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Memorandum

AIC Strategic Energy Management Program

To: Ameren Illinois
From: The Opinion Dynamics Evaluation Team
Date: February 6, 2019
Re: Strategic Energy Management Evaluability Assessment

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1. Introduction

Strategic Energy Management (SEM) programs represent a new and growing source of savings in the Commercial and Industrial (C&I) sector, and in recent years utilities have claimed savings from capital projects, operations and maintenance (O&M) changes, and behavioral changes through their SEM programs. These programs vary widely across the country in terms of implementation and savings achieved. Many SEM programs across the country are still in limited or pilot forms. In Illinois, ComEd and Nicor Gas began an SEM pilot in PY8 with 10 participants and achieved electric and gas energy savings of 1.55% and 1.12% per participant, respectively, in the pilot's first year (total energy savings of 6,800 MWh and 484,769 therms). While many SEM programs are in their infancy, savings for large, mature programs *can* be quite significant. Between 2013 and 2015, AEP Ohio implemented an SEM program with 37 industrial participants in four distinct cohorts and achieved energy savings of 2.4% to 8.6% by cohort (a total of 78,000 MWh in energy savings).

The Ameren Illinois Company (AIC) Strategic Energy Management (SEM) offering has been in operation since 2015, when it began as a pilot to help participants achieve ongoing energy and cost savings by motivating changes in participants' organizational culture and business practices. As part of the SEM program, AIC program staff help participants identify new energy savings opportunities and assist participants in taking full advantage of AIC program offerings. The program offers a base incentive to participants to assist with SEM program implementation, and a performance incentive for participants that reach their energy reduction targets through the program. Leidos energy advisors help participants implement the SEM program and participants are assigned to energy advisors based on their geographic region. At present, AIC primarily views the SEM program as a channel to engage new customers in their existing energy efficiency offerings with a small focus on claiming savings beyond projects completed through the Custom, Standard, or RCx offerings. In PY9, AIC claimed savings for three projects by identifying specific improvements that were made through the SEM program and attempting to estimate savings from these improvements using an engineering approach.

Opinion Dynamics reviewed documentation AIC submitted for SEM projects in PY9 to give specific suggestions for how AIC can improve SEM data tracking and reporting processes in the future. In addition, we conducted secondary research to understand how other utilities have claimed savings from SEM programs. These secondary research activities included a review of industry white papers, EM&V manuals, and best practice reports from across the country. Findings from this research suggest that there is a significant opportunity for

AIC to claim greater savings from the SEM program in the future. In particular, AIC has both an opportunity to increase the number of projects and the types of savings claimed (e.g., behavioral, O&M, spillover, and persistent savings). The evaluation team also gathered findings from secondary research to help ensure that AIC will be able to evaluate and realize these potential savings from SEM projects when they are ready to claim savings from these projects. We synthesized secondary research to produce the following:

