Guidehouse

ComEd Strategic Energy Management Impact Evaluation Report

**Energy Efficiency / Demand Response Plan:
Program Year 2020 (CY2020)
(1/1/2020-12/31/2020)**

Prepared for:

ComEd

FINAL

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1. Introduction

This report presents results from the CY2020 impact evaluation of ComEd's Strategic Energy Management (SEM) Program. It summarizes the total energy and demand impacts for the program broken out by relevant measure and program structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) inputs. CY2020 covers January 1, 2020 through December 31, 2020.

2. Program Description

The goal of the SEM Program is to train 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 CY2020, 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 contractors 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 is the savings claimed by the SEM Program.

The program had 124 electric participants in CY2020. The program has only one installed measure type, which is the whole building measure.

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3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the SEM Program achieved in CY2020. The gas companies claimed all therm savings from the program.

Table 3-1. CY2020 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Summer Peak* Demand Savings (kW)
Electricity		
Ex Ante Gross Savings	33,403,760	NR
Program Gross Realization Rate	1.01	NA
Verified Gross Savings	33,582,105	NR
Program Net-to-Gross Ratio (NTG)	1.00	NA
Verified Net Savings	33,582,105	NR
Converted from Gas†		
Ex Ante Gross Savings	NA	NA
Program Gross Realization Rate	NA	NA
Verified Gross Savings	NA	NA
Program Net-to-Gross Ratio (NTG)	NA	NA
Verified Net Savings	NA	NA
Total Electric Plus Gas		
Ex Ante Gross Savings	33,403,760	NR
Program Gross Realization Rate	1.01	NA
Verified Gross Savings	33,582,105	NR
Program Net-to-Gross Ratio (NTG)	1.00	NA
Verified Net Savings	33,582,105	NR

NA = not applicable (refers to a piece of data that cannot be produced or does not apply)

NR = not reported (refers to a piece of data that was not reported—i.e., demand savings)

The coincident summer peak period is defined as 1:00 p.m.-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

Source: ComEd tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 shows the total verified gross savings for the SEM Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2020. Figure 4-1 shows the savings across the useful life of the program. The electric CPAS across all measures installed in 2020 is 33,582,105 kWh (Table 4-1). The Gas companies claimed all gas savings for this program; as such, electric CPAS is equivalent to total CPAS. The historic rows are the CPAS contribution back to CY2018.

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

End Use Type	Research Category	EUL	CY2020 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings								
						2018	2019	2020	2021	2022	2023	2024	2025	2026
Whole Building	SEM	5.0	33,582,105	1.00	167,910,525			33,582,105	33,582,105	33,582,105	33,582,105	33,582,105	-	-
CY2020 Program Total Electric Contribution to CPAS			33,582,105		167,910,525			33,582,105	33,582,105	33,582,105	33,582,105	33,582,105	-	-
Historic Program Total Electric Contribution to CPAS‡						14,039,833	37,336,439	37,336,439	37,336,439	37,336,439	23,296,606			
Program Total Electric CPAS						14,039,833	37,336,439	70,918,544	70,918,544	70,918,544	56,878,711	33,582,105	-	-
CY2020 Program Incremental Expiring Electric Savings§									-	-	-	-	33,582,105	-
Historic Program Incremental Expiring Electric Savings‡§								-	-	-	14,039,833	23,296,606	-	-
Program Total Incremental Expiring Electric Savings§								-	-	-	14,039,833	23,296,606	33,582,105	-

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2020 contribution to CPAS.

*A deemed value. Source found on the Illinois Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/ntg_2020.

† Lifetime savings are the sum of CPAS savings through the effective useful life (EUL).

‡Savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings

§Expiring savings are equal to CPAS Y_{n-1} - CPAS.

Source: Evaluation team analysis

5. Program Savings by Measure

The SEM Program has a single measure; measure-level results are the same as the program-level results discussed in Section 3.

6. Impact Analysis Findings and Recommendations

6.1 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, which are customized for each site.

6.2 Other Impact Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2020 evaluation.

Finding 1. Daily models appear to be extremely sensitive to low production, which result in claimed savings inconsistent to other normal operating days. In these cases, it seems the production variables may be lagging, creating predicted energy usage that is much larger or smaller than actual energy usage.

