Continuous Energy Improvement Market Evaluation

2019 Final Report

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Acronym List

Acronym	Definition
BAB	Budgets and Benefits
CEE	Consortium for Energy Efficiency
CEF Industrial Chapter	Clean Energy Fund Investment Plan Industrial Chapter
CEI	Continuing Energy Improvement
DIPA	Direct influence participant adoption
MPI	Market progress indicator
MT&R	Monitoring, tracking, and reporting
NOMAD	Naturally occurring market adoption
OsEM	On-site Energy Manager
RTEM	Real-time energy management [formerly referred to as Energy Management Information Systems (EMIS)]
SEM	Strategic Energy Management
UEB	Unit energy benefit

Executive Summary

The Continuous Energy Improvement (CEI) Market Evaluation is a five-year study to monitor the adoption of CEI practices in the industrial sector in New York. The study is designed to run in parallel with NYSERDA's CEI initiative. The Market Evaluation has two primary objectives:

- Measure the rate of CEI adoption by the broader market (exclusive of participants) as a result of both naturally occurring adoption and the CEI initiative activities
- Provide ongoing market characterization to inform program design and implementation

This report presents findings and conclusions from the following research tasks in the CEI Year 3 workplan:

- Nonparticipant survey (n=295)
- Post-program participant interviews (the Market Evaluation Team completed interviews with six of seven post-program OsEM participants and eight of 15 post-program SEM participants)
- Energy consultant interviews (n=23)
- Indirect benefits estimation for OsEM and SEM program activity

Note on Changes to the Nonparticipant Survey Analysis

This Year 3 report intended to measure the change in market adoption of targeted CEI practices from 2017 to 2019.[1] However, due to several factors affecting the analysis, quantitative comparison between the 2017 and 2019 results is not possible. The factors affecting the comparison include the following:

- **Updates to the survey instrument and scoring.** Using the information from the 2017 study, the Team updated the nonparticipant survey to improve question clarity and response rates. Changes included revising question language and response architecture and adjusting scoring algorithms to provide a more balanced measurement across SEM subelements.
- **Changes to self-reported tiers.** The Team developed the survey sampling plan using the number of employees reported by each facility as a proxy for tiers based on annual energy expenditures. The Team collected data on annual energy expenditures during the survey, then updated the tier assignment for each respondent, and post-stratified according to the new distribution across tiers. To facilitate market research interviews that occurred in parallel with the 2019 survey, the Team slightly revised the response architecture for the question used to determine each respondent's energy expenditure and corresponding tier. This revision involved making two Tier 3 response options, one for $0 to $100,000 and the other for $100,000 to $500,000 in annual energy costs. Though the 2019 options align with the 2017 options, a substantially smaller proportion of respondents self-identified as Tier 2 (9% in 2019, compared to 21% in 2017). The magnitude of

[1] Though this is Year 3 of the CEI initiative, that period includes the time to develop, launch, and implement specific programs under the initiative. As a result, during the period covered by this report, the OsEM and SEM programs were only in their second year of implementation, and the RTEM program was still in the launch phase.

the shift suggests that it was due to the change in the response options rather than an actual change in the market.

- **A significant change in the total population, as measured by the InfoGroup dataset.** NYSERDA received an updated database of industrial facilities ahead of the Year 3 Market Evaluation. This dataset had just over 6,300 records, compared to just over 6,900 in the Year 1 dataset. The reason for the difference appears to be the result of data cleaning by InfoGroup since a decline in the manufacturing sector of that magnitude is unlikely.

Because a quantitative comparison was not possible, the Team used qualitative information from the Year 3 research to determine that there was very little change in adoption of CEI practices from 2017 to 2019. This result is not unexpected given the long adoption cycle typical of nonresidential programs and considering that the first participants only completed their engagement with the NYSERDA CEI programs in 2018.

Key Results

Table 1 shows the 2019 level of adoption that the Team measured for each key CEI practice that NYSERDA is monitoring as a market progress indicator (MPI) compared to the 2017 baseline value and 2019 targets. Nonparticipant adoption of OsEMs, at 22%, exceeded the 2019 target of 16.5%. All other 2019 evaluated values were below target. For CEI adoption in participant and additional facilities owned by participant firms, the total number of post-program participants or additional facilities was below the target for retention or adoption for all indicators except full adoption of SEM by additional facilities. Nonparticipant adoption of monitoring and tracking systems was below the 2017 baseline, probably as a result of changes to the survey instruments or other factors affecting nonparticipant adoption analysis since 2017.

Table 1. Clean Energy Fund Industrial Chapter Market Progress Indicators

Ref.	Indicators	Referenced Subpopulation	Baseline (2017)	2019 Cumulative		Precision at 90% Conf.
				Target	Actual	
OsEM						
1	Number of energy managers hired/retained within pilot facilities	OsEM participants	0	20	5 of 7[a]	N/A
2	Number of industrial plants (beyond pilot participants) adopting OsEM role	Tier 1 and Tier 2 nonparticipant facilities (including additional facilities of participant firms)	110 facilities	30-45 increase	218 facilities	N/A
3	Percentage of the addressable market participating in strategy; nonparticipant industrial sites hiring an OsEM	Nonparticipant facilities (excluding additional facilities of participant firms)	15% (1,021)	16.5% (1.5% increase	22% (1,386)	±4%[c]
SEM						
4	Number of energy teams maintained beyond the cohort (indicating executive support for SEM)	SEM participants	0	27	7 of 15[a]	N/A
5	Number of industrial facilities (beyond pilot participants) that have adopted SEM	Additional facilities owned by participant firms	0	11	0[b] of 17	N/A
6	Number of facilities that have adopted a system for monitoring, tracking, and making decisions based on their energy use to assist with their SEM activities as a result of this strategy [c]	Nonparticipant facilities (excluding additional facilities of participant firms)	27% (1,886)	28% (1,913)	16% (1,005)	±4%c
RTEM						
7	Number of facility-wide RTEM system deployments as a result of this initiative	RTEM participants and additional facilities owned by participant firms	0	45	N/A	N/A
8	Number of enterprise-wide RTEM system deployments as a result of this initiative	RTEM participant firms	0	4	N/A	N/A
9	Qualified RTEM systems with industrial operational control	Participant facilities using qualified RTEM systems with industrial operational control	0	3-5	N/A	N/A

[a] Values represent the count of adoption based on the participant interviews. Because the Team interviewed only six of seven post-program OsEM facilities and eight of 15 post-program SEM facilities, the actual number of adopting facilities may be higher.

[b] This value includes only those facilities demonstrating full adoption of SEM. Two SEM participants reported extending some SEM practices to other New York facilities in their organizations, but neither reported extending all practices.

[c] The baseline, target, and 2019 evaluated values for Indicator 6 shown in the table reflect all nonparticipant adoption, not adoption that is necessarily a result of NYSERDA activity. Adoption resulting from NYSERDA's market interventions is assessed in the *Indirect Benefits Estimation* section of this report.

Participant Retention and Extension of CEI Practices

The objective of the OsEM and SEM programs is to effect long-term organizational or behavioral change among participants, so that the energy management practices adopted during direct program engagement are continued after participants are no longer in regular contact with program staff. The program is also supposed to facilitate the spread of CEI practice to other facilities that witness the benefits experienced by participants. Given the holistic nature of the changes encouraged through these programs, NYSERDA expects that participants may require additional time following their direct engagement with the program to continue implementing recommended CEI practices, and to spread the concepts to other facilities. The Team interviewed participants who had completed or nearly completed the direct engagement phase of the OsEM or SEM programs. The interviews collected data on the participant facilities' adoption of the

target practices, retention of practices and whether participants extended practices to additional New York facilities owned by the parent companies.

OsEM

Table 2 shows the retention of OsEMs by participant facilities. Of six participant facilities interviewed, five indicated they had retained the OsEM in some form. Of these five participant facilities, two extended the OsEM role to additional facilities in their companies. One participant facility extended the role to two of three additional facilities in New York and was considering applying it to the last one as well. The other extended the OsEM role to two of the largest of its nine additional facilities in New York.

Table 2. Persistence of On-Site Energy Manager Role Following Program Participation

OsEM Status Following Program Participation	Participating Facilities
Retained Role	5
Did Not Retain Role	1
Unknown (not interviewed)	1
Total OsEM Participants	**7**

SEM

To better suit the interview format, the Team condensed the 13 SEM subelements to 10 practices. All 10 practices addressed in the interviews were still in place or being used by the majority of respondents by the end of their initial 12 months of SEM program participation (five or more facilities reported adopting each practice).

All respondents had retained the practices they adopted, and three respondents had adopted additional practices after their initial engagement with the program ended. Three respondents reported they had all 10 practices in place at the time of their interview, making them full SEM adopters. Three other respondents were nearly full adopters, missing only an available budget (two facilities) or a practice of reporting to stakeholders (one facility). Two respondents reported that additional New York facilities owned by their companies had also adopted some SEM practices. Of these two respondents, one had extended most of the 10 SEM practices to three other facilities, and one said three practices had already been adopted by the additional facility before the respondent participated.

Table 3 shows the rate of adoption and retention of 10 SEM practices by the eight SEM participants interviewed.

Table 3. Persistence of SEM Practices Following Program Participation

SEM Practices Adopted by Interview Respondents	Adopted During Program Participation (n=8)	In Place at Time of Interview (Retained) (n=8)
Company energy policy and energy reduction goals	7	8
Budget available for energy management activities	5	6
Designated energy champion	8	8
Staff assigned to energy team	7	7
Assessment of existing energy management practices, assessment (map) of energy use by end-user system	7	7
Maintaining a register of energy improvement opportunities, scheduling and tracking implementation	6	6
Employee training	5	6
Have system for monitoring, tracking, and making decisions based on energy usage	6	6[a]
Regular review of usage performance against goals	8	8
Reporting energy performance to key stakeholders across the organization (facility management, operations, line engineers, accounting, senior management, others)	6	7
Fully adopted SEM (all practices above in place)	**2**	**3**

[a] Five facilities reported they had an energy management information system in place; the Team credited one additional one facility for this practice based on the fact they had a project register and an established practice of reviewing energy performance against goals.

Nonparticipant Adoption

Table 4 shows 2019 nonparticipant adoption of the key CEI practices tracked by NYSERDA's MPIs. Tier 1 facilities showed relatively high adoption rates for most practices, including 54% of Tier 1 facilities that have adopted an OsEM. Full SEM adoption was the least-adopted practice among Tier 1 facilities, with only 7% of facilities qualifying as full adopters. Tier 2 adoption was not statistically different from Tier 1 adoption for any practice, but it was statistically higher than Tier 3 for adoption of monitoring and tracking systems and the company commitment minimum element of SEM.

Table 4. 2019 Nonparticipant Adoption of Key CEI Practices

Key CEI Practice	Tier 1 (n=46)	Tier 2 (n=26)	Tier 3 (n=223)	Overall (n=295)[a]
OsEM	54%[d]	31%	20%[b]	22%
Any Monitoring and Tracking System	35%[d]	35%[d]	14%[b, c]	16%
RTEM System	11%[d]	4%	4%[b]	4%
SEM Minimum Elements[e]				
Company Commitment (2 subelements)	20%[d]	8%[d]	1%[b, c]	2%
Planning and Implementation (7 subelements)	9%[d]	0%	1%[b]	1%
Measuring and Reporting (4 subelements)	24%[d]	8%	4%[b]	5%
Full SEM Adoption (All subelements)	7%	0%	0%	0%

[a] Overall column shows the weighted average of Tier-level results

[b] Indicates statistically significant difference compared to Tier 1.

[c] Indicates statistically significant difference compared to Tier 2

[d] Indicates statistically significant difference compared to Tier 3.

[e] Values shows percentage of facilities that have fully adopted the minimum elements.

Energy Consultant Interviews

The Market Evaluation Team interviewed 23 consultants who participate in NYSERDA's flexible technical assistance program or industrial process efficiency program, and work with industrial clients. These interviews collected information on the consultants' own awareness and understanding of energy management principles, their perspectives on their clients' awareness of energy management principles, and their observations on the OsEM program.

Consultant Awareness of Energy Management

Consultants' responses indicated that they themselves had mixed awareness of energy management systems. Though most consultants (18 of 23) said they were familiar with at least some systems, three of these also made statements that indicated they did not distinguish between energy management and individual energy efficiency projects. None of the consultants interviewed routinely promoted services to help clients implement CEI practices, though a handful had tried to recruit clients for NYSERDA's OsEM program. Four consultants perceived that even if clients were interested in adopting SEM or another CEI system, these clients might not seek technical assistance from outside the company or might seek consultant assistance only for very discrete pieces of the implementation project.

Client (Facility) Awareness of Energy Management

Consultants reported that, with the exception of a few types of clients, facilities had generally low awareness of energy management systems. According to interviewees, international firms, large firms that sold products directly to consumers (such as Pepsi or GM), and facilities with a significant opportunity for energy savings (such as facilities with extensive automation) were all more likely to be aware of or already practicing a continuous improvement system to manage energy usage. Several consultants mentioned that, in general, larger firms were more likely to be aware than smaller firms.

Response to the OsEM Program

With regard to the OsEM program, consultants reported adoption barriers to both clients and consulting firms. For clients, respondents perceived that a lack of specific information about financial benefits made it difficult for facilities to determine whether it was worth their time to participate. (Consultants did not mention case studies available on the NYSERDA website that provide detail on actual costs and energy savings.) In addition, consultants said industrial facilities tended to believe they do not need outside technical assistance or are uncomfortable bringing in an outside consultant to play a management role in the facility. One consultant who focused on smaller firms said such firms did not have enough potential energy cost savings to justify a full-time OsEM position.

For consultants, respondents said it was difficult to find staff with the right level of experience who are also willing to take on the OsEM role. Consultants currently view this position as offering little opportunity for career advancement, detracting from the consultant's ability to work on other projects, and potentially requiring considerable travel to be on the facility site at least 50% of the time. Consulting firms bear an opportunity cost for dedicating one of their senior staff to a single high-intensity project, and several consultants reported they could make more money pursuing other opportunities.