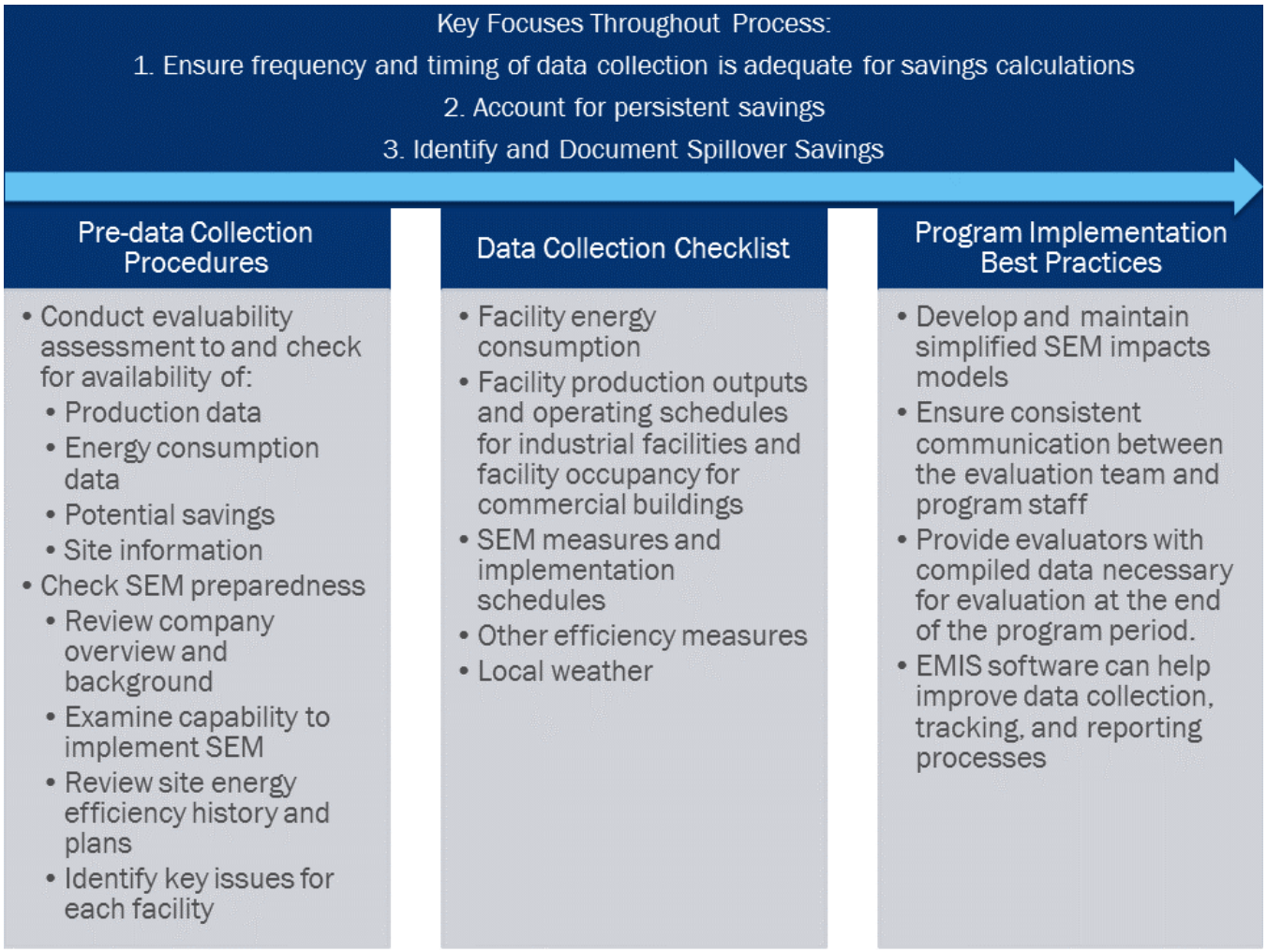
- An overview of SEM impact evaluation methodology
- A list of steps AIC should go through before SEM program implementation to ensure savings can be claimed from SEM projects
- A high level summary of information evaluators need to most easily assess savings from SEM programs
- SEM data tracking and reporting best practices

We provide recommendations for improvements that AIC can make to data tracking and reporting processes based on our findings from the secondary research and a review of AIC's submitted documentation for SEM projects.

2. Key Findings

This section includes results from a review of and AIC's PY9 SEM project documentation and secondary research about EM&V. This section includes an overview of SEM methodology, suggestions for pre-data collection procedures, a data collection checklist, and SEM data tracking and reporting best practices. Figure 1 presents a summary of key findings from each of these three research activities.

Figure 1. Key Guidelines and Best Practices for Implementing SEM Programs



2.1 Overview of SEM Impact Evaluation Methodology

As part of our SEM research activities, the evaluation team reviewed PY9 SEM project documentation and interviewed program staff about program implementation processes including customer recruitment, data collection, and savings documentation. AIC currently encourages SEM participants to document the

improvements they make through the SEM program. In PY9, Leidos used customer documentation to estimate savings from these improvements using an engineering analysis. The evaluation team then evaluated the savings from these projects using engineering desk reviews. This approach enabled AIC to claim savings for capital improvements when adequate data was available, but did not allow AIC to claim savings resulting from O&M or behavioral improvements.

