# Strategic Energy Management Impact Evaluation Report

## Energy Efficiency Plan Year 2020 (1/1/2020-12/31/2020)

**Prepared for:**

**Peoples Gas and North Shore Gas**

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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) 2020 Strategic Energy Management Program. It presents a summary of the energy impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. The program year 2020 covers January 1, 2020 through December 31, 2020.

# 2. Program Description

The goal of the SEM Program is to train staff at participating sites in how to apply a process of continuous energy management improvements that result in energy savings and demand reductions. The program trains participants to identify low-cost and no-cost measures, improve process efficiency, and reduce energy usage and demand through behavioral changes. In 2020, ComEd, Nicor Gas, Peoples Gas, and North Shore Gas continued to manage the SEM Program.

The program achieves energy savings through operational and maintenance (O&M) improvements, incremental increases in capital energy efficiency projects, and the identification of additional capital projects that would not otherwise have been considered (e.g., process changes, consideration of energy efficiency in all capital efforts). The program provides training and implementer support to identify O&M improvements. This training usually lasts for 1 year and occurs monthly or bimonthly.

SEM Program savings are calculated using site-specific models developed by the implementation contractor that have built-in statistical regression analysis. The energy model uses 2 years of utility data prior to program participation. This data is associated with site information such as production and temperature to create baseline models that estimate a site's baseline usage based on these variables. After program participation begins, the model compares actual energy consumption to modeled energy consumption. The difference between the modeled energy consumption and actual billing data, minus energy savings for capital projects claimed through other programs, is the savings claimed by the SEM Program.

PGL and NSG had 12 natural gas participants in the SEM Program with 10 that claimed savings in 2020, as shown in Table 2-1. The program has only one installed measure type, which is the whole building measure.

#### Table 2-1. 2020 Volumetric Summary for PGL and NSG

| Participation | PGL | NSG | Total |
|---|---|---|---|
| Participants * | 8 | 4 | 12 |
| Installed Projects † | 7 | 3 | 10 |

\* Participants are defined as customers who form the individual energy teams. Each participant may have several models covering saving across several location. Two participants did not claim energy saving projects in 2020.
† Installed Projects are defined as the total impact of all activities completed at the site that result in natural gas energy savings claimed by the SEM Program. This include several behavioral and low-cost measures and is custom to each site.
*Source: Peoples Gas and North Shore Gas tracking data and Guidehouse evaluation team analysis.*

# 3. Program Savings Detail

Table 3-1 summarizes the energy savings the PGL SEM Program achieved by path in 2020.

**Table 3-1. 2020 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 Strategic Energy Management | 626,230 | 88.9% | 556,497 | 1.00 | 556,497 |

\* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
*Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.*

Table 3-2 summarizes the energy savings the NSG SEM Program achieved by path in 2020.

**Table 3-2. 2020 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 Strategic Energy Management | 214,338 | 29.1% | 62,428 | 1.00 | 62,428 |

\* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
*Source: North Shore Gas tracking data and Guidehouse evaluation team analysis.*

# 4. Program Savings by Measure

The SEM Program tracked and evaluated savings at the site level, rather than at the measure level. SEM site level detail can be found in Table B-1. Appendix C shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing this impact evaluation report.

# 5. Impact Analysis Findings and Recommendations

## 5.1 Impact Parameter Estimates

As a behavioral-based model program, the SEM Program does not have standard impact parameters that are used to determine program savings. The program savings are calculated using billing regression methodologies built into the program models that are customized for each site.

## 5.2 Findings and Recommendations

The implementation contractor (IC) did not calculate incremental annual savings in the SEM models in order to remove Year 1 SEM savings from the final results. Therefore, the ex ante

savings estimates included both Year 1 and Year 2 achievements, instead of only the incremental savings achieved in Year 2.

>**Recommendation 1.** When calculating Year 2 SEM savings[1], calculate the incremental impacts of Year 2 by removing the Year 1 results.

