NAVIGANT

Joint ComEd and Nicor Gas Company Strategic Energy Management Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2018 (CY2018)
January 1, 2018 to December 31, 2018

Presented to
ComEd
Nicor Gas

FINAL
April 26, 2019
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(The June 4, 2019 revised version corrects wrong numbers previously displayed in *Table 8-1 CY2018 Energy Savings by Site* for ex ante natural gas savings and gas realization rates. No impact calculations were affected or changed - it was strictly a display error that occurred when transferring numbers from Excel spreadsheet to Word document that was corrected. This revised version does not in any way affect electric or gas verified savings previously reported as final on April 26, 2019.)

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ComEd and Nicor Gas Strategic Energy Management Impact Evaluation Report

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1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's and Nicor Gas' CY2018 Strategic Energy Management (SEM) Program. It presents a summary of the energy and demand impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. CY2018 spans January 1, 2018 through December 31, 2018.

2. PROGRAM DESCRIPTION

The SEM Program, managed by both ComEd and Nicor Gas, began as a pilot in EPY7/GPY4. The goal of the SEM Program is to apply a process of continuous energy management improvements that result in energy savings and demand reduction. The program seeks to educate participants to identify low-cost and no-cost measures, improve process efficiency, and reduce energy usage through behavioral changes. To encourage these savings, Nicor Gas provides an incentive of $0.10 per therm saved. In the pilot year, ComEd provided a 10% bonus to rebates given on capital projects. Since that year, ComEd has offered an incentive of $0.01 per kWh. While the utilities jointly manage the program, CLEAResult implements the day-to-day operation.

The program achieves energy savings through operational and maintenance (O&M) improvements, incremental increases in capital energy efficiency projects, additional capital projects that would not otherwise have been considered (e.g., process changes, consideration of energy efficiency in all capital efforts), and improved persistence for O&M and capital projects.

The SEM Program provides training and implementer support to identify O&M improvements. Training is typically broken into group training and site-level training/audits. Sites of similar operation are formed into groups called cohorts. Cohorts are made up of SEM participants that began in the program at the same time. This training usually lasts for one year and occurs monthly or bi-monthly.

The SEM Program savings are calculated using site-specific models developed by CLEAResult 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 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 modeled consumption is dependent on variables such as temperature and production. The difference between the modeled energy consumption and actual billing data is the savings claimed by the SEM program.

Cohort 3 began participation in the SEM Program in November 2017. Cohorts 1 and 2 started their training in previous program years. Cohort 3 was comprised of 10 industrial participants in their first year of the program. These sites elected to establish an SEM practice within their organization to pursue energy savings.

In addition to Cohort 3, the practitioner group was formed to support five participants from Cohort 2 and five participants from Cohort 1. This practitioner group was formed from sites that participated in the past and focused on maintaining changes and identifying new opportunities for energy savings. The Practitioner Cohort measurement period lasted approximately 365 days and started in the second half of 2017.

Table 2-1. CY2018 Volumetric Findings Detail

Participation Group	Customer Segment	Time Period
Cohort 3 (Year 1)	10 Industrial	November 1, 2017- October 31, 2018
Practitioner Cohort (Year 2)	2 Industrial 2 Universities 1 Hospital	Variable
Practitioner Cohort (Year 3)	5 Industrial	Variable

Source: ComEd and Nicor Gas tracking data and Navigant team analysis.

3. PROGRAM SAVINGS DETAIL

Table 3-1 and Table 3-2 summarize the incremental energy and demand savings the SEM Program achieved in CY2018. The program had 18 participating sites, as shown in the above table. The SEM program does not report demand savings since the calculators and implementer did not provide that to Navigant.