The evaluation team also reviewed strategies that other SEM programs around the country have used to claim savings and found the standard protocol for the evaluation of SEM programs is to run a regression model that compares energy consumption before and after SEM program implementation. This model should also control for weather, facility production patterns, occupancy patterns, and other non-SEM related activities that may affect consumption. The benefit of this type of model is that it allows programs to capture the full suite of savings associated with SEM improvements including behavioral and O&M savings. We recognize there are some inherent challenges AIC may face transitioning from an engineering analysis to a model-based approach. However, we highly recommend that AIC consider a model-based approach in the future because it allows evaluators to be able to determine the full suite of SEM impacts. Key data collection requirements for a model-based approach and additional opportunities to claim savings from the SEM program are discussed below.

Frequency and Timing of Data Collection

One of the most critical factors in evaluating SEM programs is the frequency and timing of the data that are collected. The ideal duration of data collection is 12 months pre-initiative and 12 months post-initiative, but the necessary duration of data collection largely depends on the customer. A customer with consistent energy consumption patterns like a commercial office facility can likely collect data for shorter durations because their consistent consumption patterns are easy to extrapolate. A customer with variable consumption patterns, such as a manufacturing facility with varying production patterns may require longer post-initiative data collection periods to account for seasonal variations.

Persistence of Savings

The AIC SEM program is two years in duration. However, one of the main objectives of the SEM program is to encourage customers to achieve “continuous” energy savings. AIC has the opportunity to claim savings for SEM improvements that persist beyond the first year of the program for capital projects, O&M and behavioral improvements. The persistence values for capital projects are generally well-known and AIC can calculate the persistence for these projects using methodology that is similar for other custom capital projects.

AIC is currently only able to capture persistent savings from SEM projects and transitioning to a model-based approach could also allow AIC to capture persistent savings from O&M and behavioral savings. The SEM Program design encourages persistent O&M and behavioral savings because program administrators teach participants how to continue to optimize systems and discover new opportunities to save energy beyond the first year years of the program. Persistent savings associated with O&M or behavioral changes are less predictable than the savings associated with capital projects, because they require consistent participant commitment to these changes. Conducting a persistence study is one way of quantifying persistent savings for O&M and behavioral projects. This type of study can provide program staff with information about how frequently customers are discovering new savings opportunities, and how long these management changes endure. The evaluation team could use a combination of SEM modeling and surveys with program participants about their process changes to conduct this type of study.

Calculating persistence for O&M, behavioral and capital projects can help program administrators understand how improvements are enduring within the program implementation period from participants' first to second years of program implementation and the overall duration of these changes.

Spillover

In PY9, some AIC SEM program participants reported taking similar actions to those developed with support from AIC through the SEM program at other, non-participating facilities. If these participants were motivated to replicate the program at other facilities in AIC service territory because of their experience with the SEM program, then these savings could be categorized as spillover. The evaluation team did not find any formal guidelines for claiming spillover savings from SEM programs.). AIC and the evaluation team should work together to develop a strategy for claiming spillover savings associated with the SEM program in future program years.

2.2 Pre-Data Collection Procedures

AIC currently uses multiple criteria to make decisions about which customers to recruit to the SEM program. These criteria include factors such as energy savings potential, the size of the account or customer, and the customer's level of motivation to implement SEM changes. In the future, AIC can take additional steps to increase the likelihood that savings can be documented and claimed from potential SEM participants before they begin participating in the program. These steps include making sure the participant is prepared to undertake an SEM program, completing evaluability assessments, and conducting analyses to ensure savings can be accurately detected before the program begins (Dias, 2017; Ochsner, Stewart, Gage, & Kociolek, 2015).

SEM Preparation and Data Evaluability

If AIC decides that the ability to claim savings through a regression model-based approach is a necessary quality for program participants then AIC should assess participants according to the factors listed in Table 1. At the very least, AIC should review the information in the table with the customer before they begin the SEM program so they can develop a plan for how this data will be collected and shared with AIC. AIC already assesses potential participants using several of these factors such including savings potential and SEM readiness. Transitioning to a model-based approach will require AIC to consider additional criteria such as the availability of production and consumption data for potential participants.