Indirect Benefits Estimation

The Market Evaluation Team estimated the 2019 indirect benefits from direct influence participant adoption (by additional facilities of participant firms) and nonparticipant adoption influenced by NYSERDA. The Team used the participant interviews and the nonparticipant survey to calculate the number of facilities that had adopted either OsEM or SEM due to NYSERDA's program activity but without directly participating in a program. The Team then applied per-unit savings and carbon reduction estimates provided by NYSERDA to the total number of OsEM adopters to estimate the total indirect benefits. In addition, to estimate the indirect benefits from 2018, the Team applied the nonparticipant portion of indirect benefits from 2019.

Table 5 shows the estimated 2018 and 2019 indirect benefits from each program, NYSERDA's total indirect benefits targets for OsEM and SEM and the percentage of those benefits that the programs have achieved to date.

Table 5. Estimated Indirect Benefits Achieved to Date (SEM and OsEM Programs Only)

Indirect Benefits Type	CEI Initiative Program Year			2030 OsEM/ SEM Target	% of Target Achieved
	2018	2019	Cumulative (2018-2019)		
Total MWh Benefits	4,278	8,378	12,657	180,000	7%
Total MMBtu Benefits	42,784	92,784	135,568	2,250,000	6%
Total CO_2e Benefits	4,573	9,445	14,018	219,964	6%

Key Findings and Recommendations

The Market Evaluation Team has made the following conclusions and recommendations for NYSERDA's CEI initiative and the three programs.

Finding 1

Participants' high retention rates and extension of OsEM and SEM practices to additional facilities validates NYSERDA's hypotheses about the value of these practices to end users. The majority of the facilities the Team interviewed about the OsEM and SEM programs retained at least one key practice adopted during their participation. Five of six OsEM participants retained the OsEM role. Three of eight SEM participants adopted all ten SEM practices measures, while an additional three had adopted nine of ten practices. Several participants found the practices sufficiently useful that they extended them to other facilities in their organization. However, the rate of adoption by these additional facilities was lower than the nonparticipant rate of adoption.

Recommendation 1

Disseminating information directly to nonparticipant facilities may be a more effective driver of market transformation than word-of-mouth from participant facilities. NYSERDA should continue to use positive participant experiences to develop detailed case studies and promotional materials. Participants said their primary consideration in maintaining practices or extending them to other facilities was the potential for a return on the investment. Materials should present quantitative details on financial outcomes for participants and highlight participants that extended SEM practices to their other facilities, which shows a high degree of confidence in the approach. To reach a broader audience, NYSERDA should use multiple channels, identified by sector, to distribute case studies and materials. They should also involve organizations viewed as trusted advisors by industry, such as consultants, trade associations, parts suppliers, or business councils, to help generate awareness of the programs and their results. NYSERDA should also consider engaging representatives from participant facilities as trusted messengers to disseminate results.

Finding 2

OsEM participants, as anticipated by NYSERDA, preferred that an internal hire serve as OsEM in a long-term capacity, rather than an outside consultant. Four of five participant facilities that retained the OsEM role did not extend the contract with the consulting firm they worked with during the program, and instead appointed an internal staff person to take over the role. Consultants noted that providing an OsEM presented challenges to their own companies. These challenges include that the OsEM role requires very senior staff, but these staff prefer to work on less time-intensive projects that do not require as much travel. In addition, consultant firms need these staff to engage with numerous clients to build a pipeline of work for their more junior consultants. Both participants and consultants said the OsEM role, to be sustainable, may need to be less time-intensive or be extended over multiple facilities.

Recommendation 2

NYSERDA should consider explicitly requiring a transition from the consultant as OsEM to the internal employee during the consultant's contract period, to ensure the internal hire receives training and mentoring from the consultant, and to help other staff understand that the role is continuing even though the consultant's engagement is ending. For example, consultants may need to specifically integrate staff training activities and incorporate an exit or transition strategy into their scope. With fewer hours needed, the OsEM role would be easier for consulting firms to fill. In addition, ensuring that an internal hire is in place should reassure consultant firms that their engineers would not be poached by the client once the subsidies end (as occurred in one case).

NYSERDA should also consider using marketing materials, including case studies, to raise the profile and awareness of the OsEM role among consultant and engineers.

Finding 3

Both facilities and consultants may need additional training to understand and value all of the SEM subelements. The nonparticipant survey results found that most facilities have adopted some SEM subelements, though only 7% had adopted them all, and few had adopted the practices most indicative of commitment to a continuous improvement management system. Despite taking steps such as expressing a commitment to strategic energy management, identifying an energy manager, and investing in the institutional tools needed to practice CEI, most facilities stopped short of following through on a long-term commitment by not continuing regular meetings, monitoring, reporting, or training. For example, many facilities that completed energy management assessments, energy maps and project plans, failed to adopt performance goals as KPIs, or keep project registers up to date. Some energy consultants also showed a lack of familiarity (or lack of understanding) of the management-oriented characteristics of SEM (as opposed to a series of individual actions or projects).

Recommendation 3

Case studies and other materials used to promote SEM should emphasize the business case of adopting SEM as a holistic management system rather than simply the payback from individual project energy savings. For example, case studies should highlight actions and benefits associated with long-term, ongoing, continuous improvement practices such as additional energy savings from processes participants thought were already optimized, from projects identified after the initial treasure hunt, or from facilities that can definitively report progress against production efficiency targets through ongoing data tracking, analysis, and review. Case studies should highlight benefits beyond energy savings, such as greater market competitiveness, lower maintenance and downtime costs, and improvements in health and safety resulting from improved energy management. Finally, materials should be distributed to consultants and other service providers to industrial facilities as well as to end users.

Finding 4

NYSERDA's CEI programs have not been active long enough to impact the nonparticipant market. The nonparticipant market has shown little change in the level of adoption since Year 1 and virtually no change influenced by NYSERDA program activity. Though changes in the adoption rate since 2017 cannot be precisely quantified because of a revision in the survey methodology, qualitative evidence suggests little to no increase in adoption of CEI practices over the last two years. Energy consultants provided mixed reports on the levels of awareness and demand for energy management services among industrial clients and indicated no clear trend for greater energy management activity over the past two years. Survey results also showed that overall adoption levels are low. Any adoption that has taken place in the nonparticipant market is almost entirely naturally occurring. Since NYSERDA has not yet initiated the information distribution component of the CEI Initiative, this result is not surprising.

Recommendation 4

As noted above, in addition to continuing direct program activity, NYSERDA should focus on disseminating compelling materials about the success of CEI programs through credible messengers acting through multiple channels. Some testing and trial and error may be necessary to identify the best channels of information. NYSERDA should maintain detailed records of all outreach activities, including

distribution of materials to partner organizations, and, to the extent possible, any outreach activities conducted by those partners (such as speaking at trade association meetings, presenting at conferences, reposting materials or linking to NYSERDA's website.

1. Introduction

The CEI Market Evaluation is a five-year study to monitor the adoption of CEI practices in the industrial sector in New York. The study is designed to run in parallel with NYSERDA's CEI initiative. The Market Evaluation has two primary objectives:

- Measure the rate of CEI adoption by the broader market (exclusive of participants), both as a result of naturally occurring adoption and as a result of the CEI initiative activities
- Provide ongoing market characterization to inform program design and implementation

This report presents findings and conclusions from the research conducted by the Market Evaluation Team in 2019, Year 3 of the CEI Market Evaluation.

1.1. Background and Key Terms

In its 2016 CEF Industrial Chapter, NYSERDA proposed a CEI initiative directed to the industrial sector to demonstrate the benefits of CEI and encourage broader adoption. Through this initiative, NYSERDA planned to offer multiple programs that use different approaches to overcome potential obstacles to adoption, such as lack of awareness, lack of resources or necessary skills, and lack of appropriate data collection and measurement tools. As of 2019, three programs are active: On-site Energy Manager (OsEM), Strategic Energy Management (SEM), and Real-Time Energy Management (RTEM).[2]

- NYSERDA's ***OsEM program***, launched in September 2016, is designed to encourage facilities to adopt an energy manager role within their facilities. On-site energy managers (OsEMs) encourage continuous improvement in energy efficiency by identifying, promoting, and supporting implementation of operational, organizational, and behavioral changes in a facility or organization. The program subsidizes the cost of an OsEM—either an internal employee or an outside consultant—for a minimum of 12 months.
- The ***SEM program***, launched in July 2017, establishes cohorts of peer facilities that participate in 12 monthly training sessions with a professional energy coach. Together, facilities work through the steps necessary to implement SEM practices in their own facilities.
- The ***RTEM program***, launched in November 2017, identifies qualified energy management information systems (EMIS) providers and subsidizes the EMIS assessment and installation for participating facilities. The program builds market linkages by connecting EMIS suppliers to interested customers, which helps overcome barriers related to risk, cost, and lack of information.

All three of these programs are intended to effect a long-term change in the behavior of participant firms. The programs guide participants as they develop and implement the new practices and systems necessary to engage in CEI. NYSERDA anticipates that the process to fully implement CEI practices may continue after participants' direct engagement with the program has ended. Participants may achieve energy

[2] Although this is Year 3 of the CEI initiative, this period includes the time to develop, launch, and implement specific programs. As a result, during the period covered by this report, the OsEM and SEM programs were only in their second year of implementation, and the RTEM program was still in the launch phase.

savings only after direct engagement with the program has ended, but once they have begun, participants are expected to continue identifying and implementing new energy savings projects on an on-going basis.

The CEI initiative programs are primarily targeted to facilities with higher energy costs, though NYSERDA is in the process of developing additional programs for smaller facilities. Much of the Market Evaluation research is therefore structured to allow disaggregation by tier of annual energy expenditure. The three tiers used in the Market Evaluation are defined in Table 6.[3]

Table 6. Industrial Market Tier Definitions

Tier	Annual Energy Expenditure	2019 Nonparticipant Population[a]	
		Total	Percentage
Tier 1	Greater than $1 million	270	4%
Tier 2	$500,000 to $1,000,000	235	4%
Tier 3	Less than $500,000	5,782	92%
All Facilities		**6,287**	**100%**

[a] The nonparticipant tier-level populations are based on the nonparticipant survey results. The nonparticipant population does not include approximately 39 participant facilities or 50 additional facilities in New York owned by participant firms. These facilities were analyzed separately.

1.2. Year 3 Research Tasks and Objectives

In Year 3, the Market Evaluation Team's primary research objectives were to assess the level of adoption of key CEI practices in 2019 and to estimate the indirect benefits generated to date by the CEI initiative activities. The Team also conducted a qualitative assessment of changes in the adoption of CEI practices in the nonparticipant market.[4]

To accomplish these objectives, the Team conducted several primary data collection and analysis tasks, briefly described below.

- **Nonparticipant surveys.** NYSERDA's survey partner APPRISE implemented a second wave of the nonparticipant facility phone survey from Year 1, using the revised survey instrument that the Team developed in Year 2. The Team used the survey data to assess the level of adoption of several CEI practices, including OsEM and SEM.

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[3] The Team also analyzed subsector-level data within tiers, using the North American Industry Classification System (NAICS) codes at the three-digit level to define subsectors. Because the Team found very little differentiation by sector, this report does not include results at that level.

[4] The original research timeline called for quantitative analysis of changes in nonparticipant market adoption in Year 3, relative to 2017. However, the Team could not quantify these changes due to adjustments made to the survey instrument in 2018 to improve the quality of data collection. The 2019 survey did provide data to quantitatively assess the 2019 level of adoption. The Team will use this data to quantify changes in the level of nonparticipant adoption in 2021, relative to 2019. The 2019 survey data also included self-report information on respondent actions over the past two years that informed the indirect benefits analysis.

- **Participant interviews.** The Team conducted a first wave of interviews with participants that had completed or nearly completed an initial 12 month engagement with the SEM and OsEM programs. The interviews collected data to determine the rate of adoption and persistence of the practices promoted through each program, and the number of additional facilities from each participating firm that had adopted each practice. The Team also used the interviews to collect general feedback from participants on their program experience.
- **Energy consultant interviews.** The Team conducted a second wave of energy consultant interviews first conducted in Year 1 to gather supplier perspectives on market attitudes toward CEI practices and to estimate the number of consultants providing CEI-related services to customers outside NYSERDA programs. These interviews also informed a qualitative analysis of changes in nonparticipant levels of CEI adoption.
- **Indirect benefits analysis**. The Team used the algorithm developed in Year 2 and primary and secondary data from Year 3 research to estimate the indirect benefits resulting from the CEI initiative to date.

More details on the Team's methodology for conducting each activity and analyzing the results is presented in the *Methodology* section of this report.

2. Market Characterization and Assessment Results

The Market Evaluation Team used primary data collected through the survey with nonparticipants and interviews with participants and energy consultants to assess the level of CEI adoption across the industrial sector in 2019. The Team also evaluated the six market progress indicators (MPIs) listed in the Industrial Chapter of NYSERDA's *Clean Energy Fund Investment Plan* Industrial Chapter (referred to here as the CEF Industrial Chapter).

2.1. Market Progress Indicators

Table 7 shows the CEI market progress indicators, baseline values, and 2019 targets from the 2019 version of the CEF Industrial Chapter and compares the 2019 targets to the 2019 evaluated (actual) values from this study. In collaboration with NYSERDA, the Team identified the subpopulation referenced by each MPI to clarify how it should evaluate each indicator for 2019. Three indicators, relating to adopting RTEM systems, required post-participation interviews with program participants and were not addressed in 2019.

The initiative did not meet targets for total number of facilities retaining an OsEM or for continuing to practice SEM by 2019 (Indicators 1 and 4). The reason was due in large part to lower than expected participation. The total number of facilities that have completed or nearly completed the direct engagement period of the programs (seven for OsEM and 15 for SEM) are below the respective targets. However, a significant number of post-program participant facilities interviewed retained the OsEM role or SEM practices adopted during their participation. For OsEM, the Team interviewed six of the seven post-program facilities and, of these, five continued to use the OsEM role. The Team interviewed eight of the 15 post-program SEM facilities and found that seven continued to maintain an energy team.