Table 3-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	14,151,028	NA	NA
Program Gross Realization Rate	1.04	NA	NA
Verified Gross Savings	14,778,772	NA	NA
Program Net-to-Gross Ratio (NTG)	0.95	NA	NA
Verified Net Savings	14,039,833	NA	NA
Converted from Gas*			
Ex Ante Gross Savings	NA	NA	NA
Program Gross Realization Rate	NA	NA	NA
Verified Gross Savings	NA	NA	NA
Program Net-to-Gross Ratio (NTG)	NA	NA	NA
Verified Net Savings	NA	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	14,151,028	NA	NA
Program Gross Realization Rate	1.04	NA	NA
Verified Gross Savings	14,778,772	NA	NA
Program Net-to-Gross Ratio (NTG)	0.95	NA	NA
Verified Net Savings	14,039,833	NA	NA

* Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh). All of the gas savings is claimed by the gas utility in this joint program.
NA = Not applicable
Note: The coincident Summer Peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August.
Source: ComEd tracking data and Navigant team analysis.

Table 3-2. CY2018 Total Annual Incremental Therm Savings – Nicor Gas

Savings Category	Energy Savings (Therms)
Natural Gas	
Ex Ante Gross Savings	964,605
Program Gross Realization Rate	1.10
Verified Gross Savings	1,058,966
Program Net-to-Gross Ratio (NTG)	1.00
Verified Net Savings	1,058,966

Source: ComEd and Nicor Gas tracking data and Navigant team analysis.

4. CUMULATIVE PERSISTING ANNUAL SAVINGS

The measure-specific and total ex ante gross savings for the SEM Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following table and figure. The total CPAS across all measures is 14,039,833 kWh. The program did not achieve gas savings eligible to be converted to electricity and counted toward ComEd's goal.[1]

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[1] The evaluation will determine which gas savings will be counted toward goal while producing the portfolio-wide Summary Report.

Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings								
						2018	2019	2020	2021	2022	2023	2024	2025	2026
Whole Building	SEM	5.0	14,778,772	0.95	70,199,167	14,039,833	14,039,833	14,039,833	14,039,833	14,039,833				
CY2018 Program Total Electric CPAS			**14,778,772**		**70,199,167**	**14,039,833**	14,039,833	14,039,833	14,039,833	14,039,833	-	-	-	-
CY2018 Program Expiring Electric Savings‡							-	-	-	-	14,039,833	14,039,833	14,039,833	14,039,833

Note: The green highlighted cell shows program total first year electric savings.
* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
† Lifetime savings are the sum of CPAS savings through the EUL. The EUL was determined by primary research completed by Navigant during previous SEM evaluations for AEP Ohio.
‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
Source: Navigant analysis

Figure 4-1. Cumulative Persisting Annual Savings
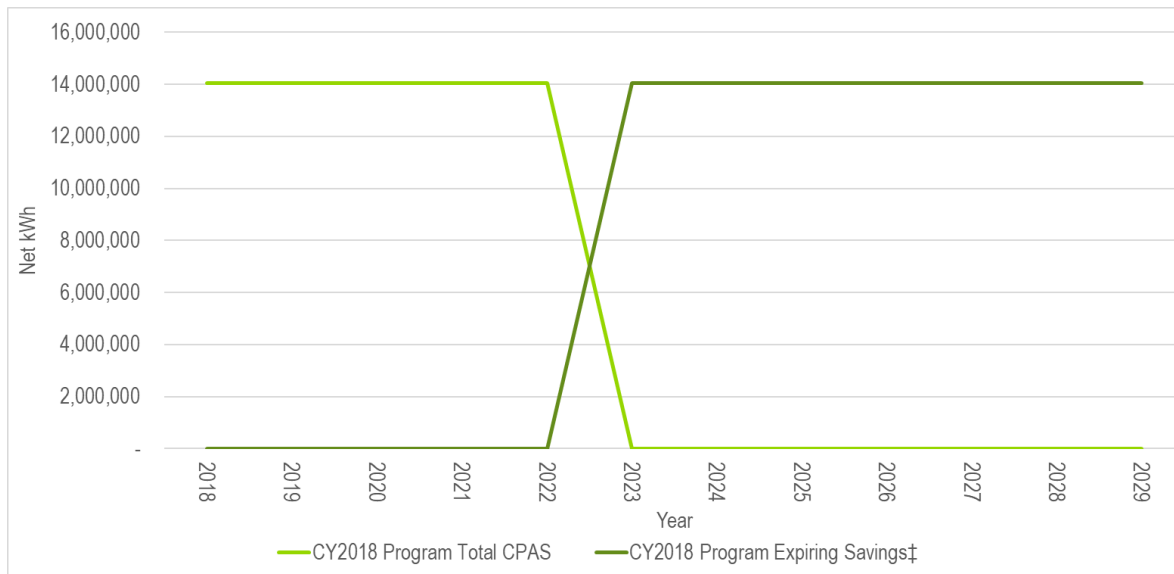
‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
Source: Navigant analysis