Table 1. Information Needed to Assess a Site's SEM Suitability and Data Evaluability

SEM Preparation	Data Evaluability
Company Overview and Background: Describing relevant details that might influence the SEM program, such as ownership structure, management structure, corporate energy or sustainability programs, quality or certification programs)	**Energy Consumption Data Availability**: Number of meters on site (and if possible what the meters are tied to and the percentage of load they represent), any available submetering, if utility data or bills is available for 12-24 months, any systems used for tracking energy use, any interval data availability or plans
SEM Readiness: Describing the site's ability and willingness to dedicate staff to the engagement, who the Energy Champion and Executive Sponsor would be, any major process changes that are planned, experience with	**Production Data Availability**: describing how the site tracks production data including what they track, how frequently, the methods for recording and reporting the data, and whether the data can be provided to AIC and the evaluator

SEM Preparation	Data Evaluability
Lean, Six Sigma, etc., sustainability or energy goals and teams	
Energy Efficiency History and Plans: Describing any relevant relationship with utility programs (account executive, 3rd party contractors, etc.), project activity and history, pending projects, planned major capital projects. Also, any measures the AE/Coach recommend be included or excluded, existing plans with the utility or 3rd parties	**Savings Potential**: including estimated annual energy consumption (kWh, Therm, other), estimated savings, utility rate schedule, $/energy source (kWh, Therm, other)
Key issues for each facility: Any issues that the Investor Owned Utility (IOU) PM should know or that need to be documented, relative to each facility, should be noted in the report.	**Site Description:** describing the type of product manufactured, hours of operations. seasonality (if applicable), suggested site boundary for SEM engagement, and a map of the site (if available)
Source: Replicated from (Dias, 2017)	

Savings Detection Analysis

SEM facilities are generally large consumers of energy, which can make it difficult to detect SEM savings given the large values and variability associated with the consumption data. This "signal to noise" issue is a common challenge to detecting savings from SEM programs (NEEP, 2017). To address this, program administrators or the evaluation team can conduct tests to ensure that savings can be detected from available data for new program participants (NEEP, 2017). An example of one test that can be used is a Fractional Savings Uncertainty analysis (FSU), which incorporates the uncertainty around the savings estimate and the total expected savings to determine the likelihood that savings will be detected for a specific participant (Ochsner et al., 2015). For potential participants that have a low likelihood of savings detection, AIC and the evaluation team can strategize about how to change data collection methods to improve the likelihood of savings detection or whether or not to include the participant in the program (Ochsner et al., 2015).

2.3 Data Collection Checklist

We gathered and triangulated recommendations on the types of data that AIC should collect in order for us to evaluate SEM projects from several different industry best practice reports and white papers. These information sources suggest that AIC needs to collect the following types of data to be able to claim savings from the SEM Program:

1. Facility energy consumption
2. Facility production outputs and operating schedules for industrial facilities and facility occupancy for commercial buildings
3. SEM measures and implementation schedules
4. Other efficiency measures
5. Local weather

Table 2 gives an overview of the data required to calculate savings using a model-based approach and the current status of the availability of this data for AIC. This review revealed the largest data needs are granular production data and more detailed documentation about SEM projects for all projects claiming savings.

Table 2. Current Status of Evaluator Access to AIC SEM Data Inputs for Model-Based Calculations