Nonparticipant uptake of relevant practices, measured with Indicators 2,3, and 6, was mixed. Nonparticipant adoption of the OsEM role was 22%, well above the target of 16.5%, even considering the margin of error (±4%, at 90% confidence). However, systems for monitoring, tracking, and making decisions based on energy usage are not as widespread as the target, with only 16% reporting using such a system compared to a target of 28%.[5]

Although it appears adoption of OsEMs has increased and adoption of monitoring and tracking systems has declined since 2017, readers should note that 2017 results and 2019 results are not directly comparable due to changes in the survey and population base. The Market Evaluation Team captured qualitative information through the energy consultant interviews that indicated little has changed in the past two years.

[5] The current baseline and target were based on the 2017 Market Evaluation nonparticipant survey, and were likely overstated due to question wording. See ***Factors Impacting Comparison to 2017*** for additional discussion.

Finally, the post-program participant facilities did not own enough additional facilities in the state to achieve the targets for additional facilities (Indicator5). However, several participant facilities did extend either the OsEM role or SEM practices to additional facilities in their organizations.

Table 7. Clean Energy Fund Industrial Chapter Market Progress Indicators

Ref.	Indicators	Referenced Subpopulation	Baseline (2017)	2019 Cumulative		Precision at 90% Conf.
				Target	Actual	
OsEM						
1	Number of energy managers hired/retained within pilot facilities	OsEM participants	0	20	5 of 7[a]	N/A
2	Number of industrial plants (beyond pilot participants) adopting OsEM role	Tier 1 and Tier 2 nonparticipant facilities (including additional facilities of participant firms)	110 facilities	30-45 increase	218 facilities	N/A
3	Percentage of the addressable market participating in strategy; nonparticipant industrial sites hiring an OsEM	Nonparticipant facilities (excluding additional facilities of participant firms)	15% (1,021)	16.5% (1.5% increase)	22% (1,386)	±4%[c]
SEM						
4	Number of energy teams maintained beyond the cohort (indicating executive support for SEM)	SEM participants	0	27	7 of 15[a]	N/A
5	Number of industrial facilities (beyond pilot participants) that have adopted SEM	Additional facilities owned by participant firms	0	11	0[b] of 17	N/A
6	Number of facilities that have adopted a system for monitoring, tracking, and making decisions based on their energy use to assist with their SEM activities as a result of this strategy	Nonparticipant facilities (excluding additional facilities of participant firms)	27% (1,886)[c]	28% (1,913) (1% increase)	16% (1,005)	±4%[c]
RTEM						
7	Number of facility-wide RTEM system deployments as a result of this initiative	RTEM participants and additional facilities owned by participant firms	0	45	N/A	N/A
8	Number of enterprise-wide RTEM system deployments as a result of this initiative	RTEM participant firms	0	4	N/A	N/A
9	Qualified RTEM systems with industrial operational control as a result of this initiative	Participant facilities implementing qualified RTEM systems with industrial operational control	0	3-5	N/A	N/A

[a] Values represent the count of adoption based on the participant interviews. Because the Team interviewed only six of seven post-program OsEM facilities and eight of 15 post-program SEM facilities, the actual number of adopting facilities may be higher.
[b] This value includes only those facilities demonstrating full adoption of SEM. Two SEM participants reported extending some SEM practices to other New York facilities in their organizations, but neither reported extending all practices.
[c] The baseline, target, and 2019 evaluated values for Indicator 6 shown in the table reflect all nonparticipant adoption, not adoption that is necessarily a result of NYSERDA activity. Adoption resulting from NYSERDA's market interventions is assessed in the *Indirect Benefits Estimation* section of this report.

2.2. Market Adoption Overview

Table 8 presents a 2019 market-wide view of the practices identified in the market progress indicators across subpopulations monitored by the Market Evaluation. Participants showed substantially higher adoption of key practices than nonparticipants. Notably, adoption among additional facilities owned by participant firms was equal to or slightly below the nonparticipant adoption level. Given the small sample

of participants, it is not possible to determine the exact reason for the difference, but it may be related to the finding from the participant interviews that the facility with the highest energy expenditures tends to be the participant, which means other facilities in a given firm likely have less opportunity for financial benefit from CEI. The extension of CEI practices from participants to additional facilities may therefore represent penetration into a subset of facilities that would otherwise be less inclined than the nonparticipant market to adopt CEI.

The nonparticipant survey results (discussed in more detail in the *Nonparticipant Adoption* section) indicated that though there is some adoption activity in the nonparticipant market, virtually all is naturally occurring and not influenced by NYSERDA's CEI programs. NYSERDA's limited influence on nonparticipants in 2019 is not surprising since it has only just begun disseminating results from the pilots, part of its market intervention strategy. The CEF Industrial Chapter indicates that NYSERDA intends to complement the program activity with widespread dissemination of detailed case studies and other materials based on participant experiences. To date, NYSERDA has developed promoted several case studies for OsEM and SEM. Promotion includes posting the case studies on its website, as well as including the case studies in presentations, and referencing the case studies on conference calls to relevant audiences.

Table 8. 2019 Market-Wide Adoption

CEI Market Indicator Practices	Participant Facilities		Additional Facilities from Participant Firms		Nonparticipant Facilities[a]	2019 Total Market (%)
	OsEM	SEM	OsEM	SEM		
(n)[b]	**7**	**15**	**21**	**17**	**6,287**	**6,373**
OsEM						
Has hired or retained on-site Energy Manager (post-program)	71%	N/A	19%	N/A	22%	22%
SEM						
Has active energy team	N/A	47%	N/A	18%	27%	27%
Has system for monitoring and tracking	N/A	40%	N/A	18%	16%	16%
Has fully adopted SEM	N/A	20%	N/A	0%	0%	0%
RTEM						
Has had an RTEM system assessment	N/A	N/A	N/A	N/A	9%	9%
Has RTEM system in place	N/A	33%	N/A	6%	4%	4%

[a] Percentages have absolute precision of ±4% at 90% confidence.
[b] Data on participant facilities and additional facilities of participant firms is from the participant interviews. Data on nonparti cipant facilities is from the 2019 nonparticipant survey. Sixteen facilities that are currently active participants, and 10 facilities that are owned by these active participant companies, are excluded from the subpopulation totals (n).

2.3. Participant Impacts

The Market Evaluation Team conducted in-depth telephone interviews with representatives of six of seven facilities that completed participation in OsEM and eight of 15 facilities that completed participation in SEM. The Team gathered detailed feedback on participants' experience and satisfaction with the programs. The Team also used information from the interviews to estimate the persistence of

program practices following participation (or at the end of participation, for a few respondents that had not quite finished at the time of the interviews) and to identify the number of additional facilities owned by the participant companies that had also adopted energy best use practices based on the participant facility's experience.

2.3.1. OsEM

OsEM Retention. The Team interviewed representatives from six facilities that participated in OsEM and asked if they had retained the OsEM from the program or had hired or assigned internal staff to serve this role. As shown in Table 9, the majority retained the OsEM role. One did not retain the role, and the status for one facility, not interviewed, is unknown.

Table 9. Persistence of On-Site Energy Manager Role Following Program Participation

OsEM Status Following Program Participation	Participating Facilities
Retained role	5
Did not retain role	1
Unknown (not interviewed)	1
Total OsEM Participants	**7**

Of the five facilities that retained the OsEM, two retained the same consultant they had hired during their program participation: one facility hired its consultant as a full-time employee and the other extended the contract at the participating facility and expanded the role to an additional facility in New York. The three other facilities assigned the OsEM tasks the consultant had performed to existing internal staff to varying degrees (none reported hiring additional staff for this role). All five respondents reported having realized financial benefits from their participation in OsEM, which was further demonstrated by the fact their companies chose to maintain the role.

Only one facility did not retain its consultant or assign OsEM roles to other staff following its program participation. This respondent reported that most of the projects scoped by the firm's OsEM consultant did not meet corporate payback requirements and that any savings realized from completed projects were offset by the cost of participating in the program. Thus, for this facility, participating in OsEM had a negligible financial impact.

Following participation in OsEM, only the respondent whose firm hired its OsEM consultant as a full-time employee reported continuing to devote as much time to OsEM activities (40 hours per week). Another respondent reported that OsEM activities following the program dropped from 20 hours a week to six (but also reported that this might not be enough time to complete the necessary work). A third respondent reported going from 40 hours of staff time per week to 16 to 24 hours.

Additional Facility Adoption. Of the six representatives of OsEM facilities interviewed, two had initiated the OsEM role at some of their additional facilities located in New York. One respondent added an OsEM role at two of three other New York facilities (one Tier 1 and one Tier 2) and was considering adopting OsEM at a fourth New York facility. The other participant adopted OsEM practices at two of nine other facilities in New York (both Tier 1). The six participant facilities interviewed had 21 additional facilities in the state, and they extended the OsEM role to four facilities (Table 10). The one participant

who did not respond to interview requests had no additional facilities in New York so could not have extended OsEM to any other facilities in the state.[6]

Table 10. Adoption of On-Site Energy Manager Roles at Participants' Additional Facilities

Participant Facility Status	Participating Facilities	Additional Facilities in New York	Additional Facilities Adopting SEM Practices
Participants that extended OsEM to additional facilities	2	12	4
Participants that did not extend OsEM approach	3	9	0
Participants with no additional facilities in New York	1	0	0
Participant not interviewed	1	0	0
Totals for OsEM Participants	**7**	**21**	**4**

Respondents generally reported that the OsEM participating facility was their New York facility with the highest, or among the highest, energy use. Similarly, the two respondents who adopted OsEM at additional facilities prioritized the ones with higher energy use than their smaller facilities. The three respondents from facilities that did not extend OsEM to additional facilities all said lower energy usage, and less potential for financial benefit, at their other facilities was an obstacle. Two respondents also said they did not adopt OsEM at additional facilities because those facilities were newer buildings so respondents perceived they were already highly efficient.

Customer Experience. All but one respondent expressed high satisfaction with OsEM. These respondents highlighted the expertise of their OsEM consultant, the benefits of the education and information they received, and the financial advantages of energy savings and salaries subsidized by the program. One respondent gave a rating of moderate satisfaction, saying the firm did not realize a financial benefit from participation and expressing disappointment that the OsEM consultant was not able to fully scope some projects without assistance from other consultants.

Respondents offered these suggestions to improve OsEM:

- Perform an energy audit prior to enrollment, which would be useful to quantify the potential value of an OsEM to the facility (2 respondents).
- [Increase available subsidy to] extend the participation period past 18 months if the OsEM is still engaged in ongoing projects at that time (1 respondent).[7]

Two respondents were so satisfied with their consultant OsEMs that they pursued hiring them internally: one hired its OsEM consultant as a full-time employee, while a second was unsuccessful in its attempt to get its OsEM consultant to apply for a job with the firm.

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[6] The Team determined the number of additional facilities in New York for each participating firm through a combination of the participant interviews, online searches, and review of the InfoGroup database.

[7] The latest OsEM solicitation allowed for up to 4 years participation (as long as total cost-share subsidy remains under the cap of $200,000).

2.3.2. SEM

SEM Persistence. The Team interviewed representatives from eight facilities that participated in SEM and asked them which SEM practices they followed during and after program participation. Table 11 shows each of the 10 SEM practices addressed in the interview, and the number of facilities that reported beginning the practice during their engagement in the training portion of the program, and the number of facilities that had adopted the practice by the tie of the interview. [8]

Two facilities had fully adopted SEM during their participation in the SEM cohort, and were still actively employing all ten practices at the time of the interview. Of the participant facilities that did not fully adopt SEM during their program participation, three adopted an additional SEM practice following the participation period (one adopted an energy management budget, one adopted employee training, and one reported energy performance to stakeholders). For one of these facilities, this additional practice resulted in fully adopting all 10 SEM practices.

None of the participants interviewed reported having stopped any SEM practice they had adopted during their program participation. Overall, three of eight facilities interviewed had fully adopted SEM, and an additional three had adopted nine of the 10 categories, missing either an available budget (two facilities) or reporting (one facility).

Table 11. Persistence of SEM Practices Following Program Participation

SEM Practices Adopted by Interview Respondents	Adopted During Program Participation (n=8)	In Place at Time of Interview (Retained) (n=8)
Company energy policy and energy reduction goals	7	8
Budget available for energy management activities	5	6
Designated energy champion	8	8
Staff assigned to energy team	7	7
Assessment of existing energy management practices, assessment (map) of energy use by end-user system	7	7
Maintaining a register of energy improvement opportunities, scheduling and tracking implementation	6	6
Employee training	5	6
Have system for monitoring, tracking, and making decisions based on energy usage	5	6[a]
Regular review of usage performance against goals	8	8
Reporting energy performance to key stakeholders across the organization (facility management, operations, line engineers, accounting, senior management, others)	6	7
Fully adopted SEM (all practices above in place)	**2**	**3**

[a]Five facilities reported they had an energy management information system in place; the Team credited one additional one facility for this practice based on the fact they had a project register and an established practice of reviewing energy performance against goals

[8] The Team consolidated the list of SEM practices from 13 to 10 to better fit the format of the in-depth interview.

Additional Facility Adoption. Of the eight representatives of SEM facilities the Team interviewed, two had extended some SEM practices to other facilities in their organizations located in New York. One said most of the SEM practices addressed in the interview had been extended to three (all Tier 3) of their five other facilities in New York. The second respondent reported that the firm's only other facility in New York (Tier 2) was already employing some of the SEM practices at the time the respondent's facility began the program. In total, the eight participating facilities interviewed had 15 additional facilities in New York, and SEM practices were extended to four of these facilities.

Table 12 shows the practices employed by the four other facilities in these two respondents' firms. None of the four facilities were employing all ten practices.

