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Strategic Energy Management Program Impact Evaluation Report

Energy Efficiency Plan: Program Year 2023 (1/1/2023-12/31/2023)

Prepared for:

Nicor Gas Company

FINAL

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2023 Strategic Energy Management (SEM) Program and a summary of the energy impacts for the total program, as well as relevant measure and program structure details. The appendix presents the impact analysis methodology and cost-effectiveness input summary. Program year 2023 covers January 1, 2023 through December 31, 2023.

2. Program Description

The goal of the SEM Program is to train personnel at participating commercial and industrial customer sites to apply a process of continuous energy management improvements that result in tangible energy savings. The program trains participants to identify low-cost and no-cost measures, improve process efficiency, and reduce energy usage through behavioral changes. In 2023, ComEd, Nicor Gas, Peoples Gas, and North Shore Gas continued to administer the SEM Program for their customers.

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 and 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 one year and occurs monthly or bimonthly.

SEM Program savings are calculated using site-specific energy models developed by the implementation contractors that have built-in statistical regression analysis. The energy model uses at least one year of utility data prior to program participation. This data is associated with site-specific parameters, such as production volume, hours of operation, and local climate data to create baseline models that estimate a site's typical energy usage. After program participation begins, actual (billed) energy consumption is compared to the forecasted energy consumption predicted by the model. 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.

The program had 24 gas participants across the Private and Public sectors that claimed savings in 2023, as shown in Table 2-1. The program savings are characterized as a single installed measure type, as the program holistically analyzes the consumption of the whole building.

Table 2-1. 2023 Volumetric Findings Detail

Participation	Total
Private Sector	
Participants *	14
Installed Projects †	14
Public Sector	
Participants *	10
Installed Projects †	10
Program 2023 Total	
Participants *	**24**
Installed Projects †	**24**

* Participants are defined as customers who formed the individual energy teams. Each participant may have several models covering saving across several locations.
† Installed Projects are defined as the total impact of all SEM activities completed at the site. This include several behavioral and low-cost measures and is custom to each site.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

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

Table 2-2. 2023 Measure Quantities

Program Category	Program Path	Measure	Quantity Unit	Installed Quantity
Private	Alumni - Private Sector	SEM – whole building	14	14
Public	Alumni - Public Sector	SEM – whole building	10	10

Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

3. Program Savings Detail

Table 3-1 summarizes the energy savings the SEM Program achieved by path in 2023.

Table 3-1. 2023 Annual Energy Savings Summary

Program Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
Private					
Alumni - Private Sector	855,938	101%	861,687	0.97	835,836
Private Subtotal	**855,938**	**101%**	**861,687**	**0.97**	**835,836**
Public					
Alumni - Public Sector	198,079	101%	199,409	0.97	193,427
Public Subtotal	**198,079**	**101%**	**199,409**	**0.97**	**193,427**
Total or Weighted Average	**1,054,017**	**101%**	**1,061,096**	**0.97**	**1,029,264**

Note: Totals may not sum due to rounding.
† A deemed value. Available on the SAG web site: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/.** The program did not have any disadvantaged communities designated site.[1]
Source: Guidehouse evaluation team analysis.

4. Program Savings by Measure

The SEM Program claims savings at the project-site level, so this report does not present measure-level savings. The 2023 evaluation-verified savings for the program are based on a random sample of sites and reported at the project-level (project-site analysis). 5.2Appendix A provides more information about sampled project-level savings.

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. Appendix C shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing this impact evaluation report.

[1] Illinois Energy Efficiency Policy Manual Version 3.0, Section 7.4, available at **https://www.ilsag.info/policy/**

Table 5-1 shows the unit therm savings and realization rate findings by measure from the evaluation team's review. The realization rate is the ratio of the verified savings to the ex ante savings. Following Table 5-1 are findings and recommendations, including discussion of all measures with realization rates more or less than 100%. Appendix A provides a description of the impact analysis methodology.