Type of Data	Data Needed	Current Status of Data Availability
Facility energy consumption	Interval facility energy consumption at the daily or hourly scale	According to AIC program staff, AIC has 15-minute interval data available for most SEM-eligible customers and over 60% of eligible customers have AMI data available.
Production Data	Documentation of any non-SEM-related changes in facility operations or production that may influence energy consumption patterns. This data should be at the same time interval scale as the consumption data, ideally daily or hourly.	The review of program data revealed a few SEM customers provided production data in PY9, and this data was at the monthly level.
Description of SEM Projects Implemented	Detailed documentation about all SEM measures that are implemented during the program period including: • Timing of measure implementation at the finest granularity possible • Detailed notes about facility operating procedures before and after behavioral or O&M changes were made including the timing of these changes For capital projects implemented through SEM we will need detailed information about: • Information about the type of equipment that was replaced and the scheduling and run time of this equipment • Time and date of replacement and any operational changes to equipment scheduling or run time that occurred after the new equipment was installed • Detailed descriptions of the measures that were implemented and how associated energy savings were calculated	SEM Participants supplied adequate documentation for two out of the three projects AIC sought to claim savings for in PY9. In future years, AIC should ensure the proper SEM project documentation is supplied for all customers.
Other Efficiency Measures or Measures That May Affect Consumption	Detailed descriptions of efficiency projects including capital projects and operations changes that were implemented during the SEM evaluation period, but that cannot be attributed to the SEM program including detailed information about the date of replacement, type of equipment that was replaced, and documentation of any scheduling changes.	The evaluation team has access to information about other capital projects AIC claims savings for through AIC in the Amplify database. The evaluation team will also need more detailed information about when these projects were implemented and other applicable operations and scheduling changes to in order for AIC to claim savings with a model-based approach.
Local weather	Daily weather data including HDD and CDD for participating sites	The evaluation team has access to this data through secondary sources.

Bernath & Buffum (2017) caution that neglecting to include any explanatory variable that influences energy consumption in the model will likely result in very inaccurate savings estimates. Detailed descriptions of the types of data that need to be collected are included below.

1. Facility energy consumption

The evaluation team strongly prefers using interval facility energy consumption at the daily or hourly scale to calculate impacts. Although monthly data can be used in SEM analyses, models that use hourly or daily energy consumption data produce considerably better estimates of energy savings than monthly data and are the preferred industry standard (Cervantes & Brick, 2012).

Bonneville Power Administration (BPA) found a strong positive correlation between the frequency of a facility's energy consumption data and the statistical significance of SEM energy savings at the site (Gage et al., 2017). AIC should supply the evaluation team with the finest granularity consumption data possible.

2. Facility production outputs for industrial facilities and facility occupancy for commercial buildings

It is essential that we have access to production data for industrial facilities and occupancy data for commercial buildings to calculate impacts. If internal factors that affect building energy consumption patterns such as production output, scheduling, and occupancy are not controlled for, they can invalidate the SEM models and result in negative savings or savings inaccurately attributed to SEM. As such, we need information about any non-SEM-related changes in facility operations or production that may influence energy consumption patterns (Stewart, 2018). Ideally the building production and/or occupancy data collected and supplied to the evaluator would be collected on the same interval basis as the energy consumption data, at the finest granularity possible. In the case that production data are not available, facility operating schedules could be used a proxy.

In PY9, two of the three projects AIC claimed savings for did not include production or operational data. As suggested in the 2017 AIC Custom report, report collecting production data during program implementation will allow AIC to compute savings estimates that are closer to real-time.

3. SEM measures and implementation schedules

The evaluation team will need detailed documentation about all SEM measures that are implemented during the program period. Similar to the collection of production data and energy consumption data, we need this information about the timing of SEM measure implementation at the finest granularity possible.

Capital Projects

For all capital projects implemented through the SEM program, we need detailed notes about the equipment that was in operation before being replaced through the SEM program and the previous equipment scheduling and run time. We also need information about the time and date of replacement, as well as any operational changes to equipment scheduling or run time that occurred after the new equipment was installed. The implementation team will need to supply detailed descriptions of the measures that were implemented and how they calculated the associated energy savings such that evaluators can verify energy savings and incorporate savings data into the SEM model.

Behavioral and Operations Changes

Detailed notes about facility procedures before operational or maintenance changes are implemented are especially critical to helping evaluators to detect the savings associated with these changes. The evaluation team needs detailed information about operation schedules before and after a behavioral or operational change is made for the specific processes where a change was made.

