Energy Management Practices

2017-2020 Impact Evaluation Phase 1

Final Report

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Table of Contents

Executive Summary

NYSERDA's Energy Management Practices (EMP) initiative contains two programs: 1) Strategic Energy Management (SEM), including a wastewater-specific segment called Wastewater Energy Coaching (WEC), and 2) On-site Energy Manager (OsEM). Both programs began enrolling customers in 2017. This report summarizes the impact evaluation findings conducted on the first 26 participants (22 in the sample) to complete either program.

As shown in Table 1, the Impact Evaluation Team found verified gross savings realization rates (VGS RR) of 103% for SEM electric savings. The OsEM program achieved an electric VGS RR of 151%. Together, the Impact Evaluation Team found the verified gross savings realization rate of 125% for the combined EMP programs. The VGS RR is the verified gross (evaluator-calculated) savings divided by the gross (implementor-calculated) savings. The table also shows the verified savings percentage relative to the baseline energy usage.

Table 1. Total Annualized Electric Energy Savings

	Gross Savings (kWh)	Verified Gross Savings (kWh)	Savings Weighted VGS RR	Verified % Savings Relative to Baseline
SEM (Non-WEC)	27,167,390	28,139,349	104%	4.5%
SEM (WEC)	3,098,646	3,127,773	101%	3.7%
SEM Subtotal	*30,266,036*	*31,267,123*	*103%*	*4.4%*
OsEM	26,028,374	39,198,739	151%	6.1%
Total	**56,294,410**	**70,465,862**	**125%**	**5.3%**

The Impact Evaluation Team found that 69% of the sampled SEM (non-WEC) electric savings were included as part of the OsEM program savings (39% of the OsEM program electric savings). The savings are likely influenced by OsEM program interventions, based upon the timing of the impacts and the measures implemented. However, upon reviewing projects in the pipeline as well as completed projects outside of the sample set, it was discovered that this was an isolated circumstance whose effects will likely diminish over the course of the multi-phase impact evaluation. Therefore, these gross savings were verified for both programs, understanding overlap is not addressed at a program level.

The programs achieved similar results for natural gas savings, with the VGS RRs of 103%, as shown in Table 2.

Table 2. Total Annualized Natural Gas Energy Savings

	Gross Savings (MMBtu)	**Verified Gross Savings (MMBtu)**	**Savings Weighted VGS RR**	**Verified % Savings Relative to Baseline**
SEM (Non-WEC)	55,634	56,440	101%	**3.5%**
SEM (WEC)	N/A	N/A	--	**--**
SEM Subtotal	*55,634*	*56,440*	*101%*	**3.5%**
OsEM	107,728	111,712	104%	**3.4%**
Total	**163,632**	**168,152**	**103%**	**3.5%**

Project-level realization rates varied considerably for both programs, but the differences balanced when aggregated. The Impact Evaluation Team reviewed results from similar SEM programs in other jurisdictions and found that the verified savings relative to sites' baselines ranged from 1% to 8% for electric savings and 1% to 7% for natural gas savings. Savings from NYSERDA's SEM program are comparable to these results.

The Impact Evaluation Team also calculate unit energy benefits (UEB) to assist in the calculation of indirect benefits from the EMP initiative. The UEB is the annual energy savings per end user resulting from implementing SEM and OsEM measures. Table 3 shows the UEB for each program by fuel type.

Table 3. Unit Energy Benefits by Fuel Type

	Energy Savings (kWh)	**Natural Gas Savings (MMBtu)**
SEM (Non-WEC)	2,238,681	7,006
SEM (WEC)	426,899	N/A
SEM Subtotal	*1,634,754*	*7,006*
OsEM	5,599,820	18,619
Total	**2,896,366**	**12,366**

The Impact Evaluation Team recommends some minor changes in program implementation, including improving and standardizing regression modeling best practices and providing more robust project documentation. However, overall, the Impact Evaluation Team found program participants generally valued their time participating in the programs, and the overall impacts reflect the high level of interest and engagement these programs achieved.

Introduction

In 2017, NYSERDA began to enroll participants in the new Energy Management Practices (EMP) initiative. The goal of this initiative was to integrate energy efficiency as a core business practice by guiding participants through a process of identifying, developing, and executing new energy management strategies in their facilities. There were two different programs for participants:

1. Strategic Energy Management (SEM), including a wastewater-specific segment called Wastewater Energy Coaching (WEC)

2. On-site Energy Manager (OsEM)

Strategic Energy Management (SEM), including Wastewater Energy Coaching (WEC), used independent third-party energy efficiency teams (herein referred to as the implementers). These programs encouraged energy efficiency through:

- Treasure hunts, where the implementers and owners' representatives walked through the facilities and identified areas of energy waste (behavioral, operational, and equipment based) and possible measures to reduce or eliminate that energy waste.

- Cohort meetings, where other program participants met to share best practices and learn how other participants approached similar issues.

- Billed-use regression modeling for savings tracking, where the program implementor identified independent variables that drive energy use in the facility (e.g., production levels) and built statistical models to forecast how the building uses energy. The difference between the facility's actual energy use and this forecasted model then measures the impact of the sum total savings of the energy measures put into place. These reports were updated and shared with the participant throughout their participation and provided immediate feedback to show how projects have impacted the facility's energy use.

- Project management and tracking, where all the potential measures are tracked, including their current status, so participants can move as many identified measures through to completion as possible.

OsEM also seeks to assist participants with putting into place an energy management process. However, rather than having a third-party energy coach, the program offers cost-sharing with sites to embed part- or full-time energy managers (staff or consultants) into their facilities and operations. These energy managers are responsible for identifying measures, calculating potential energy savings, securing management approval, and tracking projects to completion.

In 2021, NYSERDA contracted with the Impact Evaluation Team to conduct a multi-year evaluation of the program, and this report details the findings and recommendations as part of that process. This report summarizes the first of five impact evaluations planned from 2021 to 2025 using a phased incremental sampling approach describe below. The evaluation objectives are listed in Table 4.