5. PROGRAM SAVINGS BY MEASURE

The SEM Program tracked and evaluated savings at the site level, rather than measure level. SEM site level detail can be found in Table 8-1.

6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

6.1 Impact Parameter Estimates

As a behavioral-based model program, 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.

6.2 Other Impact Findings and Recommendations

High level details regarding site results are included in Table 8-1. Details regarding each site that does not have a realization rate of 1.00 are shown below:

Site 1
This site implemented many energy saving measures throughout the year and achieved savings. There was an unexplained decrease in savings for electricity usage during the last month of the measurement period (10/1/2018-10/31/2018). This data point was removed since it was the final data point in the post period and indicated a trend that was not consistent with any of the other post period data. The evaluation team then annualized the cumulative savings by averaging the savings on a monthly basis and adding projected savings for the final month.

Site 6
Data points between 4/23/2018 and 9/9/2018 showed negative savings, for gas usage, directly related to non-SEM activities resulting from short-term malfunctions of its cogeneration operation. In all other time periods, evaluation found steady savings due to the implementation of energy saving measures. The evaluation team removed the time period representing negative savings because it related to equipment malfunction, savings were then annualized.

Site 7
There was irregular production during the week of 5/21/2018. The savings during this period were twice any other savings period. Evaluation removed this data point to ensure that savings would not be overpredicted.

Site 13
The site showed steady savings before the summer months. During the summer months, there was unprecedented attendance that was inconsistent with the baseline model, resulting in a negative impact on site savings. Navigant ran a regression analysis during this post period to identify the impact of this additional attendance. Navigant was able to identify the impact of this event and removed it from the final annualized savings.

Site 17
Navigant removed one outlier from the measurement period because it was significantly more than 110% of any baseline value. The outlier created negative savings that was attributed to a single change in production and not a lack of SEM activity.

Site 19
This site showed unusually high savings in the second and third week of program participation. This savings was not justified by documented site activities or in the provided report and showed behavior that was inconsistent with data points around it. Navigant followed up with the implementer and client to understand what was causing this issue. The implementer provided Navigant with an explanation regarding this short-term behavior resulting in a realization rate of 1.0.

Based on evaluation analysis, Navigant reported the following findings and recommendations:

Finding 1. The program excluded baseline and measurement period data points from model tab that were deemed outliers. In some cases, the only justification for removing these data points was these data points "were identified as residual outliers and significantly biased the regression coefficients compared to the other baseline data points."

Recommendation 1. The program should justify the removal of any data points in the pre-condition based on site operational changes and not just its impact on the model.

Finding 2. Sites 7 and 17 had post variable values falling outside of accepted standards (more than 110% of maximum baseline or less than 90% of minimum baseline). In these cases, the model may not accurately represent what is occurring during these periods.

Recommendation 2. The implementer should continue to identify variable values that fall outside of accepted levels and account for them by testing their impact or removing them, as needed. Justification for removal of a data point should be clear and grounded in real-world effects, as much as possible, and not just model inconsistencies. Time periods with outliers in the baseline should be compared to the post condition to identify seasonal effects. If outliers require removal of data points, savings should be adjusted to represent 12 months of savings.

Finding 3. Sites 2, 3, 13, and 14 showed changes in their production and operation during the measurement period that made it difficult to accurately estimate savings.