Table 12. Adoption of SEM Practices by Participants' Additional Facilities

SEM Practice	Respondent 1 (3 Facilities)	Respondent 2 (1 Facility)
Policy and usage goals	Adopted	Adopted, before program
Staff assigned to energy team, or as energy champion	Adopted	Not adopted
Assessments of existing energy management practices, assessment (map) of energy use by end-user system	Adopted	Not adopted
Maintaining a register of energy improvement opportunities, and scheduling and tracking implementation	Adopted	Not adopted
Employee training	Adopted	Not adopted
Energy management software	Not adopted	Adopted, before program
Regular review of performance against goals	Adopted	Adopted, before program
Reporting energy performance to key stakeholders across the organization (facility management, operations, line engineers, accounting, senior management, etc.)	Not adopted	Adopted, before program

Customer Experience. Six of the eight interview respondents expressed high satisfaction with the SEM program, often highlighting the energy models, the "treasure hunt" for projects with potential savings, the program staff expertise, and the face-to-face interactions with staff from peer facilities as the most valuable aspects of the program experience. Of the two respondents who were less satisfied, one was the facility that already had the most SEM practices in place prior to the program (and that adopted the fewest practices during the program). This respondent said the program content did not meet the firm's expectations, was too high-level to implement, and did not introduce enough new practices. The other respondent found the program experience personally valuable but expressed frustration that more staff in the firm were not receptive to adopting SEM practices.

Respondents offered these suggestions to improve the program:

- Reduce the required time for traveling to attend meetings (4 respondents)
- Offer a webinar option to mitigate travel concerns (2 respondents)
- Hold more of the meetings closer to the participating facilities' locations (2 respondents).
- Make program materials available in electronic format so that participants could more easily share those materials with their coworkers (1 respondent).

2.4. Nonparticipant Adoption

The Team conducted a statewide phone survey of manager-level contacts at industrial manufacturing facilities to collect data on the penetration of the key CEI practices and behaviors, including the CEI components that NYSERDA uses to track market progress (see Table 7). The Team's analysis focused on differences across energy expenditure tiers, since a facility's total energy expense is expected to be a major factor influencing adoption. In this section, the Team also discusses the qualitative indications of nonparticipant adoption in 2019 compared to 2017 and the specific changes in implementing the survey that make it impossible to quantify these changes in this evaluation.

2.4.1. OsEM Adoption

Nonparticipant adoption of OsEMs is tracked as Indicators 2 and 3 (Table 7 above). NYSERDA's OsEM program requires that the OsEM is an industrial energy expert, stationed on the site 20 to 40 hours per week and dedicated to championing the organizational behaviors and practices needed to continuously improve processes and optimize energy efficiency. To assess whether facilities had adopted the OsEM role, the Team asked respondents if they had assigned responsibility for energy management to an individual (either alone or as the leader of a team) and whether that individual was stationed on site. Facilities that had assigned responsibility to an individual who was stationed at the facility are considered to have adopted OsEM.

Table 13 shows nonparticipant OsEM adoption by tier and overall in 2019. The OsEM role was most common among Tier 1 facilities, with 54% adoption, but all tiers showed some adoption of this role.

Table 13. Nonparticipant OsEM Adoption in 2019

Tier	2019
Tier 1 (n=46)	54%[d]
Tier 2 (n=26)	31%
Tier 3 (n=223)	20%[b]
Overall (n=295)[a]	**22%**

[a] Overall is the weighted average of Tier-level results

[b] Indicates statistically significant difference compared to Tier 1.

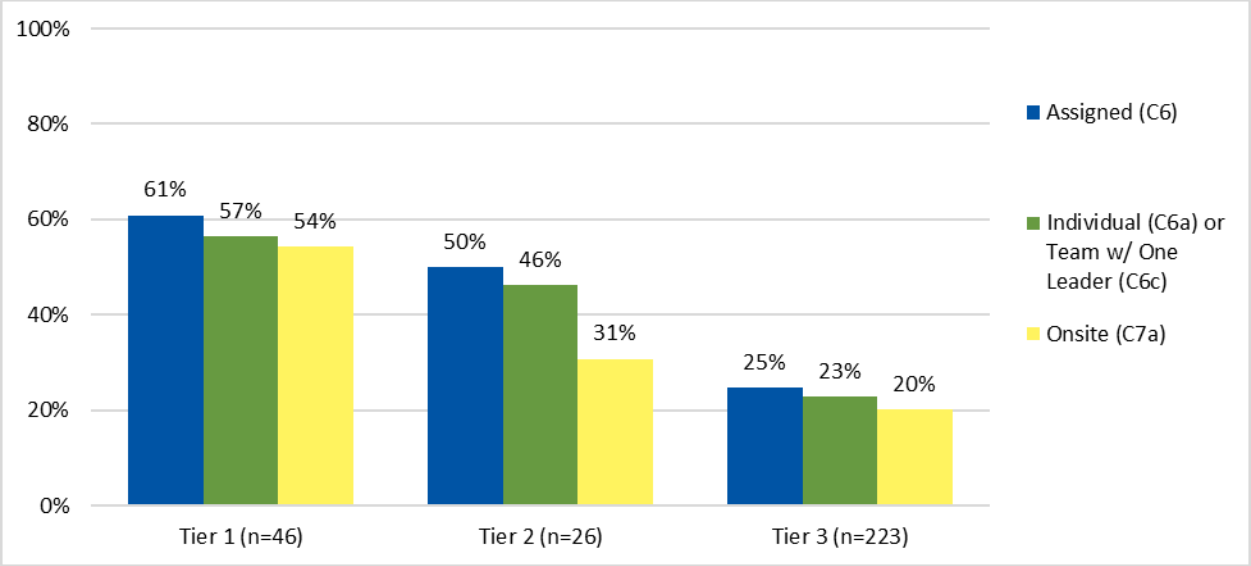
[c] Indicates statistically significant difference compared to Tier 2 (if applicable).

[d] Indicates statistically significant difference compared to Tier 3.

Source: Year 3 survey questions C6, C6a, C6c, and C7a.

Figure 1 shows the percentage of respondents meeting each of the separate criteria for OsEM adoption: assigning responsibility for energy management, designating an individual as energy manager or energy team lead, and having that individual stationed at the facility. Tier 1 facilities were the most likely to have met each of these requirements, followed by Tier 2 and then Tier 3. Across all tiers, almost all facilities that meet the first criterion (assigning responsibility for energy management) also met the second and third criteria by designating an individual as energy manager or energy team lead, and having that person work on site.

Figure 1. Adoption of Components of an OsEM Role



Source: Year 3 Nonparticipant Survey questions C6, C6a, C6c, and C7a.
Note: All Tier 1 values are statistically significantly greater than Tier 3 values.

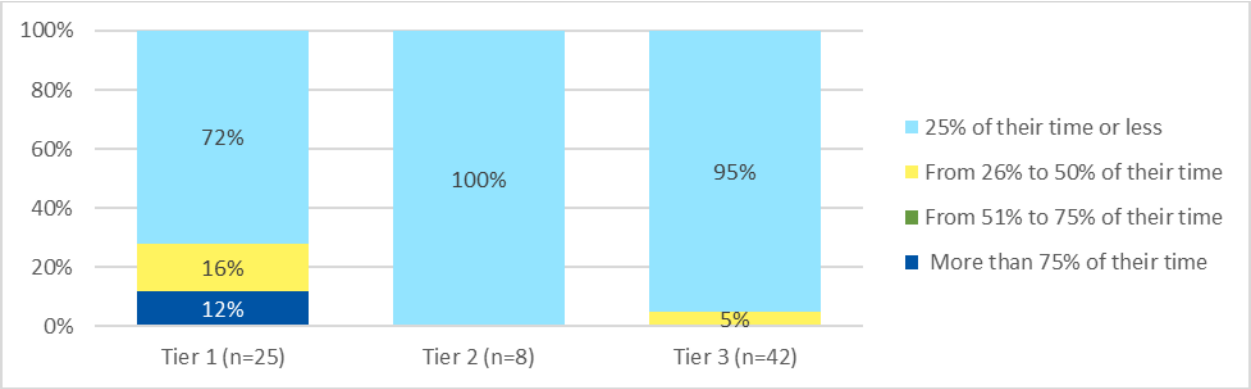
Energy Manager Targets

Across Tiers, nearly half of individuals assigned to energy management (44% in Tier 1, 57% in Tier 2, and 41% in Tier 3) have energy performance targets that are part of their job description or performance review.

Time Dedicated to Energy Management

According to survey data, energy management is not the primary responsibility for most OsEMs. Figure 2 shows the percentage time the OsEM dedicates to energy management among facilities that have an OsEM.

Figure 2. Percentage of OsEM Time Dedicated to Energy Management



Source: Year 3 Nonparticipant Survey questions C8x.

OsEM Certification

Respondents indicated that most energy managers do not have a specific certification related to the subject. Of those who are certified, the most common certification was a Certified Energy Manager

(CEM), offered by the Association of Energy Engineers (AEE). Table 14 shows all certificates mentioned, as well as the number of OsEMs that do not have a certificate, or whose certification status was unknown.

Table 14. OsEM Certification Status

Certification	Tier 1	Tier 2	Tier 3
CEM (Certified Energy Manager, through AEE)	3		1
CP EnMS (Certified Practitioner in Energy Management Systems, through 50001)	1		
LEED Professional		1	
Other/Unknown Type		1	1
No certification/Don't know	21	6	43
Total OsEMs	**25**	**8**	**45**

Consultant Support

NYSERDA's OsEM program allows participants to propose an internal employee, external consultant, or combination of both to fill the OsEM role. The Market Evaluation Team assessed the approach used by nonparticipant adopters and found that over 98% of all facilities had designated energy management responsibility to an employee. However, survey respondents also said that nearly one-third of those employees—32%, across all tiers—received support from an outside consultant.

2.4.2. Monitoring and Tracking System Adoption

A key element of successful CEI practice is maintaining a system that monitors and records energy usage over time and allows employees to analyze progress against targets. Adoption of this type of system in the nonparticipant market is NYSERDA's Indicator 6 (Table 7 above). A monitoring and tracking system is any tool used to record energy usage data over time, facilitate analysis of usage against goals, and help with making decisions related to additional energy and process improvements.

Monitoring and tracking systems can be as simple as an Excel-based spreadsheet, as long as it is consistently maintained. However, periodically checking energy usage as reported on utility bills or through a utility website is not considered a monitoring and tracking system because the data are not recorded, not compared against goals, and not clearly used for making decisions about energy usage. As in 2017, the Team assumed that any facility that took the time to monitor and record their energy data used these data to inform decisions.

Table 15 shows the rate of adoption of some type of monitoring and tracking system, by tier.

Table 15. Nonparticipant Monitoring and Tracking System Adoption in 2019

Tier	2019 Adoption
Tier 1 (n=46)	35%[d]
Tier 2 (n=26)	35%[d]
Tier 3 (n=223)	14%[b, c]
Overall[a]	**16%**

[a] Overall result is the weighted average of Tier-level results.

[b] Indicates statistically significant difference compared to Tier 1.

[c] Indicates statistically significant difference compared to Tier 2.

[d] Indicates statistically significant difference compared to Tier 3.

Source: Year 3 survey questions D7 and D8.

To receive full credit for having a monitoring and tracking system, facilities had to indicate that they used a tool or system to track energy use over time and specifically identify the type of system. The Market Evaluation tracks adoption of three types of monitoring and tracking systems: RTEM systems,[9] monitoring, targeting, and reporting tools (MT&Rs), and spreadsheet tools.

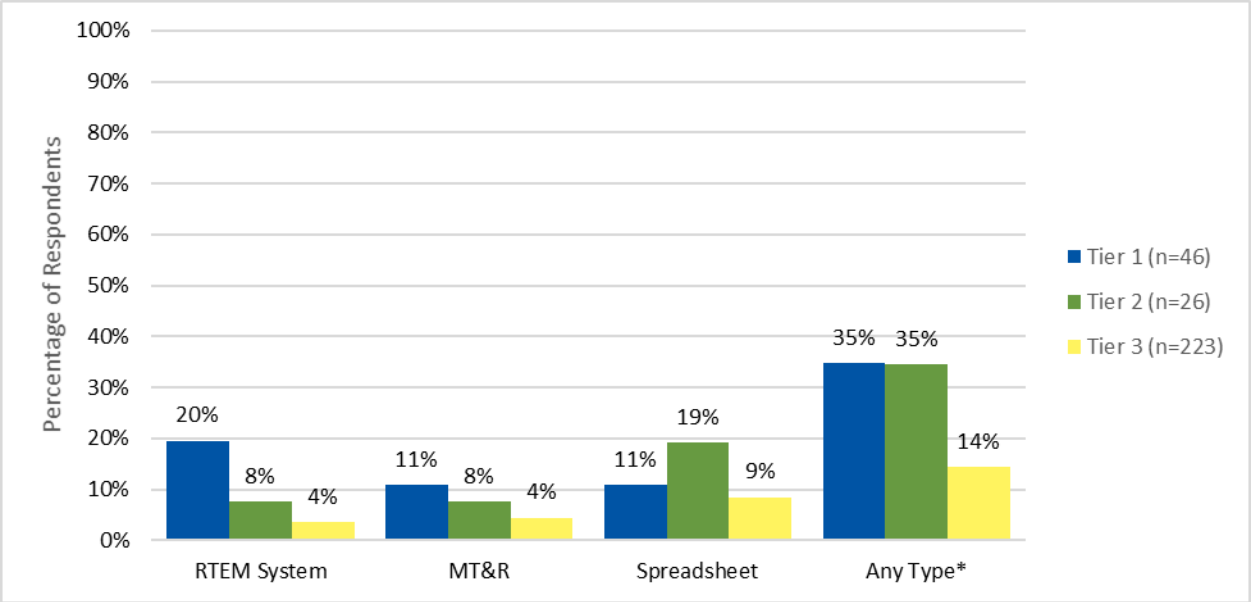
An RTEM system is a sophisticated software tool that automatically receives and records energy usage data at various levels, from specific equipment or production line to facility level or even across multiple facilities. These systems usually integrate energy usage data with production data and sometimes with other variables such as weather and the facility schedule. RTEM systems usually include a dashboard that provides automated analysis of key metrics and can generate more detailed reports. Some RTEM systems are managed by the provider, which processes data, monitors for changing trends, progress against goals, or anomalies and reports these to the client facility.

