Strategic Energy Management Impact Evaluation Report

Energy Efficiency Plan Year 2021
(1/1/2021-12/31/2021)

Prepared for:

Nicor Gas

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Prepared by:

Dustin Bailey
David Bluestein
Charles Ampong
Guidehouse

Submitted to:

Nicor Gas Company
1844 Ferry Road
Naperville, IL 60563

Submitted by:

Guidehouse
150 N. Riverside Plaza, Suite 2100
Chicago, IL 60606

Contact:

Ed Balbis	Stu Slote	Kevin Grabner
Partner	Director	Associate Director
561.644.9407	802.526.5113	608.616.5805
ebalbis@guidehouse.com	stu.slote@guidehouse.com	kevin.grabner@guidehouse.com

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2021 Strategic Energy Management (SEM) Program. It presents a summary of the energy impacts for the total program and is broken out by relevant measure and program structure details. Appendix A presents the impact analysis methodology. Program year 2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The goal of the SEM Program is to train personnel at participating sites to apply a process of continuous energy management improvements that result in natural gas and electric energy savings and electricity 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 2021, 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, 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 contractors that have built-in statistical regression analysis. The energy model uses two years of utility data prior to program participation. This data is associated with site information, such as production and temperatures, 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.

Nicor Gas had 31 participant sites in the SEM Program and 20 sites claimed savings in 2021[1], as shown in Table 2-1. The program savings are characterized as a single installed measure type, which is the whole building measure.

Table 2-1. 2021 Volumetric Summary for Nicor Gas

Participation	Total
Participant Sites *	31
Installed Projects †	20

* Participants are defined as customers who form 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 evaluation team analysis.

[1] The implementer provided the following explanation for 11 sites that did not claim savings: The reasons were: no viable model (8), school districts that dropped from SEM (2), and one site with a model but zero savings (1).

3. Program Savings Detail

Table 3-1 summarizes the energy savings the Nicor Gas SEM Program achieved in 2021.

Table 3-1. 2021 Annual Energy Savings Summary for Nicor Gas

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
Strategic Energy Management	1,180,570	103%	1,216,523	1.00	1,216,523

* 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_2021.
Source: 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**.**

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.

5.2 Findings and Recommendations

The implementer did not annualize savings for several sites. These sites removed data points for a variety of reasons but claimed savings only based on the valid data points.

> **Recommendation 1.** There are exceptions where a site may be seasonal or only a very small number of data points are available (less than 6 months), but in most cases, if data points are removed in the post-installation period, the implementer should adjust savings to represent a typical 12-month year. This can be done by estimating average savings during the valid data points and adjusting it to represent 12 months.

Several of the provided models converted monthly gas usage to daily gas usage based on each month's total days before creating the baseline model. This results in daily values for months of 31 days being treated equally with daily values for months with 28 or 30 days. When the results of this model are then converted back to monthly usage, this creates an error that results in the annual total not zeroing out as expected. This error is occurring since this approach introduces

an additional variable (number of days per month) that is not properly accounted for in the provided models.

Recommendation 2. To make the models simpler to review, the implementer should not convert the usage data to a different time scale. If they do convert this data, it should be clear within the provided models how this process of conversion was handled in each step.

Site M had a variable that was 142% larger than the maximum value for this variable in the baseline period. This outlier resulted in savings that was twice as large as the savings in the periods before and after and ten times the average savings during the post period. Guidehouse concluded that this was a result of this outlier and not related to activities occurring at the site and removed it from the post period model results.

Recommendation 3. All post model variables should be checked to identify if they fall outside 90% of the minimum or 110% of the maximum baseline conditions. If variables are found to be outliers, the results occurring during those periods should be checked to verify that they are statistically valid.

Appendix A. Impact Analysis Methodology

Verified Gross Program Savings Analysis Approach

Verified gross savings from the 2021 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). For participants with coordinated gas and electric activities, Guidehouse independently evaluated the electric savings for ComEd and the natural gas savings for Nicor Gas using separate energy models.

Guidehouse'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 reviewed and updated the statistical models provided by the implementer. Guidehouse staff followed the following process for this review:

Step 1: Recreated the energy models (the ex post model) 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. As needed, telephone or email communications can be completed with the customer energy champions to explain these changes.

Step 4: Made additional changes to the models, as needed. Changes included excluding outlier data points or including additional variables. Data points that were above 110% or below 90% of baseline period maximum and minimum variables respectively can be excluded if the residual was out of line with other residuals in the measurement period. If data points are excluded, the final savings is estimated by annualizing the remaining valid measurement period results.