Table 4. Evaluation Objectives and Main Research Questions

Objective	Evaluation Questions	Data Sources
Evaluate verified gross energy impacts	What is the annualized evaluated gross energy savings based on electric (kWh) and fuel savings (MMBtu) at customer sites?	On-site or remote measurement and verification (M&V) using IPMVP recommended methods, program data.
Verified gross savings realization rate (VGS RR)	What is the ratio of the sum of the evaluated savings divided by the sum of the Program-reported savings?	
Provide assistance to market evaluation in determining indirect impacts	Provide assistance to market evaluation in determining indirect impacts	Market Evaluation Contractor, M&V and CEI Market Evaluation Year 3 Report.

Sampling Methodology

The Impact Evaluation Team is using a phased incremental sampling approach that will achieve a 10% precision level for gross energy savings at 90% confidence at the end of the multi-year evaluation. In this first evaluation year, the Impact Evaluation Team identified a population of 26 completed projects from the earliest completed program participants. These included the 2017 and 2018 SEM cohorts (12 projects), the 2018 WEC cohort (7 projects), and all completed OsEM projects not in the bonus phase (7 projects).[1] From this population, the Impact

[1] The OsEM sample frame included all projects which have completed both the program participation and the bonus period. These included all Pilot 1 projects and one Pilot 2 project that met those criteria.

Evaluation Team selected a total of 22 projects, randomly sampled as necessary from each program. The number of projects sampled for each program was based on the expected number of projects to be completed by 2025 and achieving the desired level of precision at the end of the evaluation. Table 5 shows the population of completed projects and sample for each program.

Table 5. Year 1 Evaluation Sample

	Population	**Sample**
SEM (Non-WEC)	12	10
SEM (WEC)	7	5
SEM Subtotal	*19*	*15*
OsEM	7	7
Total	**26**	**22**

While the realization rates shown in this report are weighted by savings, the realization rates may not be representative of the final population of program participants due to the incremental sample design and the size of the sample in phase one of this study. The Impact Evaluation Team will compare the characteristics of the sample and the population in subsequent phases and will develop weighting strategies as needed to ensure the study's results are representative of the final population of program participants.

Savings Calculation Methodology

To estimate verified gross savings, the Impact Evaluation Team used two IPMVP approaches: IPMVP Option A (Partially Measured Retrofit Isolation) and IPMVP Option C (Whole Facility Billing Regression).

The Implementation Team used regression modeling for claiming savings for all SEM and WEC projects, while the OsEM program used engineering calculations to estimate and claim energy savings. The Impact Evaluation Team used Option C wherever possible, but used Option A for projects where Option C was not viable due to poor regression metrics. In both approaches, the Impact Evaluation Team conducted interviews with program participants to identify measure performance-related issues.

IPMVP Option A Methodology

IPMVP Option A allows for partial measurement of relevant data or direct metering of energy use to calculate a project's energy savings. It allows for some flexibility to stipulate values with a low overall impact on the savings error.

The primary approach the Impact Evaluation Team took to calculate savings using IPMVP Option A was to collect or recreate energy savings calculations and gather any necessary data or updates to assumptions. The Impact Evaluation Team then reviewed and adjusted the original calculations or created new calculations based on the data and feedback from participants collected.

Due to the ongoing COVID-19 pandemic and case spikes in the summer/fall of 2021, the Impact Evaluation Team did not conduct any on-site data collection and instead collected data from participants remotely or used the data supplied with the program documentation.

IPMVP Option C Methodology

IPMVP Option C is a whole building meter verification approach. The process involves first identifying independent variables that drive energy use (e.g., production, weather, and schedule variables). Using these independent variables, a statisitical model is created of the baseline energy use to represent the counterfactual energy use. In other words, the model represents how the building would have used energy in the absence of some intervention. Savings are then calculated by taking the difference between this counterfactual model and the actual facility's energy use.

To validate savings, the Impact Evaluation Team first recreated each of the implementor's regression models to verify the claimed savings values and better understand the approach being used by the Implementation Team. Next, the Impact Evaluation Team validated each baseline model and the claimed savings using a set of industry-accepted validation metrics as described below. Finally the validation results were combined with engineering judgment based on the project documentation to determine whether the evaluators could improve each baseline model to provide more accurate savings results, accept the implementor's model, or move to IPMVP Option A.

The primary validation metrics and thresholds used, based on IPMVP and ASHRAE Guideline 14, in order of importance, are:

1. Net Determination Bias Error: Less than 0.005%
2. CV(RSME): Less than 15% for monthly models; less than 30% for daily models
3. Independent Variable T-Statistics: No variables with an absolute value t-statistic below 2
4. Adjusted R^2: Greater than 75%

The Impact Evaluation Team also used Fractional Savings Uncertainty (FSU) as an additional validation metric for the claimed savings value, which indicates whether a model can confidently distinguish savings from noise. To validate the savings claim, the model had to have an FSU of less than 50% at 68% confidence.

Wherever possible, the Impact Evaluation Team looked to improve the models used by the Implementation Team. For each implementation model, the Implementation Team had selected a set of independent variables that they identified as the primary driver of energy consumption. The Impact Evaluation Team reviewed these independent variables and also attempted to identify any additional independent variables that could be added to the model to improve the goodness-of-fit validation metrics without overfitting the model.

The Impact Evaluation Team also reviewed the projects for non-routine events (NREs). NREs are events with significant energy impacts (causing either an increase and decrease in energy use) on the facility that are not attributable to the program. An example of an NRE would be a small building addition, a production line being decommissioned/modified, or a temporary equipment failure. Where any potential NREs were identified, the Impact Evaluation Team interviewed the participant to attempt to identify the event. If the participant could identify the NRE with rough start and end dates, the Impact Evaluation Team made a non-routine adjustment (NRA) following the *IPMVP Application Guide on Non-Routine Events & Adjustments* guidance. If the participant could not identify the NRE, no adjustment was made.

Results

With the exception of OsEM electric savings, the realization rates for the programs were close to 100%, although with somewhat high variability in individual project realization rates. The Impact Evaluation Team calculated average realization rates using both the program tracking values and annualized savings rates, as shown in Table 6 and Table 7. All realization rates are unweighted.