A tool as powerful as an RTEM system is not required for SEM. Facilities can use simpler software tools that provide a template for inputting data and store data to inform manual analysis. An MT&R tool provides similar information to an RTEM system but usually requires manual data entry and provides only basic data exports. Facilities that use MT&Rs usually do most of their analysis in a companion spreadsheet. Other facilities simply record utility bill data and possibly daily production or similar data in a spreadsheet. Any of these three tools can help facility managers make informed decisions, if the tools are maintained.

Figure 3 shows the distribution of these tools within each tier. An RTEM system, the most sophisticated of the three types of tools, was the most common tool mentioned by Tier 1 respondents. Spreadsheet tools were most common for Tier 2 and Tier 3 facilities.

[9] RTEM systems are also referred to as Energy Management Information Systems, or EMIS. Previous CEI Market Evaluation reports and the nonparticipant survey questions used the term EMIS. The term is being changed in this report to be consistent with other NYSERDA publications and to respond to changes in industry terminology.

Figure 3. Adoption of Monitoring and Tracking Systems, by Tier



Source: Year 3 survey questions D7 and D8.
** Tier 1 and Tier 2 values show statistically significant difference compared to Tier 3.*

2.4.3. RTEM System Adoption

As just stated, any of the three monitoring and tracking systems can be helpful to manage energy usage. RTEM systems are the most sophisticated and can be powerful tools for achieving continuous improvement in energy efficiency.

In 2017, NYSERDA's CEI initiative launched the RTEM program to promote adoption of RTEM systems in the industrial sector, and the program is currently moving through its first round of participation. Three of the CEF Industrial Chapter's market progress indicators (Indicators 7, 8, and 9 in Table 7) track different aspects of RTEM system adoption among participants and additional facilities in their organizations. The Team assessed the baseline level of RTEM system adoption among nonparticipants to provide a comparison for analyzing the indirect impacts from the RTEM program going forward.

Although the survey asked respondents if they used an RTEM System (referred to as an EMIS), the Team did not use that information to assess the level of qualified RTEM systems in use. Instead, the Team asked about specific features that define an RTEM system: having an automated analysis or visual display of energy use over time; analyzing energy use against a baseline or energy usage target, and integrating energy usage data with production data. Table 16 shows the percentage of facilities whose monitoring and tracking system has each feature, and the percentage that had adopted a system qualifying as an RTEM system (defined as a system with all of the indicate features).

Table 16. Percentage of Facilities with Qualified RTEM Systems

Tier	Automated analysis or visual display	Analyzes against a baseline or toward a target	Integrates energy use with production data	Qualified RTEM Systems
Tier 1 (n=46)	46%	30%	15%	11%[d]
Tier 2 (n=26)	31%	15%	12%	4%
Tier 3 (n=223)	14%	10%	5%	4%[b]
Overall[a]	**16%**	**11%**	**6%**	**4%**

a Overall score is the weighted average of Tier-level results
b Indicates statistically significant difference compared to Tier 1.
c Indicates statistically significant difference compared to Tier 2.
d Indicates statistically significant difference compared to Tier 3.
Source: Year 3 survey questions D7 and D8c

2.4.4. SEM Adoption

Though differing approaches to SEM are recognized by energy professionals, the Market Evaluation bases its definition on the Consortium for Energy Efficiency (CEE) definition.[10] The CEE definition identifies three minimum elements for SEM, each consisting of two to seven subelements. The three minimum elements for SEM, as defined by the CEE, are these:

- ***Company Commitment.*** A clear, long-term executive-level commitment to energy performance, demonstrated by the existence and communication of an energy policy, goals, and resources to meet those goals.
- ***Planning and Implementation***. An energy management plan and evidence of a continuous improvement approach to plan implementation.
- ***System for Measuring and Reporting Energy Performance.*** A systematic, ongoing measuring and reporting of energy performance data.

The Market Evaluation's framework for SEM assessment, which consists of adapted definitions of each minimum element and subelement to facilitate more precise measurement over time, is included in *Appendix B*.

Table 17 shows the percentage of nonparticipant respondents meeting each level of adoption (full, some, or none) for the SEM subelements and minimum elements. Full adoption of SEM overall was 0%, and full adoption of each minimum element was also very low. Although 84% or more of nonparticipant respondents reported practicing some subelements of each minimum element, adoption was low for practices associated with a long-term commitment to an energy management system, including a company policy and goals, energy goals and KPIs associated with an energy management system, employee engagement, a project register, and ongoing reassessment. Nevertheless, respondents reported relatively high adoption of some energy measurement and reporting practices and of initiating or completing at least one energy management project in the past two years (47% for 2f. Implementation).

[10] Consortium for Energy Efficiency. *CEE Strategic Energy Management Minimum Elements, 2014.* Accessed online July 27, 2017: https://library.cee1.org/content/cee-strategic-energy-management-minimum-elements/

Table 17. Nonparticipant SEM Adoption in 2019[a]

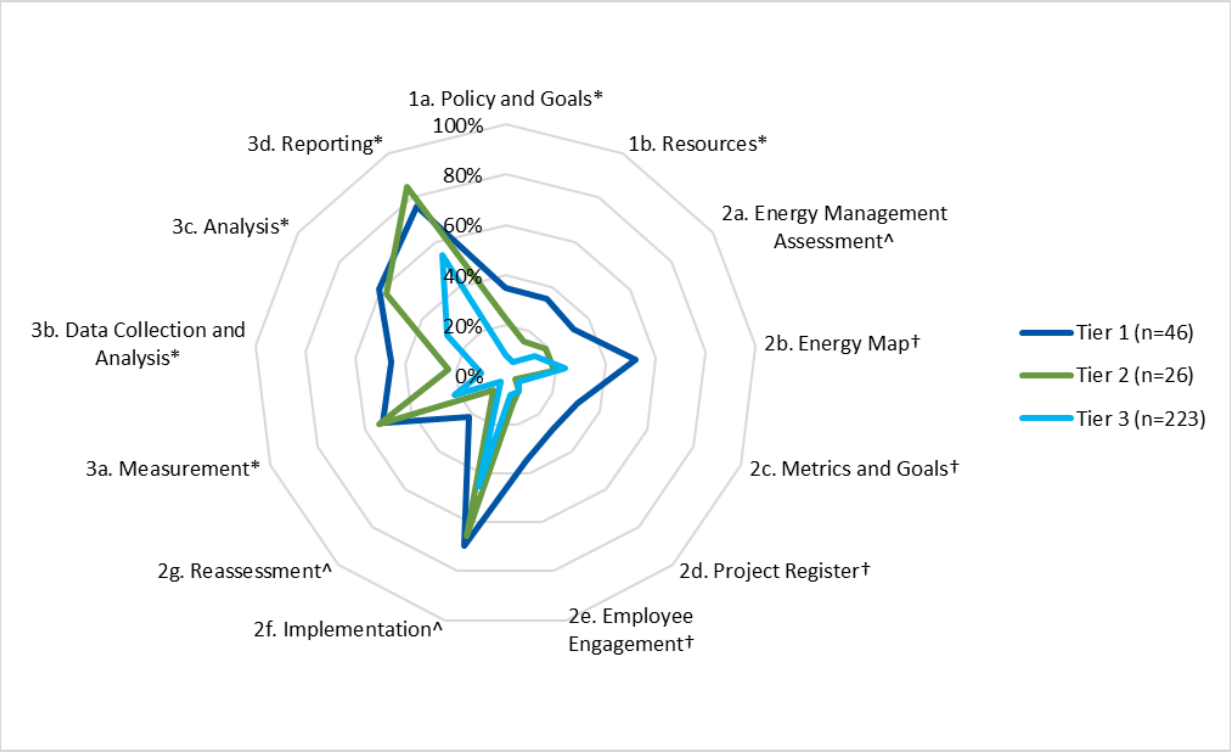
Subelement	2019		
	Full	Some	None
1a. Policy and Goals	10%	19%	71%
1b. Resources	8%	91%	1%
1. Company Commitment (Max score of 4)	**1%**	**99%**	**0%**
2a. Energy Management Assessment	15%	59%	26%
2b. Energy Map	25%	1%	74%
2c. Metrics and Goals	4%	26%	70%
2d. Project Register	9%	12%	79%
2e. Employee Engagement	9%	2%	89%
2f. Implementation	47%	1%	52%
2g. Reassessment	4%	7%	89%
2. Planning and Implementation (Max score of 6)	**1%**	**84%**	**14%**
3a. Measurement	24%	0%	76%
3b. Data Collection	12%	65%	23%
3c. Analysis	31%	46%	23%
3d. Reporting	56%	16%	28%
3. Measure and Reporting Energy Performance (Max score of 8)	**5%**	**89%**	**6%**
Total SEM Adoption (Max score of 26)	**0%**	**100%**	**0%**

[a] Percentages in this table are weighted average of tier-level results

Source: Year 3 survey questions: C3, C4, C4a, C5, C6, C6a, C8-C10, D1-D4, D4a, D4b, D6, D6a, D7, D11, and D13-D19

Figure 4 shows the percentage of facilities in each tier that met the criteria for full adoption of each SEM subelement. Adoption of most subelements was higher for Tier 1 and Tier 2 than for Tier 3.

Figure 4. Full SEM Subelement Adoption in 2019 by Tier



Source: Year 3 survey questions: C3, C4, C4a, C5, C6, C6a, C8-C10, D1-D4, D4a, D4b, D6, D6a, D7, D11, and D13-D19
†Tier 1 shows statistically significant difference from Tier 2;
^Tier 1shows statistically significant difference from Tier 2
**Tier 1 and 2 show statistically significant difference from Tier 3*

Adoption of each subelement is discussed in further detail in the sections that follow.

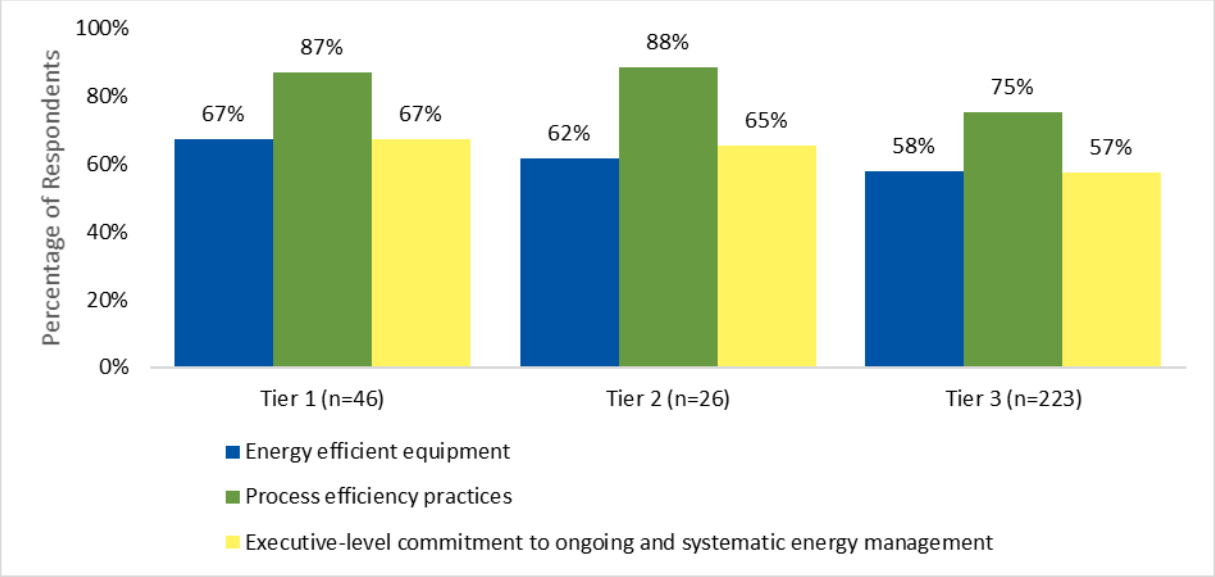
Company Commitment

SEM, like other continuous improvement management systems, requires clear, executive-level commitment to ongoing performance improvement, demonstrated by the existence and communication of a company policy and associated goals and a commitment of resources to achieve those goals. In 2017, the Team added an additional subelement, Efficiency Attitude, to the Company Commitment minimum element, to provide insight into management attitudes, which the Team expected might be a leading indicator for commitment.

To remain consistent with the CEE minimum elements, the Team did not include Efficiency Attitude in overall scoring for 2019. Nevertheless, the results, shown in Figure 5, do indicate corporate-level recognition of the importance of energy and process efficiency and a commitment to systematic energy management are basic characteristics of facilities at an early stage of SEM adoption. Across all tiers,

respondents were most likely to indicate process efficiency as important and were about equally likely to indicate energy efficiency and an executive commitment to energy management as important.[11]

Figure 5. Importance of Energy Factors for Competitiveness



Source: Year 3 survey question C1

The CEE included two subelements as necessary for demonstrating company commitment to SEM. These are adopting energy efficiency as a company policy, including targets for improved energy efficiency (1a. Policy and Goals), and dedicating sufficient staff and budgetary resources to implement SEM (1b. Resources). Table 18 shows the adoption levels for these two scored Company Commitment subelements, by tier. These are described in more detail following the table.