Guidehouse 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

Guidehouse reviewed site-specific models from a sample of 14 sites drawn from a population of 20 projects for the 2021 evaluation. The sample included 90% of ex ante program energy savings. Table A-1 shows a profile of the sample selection.

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

	Population Summary			Sample Summary		
Program Sector	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (Therms)	n	Ex Ante Gross Savings (Therms)	Sampled % of Population (% Therms)
	Small	12	405,419	7	285,660	70%
	Medium	5	372,815	5	372,815	100%
	Large	3	402,336	3	402,336	100%
Total SEM		**20**	**1,180,570**	**15**	**1,060,811**	**90%**

Source: Guidehouse evaluation team analysis.

Appendix B. Site Level Impact Analysis Details

Table B-1 summarizes the site-level incremental gas savings the SEM Program achieved in 2021, and differences between ex ante savings and verified savings are explained below. The evaluation team sampled 14 out of the 20 sites that realized savings in 2021.

Table B-1. 2021 Energy Savings by Site

Site Identifier	Nicor Gas Project ID	Ex Ante Gross Savings (therms)	Verified Gross Therm Realization Rate	Verified Gross Savings (therms)
Site A	SEM-Alumni-4	155,167	100%	155,197
Site B	SEM-Alumni-6	22,496	100%	22,495
Site C	SEM-Alumni-7	63,748	100%	63,747
Site D	SEM-Alumni-9	89,224	100%	89,244
Site E	SEM-Alumni-11	30,182	100%	30,186
Site F	SEM-Alumni-13	35,997	147%	52,818
Site G	SEM-Alumni-14	74,593	100%	74,594
Site H	SEM-Alumni-16	121,532	113%	137,042
Site I	SEM-Alumni-20	125,637	100%	125,026
Site J	SEM-Alumni-21 SEM-Muni-6	101,581	100%	102,052
Site K	SEM-Muni-2	80,534	100%	80,400
Site L	SEM-Muni-5	23,273	100%	23,273
Site M	SEM-Muni-7	35,371	82%	29,081
Site N	SEM-Muni-9	101,456	106%	107,189

Source: Nicor Gas tracking data and Guidehouse team analysis.

Site A: No issues with this site.

Site B: No issues with this site.

Site C: No issues with this site.

Site D: No issues with this site.

Site E: No issues with this site.

Site F: The implementer converted monthly gas data to daily before creating the SEM model. This caused issues that resulted in the ex post model being slightly different. The ex ante calculations removed 4 months of data due to a faulty meter but then did not annualize the final savings to a 12 month period.

Site G: No issues with the claimed saving but evaluation staff noted a negative gas usage trend towards the end of the year. It seems that this may be due to site operational changes and the implementer may want to redo the baseline model future calculations.

Site H: There is a mismatch between the savings reported in the tracking data and the savings in the documentation calculations. The ex ante calculations show a savings of 136,844 where the tracking data report shows 121,532.

Site I: The implementer converted monthly gas data to daily before creating the SEM model. This caused issues that resulted in the ex post model being slightly different.[2]

Site J: The implementer converted monthly gas data to daily before creating the SEM model. This caused issues that resulted in the ex post model being slightly different. This site includes SEM-Muni-6 and SEM-Alumni-21.

Site K: The implementer converted monthly gas data to daily before creating the SEM model. This caused issues that resulted in the ex post model being slightly different.

Site L: No issues with this site.

Site M: The ex post model removed data point (2/8/2021) that had Heating ON (1 IF > 3700 Therms/week) * HDD (60°F) variable that was 142% greater than maximum in the baseline. Verified savings was re-annualized, but the overall realization rate was below one as this datapoint claimed savings much higher than the average period savings.

Site N: The ex ante calculation did not annualize savings even though there was only 51 valid data points. The ex post calculation annualized the 51 data points to represent a typical 52 week year.

Table B-2 gives the strata-level verified gross realization rates and statistical precision values at 90% confidence for the SEM Program.

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

Program Sector	Strata	Relative Precision +or-%	Mean RR	Standard Error
	Small	7%	104%	0.04
	Medium	0%	102%	-
	Large	0%	104%	-
SEM Total RR (90/10)		**3%**	**103%**	**0.02**

Source: Guidehouse analysis

[2] The implementer provided the following explanation: This methodology normalizes for the number of days in each period instead of attempting number of days as a variable. Typically, number of days does not fit since the statistically significant variables will likely be a sum of the days. In this case, the weighted regression would be nearly identical to a non-weighted regression (which we saw with the marginal differences in the two approaches). The weighted regression methodology is outlined in ASHRAE Guideline 14.

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

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Nicor Gas	Strategic Energy Management	Sites	20	7.0	1,180,570	1,216,523	1,216,523

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