Table 6. Program-Specific Electric Realization Rates

	Overall	Annualized
SEM (Non-WEC)	107%	104%
SEM (WEC)	96%	101%
OsEM	151%	

Table 7. Program-Specific Natural Gas Realization Rates

	Overall	Annualized
SEM (Non-WEC)	102%	101%
SEM (WEC)	N/A	N/A
OsEM	104%	

The Impact Evaluation Team identified that approximately 69% of the sampled SEM (non-WEC) electric savings were double counted in the OsEM program savings (approximately 39% of the OsEM program electric savings). . The savings are likely influenced by OsEM program interventions, based upon the timing of the impacts and the measures implemented. However, upon reviewing projects in the pipeline as well as completed projects outside of the sample set, it was discovered that this was an isolated circumstance whose effects will likely diminish over the course of the multi-phase impact evaluation. Therefore, these gross savings were verified for both programs, understanding overlap is not addressed at a program level.

Savings Annualization

The Impact Evaluation Team annualized savings for the SEM and WEC programs because the implementation team claimed savings over irregular periods, between 9- and 29-months' worth of savings. The Impact Evaluation Team, working with NYSERDA and the Program Implementation Team, determined the best approach for annualizing savings would be to claim the savings accumulated one year after the model workshop with the program participants. This one-year period avoids periods of non-savings before program participants begin to fully engage with the program and limits uncertainty associated with non-routine events that occurred after program engagement.

To identify the annualized SEM and WEC savings, the Impact Evaluation Team took the program reported gross savings (gross) and the evaluated VGS models and adjusted them to reflect those dates.[2]

[2] Note that there was one non-sampled SEM (WEC) project in which the implementer's claimed savings started approximately six months after the model workshop due to an apparent issue with the savings estimate in the first six months. To avoid using erroneously high savings in the gross savings total, the Impact Evaluation Team used the first 365 days after the start of the corrected model as the annualized savings period for this project.

All discussions of results herein refer to annualized savings. Table 8 and

Table 9 show the total annualized savings for all programs.[3] For the combined EMP programs, the Impact Evaluation Team found the verified gross realization rate of 128% for electric energy savings and 102% for natural gas savings. The verified gross realization rate (RR) is the verified gross (evaluator-calculated) savings divided by the gross (implementor-calculated) savings. The tables also show the verified savings percentage relative to the baseline energy usage.

Table 8. Total Annualized Electric Energy Savings

	Gross Savings (kWh)	**Verified Gross Savings (kWh)**	**Savings Weighted VGS RR**	**Verified % Savings Relative to Baseline**
SEM (Non-WEC)	27,167,390	28,139,349	104%	4.5%
SEM (WEC)	3,098,646	3,127,773	101%	3.7%
SEM Subtotal	*30,266,036*	*31,267,123*	*103%*	*4.4%*
OsEM	26,028,374	39,198,739	151%	6.1%
Total	**56,294,410**	**70,465,862**	**125%**	**5.3%**

[3] In addition to the electric and natural gas savings included in these tables, one SEM project also had steam verified gross savings of 12,449 pounds of steam and a realization rate of 100%.

Table 9. Total Annualized Natural Gas Energy Savings

	Gross Savings (MMBtu)	Verified Gross Savings (MMBtu)	Savings Weighted VGS RR	Verified % Savings Relative to Baseline
SEM (Non-WEC)	55,634	56,440	101%	3.5%
SEM (WEC)	N/A	N/A	--	--
SEM Subtotal	*55,634*	*56,440*	*101%*	*3.5%*
OsEM	107,728	111,712	104%	3.4%
Total	**163,620**	**168,152**	**103%**	**3.5%**

The Impact Evaluation Team reviewed results from similar SEM programs in other jurisdictions and found that the verified savings relative to sites' baselines ranged from 1% to 8% for electric savings and 1% to 7% for natural gas savings. Savings from NYSERDA's SEM program are comparable to these results. The table below shows the verified savings relative to baseline for comparable programs.[4]

[4] Note that some of these programs have been evaluated multiple times. The listed reports are the most recent evaluations of the programs that include savings relative to baseline.

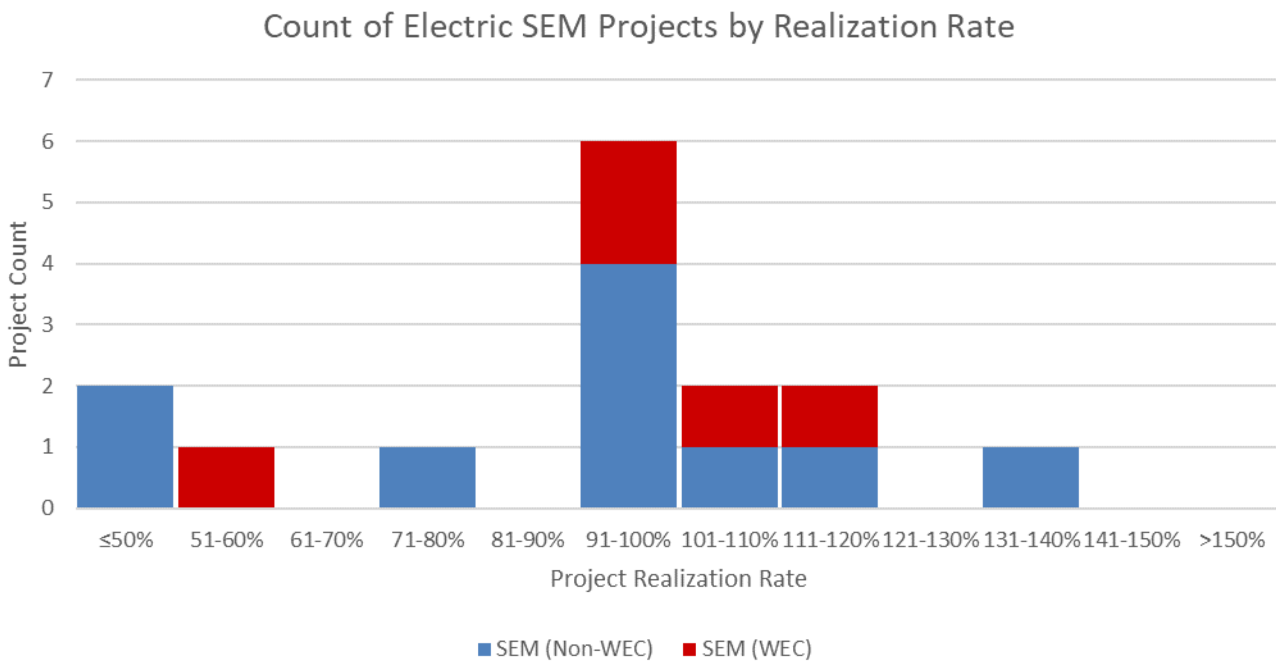
Table 10. Verified Savings Percentages From Comparable SEM Programs