Table 18. 2019 Full Adoption Levels by Tier for Company Commitment

Subelement	2019 Full Adoption			
	Tier 1 (n=46)	Tier 2 (n=26)	Tier 3 (n=223)	Overall (n=295)[a]
1a. Policy and Goals	35%[d]	23%[d]	9%[b, c]	10%
1b. Resources	35%[d]	15%	6%[b]	8%
Minimum Element Adoption (Max Score of 4)	**20%[d]**	**8%[d]**	**1%[b, c]**	**2%**

[a] Overall is the weighted average of Tier-level results
[b] Indicates statistically significant difference compared to Tier 1.
[c] Indicates statistically significant difference compared to Tier 2.
[d] Indicates statistically significant difference compared to Tier 3.
Source: Year 3 survey questions C3, C4, C5, C6, C6a, C8-C10

For **Subelement 1a. Policy and Goals**, the Team required that facilities have a written energy policy and energy performance goals and to communicate these goals to staff. Tier 1 facilities were more likely to

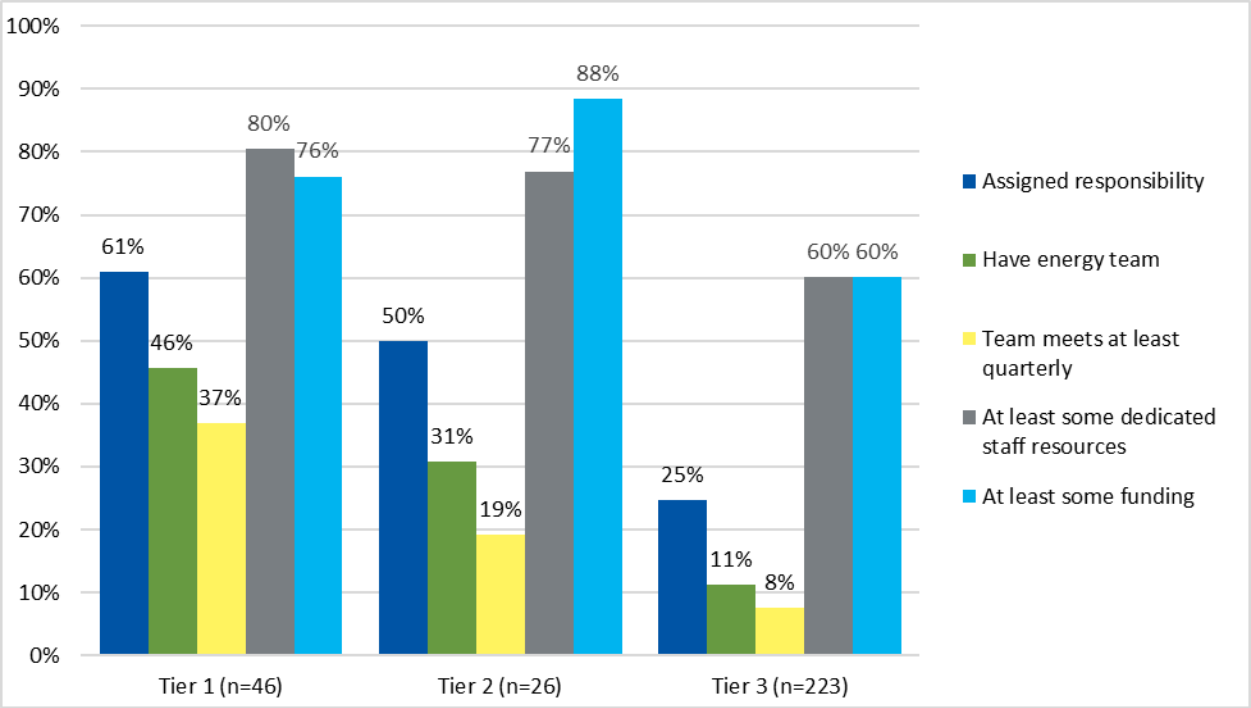
[11] This question asked respondents to rate the importance of three factors in maintaining a competitive advantage. The question used a 5-point scale, with 1 being *not at all important* and 5 being *extremely important*. The Team interpreted a response of 4 or 5 as important.

have set energy performance goals (59%) than to have a written energy policy (43%). But Tier 2 and Tier 3 facilities were about equally as likely to have a written policy as to have goals. Across all three tiers, the majority of facilities that had a written energy plan also had goals, and vice versa. In addition, nearly all facilities that had adopted energy performance goals had communicated those goals to staff.

Subelement 1b. Resources assessed whether facilities had assigned responsibility for energy performance and had dedicated staffing and financial resources to implementing SEM. This subelement showed lower adoption within each tier than the Policy and Goals subelement.

Figure 6 shows the level of adoption of each of the components used to score a facility's available resources for energy management. Most respondents believed their facility had dedicated at least some staff and some level of funding to SEM implementation, even among Tier 3 facilities, 60% of which had dedicated some amount of resources to energy management. However, when asked whether the facility had formed an energy team that had responsibility for energy management and that met at least quarterly—the minimum threshold for being considered an adopter for this subelement—far fewer facilities responded affirmatively.

Figure 6. Adoption of Components of Subelement 1b. Resources, by Tier



Source: Year 3 survey question C6, C6a, C8-C10

Planning and Implementation

The Planning and Implementation minimum element, comprising seven subelements, focuses on the facility's operational starting point or foundation to strategically manage energy. Planning and Implementation subelements measure whether the facility takes the actions needed to systematically identify energy savings opportunities, realize those potential savings, then continuously update its plan to achieve more savings going forward.

Table 19 provides the levels of full adoption of each Planning and Implementation subelement, by tier. As with Company Commitment, Tier 1 shows the highest level of adoption of all subelements related to Planning and Implementation, across the three tiers.

Table 19. 2019 Full Adoption Levels by Tier for Planning and Implementation

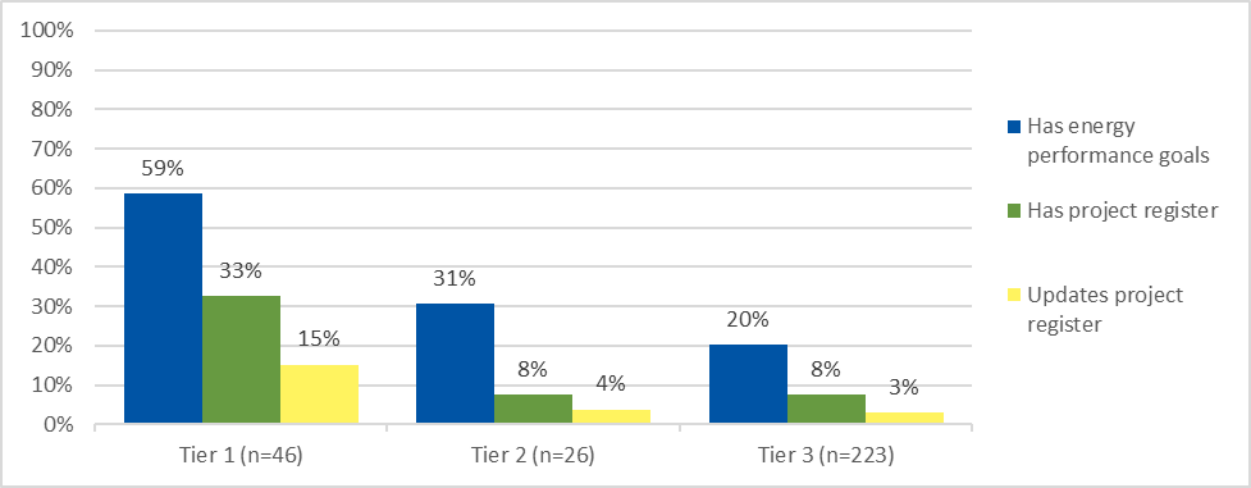
Subelement	2019 Full Adoption			
	Tier 1 (n=46)	Tier 2 (n=26)	Tier 3 (n=223)	Overall (n=295)[a]
2a. Energy Management Assessment	33%[d]	19%	14%[b]	15%
2b. Energy Map	52%[c, d]	19%[b]	24%[b]	25%
2c. Metrics and Goals	13%[d]	4%	3%[b]	4%
2d. Project Register	28%[c, d]	8%[b]	8%[b]	9%
2e. Employee Engagement	35%[c, d]	12%[b]	8%[b]	9%
2f. Implementation	70%[d]	65%	45%[b]	47%
2g. Reassessment	22%[d]	8%	3%[b]	4%
Minimum Element Adoption (Max Score of 14)	**9%[d]**	**0%**	**1%[b]**	**1%**

[a] Market-wide is the weighted average of Tier-level results
[b] Indicates statistically significant difference compared to Tier 1.
[c] Indicates statistically significant difference compared to Tier 2.
[d] Indicates statistically significant difference compared to Tier 3.
Source: Year 3 survey questions C4a, D1-D4, D4a, D4b, D6, D6a, D11, D13-D16

Subelements for having energy management assessments (2a), an energy map (2b), and a project register (2d) ensure that companies have the information necessary to identify improvement opportunities. Facilities were more likely to have energy management assessments and energy maps, both one-time activities, than to maintain a project register, which requires an ongoing commitment.

Subelement 2d. Project Register requires that companies have a plan to achieve their energy goals, document potential energy efficiency projects, and track the progress of projects. The Team recognized a project or opportunity register, a tune-up action item list, or energy management tracking software as meeting the criteria for a project register. As shown in Figure 7, a little over 50% of the Tier 1 facilities that had formal performance goals also had a plan to achieve those goals. For Tier 2 and Tier 3, the percentage was between 25% and 35% of facilities with goals. Across all three tiers, only about half of the facilities that had a plan also regularly updated that plan to document completed projects.

Figure 7. Adoption of Components of Subelement 2d. Project Register



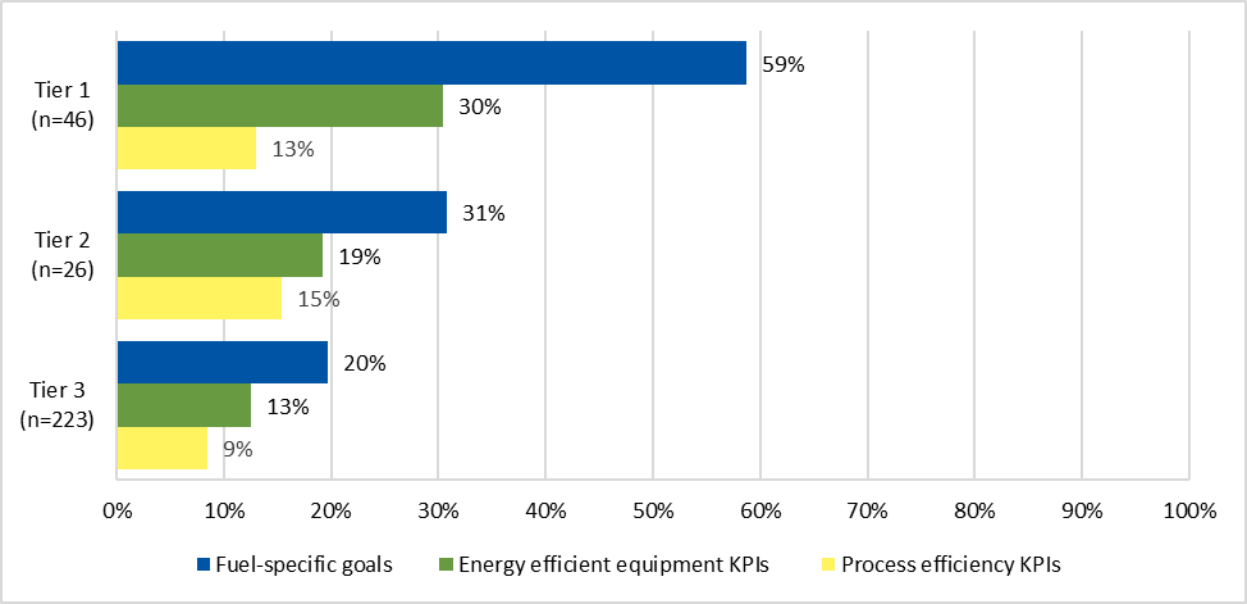
Source: Year 3 survey question C4, D6, and D6a

Subelement 2c. Metrics and goals had the lowest rate of full adoption across tiers of the subelements related to Planning and Implementation. This subelement required that companies create specific, measurable goals and demonstrate an internal commitment to meet those goals. To assess this subelement, the Team asked if facilities had created fuel-specific energy performance goals for either electricity or natural gas (or both) in the form of an absolute reduction or a reduction of energy usage per unit of production over time. In addition, facilities needed to have adopted facility KPIs for both energy and process optimization through an energy management initiative.[12]

As shown in Figure 8, facilities were most likely not to meet full criteria for this subelement because of the requirement to have both energy efficiency and process optimization KPIs, especially for process efficiency.

[12] The survey language described energy management initiatives as "services through ISO 50001, a strategic energy management program, continuous energy improvement, Lean, Six Sigma, Kaizen, total quality management or another continuous improvement initiative."

Figure 8. Adoption of Energy and Process Optimization KPIs



Source: Year 3 survey questions D4, D11, and D13

Subelement 2e. Employee Engagement. The Team required that the facility have an energy manager or energy team and that the manager or team had conducted some kind of engagement activity related to energy or conservation within the past two years. Both requirements were significant hurdles for facilities. In Tier 1, about 60% of facilities with an energy manager or team had conducted engagement activities. In Tier 2 and Tier 3, only between 25% and 30% of facilities with an energy manager or team had conducted engagement activities.

Subelement 2f. Implementation. This subelement measures whether a facility has actually completed an energy or process efficiency improvement project. Since this subelement most parallels traditional ideas about practicing energy efficiency and is the only subelement that directly results in financial benefit to the facility, it is not surprising that this was the most commonly adopted of all 13 SEM subelements. Between 45% and 70% of each tier responded positively to having completed an energy efficiency project in the past two years.

S**ubelement 2g. Reassessment.** This subelement assesses whether the facility takes a continuous approach to addressing energy and process efficiency by periodically updating its goals and its plan to achieve those goals. The Team gave full credit to facilities that have a plan and revisit that plan at least quarterly or when operations change. Like subelement 2d, this subelement required that the facility first have a plan to achieve its savings goals, which disqualified over 65% of facilities. Overall, 22% of Tier 1 facilities, 8% of Tier 2 facilities, and 3% of Tier 3 facilities reported having a plan and reviewing it at least annually.