Recommendation 3. The implementer should investigate potential solutions or ways to quantify the impact of these production changes. These changes could be accounted for using a post-period variable if it was shown to be statistically significant. If a variable does not sufficiently account for this change, the implementer could attempt to collect specific onsite information to directly calculate the impact of these changes.

Finding 4. Savings were both positive and negative for many sites. Negative savings was converted to zero as the implementer did not feel that the SEM Program caused the site to use additional energy.

Recommendation 4. The methods closely follow the guidance of the National Renewable Energy Laboratory's (NREL) Uniform Methods Project (UMP) protocol for SEM, but the program should consider including the level of uncertainty as called out in the UMP.

Finding 5. Site 19 had a sudden change in energy use that accounted for a large portion of claimed savings, around 60%. This change in energy use was not well justified in either the provided reports or models.

Recommendation 5. All sudden changes in energy use should be explained in the provided documentation for each site. If the change accounts for a large portion of the claimed energy savings it is especially important to understand what that change was and how it was related to the SEM activates occurring at the site.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

7.1 Verified Gross Program Savings Analysis Approach

Verified gross savings from the CY2018 SEM Program were calculated using implementer provided statistical models that are grounded in site-specific data. These multi-regression models draw upon site data including energy usage, production, weather data and seasonality effects (including holidays or shutdowns). Navigant independently evaluated the electric and gas savings using separate energy models.

Navigant's review of the models was driven by the following procedure:

- A site-specific analysis approach. Because 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.

- The 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, Navigant-calibrated building automation system trend logs and telephone conversations with onsite staff.

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

Step 1: Navigant recreated the energy models to ensure they aligned with the provided data.

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

Step 3: Navigant 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: Navigant made additional changes to the model 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.

Navigant 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 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.

7.2 Verified Net Program Savings Analysis Approach

Navigant calculated the verified net energy and demand savings by multiplying the verified gross savings estimates by a deemed net-to-gross (NTG) ratio. Table 7-1 shows the deemed NTG values for CY2018 (previously referred to as electric PY10 and gas PY7). The deemed NTG value of 0.95 for electric savings and 1.00 for gas savings were agreed to by stakeholders in discussions in the Stakeholder Advisory Group (SAG).[2]

Table 7-1. Deemed NTG Values for CY2018

Program Channel	CY2018 Deemed NTG Value
Electric	0.95
Natural Gas	1.00

Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01_Final.xlsx and Nicor_Gas_GPY7_NTG_Values_2017-03-01_Final.xlsx, which are to be found on the http://www.ilsag.info/net-to-gross-framework.html

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

The program had electric and natural gas realization rates (RR) above 1.0 due to multiple sites including data that was unrelated to SEM activities. Table 8-1 summarizes the site-level incremental electric and gas savings the SEM Program achieved in CY2018. A site-level summary is included in Section 6.2. Sites with zero savings included projects that occurred late in CY2018 and showed no savings for this calendar year. Also, some sites with zero savings had difficulty creating accurate modeling due to operational changes. Many of these projects have been moved to the next calendar year. Also, several sites reported no ex ante electric or gas savings. Although activities were completed at these sites, the energy model was unable to detect energy savings occurring for a variety of reasons. For these sites, Navigant claimed zero savings to align with the implementer, but each site model was verified and checked. Sites 1-10 participated in Cohort 3. Sites 11-20 participated in the Practitioner Cohort.