State/ Region	Program Administrator	Study Period	Verified % Savings Relative to Baseline		Sector
			Electric (kWh)	Natural Gas	
OR	Energy Trust of Oregon	2010-2013	3.2%	3.5%	Industrial
IL	ComEd/ Nicor Gas	2015-2016	1.55%	1.12%	Industrial
Pacific Northwest	Bonneville Power Administration	2010-2014	4.1%	Not evaluated	Industrial
WA	Puget Sound Energy	2015-2016	4.4%	7.0%	Commercial

SEM Electric Savings

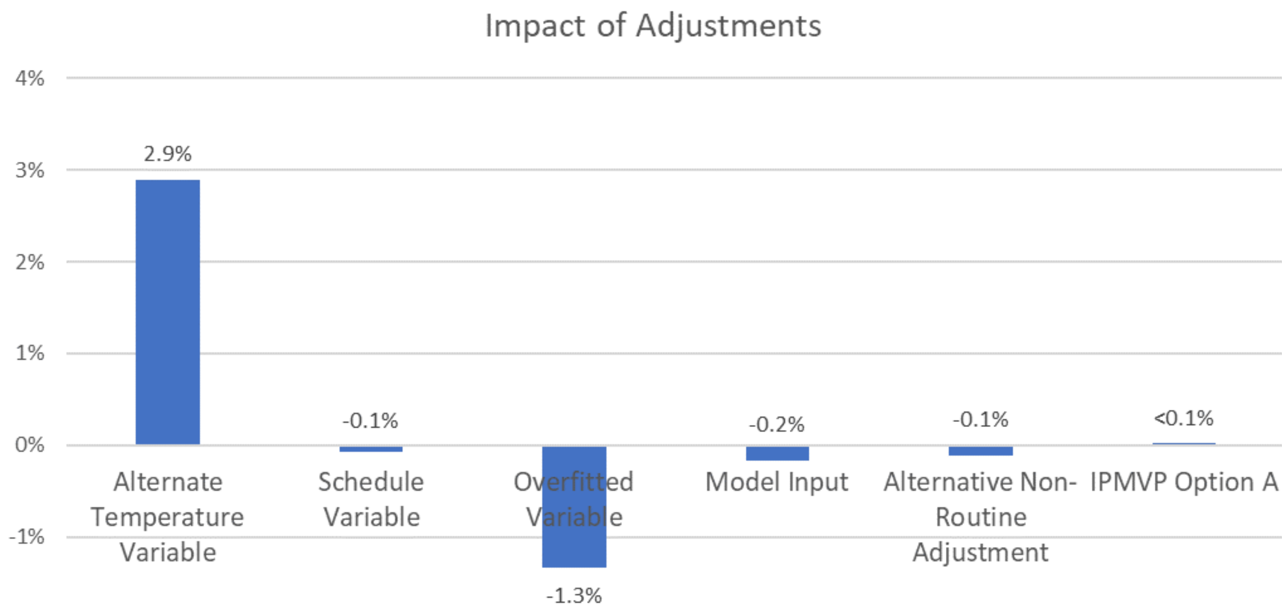
The Impact Evaluation Team adjusted seven of the ten non-WEC SEM projects and three of five WEC projects for various reasons. However, overall, these adjustments largely offset as shown in Figure 1, leaving the program with an overall realization rate of 104%.

Figure 1. Electric SEM Project Realization Rate Distribution



The Impact Evaluation Team made six different types of adjustments on SEM projects. The impact of these adjustments is shown in Figure 2, with descriptions of the adjustments following.

Figure 2. Adjustment Impacts on Electric SEM Verified Savings



The adjustments on the natural gas savings for SEM were primarily due to using alternative temperature variables. On one project, we did remove an overfitted variable, but it's impact was negligible.

1) Alternate Temperature Variable (four cases)

The Implementation Team primarily used average daily temperatures for their models. However, the Impact Evaluation Team noted that several models could be improved using actual heating or cooling degree days. The primary reason for this effect is that many heating and cooling systems operate non-linearly to temperature. For instance, a cooling system may have no usage between the coldest periods of the year and outside temperatures approaching 55ºF. From there, they may linearly increase as the outdoor temperatures increase. Using a cooling degree day analysis properly accounts for this piecewise functionality, while an average temperature model will tend to overestimate usage during mild periods and underestimate usage during more extreme outside temperatures.

Additionally, for one WEC project, the Impact Evaluation Team found that outside air density improved the model more than the outside air temperature. This is because the site primarily uses large blower systems for aeration, where air density is a primary driver of energy consumption for the blowers. Air temperature is a proxy variable for air density in this case, so using density directly improved the model.

2) Schedule Variable (two cases)

The Implementation Team appeared to attempt to keep models simple and use as few independent variables in models as possible (typically one weather or production variable). However, the Impact Evaluation Team identified two instances where adding a simple schedule variable improved the model performance. In this case, holiday flags (for a daily model) and days in the month (for a monthly model) were statistically significant variables and improved the models.

3) Overfitted Variable (two cases)

Because this cohort of participants was industrial customers, production data was often one of the primary independent variables used by the Implementation Team. However, some of these production variables had a negative coefficient, indicating that for every unit of production, the energy bill should decrease. This indicates these variables do not have real predictive powers and the variable is overfitting the model, because adding additional units of production should not decrease energy use in reality. In this case, while the variable showed statistical significance, the Impact Evaluation Team removed the production variable.

4) Model Input Adjustment (three cases)

In two cases, the Impact Evaluation Team could not replicate the implementer's original models, and none of the provided models were reasonably close to the program's claimed savings values. In these cases, the Impact Evaluation Team built a new model from the ground up. In one case, the Impact Evaluation Team identified that one participant had initially enrolled six buildings in the program, but after discussing with the owner's representative, the implementer and owner's teams only focused on two buildings. As a result, the Impact Evaluation Team only used the energy use for these two buildings to create a new baseline model.