The IC did not properly account for the full effective useful life (EUL) impact of capital projects in SEM models. The IC only accounted for the impact of capital projects 1 year after the project was installed. Although this 1-year period aligns with the incentive period, most projects have an EUL beyond 1 year and must be removed consistently across multiple SEM-year savings.

>**Recommendation 2.** Account for the entire EUL of capital projects across multiple years to properly estimate SEM savings.

The Guidehouse team noted during the review of these projects that several models had outlier variables in the post condition. An outlier variable is defined as any variable which is either 10% greater than the maximum or 10% lower than the minimum for that variable in the baseline model. Outlier variables are often not statistically significant and can inaccurately represent site usage.

>**Recommendation 3.** Once the final data is collected for any model, identify outliers, and carefully review the results of these data points. Any outlier that seems to be resulting in savings that is inconsistent with other time periods that do not include outliers should be explained through site activities that are occurring that would result in this savings difference. If these data points cannot be explained, these should be removed, and savings should be annualized based on the savings that occurred during normal operation.

Several sites calculated savings for periods that were less than a full year. This occurred when data points were removed for a variety of reasons, or less than a full year of post data was collected.

>**Recommendation 4.** SEM savings should be annualized to represent a full year. This is typically done by ratioing the number of valid data points (e.g., 42 weeks or 336 days) to a full a year. If the site has a very low number of valid data points (6 months or less) or if the site seems to have very seasonal operation, it may be inappropriate to estimate savings using this simple annualization method. In these cases, less than a year of savings can be claimed as long as it is clearly documented in the provided reports.

When reviewing the site models, Guidehouse staff noted that one project included a dependent variable to estimate site usage. Specifically, the site gas usage was being calculated as a function of gas usage of the largest process equipment at this site. Without the inclusion of an independent variable, such as outside air temperature or production, this model is unable to

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[1] This process assumes the same baseline model is used for both Year 1 and Year 2. Any re-baselining of the SEM model would require a change in the handling of incremental savings.

measure the impact of site changes that may be occurring. For this site, the Year 1 and Year 2 models showed a change in gas usage of approximately 0.1% of the total usage, which is ten to twenty times less than expected as compared to other SEM models.

> **Recommendation 5.** Independent variables need to be chosen when creating historical baseline models used in the SEM Program. These variables should relate to the usage at the site, such as increased production resulting in increased usage, but these should be *independent* of measures occurring at the site. If the chosen variables are directly related to output (i.e., gas usage to estimate gas usage), the model will not properly account for the impact of projects completed at the site.

## 5.3 Historical Realization Rates and Net-to-Gross (NTG) Values

Table 5-1 shows the historical gross realization rates and NTG values for the SEM Program.

### Table 5-1. Historical Realization Rates and NTG Values

| Program Year | PGL Verified Gross RR | NSG Verified Gross RR | PGL NTG | NSG NTG |
|---|---|---|---|---|
| 2019 | 99% | 102% | 1.00 | 1.00 |
| 2020 | 89% | 29% | 1.00 | 1.00 |

*Source: Guidehouse evaluation research.*

# Appendix A. Impact Analysis Methodology

## Verified Gross Program Savings Analysis Approach

Verified gross savings from the 2020 SEM Program were calculated using implementer provided statistical models that are grounded in site-specific data. These multi-variable regression models draw upon site data including energy usage, production, weather data and seasonality effects (including holidays or shutdowns). Using separate energy models Guidehouse staff independently evaluated the electric and gas savings.

The Guidehouse team's review of the models was driven by the following procedure:

- **A site-specific analysis approach** – since this program contains primarily behavioral-based changes, the International Performance Measurement and Verification Protocol (IPMVP) Option C (billing/metered data regression) was the main approach to impact evaluation.

- **Data collection focused on verifying and updating the assumptions that feed into the implementer's energy model for each site** – this data included: program tracking data and supporting documentation (project specifications, invoices, etc.), utility billing and interval data, Guidehouse-calibrated building automation system trend logs and telephone conversations with onsite staff.