Measuring and Reporting Energy Performance

The Measuring and Reporting Energy Performance minimum element measures the capability of a facility to effectively monitor its progress against energy and process efficiency performance goals. Several subelements require specialized expertise, which can fall outside the resources and tools companies typically require to meet a facility's core mission. To satisfy this minimum element, a facility

employee (or contracted energy manager) must collect energy use data over time using a tool or software program, regularly analyze the data to inform energy efficiency project decisions and planning, and report the findings on the collected data and analyses to company stakeholders at least once per year. Table 20 shows the full adoption levels by tier for the third minimum element of SEM.

Table 20. 2019 Full Adoption Levels by Tier for Measuring and Reporting

Subelement	2019 Full Adoption			
	Tier 1 (n=46)	Tier 2 (n=26)	Tier 3 (n=223)	Overall (n=295)[a]
3a. Measurement	52%[d]	54%[d]	22%[b, c]	24%
3b. Data Collection and Analysis	46%[d]	23%[d]	10%[b, c]	12%
3c. Analysis	61%[d]	58%[d]	28%[b, c]	31%
3d. Reporting	76%[d]	85%[d]	54%[b, c]	56%
Minimum Element Adoption (Max Score of 8)	**24%[d]**	**8%**	**4%[b]**	**5%**

[a] Overall is the weighted average of Tier-level results
[b] Indicates statistically significant difference compared to Tier 1.
[c] Indicates statistically significant difference compared to Tier 2.
[d] Indicates statistically significant difference compared to Tier 3.
Source: Year 3 survey questions D1, D7, D17-D19

Subelement 3a. Measurement. This subelement measured the facilities' use of a tool to record energy use over time so the data are available to track progress against energy goals. This subelement is equivalent to the monitoring and tracking system adoption discussed earlier.

Subelement 3b. Data Collection and Analysis. Facilities received full credit if they set energy performance goals and reviewed their energy consumption data at least monthly. The great majority of facilities that reported setting goals also reported monitoring progress against those goals.

Subelement 3c. Analysis. To receive full credit, facilities had to indicate they had determined their baseline energy usage against which to analyze progress against energy performance goals. Tier 1 and Tier 2 facilities had similar full adoption levels (61% and 58%), but Tier 3 facilities had a much lower adoption level (28%).

Subelement 3d. Reporting. Facilities had to share energy data with shareholders, management, or operations staff at least annually to receive full credit. Of facilities meeting this criterion, 76% were Tier 1, 85% were Tier 2, and 54% were Tier 3. Of these, most disseminated data to stakeholders monthly (41% of Tier 1 facilities, 42% of Tier 2 facilities, and 25% of Tier 3 facilities).

2.4.5. Factors Impacting Comparison to 2017

One of the original intentions of the Year 3 research was to assess changes in nonparticipant adoption from the 2017 baseline values. However, several factors that affected the survey and analysis in 2019 preclude a statistically rigorous comparison to 2017:

- **Improvements to the nonparticipant survey instrument.** As part of the Year 2 workplan, the Team used the information collected in 2017 to make numerous adjustments to the survey instrument and scoring methodology that improved the quality of data collection and analysis. Where the survey language or response options changed from 2017 to 2019, it is not possible to make a quantitative comparison of the results. Though this limits granular assessments of changes

in the market since 2017, the revised survey instrument results in a more accurate snapshot of market adoption as of 2019 and provides a better foundation for the 2021 survey and other research going forward.

- **Changes in self-reported tiers.** As noted previously, the Team conducts much of the Market Evaluation research at the tier level—separating the population into three groups that represent high (Tier 1), medium (Tier 2), and low (Tier 3) annual energy costs. The Team used the survey to identify the correct tier for each respondent and appropriately weight the survey analysis. To facilitate the market research interviews that occurred in parallel with the 2019 survey, the Team slightly revised the question used to determine the respondent's tier, shown in Table 21. Although 2019 options align with 2017 options, the substantial shift in response patterns suggests that the change in choice architecture (from three response options to four) caused a smaller proportion of respondents to self-identify as Tier 2.

Table 21. Choice Architecture for Question to Determine Energy Expenditure Tier

Tier	2017 Choice Options	2019 Choice Options
Tier 1	More than $1,000,000	More than $1,000,000
Tier 2	Between $500,000 and $1,000,000	Between $500,000 and $1,000,000
Tier 3	Between $0 and $500,000	Between $100,000 and $500,000
		Less than $100,000

- **Revised population estimates.** The Market Evaluation Team uses the InfoGroup database of New York manufacturing facilities to define the population, in total and by sector. In 2017, InfoGroup provided a dataset with just over 6,900 records. In 2018, InfoGroup provided an updated dataset with just over 6,300 records (including nonparticipants, participants, and additional facilities owned by participant firms). These data formed the basis for the Team's tier and sector population estimates, which affect the stratified sampling approach as well as the calculation of the number of facilities adopting CEI practices. The Team does not know what contributed to fewer available records in 2019. NYSERDA reported that the decrease was not limited to manufacturing facilities; the number of records in the entire InfoGroup database of New York commercial entities decreased by about 50,000, roughly 7%. Because the reduction occurred across all sectors, it unlikely to be the result of an actual contraction of the market and may instead be the result of records updates by InfoGroup or a similar data management factor.

In *Appendix A*, the Team presents a review of the survey and scoring changes, along with tables comparing 2017 and 2019 results, as anecdotal data.

2.5. Energy Consultant Perspective

Cadmus conducted in-depth telephone interviews with 23 energy consultants who participate with NYSERDA in the Flexible Technical Assistance (FlexTech) or Industrial Process Efficiency programs to assess market demand for energy management consulting services. The Team used these interviews to address three overarching objectives:

- Assess consultant's awareness of energy management services and consultants' perspectives on customer awareness and adoption of energy management initiatives.
- Gain consultants' perspectives on barriers to adoption of energy management systems in general.

- Gain the consultants' perspectives on the OsEM program design, and the potential for OsEM services provided outside of the program.

2.5.1. Consultant Profile

The Team interviewed consultants who worked across diverse areas (demand-side management, building performance, sustainability, design, energy auditing, retro-commissioning, project management, outreach, and business development) in full-service multidisciplinary engineering firms. All interviewees participated in NYSERDA's FlexTech or IPE programs, and all worked with industrial clients.

Most consultants said they currently have between 15 and 35 clients in New York state; some have fewer than five, some have as many as 4,000. The client firms represented a wide array of industries, and most consultants said they would work with any industrial (and in some cases commercial) customer who approached them. The most common industries mentioned were wastewater/water treatment and recycling, paper manufacturing, food manufacturing/processing, and plastics product manufacturing. One consultant said paper industries were declining in New York; another used to work with paper industries but did so no longer.

Other industries mentioned were fabricated metal, chemical manufacturing, pharmaceuticals, hospitals/healthcare, rubber product manufacturing, resins, automotive manufacturing, aerospace/ballistic missile heads, universities/schools, high-tech, uniform services (industrial-scale laundry), lumber, glass, petrochemicals, nonmetallic mineral products, value-added dairy processing, and municipal buildings.

2.5.2. Awareness of Energy Management Initiatives

Consultants were asked how aware of or interested their clients were in practices to achieve continuous energy and process improvement, such as ISO 50001, SEM, or other management initiatives oriented to energy usage. Additionally, consultants described their own familiarity with these practices.

Consultant Awareness

When asked directly about energy management initiatives ISO 50001, Six Sigma, SEM, and others, the consultants described varying degrees of familiarity. Though the majority (18 of 23) said they were familiar or very familiar with the different initiatives, three also made statements that indicated they did not differentiate between energy management as a holistic system, and specific energy projects. Several consultants said they were only somewhat familiar with the names of the initiatives but did not have a detailed understanding of each. Four consultants said the initiatives do not come up as part of their practice, and they are relatively unfamiliar with them. In general, consultants were most familiar with SEM and ISO 50001.

Ten of 23 consultants said they were familiar with SEM (seven mentioned SEM unprompted, and three others said they were familiar with the term when asked). However, when read a definition of SEM, only

six said they define SEM using the same or similar terms.[13] One consultant reported using the term "energy engineering" for a similar set of practices, though it was not clear that this term included all of the components of SEM. Another said industry professionals are not familiar with the term SEM, adding "the word strategic is not very descriptive." Another consultant reported offering energy studies in accordance with the Lean Management Framework but not "strategies."

When asked what energy saving strategies they most commonly recommended to clients, consultants said they tailored their recommendations to the specific needs and situation of the client. These strategies included peak-load shifting and value stream mapping to encourage executives to include energy as a process input. Most consultants specifically referenced projects related to identifying and implementing specific improvements, and they did not mention organizational or behavior change. Two interviewees specifically said they do not address behavioral or management strategies. Another consultant, who was familiar with SEM as well as other energy management frameworks, said the definition of SEM is too big and should be broken into "more digestible pieces."

Six consultants said they encourage their clients to use an energy management information system, but five said they do not. The majority work with whatever system the client has in place rather than recommend a specific brand or system.

Customer Awareness

Consultants reported that though customer awareness and interest in practices to achieve continuous energy and process improvement has increased in recent years, overall awareness is still low. Consultants expressed varying perspectives of how (and whether) SEM delivery has changed in the last two years. Four consultants said demand has not really changed and there is still a lot to do in the market, noting interest in how the NYSERDA program can help customers strategize spending on capital improvements. One consultant said demand was increasing, and three said at least awareness was increasing (in part due to changing legislation in New York). One consultant said SEM delivery had gone down because the industrial base in New York has declined.

Consultants reported that large clients tended to be more aware of CEI practices than smaller clients for a variety of reasons. For example, international companies that are exposed to CEI ideas from their overseas operations and often must face stricter efficiency regulations are usually more aware of energy management. Any large facility with high energy costs—characterized by one consultant as utility bills in excess of $1 million per year—may be more aware. Large customer-facing businesses (such as Pepsi, Coca Cola, or GM) that want to project a green strategy are more likely to have adopted some form energy management. Along those lines, one consultant noted that chemical industries and manufacturers whose products are midstream components of an end-use product are less interested. In addition, one respondent mentioned that facilities that already have a focus on production quality (such as light

[13] In the interviews, the Team defined SEM as follows: "Strategic energy management is defined as a holistic set of management practices intended to continuously improve energy performance by achieving persistent energy and cost savings. SEM focuses on business practice changes within an industrial facility from senior management through shop floor staff, affecting organization culture to reduce energy waste and improve energy intensity through behavioral and operational change."

manufacturing) are more likely to be aware, since marginal energy or process savings may be more valuable in these facilities.

Four consultants said their own knowledge of client awareness and interest in energy management may be low because clients with their own in-house energy management staff do not necessarily discuss these practices with their consultants, even if consultants raise the issue.

Consultants mentioned ISO 50001, Six Sigma, Kaizen, Lean, and SEM as management frameworks that their clients have used. One consultant described customers using ISO standards for production but could not confirm if it was ISO 50001. This consultant said smaller companies know Six Sigma but not necessarily Six Sigma for energy. Two consultants said customers are more aware of SEM than the other practices, with one noting that SEM is "gaining a lot of traction." One of these consultants reported customers are adopting SEM practices, and the other consultant said customers, though increasingly aware of SEM, avoid the perceived extra cost and work required.

2.5.3. Barriers to Adoption of Energy Management Initiatives

Consultants cited multiple challenges experienced when proposing energy management initiatives to industrial clients.

Cost Challenges

- The initial consulting effort and justification of the benefit/cost ratio
- Hiring qualified staff to evaluate complex distributed energy or technical systems on fixed fees
- Identifying projects that can meet client payback requirements
- Client's desire to avoid the cost of ISO 50001 certification

Process Challenges

- Client disinterest and not wanting to commit to change
- Lengthy process for gaining approval (finding the right person within the company and convincing this person to commit to improvements)
- Getting client to prioritize energy when energy costs are such a small fraction of their total costs and not a top priority
- Getting clients focused on more than maximizing production
- Communicating within client company (top and bottom employees often do not communicate that energy savings are important).
- Client who is motivated only by an incentive
- Client perception and resistance of extra work required by ISO 50001

2.5.4. Perspective on the OsEM Program

Four of the 23 consultants interviewed currently provide OsEM services through NYSERDA's OsEM program. Another consultant reported that one engineer provided services similar to OsEM six days per month to a client through FlexTech then, as part of that service, the engineer helped the company hire a full-time energy manager and is now training that person every other week. No consultants reported

providing OsEM services for clients outside the NYSERDA program. However, four consultants expressed interest in or reported having tried to provide these services in the past.

2.5.5. Barriers to OsEM

Consultants described challenges they experienced when proposing energy management initiatives and technical assistance for such initiatives to their industrial clients. Their responses fit into two categories: barriers to acquiring the customers and barriers to providing the services.

Barriers to acquiring the customers

- **Knowing the return on investment.** One consultant said, "A big issue with the programs is that it's hard to quantify [savings for] this kind of thing. Typically, they [clients] are hesitant to move forward unless they are able to evaluate a payback period." Another consultant considered the program's consultant OsEM approach too expensive for his clients who were interested. He described having proposed OsEM to several firms as follows: "All were relatively small operations. NYSERDA pays 75% of the cost. If you are looking at an employee who makes $40 an hour, you assume you pay $10 an hour, it works. If you are paying a consultant, who bills out a $40-an-hour guy at $160 an hour, that suddenly changes the company's investment a lot." A third consultant reported, "We have the hardest time just getting real, simple conservation measures installed. An OsEM is like another step removed—[clients are] not interested."
- **Perceptions of no need for outside help.** One consultant reported difficulty in getting customers to sign up "just for consulting services," saying, "…industrial customers think they already know. They think they are aware of what the options are. It's harder to convince them of the value of an outside expert." Some consultants said clients were hesitant about not having managers in house.
- **Limited marketing.** One consultant said simply, "no one is asking for that [OsEM] service…," expressing the perception that outside the NYSERDA program there was limited awareness or interest in having an outside consultant serve as an OsEM. Another said, "NYSERDA needs to dig deep and figure out ways to improve outreach. They need to identify the target audience, and not just make them aware, but also make that compelling argument."