In the other case, the Implementation Team omitted baseline data from the original model for undocumented reasons. The Impact Evaluation Team tried, wherever possible, to use either a full year or a full two years of data for baseline model creation wherever possible to avoid overrepresentation of certain weather periods in the baseline model generation. After discussing with the owner's representative, the Impact Evaluation Team believed that the additional baseline data should have been included in the baseline period to complete a full 24 months of baseline data.

Finally, one site had a "post" start date that was approximately eight months before the project had enrolled in the program. According to the Implementation Team, this was due to the customer adding a combined heat and power plant at the site just over two months after the model workshop date, and the impacts of that plant made it nearly impossible to isolate program savings using the IPMVP approach. The Impact Evaluation Team extrapolated the data to a full year, because the savings did not appear to be particularly weather sensitive.

5) Alternative Non-Routine Adjustment (one case)

   In one case, the Implementation Team identified a non-routine event (a new building coming online) that needed adjustment. The Impact Evaluation Team used a different approach (pre-post model) than the implementers for adjusting for this non-routine event, following procedures laid out in *IPMVP Application Guide on Non-Routine Events & Adjustments*.

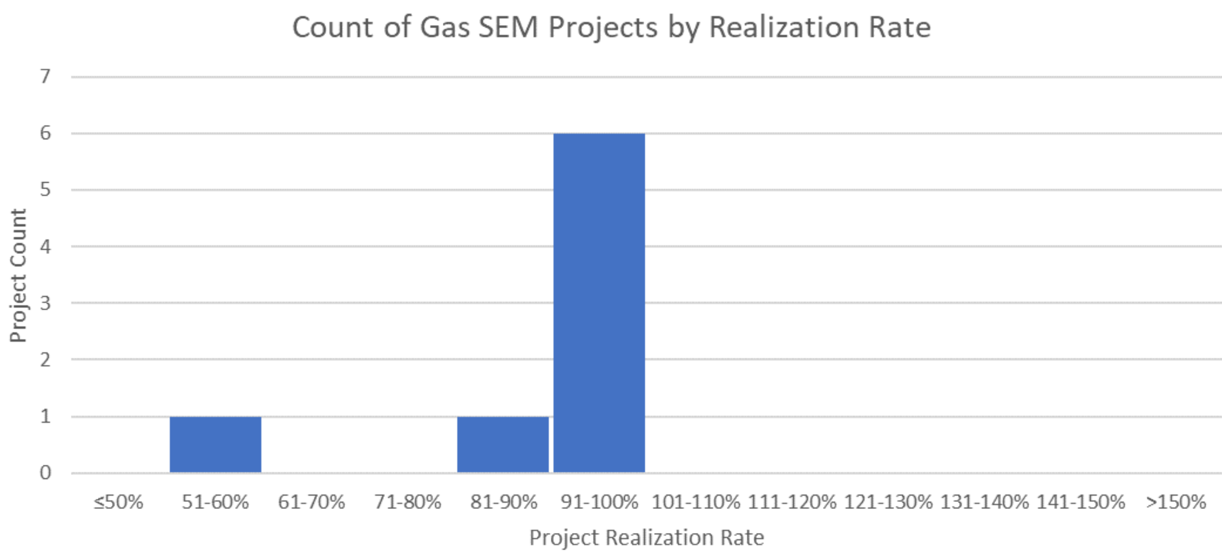
6) IPMVP Option A Alternative (one case)

   In one case, the Impact Evaluation Team believed the regression model did not sufficiently meet our calibration criteria, and opted to use the IPMVP Option A approach to verify savings.

SEM Natural Gas Savings

No WEC projects claimed natural gas savings; therefore this section only applies to non-WEC SEM projects. The Impact Evaluation Team adjusted three of the eight SEM projects for various reasons. However, overall, these adjustments largely offset as shown in Figure 3, leaving the program with an overall realization rate of 101%. These results are not immediately intuitive. The realization rate is above 100% despite no projects with realization rates above 100% because two sites claimed negative savings where the Impact Evaluation Team adjusted the savings upwards (towards zero). As a result, the individual projects have a less than 100% realization rate, but when aggregated with the rest of the program makes the verified savings value in the numerator larger, which therefore increases the realization rate.

Figure 3. Natural Gas SEM Project Realization Rate Distribution



The adjustments on these natural gas projects were similar to the electric adjustments:

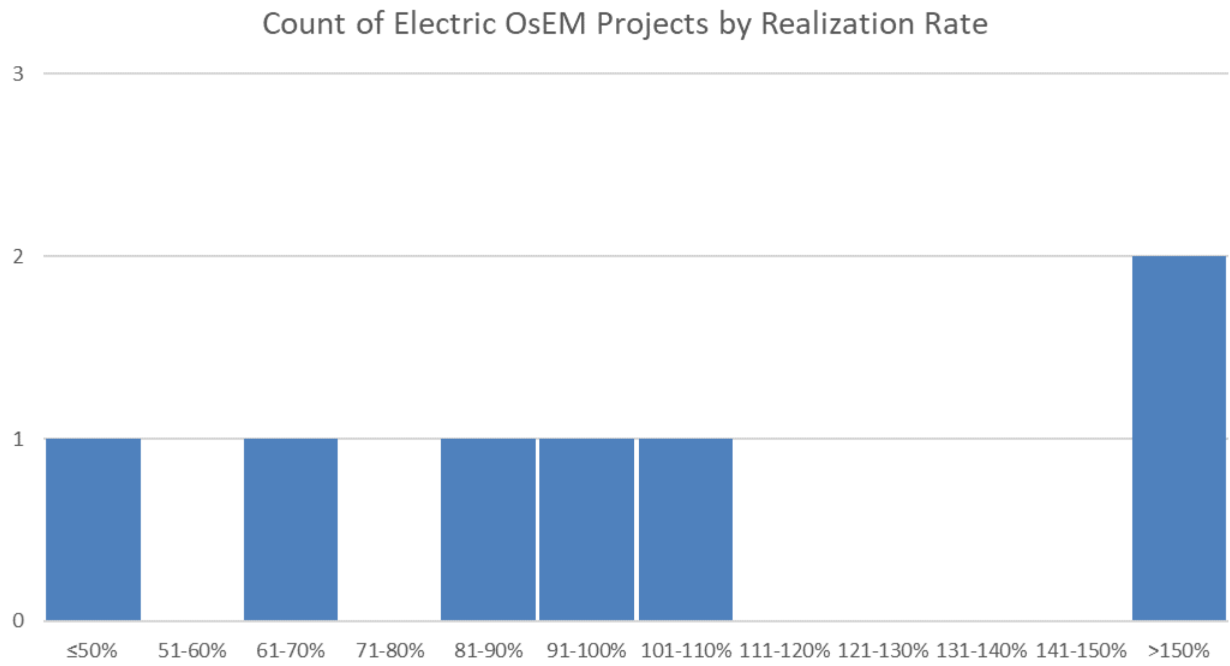
- HDD were used in lieu of average temperature (two cases)
- Production data where natural gas use was part of the production process, but had a negative coefficient was removed (one case)