Table 5-1. 2023 Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
SEM-Whole Building	Site	Vary	Vary	100.7%	Project File Review, Nicor Gas Tracking Data ‡

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated January 17, 2024.
‡ Project files and monthly billing data provided by Nicor Gas. Where conducted, on-site or telephone interview data collected by Guidehouse.

5.2 Findings and Recommendations

The following finding and recommendations reflect the minor improvements to program savings reporting and project documentation observed during the 2023 evaluation. These findings had minimal impact on overall program savings but were included to allow for continual program improvement.

Finding 1. Sites A and C did not fully annualize savings. While the omitted periods were not significant in length, full annualization led to an increase in verified savings.

> **Recommendation 1.** Annualize a full year of savings for all participants. This approach is often overlooked when utilizing weekly models, as a full year is not evenly divisible by seven.

Finding 2. Site D upgrades include a measure for a boiler tune up, tabulated via a bottom-up energy savings calculation. Upon inspection, the equation relied on a 0.5% efficiency improvement over the baseline. The upgraded efficiency calculation was determined via combustion efficiency calculations, but there was no documentation on the baseline efficiency outside of this hardcoded 0.5% value.

> **Recommendation 2.** As the efficiency increase was very small, the savings were accepted in this instance. However, in the future, the implementation team should provide additional detail on savings and efficiency improvement sources. These sources can include custom calculations based on combustion efficiency or controls system outputs, relevant TRM guidance, or regression-based modeling.

Appendix A. Impact Analysis Methodology

A.1 Engineering Review of Project Files

The analysis of the Nicor Gas SEM Program relied on pulling a sample of projects that was representative of the overall population. Projects were randomly selected through a stratified sample design at the tracking record level using the population gross therm savings determined from program tracking data. Strata were defined by project size, based on gross energy savings boundaries that placed about one-third of program-level savings into each stratum. Table A-1 shows a profile of the sample selection.

Table A-1. 2023 Profile of Gross Impact Sample for SEM Sites

Population Summary				Sample Summary		
Program	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (Therms)	Sampled Quantity (N)	Ex Ante Gross Savings (Therms)	Sampled % of Strata (% Therms)
SEM – Whole Building	Small	18.0	350,836	7.0	133,586	38%
	Medium	4.0	288,116	3.0	165,009	57%
	Large	2.0	415,065	2.0	415,065	100%
Total or Weighted Average		**24.0**	**1,054,017**	**12.0**	**713,660**	**68%**

Source: Guidehouse evaluation team analysis.

A.2 Verified Gross Program Savings Analysis Approach

Verified gross savings from the 2023 SEM Program were calculated by recreating and validating 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 and shutdowns. For participants with coordinated gas and electric activities, the evaluation team independently evaluated the electricity savings for ComEd and the gas savings for Nicor Gas using separate energy models.

The evaluation 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 Whole Facility billing/metered data regression was the main approach to evaluate savings.
- **Data collection focused on verifying and updating the assumptions that feed into the implementer's energy model for each site** – data sources include program tracking data and supporting documentation (project specifications, invoices, etc.), utility billing and interval data.

For each sampled site, the evaluation team reviewed and updated the statistical models provided by the implementer. The evaluation generally followed this process for this review:

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

Step 2: Confirmed the model savings 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. Additional data requests and follow ups with the implementation team and site contacts.

Step 4: Made additional changes to the models as needed. Changes included exclusion of outlier data points, inclusion of additional variables, or annualization adjustments. Outlier points that were more than 110% or less than 90% of baseline period variables were generally excluded if the residual was out of line with other residuals in the measurement period.

Step 5: Models were re-run to determine verified gross savings values. These values were then compared to the ex ante savings to develop measure, strata, and program level realization rates. The strata-level realization rates are then applied to the program population to inform gross program savings.

The evaluation team identified potential changes to typical operation at the sites that may have short-term or long-term effects on the statistical model. The changes that could affect the model savings include:

- Facility shutdowns
- 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 Nicor Gas programs

A.2.1 Savings Rollup

There are two basic statistical methods for combining individual gross realization rates from the sample projects into an estimate of verified gross therms savings for the population when using stratified random sampling: separate and combined ratio estimation.[2] In the case of a separate ratio estimation, a separate gross therms savings RR is calculated for each stratum and then combined. In the case of a combined ratio estimation, the evaluation completes a single gross therms savings realization rate calculation, rather than calculating separate gross realization rates by stratum.

