**Recommendation 4.** Guidehouse recommends updating calculator methodology to remove internal heat gain for AHU scheduling updates that are comparing savings during unoccupied hours.

Project 3945259 involved updates to schedules for numerous AHUs at the site. An AHU savings calculator developed by the implementer was used for this project. The ex ante savings incorporated internal heat gain although savings from updated schedules are during unoccupied periods. The verified savings calculations updated the calculator to remove internal heat gain during the unoccupied periods for a more accurate comparison between the baseline and proposes cases. This adjustment increased the project realization rate to 103%.

Project 4244061 involved updates to schedules for seven AHUs at the facility. The ex ante savings used different occupancy density settings between the base and proposed cases. The verified savings used the same occupancy density as the existing case. This allowed for a more direct comparison of energy savings between the base and proposed case as the savings calculator did not provide a clear way to attribute heat gain for the different cases. This adjustment increased the realization rate to 109%.

**Recommendation 5.** Guidehouse recommends adding descriptions to any savings calculators that explain how efficiency upgrades are incorporated.

Project 4127053 involved upgrades to condensing boiler hot water setpoints and updates to outdoor air damper settings for five AHUs at the facility. The ex ante savings used bin data to calculate saving for both upgrades. The verified savings made a few adjustments to the calculations as outlined below:

- Corrected incorrect formula references for average air temperature calculations
- Updated annual gas consumption to total normalized annual value
- Updated boiler efficiency trend line to align with manufacturer's graph

The above adjustments decreased the realization rate to 99%.

**Recommendation 6.** Guidehouse recommends ensuring normalized consumption data is used in calculations to account for variable heating loads year over year.

## 5.3 Historical Realization Rates and NTG Values

Table 5-2 below shows the historical gross realization rates and NTG values for the Gas Optimization (GO) Program, which has claimed energy savings beginning in GPY4. NSG did not record any GO energy savings projects in GPY5 or 2018.

**Table 5-2. Historical Realization Rates and NTG Values**

| Program Year | PGL Verified Gross RR | NSG Verified Gross RR | PGL NTG | NSG NTG |
|---|---|---|---|---|
| GPY4 | 98% | 109% | 1.02 | 1.02 |
| GPY5 | 91% | NA | 1.02 | 1.02 |
| GPY6 | 100% | 102% | 1.02 | 1.02 |
| 2018 | 95% | NA | 1.02 | 1.02 |
| 2019 | 102% | 100% | 0.91 | 0.91 |

*Source: Guidehouse evaluation research.*

# 6. Appendix 1. Impact Analysis Methodology

The 2019 evaluation involved retrospective adjustments to ex ante gross savings on custom measure variables of all projects installed in 2019. Franklin Energy Services provided documentation of project applications and savings. Guidehouse verified project eligibility and savings based on engineering analysis and billing data review of the program's projects.

PGL Gas Optimization Projects were randomly selected through a stratified sample design using the population gross therm savings determined from program tracking data. A total of 10 out of 16 projects completed in 2019 were sampled for engineering M&V. The sample results were rolled up to the population to produce 102% PGL gross realization rate. 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 PGL Gross Impact Sample for Custom Projects**

| | Population Summary | | | Sample Summary | | |
|---|---|---|---|---|---|---|
| Program | Sampling Strata | Number of Projects (N) | Ex Ante Gross Savings (Therms) | n | Ex Ante Gross Savings (Therms) | Sampled % of Population (% Therms) |
| PGL Gas Optimization | 1 | 2 | 104,294 | 2 | 104,294 | 100% |
| | 2 | 3 | 90,794 | 3 | 90,794 | 100% |
| | 3* | 11 | 99,502 | 5 | 76,867 | 77% |
| **TOTAL** | | **16** | **294,590** | **10** | **271,955** | **92%** |

* The strata design excluded projects that contributed less than 5% to program savings. These projects were treated as Strata 3 projects in the program roll-up.
*Source: Guidehouse analysis*

Sampling was not conducted for NSG as only two projects were completed in 2019, so a census approach was used

**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, post inspection reports and photos, and calculation spreadsheets.

# 7. Appendix 2. Impact Analysis Supplemental Information

Table 7-1 provides a summary of M&V results and adjustments for the PGL Gas Optimization Program.

**Table 7-1. 2019 PGL Summary of Sample M&V Results**

| Project ID | Ex Ante Gross Savings (Therms) | Gross Realization Rate | Summary of Adjustment |
|---|---|---|---|
| 4244061 | 55,681 | 109% | Adjusted savings comparison to be based only on difference in hours between old and new schedules. |
| 3948371 | 48,613 | 100% | No adjustments |
| 4050808 | 32,868 | 108% | Used IC's calculation for consistency with other projects |
| 3945259 | 29,341 | 103% | Updated internal heat gain to zero as only unoccupied times are compared for savings |
| 3945255 | 28,585 | 98% | Updated Pre-AHU HR - Thermal Eff to 50% from 55% based on project description and payment approval application |
| 3806478 | 25,969 | 97% | Updated internal heat gain to zero as only unoccupied times are compared for savings |
| 3944130 | 24,670 | 100% | No adjustments |
| 3880469 | 10,046 | 95% | Updated heating system efficiency from 80% to 84% to reflect past project documentation that involved the steam plant (Project 1078843). |
| 4127053 | 9,374 | 99% | Corrected incorrect formula references for average air temperature calculations for 6.2. Updated annual gas consumption to total normalized annual value. Updated boiler efficiency trend line to align with manufacturers graph. |
| 3944699 | 6,809 | 100% | No adjustments |

*Source: Evaluation analysis of program data.*

Table 7-2 provides a summary of M&V results and adjustments for the NSG Gas Optimization Program.

**Table 7-2. 2019 NSG Summary of Sample M&V Results**

| Project ID | Ex Ante Gross Savings (Therms) | Gross Realization Rate | Summary of Adjustment |
|---|---|---|---|
| 4122529 | 21,231 | 100% | No adjustments |
| 4122581 | 3,055 | 100% | No adjustments |

*Source: Evaluation analysis of program data.*

# 8. Appendix 3. Program-Specific Inputs for the Illinois TRC

Table 8-1 and Table 8-2 shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of drafting this impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to the evaluation team later.

**Table 8-1. TRC Inputs for PGL**

| Project Type | Units | Quantity | Effective Useful Life (years) | Ex Ante Gross Savings (Therms) | Verified Gross Savings (Therms) | Verified Net Savings (Therms) |
|---|---|---|---|---|---|---|
| HVAC Control Adjustments | Project | 12 | 7.5 | 262,255 | 269,131 | 244,909 |
| Behavioral/Manual Control Improvement | Project | 1 | 5 | 24,670 | 24,268 | 22,084 |
| Process Control Adjustment | Project | 3 | 7.5 | 7,666 | 7,541 | 6,862 |

*Source: Peoples Gas tracking data and Guidehouse team analysis.*

**Table 8-2. TRC Inputs for NSG**

| Project Type | Units | Quantity | Effective Useful Life (years) | Ex Ante Gross Savings (Therms) | Verified Gross Savings (Therms) | Verified Net Savings (Therms) |
|---|---|---|---|---|---|---|
| HVAC Control Adjustments | Project | 1 | 7.5 | 21,231 | 21,231 | 19,320 |
| Zone Control Valves | Project | 1 | 15 | 3,055 | 3,055 | 2,780 |

*Source: North Shore Gas tracking data and Guidehouse team analysis.*