Overall, the implementers' models were stronger for natural gas usage and therefore had fewer areas where model adjustments would lead to significant improvements of the model fits.

OsEM

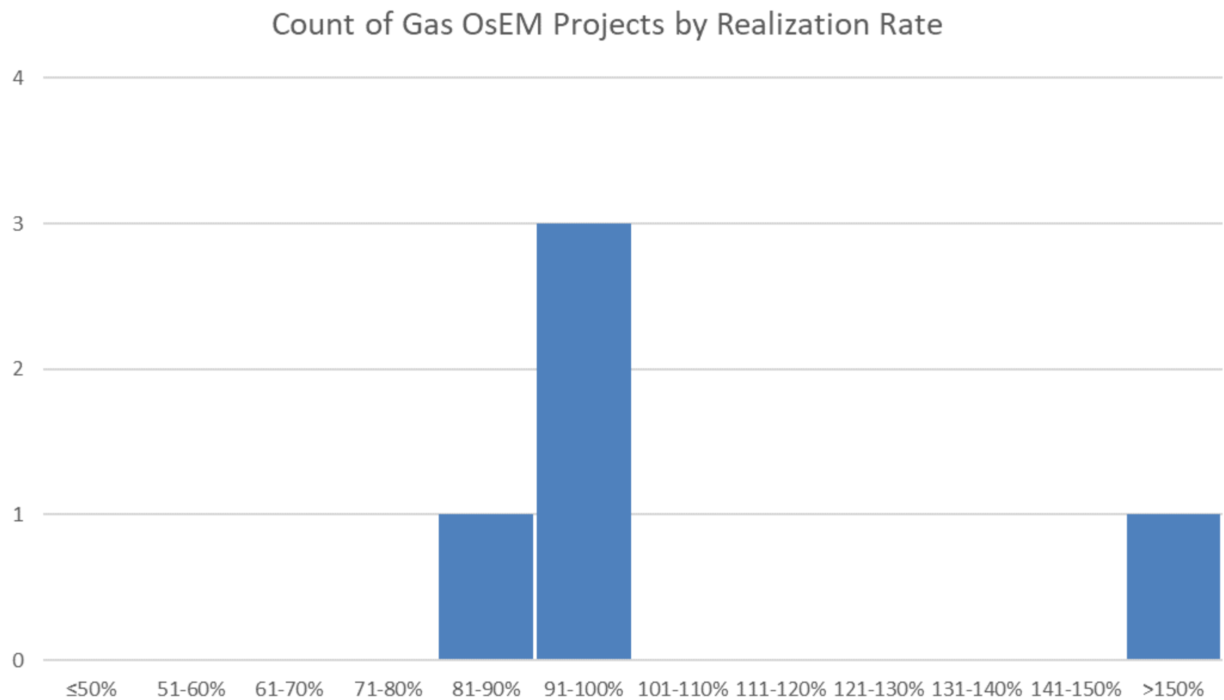
The Impact Evaluation Team adjusted savings calculations for six of the seven electric OsEM projects, and three of the six natural gas calculations for various reasons. The two largest adjustments were made on projects where the gross savings were derived in spreadsheet calculations, while the verified gross savings were calculated through IPMVP Option C regressions. In both cases, this resulted in large upwards adjustments, and in both cases the projects were the two largest projects in the program by a significant margin. The individual project level realization rates are shown in Figure 4.

Figure 4: Distribution of Individual OsEM Electric Project Realization Rates



Only five of the seven sampled OsEM projects claimed natural gas savings. The individual project level realization rates are shown in Figure 5.

Figure 5. Natural Gas OsEM Projects Realization Rate Distribution



The Impact Evaluation Team made several different types of adjustment on OsEM calculations. The impact of these adjustments are shown in Figure 6 and

Figure 7.