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[2] Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01_Final.xlsx and Nicor_Gas_GPY7_NTG_Values_2017-03-01_Final.xlsx, which are to be found on the IL SAG web site here: http://www.ilsag.info/ntg_2016.html

Table 8-1. CY2018 Energy Savings by Site *

Site	Ex Ante Gross Savings (kWh)	Verified Gross kWh Realization Rate	Ex Post Gross Savings (kWh)	Ex Ante Gross Savings (Therms)	Verified Gross Therm Realization Rate	Ex Post Gross Savings (Therms)
Site 1	2,756,846	1.17	3,221,531	0	0.00	0
Site 2	0	0.00	0	0	0.00	0
Site 3	0	0.00	0	0	0.00	0
Site 4	0	0.00	0	0	0.00	0
Site 5	0	0.00	0	0	0.00	0
Site 6	1,700,200	1.00	1,700,200	69,866	2.28	159,417
Site 7	331,047	0.68	226,281	0	0.00	0
Site 8	0	0.00	0	0	0.00	0
Site 9	0	0.00	0	66,378	1.00	66,378
Site 10	0	0.00	0	0	0.00	0
Site 11	264,322	1.00	264,322	0	0.00	0
Site 12	60,290	1.00	60,290	16,546	1.00	16,546
Site 13	0	0.00	104,531	14,285	1.34	19,196
Site 14	0	0.00	0	0	0.00	0
Site 15	383,646	1.00	383,510	0	0.00	0
Site 16	168,305	1.00	168,305	105,495	1.00	105,496
Site 17	8,342,127	1.02	8,505,557	17,439	0.99	17,337
Site 18	144,245	1.00	144,245	55,665	1.00	55,665
Site 19	0	0.00	0	223,454	1.00	223,454
Site 20	0	0.00	0	395,477	1.00	395,477
Total	**14,151,028**	**1.04**	**14,778,772**	**964,605**	**1.10**	**1,058,966**

* Note: Sites with zero savings included projects that occurred late in CY2018 and showed no savings for this calendar year. Also, some sites with zero savings had difficulty creating accurate modeling due to operational changes. Many of these projects have been moved to the next calendar year.
Source: ComEd and Nicor Gas tracking data and Navigant team analysis.

9. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 9-1, below, shows the Total Resource Cost (TRC) table. It includes only the cost-effectiveness analysis inputs available at the time of finalizing 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 evaluation later.

Table 9-1. Total Resource Cost Savings Summary

	Units	Effective Useful Life	Verified Gross Savings (kWh)	NTG Ratio (kWh)	Verified Net Savings (kWh)	Verified Gross Savings (Therms)	NTG Ratio (Therms)	Verified Net Savings (Therms)
Site 1	Per Site	5.0	3,221,531	0.95	3,060,454	0	1.00	0
Site 2	Per Site	5.0	0	0.95	0	0	1.00	0
Site 3	Per Site	5.0	0	0.95	0	0	1.00	0
Site 4	Per Site	5.0	0	0.95	0	0	1.00	0
Site 5	Per Site	5.0	0	0.95	0	0	1.00	0
Site 6	Per Site	5.0	1,700,200	0.95	1,615,190	159,417	1.00	159,417
Site 7	Per Site	5.0	226,281	0.95	214,967	0	1.00	0
Site 8	Per Site	5.0	0	0.95	0	0	1.00	0
Site 9	Per Site	5.0	0	0.95	0	66,378	1.00	66,378
Site 10	Per Site	5.0	0	0.95	0	0	1.00	0
Site 11	Per Site	5.0	264,322	0.95	251,106	0	1.00	0
Site 12	Per Site	5.0	60,290	0.95	57,276	16,546	1.00	16,546
Site 13	Per Site	5.0	104,531	0.95	99,304	19,196	1.00	19,196
Site 14	Per Site	5.0	0	0.95	0	0	1.00	0
Site 15	Per Site	5.0	383,510	0.95	364,335	0	1.00	0
Site 16	Per Site	5.0	168,305	0.95	159,890	105,496	1.00	105,496
Site 17	Per Site	5.0	8,505,557	0.95	8,080,279	17,337	1.00	17,337
Site 18	Per Site	5.0	144,245	0.95	137,033	55,665	1.00	55,665
Site 19	Per Site	5.0	0	0.95	0	223,454	1.00	223,454
Site 20	Per Site	5.0	0	0.95	0	395,477	1.00	395,477

Source: ComEd and Nicor Gas tracking data and Navigant team analysis.