

Energy Management Practices (Industrial)

2017-2020 Impact Evaluation Phase 2

Executive Summary

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NYSERDA Record of Revision

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Executive Summary

NYSERDA’s Energy Management Practices (EMP) Investment Plan 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). NYSERDA’s Technical Services Investment Plan houses an analogous Commercial OsEM effort. The two industrial programs began enrolling participants in 2017. The OsEM program was expanded in 2017 to serve both commercial and industrial customers. This report summarizes the impact evaluation findings conducted on SEM and OsEM participants that have completed projects since the first impact evaluation, finalized in 2022 (N=23). Commercial OsEM participants are covered in a separate evaluation.

As shown in Table 1, the Impact Evaluation Team found verified gross savings realization rates (VGS RR) of 148% for Industrial SEM electric savings for the second cohort of participants. The Industrial OsEM program achieved an electric VGS RR of 97%. Together, the Impact Evaluation Team found the verified gross savings realization rate of 100% for the combined industrial EMP programs in the second phase of the evaluation. 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 for Phase 2 Projects

	Gross Savings (kWh)	Verified Gross Savings (kWh)	Savings Weighted VGS RR	Verified % Savings Relative to Baseline	Relative Precision (90% Confidence)
Industrial SEM (Non-WEC)	1,391,282	2,579,528	185%	3.7%	N/A, Census
Industrial SEM (WEC)	1,205,393	1,254,803	104%	4.9%	N/A, Census
<i>Industrial SEM Subtotal</i>	<i>2,596,675</i>	<i>3,834,331</i>	148%	4.0%	<i>N/A, Census</i>
Industrial OsEM	41,501,020	40,083,879	97%	6.4%	2.8%
Industrial EMP Total	44,097,695	43,918,210	100%	6.1%	2.7%

The programs achieved somewhat higher realization rates for the natural gas savings for the combined Industrial EMP programs, with the VGS RR of 121% as shown in Table 2. In addition to electric and natural gas savings, some projects also achieved other fuel savings. However, only a small number of projects realized these savings, limiting the usefulness of these results when extrapolating to other projects. Overall, the NYSERDA EMP

initiative resulted in four industrial OsEM projects with fuel oil or diesel savings, and one industrial OsEM project with steam savings. Realization rates for these fuels were 92% for fuel oil and diesel and 91% for steam.

Table 2. Total Annualized Natural Gas Energy Savings for Phase 2 Projects

	Gross Savings (MMBtu)	Verified Gross Savings (MMBtu)	Savings Weighted VGS RR	Verified % Savings Relative to Baseline	Relative Precision (90% Confidence)
Industrial SEM (Non-WEC)	58,910	95,472	162%	0.5%	N/A, Census
Industrial SEM (WEC)	--	--	--	--	--
<i>Industrial SEM Subtotal</i>	<i>58,910</i>	<i>95,472</i>	<i>162%</i>	<i>0.5%</i>	<i>N/A, Census</i>
Industrial OsEM	287,346	322,926	112%	16.4%	8.6%
Industrial EMP Total	346,256	418,398	121%	1.9%	6.5%

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 calculated 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 efficiency measures as part of the SEM and OsEM initiatives. Table 3 shows the UEB for each program by fuel type. Note that the UEBs are based on the aggregated projects and savings from this evaluation and the prior evaluation.

Table 3. Aggregated Unit Energy Benefits by Fuel Type

	Energy Savings (kWh)	Natural Gas Savings (MMBtu)
Industrial SEM (Non-WEC)	2,047,925	11,686
Industrial SEM (WEC)	365,215	N/A
<i>Industrial SEM Subtotal</i>	<i>1,300,054</i>	<i>11,686</i>
Industrial OsEM	4,404,590	28,976
Industrial EMP Total	2,541,868	20,948

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 and technical review. However, 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.

Findings and Recommendations

Finding 1: While the Impact Evaluation Team found the SEM program’s verified gross savings realization rate to be high for electric savings (104% for WEC projects and 185% for non-WEC projects), there was significant variance in the overall project level realization rates.

Recommendation: Continue to refine and improve modeling best practices and procedures and use them consistently. Specifically:

- Use only models that can be validated using model fitness tests, such as adjusted R² and Fractional Savings Uncertainty (FSU).
- In general, models with FSU values greater than 50% at the 68% confidence level should not be used, as there is insufficient statistical data to say that the project’s savings were any different than 0. Any such model CUSUM values should be set to 0 savings.
- If a project uses a model that failed all model fitness tests but is used anyway, it would be helpful if the Implementation Team provided a description of what variables were attempted to improve the model and what attempts were made to demonstrate the model, despite failing these statistical tests, was the best that could be reasonably built.

- Where possible, identify and track dates (start and end) of any NREs, large projects, or significant production changes. This may require more frequent model updates during the participation periods.
- Include additional energy driver variables where they make sense. Heating degree days (HDD) and cooling degree days (CDD) often are improvements over average temperature and better model the non-linear effects of heating and cooling systems. Watch for scheduling variables (e.g., holidays) that can make a large impact on model accuracy.

*NYSERDA response to recommendation: **Pending: NYSERDA will consider implementation of these analyses improvements as new sites are added and for selected existing sites.***

Finding 2: In some cases, SEM models used steam consumption or chilled water consumption as an energy driver. However, the steam or chilled water is not the primary driver. Instead, the steam or chilled water consumption is driven by another variable, such as production, weather, or occupancy.

Recommendation 2: SEM models can be improved through correct consideration of primary energy drivers.

*NYSERDA response to recommendation: **Implemented: Sites with steam or chilled water consumption will incorporate additional variables, as needed.***

Finding 3: Three of the Phase 2 SEM participants had existing fossil-fuel on-site generation at their facility. One of these SEM participant sites was removed from the analysis since there was insufficient information to accurately assess direct program benefits.

Recommendation 3: Consider collecting and documenting more information (e.g., measure-specific fuel usage, savings and operational parameters both technical and economical) about sites with fossil-fuel on-site generation. This will help the program better understand the impacts of fossil-fuel on-site generation operation in New York State.

*NYSERDA response to recommendation: **Implemented: Sites with on-site generation or other fuel switching measures will be subject to additional consumption data collection and related fuel usage reporting.***

Finding 4: The Impact Evaluation Team found insufficient documentation or missing savings calculations for some limited measures in OsEM projects.

Recommendation 4: Although it will add some additional burden on the program participants, the Impact Evaluation Team recommends that NYSERDA encourage on-site energy managers to provide complete project documentation and savings calculations. When possible, documentation such as photographs, spot metering or short-term meter logging electronically saved would increase confidence in the reported savings.

*NYSERDA response to recommendation: **Pending.** NYSERDA will consider implementation of these improvements as new sites are added and for selected existing sites.*

Finding 5: The Impact Evaluation Team found inconsistent use of affinity laws for pumps and fans. Some projects did not use them at all, while other used a range of values from 2.5 to 3.

Recommendation 5: OsEM report review should continue to review the affinity exponent for the calculation of energy savings from pumps and fans. When applied to variable speed drives that cause substantial speed reductions on large motors, the difference in savings when using an affinity exponent of 2.5 or 3 can be significant.

*NYSERDA response to recommendation: **Implemented.** Sites with pump or fan measures will receive review for proper affinity exponent application.*