Figure 6: Impact on OsEM Electric Verified Savings

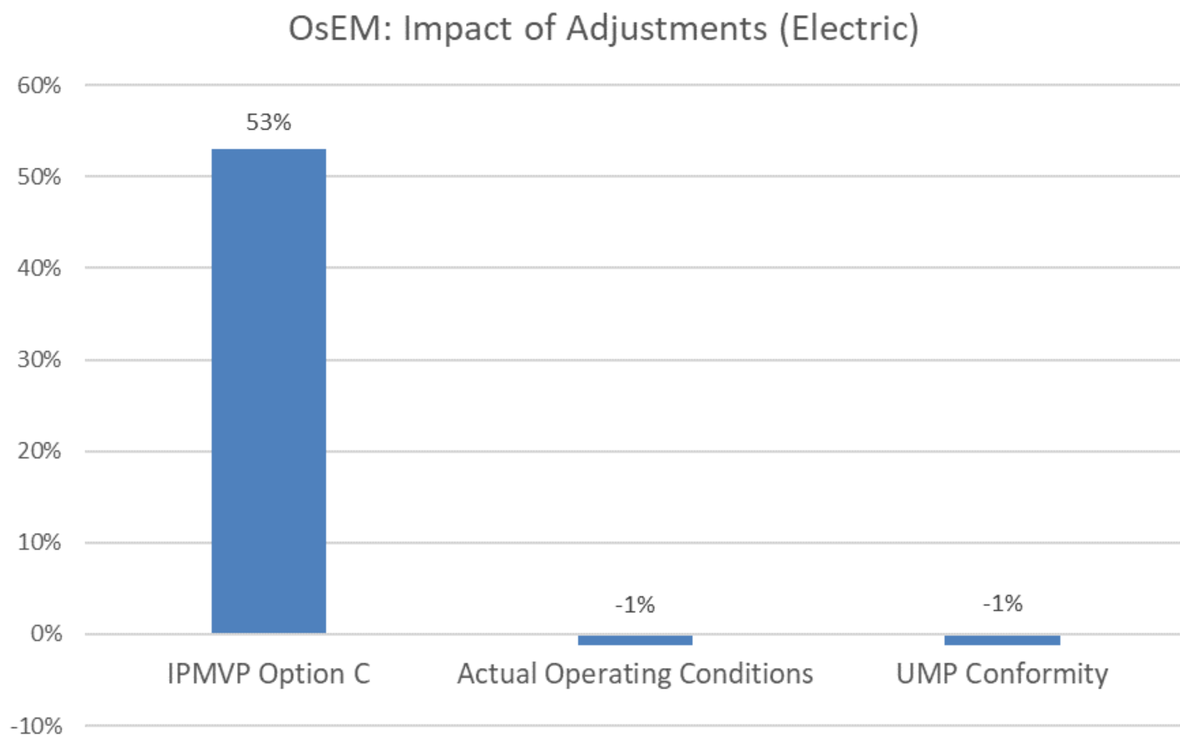
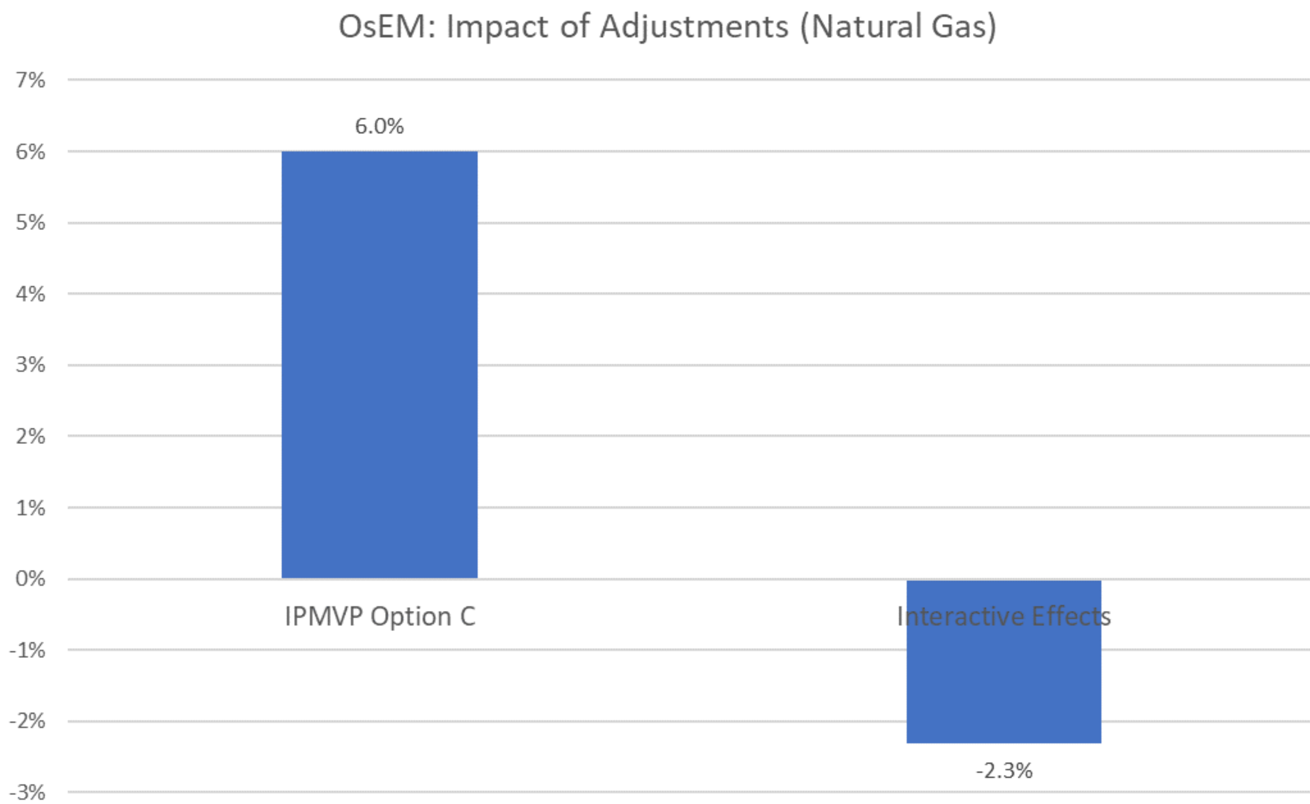


Figure 7: Impact on OsEM Natural Gas Verified Savings



The four different type of adjustments were:

- The three projects (two electric, one natural gas) evaluated with IPMVP Option C had significant upwards savings adjustments. This suggests that the on-site energy managers may have had a more considerable impact than what they had been able to quantify. However, this is just an item to watch in future evaluations, because three data points isn't enough to draw any meaningful conclusions.
- Savings were adjusted to follow the methodology from NREL's Uniform Methods Project.[5]
- Lighting projects did not typically include HVAC interactive effects, so the Impact Evaluation Team adjusted the analysis to follow the methodology outlined by the New York Technical Resource Manual.[6]
- Several calculations were modified to match actual operating conditions (e.g., hours of operations, flow) were found to differ from the ex ante calculations.