For each site, Guidehouse staff reviewed and updated the statistical models provided by the implementer. Guidehouse staff generally followed the process below for this review:

**Step 1:** Recreated the energy models to ensure they aligned with the provided data.

**Step 2:** Confirmed the model saving calculations accounted for all capital projects. Savings from capital projects were subtracted from total measurement period savings.

**Step 3:** Identified and accounted for any short-term effects that were occurring outside the SEM influence. Telephone interviews with the site staff confirmed these changes.

**Step 4:** Made additional changes to the models as needed. Changes included excluding outlier data points or including additional variables. Outlier points that were above 110% or below 90% of baseline period variables were excluded if the residual was out of line with other residuals in the measurement period.

Guidehouse staff identified a number of changes that occurred at the site that had short-term or long-term effects on the statistical model. The changes that could affect the model savings include:

- Change in hours of operation
- Change in numbers of employees
- Change in production

- Other capital measures installed at the site that were implemented through other utility energy efficiency and demand response programs or outside of the ComEd or Nicor Gas programs.

Due to the small number of projects completed in this program, the Guidehouse team, reviewed a census of site-specific models.

# Appendix B. Site Level Impact Analysis Details

Table B-1 summarizes the site-level incremental gas savings the SEM Program achieved in 2020.

**Table B-1. 2020 Energy Savings by Site**

| Site | Utility | Ex Ante Gross Savings (therms) | Verified Gross therms Realization Rate | Verified Gross Savings (therms) |
|------|---------|-------------------------------|----------------------------------------|--------------------------------|
| Site K | NSG | 97,353 | 31.6% | 30,766 |
| Site L | NSG | 100,924 | 15.5% | 15,600 |
| Site M | NSG | 16,061 | 100.0% | 16,062 |
| Site N | PGL | 991 | 0.0% | 0 |
| Site O | PGL | 8,365 | 108.7% | 9,089 |
| Site P | PGL | 182,016 | 32.6% | 59,385 |
| Site Q | PGL | 187,040 | 97.5% | 182,398 |
| Site R | PGL | 103,615 | 179.0% | 185,449 |
| Site S | PGL | 61,470 | 87.0% | 53,472 |
| Site T | PGL | 82,733 | 80.6% | 66,704 |

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

**Site K**: The initial evaluation review found that the implementation contractor (IC) did not account for capital project savings after the 1-year incentive period. A 92% adjustment (8% savings factor) was included in this model during a production issue period, with no justification of why savings would be occurring. Guidehouse staff identified and removed outlier data points that seemed to be caused by a site shutdown and showed inconsistent savings. The site also received 90,857 therms of savings in year 1 that the IC did not remove from year 2, which represented approximately 90% of the claimed savings in year 2.

After a meeting with the client and evaluator on April 30, 2021, the implementer updated the measurement period for the baseline model in order to account for year 1 savings and year 1 capital projects, which resulted in a final savings of 30,766 therms.

**Site L**: The initial evaluation review found that the IC did not account for capital project savings after the 1-year incentive period. Large portions of data were not included in the model where the IC documented zero usage in the summer. Further detail and full data points should have been provided to justify the removal of data and ensure nothing abnormal was occurring during the summer period. The site received 74,930 therms of savings in year 1 that the IC did not remove from year 2, which represented approximately 75% of the claimed savings achieved in year 2.

After a meeting with the client and evaluator on April 30, 2021, the implementer updated the measurement period for the baseline model in order to account for year 1 savings and year 1 capital projects, which resulted in a final savings of 15,600 therms.

**Site M**: The model only included 4 months of post installation data. The site usage seemed seasonal, and Guidehouse staff was unable to annualize the savings for this site using simple ratio adjustments. Since the savings could not be annualized further, ex ante savings was accepted as reported.

**Site N**: The model used a dependent variable for kiln gas usage, making it unable to detect the impact of SEM changes, resulting in savings less than 0.1% of usage. This savings is too small to be considered statistically significant, resulting in a zero ex post estimate.