4. Other efficiency measures

The evaluation team also needs to know about other efficiency projects including capital projects and operations changes that were implemented during the SEM evaluation period, but that cannot be attributed to the SEM program. We should be able to gather this information from the Amplify database. The evaluation team needs to have access the same information described above about capital projects implemented through the SEM program for other efficiency capital projects implemented outside the SEM program, including detailed information about the date of replacement, type of equipment that was replaced, and documentation of any scheduling changes.

5. Local weather

The evaluation team will need to include daily weather data in the SEM impact model to control for fluctuations in energy consumption caused by weather. The evaluation can find the weather information that we need including HDD and CDD from the NOAA website.

2.4 SEM Data Tracking and Reporting Best Practices and Lessons Learned

The evaluation team identified several data reporting and tracking best practices and lessons learned that AIC should consider during program implementation.

- **Take steps to ensure an SEM project can be evaluated before program implementation begins.**

  AIC should take steps to ensure that savings can be claimed from potential SEM participants before they begin participating in the program. These steps include making sure the participant is prepared to undertake an SEM program, completing evaluability assessments, and conducting analyses to ensure savings can be accurately detected before the program begins

- **Ensure that the proper data are collected for evaluation.**

  Data that should be collected for proper evaluation include facility energy consumption data, production data, SEM measures and implementation schedules, information about other efficiency measures implemented during the time period, weather data, and any other information about facility operations that may affect energy consumption. AIC should then provide evaluators with compiled data necessary for evaluation at the end of the program period.

- **Develop and maintain a simplified SEM impacts model for each participant**

  Degens & Kelly (2017) tested several different model specifications and found that a model that includes production data, HDD, CDD and consumption data produced similar results to final models that included all necessary explanatory variables. Leidos could develop this simplified model with customers and use this as a baseline for tracking program savings.

- **Ensure consistent communication between the evaluation team and program staff**

If AIC is able to provide evaluators with a baseline energy consumption model they can use for impact analysis, like the simplified model described above, it gives evaluators a starting point from which to work from. AIC and the evaluation team should have consistent communication when we are working on selecting a final model specification. AIC is familiar with each program site and can help us understand if our model assumptions are correct. A check-in between AIC and the evaluation team mid-way through the program year can also help ensure that all the necessary data is being collected and that model results check out.

- **Provide evaluators with compiled data necessary for evaluation at the end of the program period**

BPA SEM program administrators provided evaluators with "project completion reports" which include each type of data described in the checklist above, a description of facility operations, and an estimate of the aggregate energy savings at the facility and savings due to SEM for each facility and program year. These reporting efforts helped the evaluation process go smoothly as evaluators received all the information they needed, which prevent the need to go back and do additional costly data collection efforts.

- **EMIS software can help improve data collection, tracking, and reporting processes**

Energy Management and Information System (EMIS) allow for energy consumption data collection over short time intervals which can help participants track and report consumption data closer to real time. This helps evaluators improve the measurement and verification of energy savings. In addition, some EMIS allow users to input regression models which can compute and report savings throughout the duration of the program (Ochsner et al., 2015). The early development of these models could help reduce the time and cost associated with SEM evaluation (NEEP, 2017).

Encouraging customers to share their production data can be a barrier to SEM program implementation. Most Efficiency Vermont customers use an EMIS to share data with Efficiency Vermont and to substantiate savings claims to regulators. The use of EMIS systems helped program staff engage and build trust with Efficiency Vermont customers, which resulted in customers becoming more willing to share production data and other factors that impact energy use.

AIC reported challenges obtaining production data from customers and using EMIS software can help build trust with customers so they feel comfortable sharing this data. EMIS can also help ensure smooth data tracking, sharing and reporting processes. AIC may want to consider further coordinating incentives between the SEM program and the Metering and Monitoring program to motivate SEM participants to purchase EMIS systems for use during the SEM implementation process.

- **Learn to expect variable results when savings are evaluated using a model-based approach**

Results from SEM programs that have been calculating savings for several years such as BPA have resulted in variable savings results on a site-by-site basis. This type of variation can be caused by changes in factors such as SEM implementation strategies and the types facilities included in the SEM program (Gage et al., 2017). These variations are to be expected and program staff should learn to be comfortable with fluctuations in savings between program years.

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