Of the 23 models Guidehouse reviewed, six models showed periodic savings inconsistent with surrounding data points. In many cases, the savings were a large percentage of actual usage,

such as a usage of 20,000 kWh and a savings of 15,000 kWh. These data points occurred on days during, before, or after low production days. It was unclear whether these days represented shutdowns or other unusual site operations.

Recommendation 1. Guidehouse recommends the implementer include a shutdown variable to help properly account for SEM savings, especially in daily models. In addition, daily models might require more careful review by the implementer to identify data points that are claiming unusual savings compared to the total usage for each day. If these data points are due to unusual plant operation or misalignment between the variables and site usage, they should be removed and the final savings re-annualized.

Finding 2. During the review, the evaluation team identified a model that contained only two variables, one of which had no changes in the post-installation period. This meant that for many periods the predicted energy usage was the same even though the actual usage seem to vary over time.

Recommendation 2. If a variable does not change in the post-installation period, the implementer should consider including another variable to reflect dynamic facility operation changes over time to more accurately account for SEM savings. Some sites may have consistent operation across certain times of the year, so it is up to the discretion of the IC to identify what variables are most significant and to provide justification for variables that are include or excluded.

6.3 Site-Specific Impact Findings

Site A	Guidehouse reviewed and approved the COVID-19 pandemic adjustment in this model. No issues.
Site B	No issues.
Site C	There were outlier data points (variables above 10% of maximum or below 10% of minimum) in the baseline that create savings estimates inconsistent with surrounding data points. In addition, this site seemed to have issues regarding daily data points and low production, as discussed in Finding 1. These inconsistent data points were removed from the data set and final savings re-annualized.
Site D	No issues.
Site E	No issues.
Site F	No issues.
Site G	Guidehouse had issues recreating a regression model that exactly aligned with reported savings, but the recreated model was close and had little impact on the final realization rate.
Site H	This site seemed to have issues regarding daily data points and low production, as discussed in Finding 1. These inconsistent data points were removed and final savings re-annualized.
Site I	No issues.
Site J	No issues.
Site K	No issues.

Site L   Guidehouse found an overlapping data point for 10/30/2019 between the baseline and post-installation period results. In the ex post analysis, this data point was removed from the post-installation period calculations.

Site M   The implementer correctly zeroed out approximately 3 months of savings due to inconsistencies in the data caused by the COVID-19 pandemic but failed to re-annualize savings. Guidehouse re-annualized to 12 months of savings resulting in the high realization rate.

Site N   During Guidehouse's initial review of this project, we reviewed savings from Site N - a capital project completed in a prior year and savings were added to the final CY2020 SEM total savings. Guidehouse and ComEd held two meetings with the implementer to discuss those savings prior to completing this report. The implementer provided energy models from prior years to verify the capital project had been accounted for in the model design and incorrectly removed from the final savings estimates. Based on this review, evaluation staff agree that the implementer is justified in adding the savings to the CY2020 totals.

Site O   This site seemed to have issues regarding low production. During what seemed to be a shutdown event, the model estimated savings that was around 5 times the average savings across the post period. This inconsistent data point was removed and final savings re-annualized.

Site P   No issues.

Site Q   This model contained only two variables, one of which had no changes in the post-installation period. This meant that for many periods the predicted usage was the same even though actual usage seemed to vary.

Site R   No issues.

Site S   This site seemed to have issues regarding daily data points and low production, as discussed in Finding 1. These inconsistent data points were removed and final savings re-annualized.

Site T   This site seemed to have issues regarding daily data points and low production, as discussed in Finding 1. These inconsistent data points were removed and final savings re-annualized. These data points where included to account for baseload reduction actions taken at the site but resulted in savings that was 3 times the average savings found in the post period. Guidehouse staff feel that increased savings are due to model limitations and that impact of the baseload reduction would be seen across all data points. Guidehouse staff removed these data points and annualized the sites savings resulting in a final RR of 0.96.

Site U   Guidehouse reviewed and approved the COVID-19 pandemic adjustment in this model. No issues.