The evaluation team used the separate ratio estimation technique to estimate verified gross impacts for the program. The separate ratio estimation technique follows the steps outlined in

[2] A full discussion and comparison of separate vs. combined ratio estimation can be found in *Sampling Techniques* (Cochran, 1977), pp. 164-169.

the California Evaluation Framework,[3] which identifies best practices in program evaluation. The team matched these steps to the stratified random sampling method it used to create the sample for the component. The verified gross realization rate for the program was 100.7% at a 0.2% relative precision at a 90% confidence interval.

Table A-3. Relative Precision at 90% Confidence

Savings Category	Strata	Relative Precision (+ or - %)	Mean Realization Rate	Standard Error
SEM Whole Building	Large	0%	101.1%	--
	Medium	0%	100.3%	0.001
	Small	1%	100.0%	0.003
Total or Weighted Average		**0.2%**	**100.7%**	**0.001**

Source: Nicor Gas tracking data and Guidehouse team analysis.

[3] Tec Market Works, *The California Evaluation Framework*, prepared for the California Energy Commission, June 2004, available at **http://www.calmac.org**.

Appendix B. Impact Analysis Supplemental Information

Table B-1 summarizes the sample site-level incremental gas savings the SEM Program achieved in 2023, with differences between ex ante savings and verified savings explained in the following text.

Table B-1. 2023 Energy Savings by Sample Site

Site Identifier	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Gross Realization Rate
Site A	288,868	293,241	102%
Site B	126,197	126,197	100%
Site C	60,312	60,732	101%
Site D	53,653	53,653	100%
Site E	51,044	51,044	100%
Site F	38,462	38,462	100%
Site G	21,557	21,557	100%
Site H	19,231	19,231	100%
Site I	14,578	14,578	100%
Site J	14,422	14,422	100%
Site K	13,664	13,664	100%
Site L	11,672	11,672	100%
Total or Weighted Average	**713,660**	**718,453**	**101%**

Source: Nicor Gas tracking data and Guidehouse team analysis.

Site A: The evaluation team added one day to fully annualize the savings to 365 days, causing a slight increase in savings. Additionally, there were several outliers in the production variable, but these were kept in the model, as the weekly values were reasonable compared to overall energy consumption.

Site B: No changes were made to this model.

Site C: The evaluation team added one day to fully annualize the savings to 365 days, causing a slight increase in savings. Additionally, the implementer excluded long periods from the model due to equipment shutdown. This seems to be a conservative approach, and the implementer did not apply savings to these days via annualization, so no further adjustments were made by Guidehouse.

Site D: The method for post-measure efficiency derivation via combustion efficiency calculations is acceptable, but baseline calculations eventually dead end at a hardcoded 0.5% improvement in boiler efficiency. This approach will be allowed in this instance since it is a very

small improvement and the efficient upgrade calculations are sound, but further documentation should be provided in the future to verify efficiency improvements.

Site E: No changes were made to this model.

Site F: No changes were made to this model

Site G: No changes were made to this model.

Site H: No changes were made to this model.

Site I: The implementation team answered several follow up questions about building configuration. No changes were ultimately made to this model.

Site J: No changes were made to this model.

Site K: No changes were made to this model.

Site L: No changes were made to this model. There is a very strong adjusted R^2 value considering there is just one variable. In the future, additional variables would be useful to provide, as it was indicated that heating equipment is shut down in the summer months.

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 Table C-1 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. 2023 Verified Cost Effectiveness Inputs

Program Path	Savings Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Alumni - Private Sector	SEM- whole building	Each	14	7	855,938	861,687	835,836
Alumni - Public Sector	SEM- whole building	Each	10	7	198,079	199,409	193,427
Total					**1,054,017**	**1,061,096**	**1,029,264**

Note: Totals may not sum due to rounding.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.