**Site O**: Guidehouse staff annualized the savings claimed in the 336-day post period to a 365-day year.

**Site P**: The initial evaluation review found that this site showed 11 weeks of very high "clean in place usage" that was more than 2 times the maximum usage in the baseline period, and 5 to 10 times higher than the savings average occurring during the rest of the year. Guidehouse staff considered this period as an outlier since the "clean in place usage" was also a variable in the model and not likely a change in site usage from SEM activities. The team annualized savings based on the remaining valid data points. Additionally, the site received 45,437 therms of savings in year 1 that the IC did not remove from year 2, which represented approximately 20% of the claimed savings achieved in year 2.

After a meeting with the client and evaluator on April 30, 2021, the implementer updated the model to include an average "clean in place usage" during the period of unusually high "clean in place usage". Guidehouse staff concluded that this averaged value did not represent actual operation during this period, and the model continued to show abnormal savings that was unrelated to SEM activities. Based on this conclusion, the evaluator continued to exclude these data points, resulting in a final savings of 59,385 therms.

**Site Q**: This site had meter issues where gas savings was invalid. During this period, the IC claimed savings, but the method to how this savings was derived was not clearly detailed in either the report or provided calculation sheet. Guidehouse staff removed this period and annualized savings based on the remaining valid data points.

**Site R**: This site had major meter issues and was unable to detect savings for approximately half a year. Site savings looked stable and regular during the periods where the meter data was available, so Guidehouse staff annualized the final savings to represent a full year.

**Site S**: The initial evaluation review found that the site received 43,508 therms of savings in year 1 that the IC did not remove from year 2, which represented approximately 70% of the claimed savings achieved in year 2. The IC correctly identified 3 weeks of site operation that could not be included in the model, but did not annualize the final savings to a full year. Guidehouse staff adjusted the ex ante savings to represent a full year.

After a meeting with the client and evaluator on April 30, 2021, the implementer updated the measurement period for the baseline model in order to account for year 1 savings and year 1 capital projects, which resulted in a final savings of 53,471 therms.

**Site T**: The initial evaluation review found that the site received 68,251 therms of savings in year 1 that the IC did not remove from year 2, which represented approximately 70% of the claimed savings achieved in year 2. In addition, this site showed a shutdown for about 2

months, during which time period the IC claimed a 40% fraction of the model results as savings. The IC did not provide justification for this 40% fraction, and the site report clearly stated that the site was not engaged in SEM during 2020 due to COVID-19 impacts on production.

After a meeting with the client and evaluator on April 30, 2021, the implementer updated the measurement period for the baseline model in order to account for year 1 savings and year 1 capital projects. The implementer did not provide justification that was sufficient for Guidehouse staff to accept and verify the 40% savings during the shutdown period. The average savings during the rest of the period was calculated to estimate final savings across the full 125 day period in the post case, resulting in a final savings of 66,704 therms.

# Appendix C. Program Specific Inputs for the Illinois TRC

Table C-1 shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing 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. Guidehouse will include annual and lifetime water savings and greenhouse gas reductions in the end of year summary report.

### Table C-1. Verified Cost Effectiveness Inputs

| Utility | Research Category | Units | Quantity | Effective Useful Life | Ex Ante Gross Savings (Therms) | Verified Gross Savings (Therms) | Verified Net Savings (Therms) |
|---|---|---|---|---|---|---|---|
| PGL | Strategic Energy Management | Sites | 7 | 5.0* | 626,230 | 556,497 | 556,497 |
| NSG | Strategic Energy Management | Sites | 3 | 5.0* | 214,338 | 62,428 | 62,428 |

\* An effective useful life (EUL) of 7 years is currently under consideration with the Illinois Technical Reference Manual Technical Advisory Committee. If 7 years is accepted, Guidehouse will update the EUL for the TRC calculation.
*Source: Peoples Gas and North Shore Gas tracking data and Guidehouse evaluation team analysis.*