Site V   This site seemed to have issues regarding daily data points and low production, as discussed in Finding 1. These inconsistent data points were removed and final savings re-annualized.

Site W   When reviewing this project, Guidehouse staff, identified that on 5/6/2020 the site seemed to be shutdown with low or no production across all product lines. During this period the model showed savings was around 3 times higher than the average savings during the post period. Guidehouse decided that this savings was likely due to the model not being able to estimate usage during this atypical operation. This data point was removed and the savings for the other valid data points were

annualized. Further details of how to handle shutdowns such as this are discussed in finding 1 above.

Appendix A. Impact Analysis Methodology

A.1 Verified Gross Program Savings Analysis Approach

The evaluation team calculated verified gross savings from the CY2020 SEM Program using implementer-provided statistical models that are grounded in site-specific data. These multi-variable regression models draw on site data including energy usage, production, weather data, and seasonality effects (including holidays or shutdowns). The team independently evaluated the electric and gas savings using separate energy models.

Guidehouse's review of the models was driven by a site-specific analysis approach. Because this program contains primarily behavioral-based changes, the International Performance Measurement and Verification Protocol (IPMVP) Option C (billing or metered data regression) was the main approach the team used for 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, 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. The evaluation team generally followed the following process 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 of the SEM Program 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.

The evaluation team identified several changes that occurred at the site that had short- or long-term effects on the statistical model. The changes that could affect the model savings include the following:

- Change in hours of operation

- Change in numbers of employees at the site

- 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.

A.2 Verified Net Program Savings Analysis Approach

The evaluation team calculated the verified net energy and demand savings by multiplying the verified gross savings estimates by a deemed net-to-gross (NTG) ratio. Table A-1 shows the deemed NTG values for CY2020. The deemed NTG value of 1.00 for electric savings and 1.00 for gas savings were agreed to by stakeholders in discussions with the Illinois SAG.

Table A-1. Deemed NTG Values for CY2020

Program Channel	CY2020 Deemed NTG Value
Electric	1.00
Natural Gas	1.00

Source: ComEd_NTG_History_and_CY2020_Recs_Final_2019-10-01.xlsx and Nicor_Gas_NTG_History_and_2020_Values_2019-10-01_Final.xlsx, which are found on the Illinois SAG website: https://www.ilsag.info/ntg_2020/.

Appendix B. Impact Analysis Detail

Individual sites had electric realization rates above and below 1.0 due to multiple modeling issues identified in Section 6.3. Table B-1 summarizes the site-level incremental electric savings the SEM Program achieved in CY2020.

Table B-1. CY2020 Energy Savings by Site

Site Identifier	Ex ante Gross Savings (kWh)	Ex post Gross Savings (kWh)	Verified Gross Realization Rate
Elec Site C	1,650,194	1,667,375	1.01
Elec Site G	1,772,174	1,835,608	1.04
Elec Site H	398,829	398,329	1.00
Elec Site M	424,109	647,348	1.53
Elec Site N	1,910,805	1,910,805	1.00
Elec Site O	2,133,036	1,988,850	0.93
Elec Site P	1,025,300	1,029,914	1.00
Elec Site S	1,711,843	1,638,691	0.96
Elec Site T	1,324,580	1,270,115	0.96
Elec Site V	406,305	334,391	0.82
Elec Site W	2,163,128	2,152,157	0.99

Source: ComEd and Nicor Gas tracking data and evaluation team analysis

Appendix C. Total Resource Cost Detail

Table C-1 shows the TRC 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) is not included in this table and will be provided to the evaluation team later.

Table C-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Whole Building	SEM	Project	124	5.0	No	33,582,105	0.00	0	0	0	0	1.00	1.00	1.00	33,582,105	0	0	0	0	0
	Total			NA		33,582,105	0	0	0	0	0	NA	NA	NA	33,582,105	0	0	0	0	0

Note: This table includes the available cost analysis detail per site and is slightly different than other TRC report tables because it is provided on a per-site basis.
NA = not applicable (refers to a piece of data that cannot be produced or does not apply)
Source: ComEd and Nicor Gas tracking data and evaluation team analysis