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[5] https://www.nrel.gov/docs/fy18osti/70472.pdf

[6] https://www3.dps.ny.gov/W/PSCWeb.nsf/All/72C23DECFF52920A85257F1100671BDD

Disadvantaged Communities

NYSERDA was interested in the program's impact and whether there were differences between sites enrolled in the interim[7] disadvantaged communities (DAC) compared to sites located outside of interim DACs. The Impact Evaluation Team split the results between DAC and non-DAC participating sites, as shown in Table 11 and Table 12. Overall, there appeared to be no clear trend in the amount of savings or the realization rates of DAC and non-DAC sites by program and fuel. While the difference in total realization rates for projects inside and outside DACs is statistically significant (at the 90/10 confidence/precision level) for both electric and natural gas savings, the conflicting direction of the results and the small sample sizes suggest that it is too early to assess any systemic differences between the two groups. The Impact Evaluation Team will continue to explore this in future phases of this work.

Table 11. Program-Level Verified Electric (kWh) Gross Savings Realization Rate by Disadvantaged Community Status

	In DAC	Outside of DAC	Total
SEM Cohort	112%	83%	104%
WEC	100%	106%	101%
SEM Subtotal	*111%*	*84%*	*103%*
OsEM	176%	135%	151%
Total	**134%**	**121%**	**128%**

[7] Interim definition based upon information received from NYSERDA April 2021

Table 12. Program-Level Verified Natural Gas (MMBtu) Gross Savings Realization Rate by Disadvantaged Community Status

	In DAC	Outside of DAC	Total
SEM Cohort	100%	101%	101%
WEC	--	--	--
SEM Subtotal	100%	101%	101%
OsEM	94%	108%	104%
Total	**93%**	**105%**	**103%**

Recommendations

Overall, the Impact Evaluation Team finds that the programs successfully identified and implemented new energy efficiency opportunities at participating sites. Site participants typically reported overall positive feedback about the programs when asked generally for their thoughts on the program.

The Impact Evaluation Team recognizes that these were early participants and did notice that later projects did appear to show signs that some of these recommendations were already being instituted.

SEM

While the Impact Evaluation Team found the SEM program's verified gross savings realization rate to be 101%, there was significant variance in the overall project level realization rates. To help reduce variance and potential risk in future projects, the Impact Evaluation Team has a few recommendations for the program implementors.

1. **Continue to refine and improve modeling best practices and procedures and use them consistently**.
    a. Where possible, identify and track dates (start and end) of any NREs. This may require more frequent model updates during the participation periods. The Impact Evaluation Team identified several potential non-routine events in the data used for this program. However, site contacts could not identify or pin down these events due to the significant time lapse between the event and this evaluation, so the Impact Evaluation Team did not make NRAs. The Impact Evaluation Team wants to note that some of those NREs appeared to have a significant, often negative, impact on the site's energy consumption and verified gross savings values. Had the

Implementation Team better tracked and documented NREs, the verified gross savings likely would have been higher.

b. Include additional energy driver variables where they make sense.

   i. Heating degree days (HDD) and cooling degree days (CDD) often are improvements over average temperature. HDD and CDD better model the non-linear effects of heating and cooling systems.

   ii. Watch for scheduling variables (e.g., holidays) that can make a large impact on model accuracy.

c. Watch for independent variables that:

   i. Extend beyond 10% (or three standard deviations) of the max/min values seen in the baseline period. These values are generally not considered valid in the post-period.[8]

   ii. Meet statistical thresholds but don't have fundamentally correct underpinnings (e.g., production variables with negative coefficients)

d. Natural gas and electric models should cover the same periods unless there is a good reason they cannot. The Impact Evaluation Team suggests documenting reasons for different natural gas and electric model periods.

   i. The program should claim one year of savings starting after the participants modeling workshop.

e. **NYSERDA Recommendation Response:** Accepted. In the current SEM program, all participants will not be undergoing energymodeling. Further, tracking NREs will not be possible within the scope of the program. However, where possible, the program will continue to refine and improve modeling practices per the specific list of recommendations provided.

2. **Some improvements to model tracking and documentation would help improve the evaluation process.**

   a. Models kept on file should match the claimed savings – several models were updated, but these models were slightly different than what was provided.

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[8] Bonneville Power Association - MT&R Guidelines Rev 9.0, Page 18 (https://www.bpa.gov/EE/Policy/IManual/Documents/MTR-Reference-Guide-Rev9.pdf)

b. Where possible, track dates of large project implementations to explain model CUSUM slope changes.

c. **NYSERDA Recommendation Response:** Accepted. In the current SEM program offering, all participants will not be undergoing energy modeling. However, where possible, the program will attempt to improve model tracking and documentation.

3. **As the program shifts to commercial customers, consider, where possible, aligning the treasure hunts with cooling seasons and a heating season targeted mini-hunt (or vice versa).** This cycle's treasure hunts occurred in October and November when the heating and cooling systems were likely to be operating at their lowest levels. The Impact Evaluation Team does not believe this substantially impacted the sites evaluated for this report. These were industrial sites with more uniform energy consumption patterns around production than the weather.

   a. **NYSERDA Recommendation Response:** Pending. SEM is exploring the possibility of treasure hunts aligned with heating and cooling seasons.

OsEM

Overall, the Impact Evaluation Team found the OsEM program to have a high realization rate. This is partially because the largest projects verified with IPMVP Option C showed significantly more savings at the sites than claimed.

The Impact Evaluation Team has the following recommendation:

1. **Although it will add some additional burden on the program participants, the Impact Evaluation Team recommends better data collection on baseline conditions (e.g., leak data), to provide more confidence in results.**

   There were many projects lacking documentation of the claimed measure. For instance, several measures included a simple statement indicating the calculation was based off spot measurements, and the only documentation was a comment in the cell stating that's where the value came from. A photograph of the spot metering or short-term meter logging would provide better documentation and higher confidence in the savings. Once the existing conditions have been changed, through leak remediation or system reconfiguration, the baseline conditions are lost and it is nearly impossible to judge the true performance of the measure.

a. **NYSERDA Recommendation Response:** Accepted. The program will recommend OsEMs collect comprehensive data on baseline conditions, but will not make it a requirement due to the burden it would put on them.

The Impact Evaluation Team also identified a barrier for On-Site Managers while conducting interviews:

- Several managers mentioned corporate culture and upper leadership challenges as being primary barriers to success. The Impact Evaluation Team believes these energy managers are experienced with identifying and shepherding energy projects, but some may struggle navigating complex organizational and political structures to get the right buy in and leadership necessary to move projects through. Several contacts mentioned this was their biggest challenge in their role.