Barriers to providing the services

- **Difficult position for assigned staff.** One consultant said the OsEM services would be easier to provide if they were conducted on an on-call basis, two or three days per week. In additional, not all consultant staff are willing to work at the customer site instead of the consulting firm's offices.
- **Opportunity cost for senior staff.** One consultant said, "In terms of our marketing/business development—there are better uses for our people's time. And it's more cost-effective for us to have our internal people being in our office, working on our projects, rather than being loaned out." This consultant added "… there is a lot of work out there that offers a lot better margins." Several consultants offer technical services to help clients identify opportunities and implement projects, but most do not include business management aspects like OsEM. Another consultant noted, "it would be a stretch" to provide the services because of all the training required (even though this person thought the demand is likely there). Finally, one consultant reported that a key staff person was lost through the program because of being hired by the client firm at the end of the pilot.

2.5.6. Anticipated Changes in the Demand for Industrial Energy Management Services

Multiple consultants said that the energy division in their firm was new or growing and that they viewed energy management as a potential future service for their firm. Several consultants said new regulations in New York City were driving increased demand (although one noted that these new regulations primarily affect residential and commercial properties, not industrial properties). Others expected that new data collection capabilities and data management applications would be important drivers of greater interest in energy management. Two consultants mentioned that if energy prices rise and regulations continue to tighten then, to keep up, facilities will need better access to information, especially to their own energy use data, and to more comprehensive services from organizations such as NYSERDA, utilities, and consultants. A few consultants noted that the current low energy prices, if they continue, will slow growth in awareness and demand for energy management.

3. Indirect Benefits Estimation

NYSERDA's CEI programs generate energy savings and carbon reduction benefits *directly* when participant facilities adopt CEI practices as a result of program activities. The programs can also generate savings benefits *indirectly*. Indirect savings occur when facilities that did not participate in a program adopt one of the CEI practices due to NYSERDA's activity in the market.

There are two primary channels of indirect adoption:

- **Direct influence participant adoption (DIPA)** occurs when a company decides to extend the practices to additional facilities because of the benefits realized by the participant facility.
- **Influenced nonparticipant adoption** occurs when a nonparticipant facility adopts a CEI practice because of information it receives as a result of NYSERDA program activities or because of structural changes in the market resulting from program activity. An example of a structural change is more proactive promotion of CEI practices by energy consultants who have engaged with NYSERDA's programs, leading to greater adoption by nonparticipants.

CEI adoption through either of these channels can be considered an indirect result of NYSERDA programs only if the facility's decision is clearly influenced by NYSERDA's activity. There is a clear link to NYSERDA's program influence when additional facilities owned by a participant firm adopt a practice after the participating facility has demonstrated its benefits. However, it can be more difficult to determine when NYSERDA's program activity influenced a nonparticipant adopter, because NYSERDA cannot track all facilities that are exposed to its outreach or data sharing efforts. Some nonparticipant facilities that adopt a CEI practice may have done so with no influence from NYSERDA. This type of adoption is known as naturally occurring market adoption (NOMAD). These facilities also generate energy savings, but these savings are not indirect benefits of NYSERDA's program activity.

The actual benefits from indirect adoption are measured by the total energy savings and carbon reduction that occur, and these benefits vary by the practice adopted and the facility's pre-adoption energy usage.

As part of the Year 3 workplan, the Market Evaluation Team calculated the indirect savings benefits achieved by the CEI programs to date using the algorithm developed in Year 2, as presented here:

$$\boldsymbol{Indirect\ benefits_t = [DIPA + (Nonparticipant\ Adoption - NOMAD)]_t * UEB}$$

Where:

DIPA = Direct influence participant adoption; the additional units of adoption by participant companies after they are no longer receiving incentives or direct support from NYSERDA

Nonparticipant Adoption = Units of adoption by nonparticipating facility who have adopted the technology or practice

NOMAD = Units of naturally occurring market adoption; the estimated industrial facilities that would have adopted the technology or practice absent NYSERDA's intervention, by facility type

t = Time period

UEB = Unit energy benefit; the energy savings (MWh or MMBtu) or carbon dioxide equivalent reductions per industrial facility resulting from the adoption of OsEM or SEM by facility type

The first three inputs combine to determine the total number of facilities indirectly adopting the practice. The variable *t* defines the year being assessed, in this case, 2019. The final variable, unit energy benefit (UEB), is the amount of indirect savings and carbon reduction benefits estimated for each adopting facility. The Team used Year 3 primary data to calculate each of the variables related to units of adoption and used planning estimates from NYSERDA as the UEBs. The following sections describe this process in more detail.

3.1. Calculating Units of Indirect Adoption

The Team used information from the participant interviews to determine the number of additional facilities that had adopted OsEM and SEM through direct influence of the participants (DIPA). These results are presented in greater detail in the

Participant Impacts section of this report.

To calculate the number of nonparticipant adopters, the Team used survey results to determine the rate of nonparticipant adoption by tier then applied these percentages to the tier-level populations. The Team also used survey results to calculate the proportion of adoption that was naturally occurring (NOMAD). The resulting number of facilities after subtracting NOMAD adopters from the total number of nonparticipant adopters is the number of influenced nonparticipant adopters. These influenced adopters are the nonparticipant facilities that adopted either OsEM or SEM because of NYSERDA's program activity.

The nonparticipant survey captured key adoption characteristics to identify naturally occurring adoption. To be considered an indirect outcome of NYSERDA's program activity, the respondent must have adopted the practice after NYSERDA began its CEI initiative, credit NYSERDA (or another source that in turn was influenced by NYSERDA) as an influence on the facility's decision, and rate that influence as important.[14] Any facility that did not meet all three criteria was identified as a naturally occurring adopter. Table 22 summarizes these factors and how each was presented in the survey.

[14] The Team intended to identify which sources were connected to NYSERDA activity through consultation with NYSERDA program staff. However, no respondents who adopted either SEM or an OsEM referenced a possible NYSERDA-connected source (other than NYSERDA itself).

Table 22. Analysis Approach to Identify NOMAD

Factor	Survey Question[a]	Response Options
Timing	In approximately what year did your facility first [practice description]?	[Record year]
Source	Which, if any, of the following factors contributed to your company's decision to [practice description]?	Information from an industry association (specify association) Information from a consultant or provider (specify consultant) Information from utility, NYSERDA, or other entity (specify entity) Training, workshop, webinar, or other event (specify event) Read a case study or report (specify) Another source (specify) None of the above
Importance	How important was [repeat for each source indicated] to your company's decision to [practice description]?	Very important Somewhat important Not too important Not at all important

[a] Questions about an OsEM referenced company's decision to "assign responsibility for energy performance"; questions about SEM referenced facilities decision to "adopt a commitment to ongoing and systematic energy management."

Cadmus analyzed each adoption factor in sequence, identifying respondents as naturally occurring adopters at each step. Table 23 shows the attrition of the sample of nonparticipant adopters at each step of the analysis. No respondents were identified as influenced SEM adopters. Only one respondent, a Tier 3 facility, was identified as an influenced OsEM adopter. The Team extrapolated the results to the Tier 3 population, which means there are 26 OsEM-influenced nonparticipant adopters in the population.

Table 23. Attrition by Step of Assessment of Naturally Occurring Adopters

Influence Factor	OsEM			SEM		
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Nonparticipant Adopters (number of survey respondents)	**25**	**8**	**45**	**3**	**0**	**0**
Naturally Occurring Determination Factor						
Adopted prior to 2018	24	8	39	3	-	-
Not influenced by NYSERDA source	1	-	4	-	-	-
NYSERDA source not considered important influence	-	-	1	-	-	-
Total NOMAD (a+b+c)	**25**	**8**	**44**	**3**	**0**	**0**
Influenced Nonparticipant Adoption (sample)	**0**	**0**	**1**	**0**	**0**	**0**
Influenced Nonparticipant Adoption (population)	**0**	**0**	**26**	**0**	**0**	**0**

Table 24 shows the total number of facilities that adopted OsEM or SEM as a result of NYSERDA's indirect market influence. Four facilities adopted OsEM through direct influence. Though some SEM participants extended some SEM practices to additional facilities, none extended all practices, so the Team did not count any as indirect adopters.

Table 24. Total Number of Indirect Adopter Facilities in 2019 (Population Estimates)

Type of Adoption	OsEM			SEM		
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Direct Influence Participant Adoption	3	1	–	–	–	–
Influenced Nonparticipant Adoption	–	–	26	–	–	–
Total Indirect Adoption	3	1	26	–	–	–

3.2. Unit Energy Benefit Values and Assumptions

To calculate indirect benefits, the Team needed to apply an estimate of the energy savings and carbon reduction achieved by each indirect adopter. The Team reviewed NYSERDA Budgets and Benefits (BAB) workbook and planning workbooks to identify appropriate values to use as UEBs and to identify any possible inconsistencies in savings assumptions or gaps in documentation of assumptions and/or sources.

The BAB is an internal template NYSERDA uses to document the assumptions for long-term program costs and expected savings for each program in its portfolio along with any changes to those assumptions. The BAB serves as an agency and program-level forecasting tool, and as such, does not include per-unit assumptions. Instead, the team used assumptions from separate supporting calculation workbooks for OsEM and SEM that NYSERDA provided.

These supporting workbooks used different approaches to calculate unit-level and program-level savings for each program. The SEM workbook estimated savings as a percentage reduction of energy usage, with a seven-year measure life and decreasing annual savings during that period. It estimated energy savings by facility tier (for Tier 1 and Tier 2) and fuel type. NYSERDA's assumptions for SEM unit savings are shown in Table 25.

Table 25. NYSERDA SEM Unit Savings Assumptions

Period	Percentage Savings	Tier 1		Tier 2	
		MWh	MMBtu	MWh	MMBtu
Year 1	4%	702	5,424	211	1,627
Year 2	2%	337	2,603	101	781
Year 3	2%	330	2,551	99	765
Year 4	2%	324	2,500	97	750
Year 5	1%	159	1,225	48	368
Year 6	1%	157	1,213	47	364
Year 7	1%	156	1,201	47	360
Total for 7 Years		**2,165**	**16,718**	**650**	**5,015**

For OsEM, NYSERDA used a simpler calculation. The workbook identified expected first-year savings by facility tier (again, only for Tier 1 and Tier 2) and assumed only one year of savings. However, this single-year savings estimate is considerably higher than the first-year savings estimate for SEM; electric

savings were almost 60% higher and MMBtu savings were nearly three times higher. Table 26 shows NYSERDA's estimated per-unit savings from OsEM.

Table 26. NYSERDA OsEM Unit Savings Assumptions

Tier	MWh	MMBtu
Tier 1	1,200	15,000
Tier 2	500	5,000

NYSERDA's OsEM workbook used the conversion factors shown in Table 27 to calculate carbon reduction from energy savings. The SEM workbook did not provide estimated carbon reduction.

Table 27. NYSERDA's Conversion Factors to Calculate Carbon Reduction by Fuel Type

Conversion	Factor
Btu/kWh	9,500
Lbs/MWh	1,160
Lbs/MMBtu (natural gas)	117
Lbs/MMBtu (oil)	162
Ton/Lbs	2,000
Metric Ton/Ton	1.10231
Lbs/Metric Ton	2,205

Using NYSERDA's savings estimates, the Team derived UEB values to inform the indirect benefits calculation. To apply NYSERDA's values to the indirect benefits analysis, the Team made the following assumptions and adjustments:

- Converted SEM savings to an average annual value to capture only the benefits achieved in 2019
- Calculated Tier 3 savings as 33% of the Tier 2 estimate, for each fuel and for each program, based on the fact that the mid-point for Tier 3 energy expenses ($250,000) is 33% of the midpoint for Tier 2 expenses ($750,000)
- Applied the SEM assumption of 94% natural gas and 6% fuel oil savings to OsEM MMBtu savings to calculate carbon reduction, since no corresponding assumption was available for OsEM
- Applied the OsEM carbon reduction conversion factors to the SEM savings assumptions to calculate carbon reduction from SEM

The resulting UEB values are shown in Table 28.

Table 28. Derived Unit Energy Benefits (UEBs)

Program/Metric	Tier 1	Tier 2	Tier 3
OsEM[a]			
Electricity (MWh)	1,200	500	165
Fossil Fuels (MMBtu)	15,000	5,000	1,650
Carbon (Metric Tons)	1,446	534	176
SEM[b]			
Electricity (MWh)	309	93	31
Fossil Fuels (MMBtu)	2,388	716	236
Carbon (Metric Tons)	292	88	29

[a] OsEM values source: NYSERDA workbook, "OsEM Market Impact Worksheet 2019.xlsx," provided by NYSERDA in August 2019.
[b] SEM values source: "Participant Savings Methodology Calcs.xlsx" workbook, provided by NYSERDA in May 2019.

3.3. Summary Results

To evaluate the total indirect benefits generated in 2019, the Team applied the derived UEBs to the corresponding the number of facilities adopting OsEM, by tier. Because there was no indirect adoption of SEM, this program did not generate indirect benefits.

Table 29 lists the estimated indirect benefits from the NYSERDA CEI programs in total energy and carbon savings.

Table 29. 2019 Estimated Indirect Benefits by Program and Tier

Indirect Benefits Type	OsEM			SEM			CEI Initiative Total
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3	
Units of Indirect Adoption	**3**	**1**	**26**	**0**	**0**	**0**	
MWh Benefits	3,600	500	4,278	0	0	0	**8,378**
MMBtu Benefits	45,000	5,000	42,784	0	0	0	**92,784**
CO_2e Benefits	4,337	534	4,573	0	0	0	**9,445**

NYSERDA's targets for indirect benefits are distributed over a 12-year span, from 2018 through 2030, with targets set for 2020, 2025, and 2030. Because the nonparticipant survey is conducted only every other year, the Team can directly measure indirect adoption only for 2019 and 2021. To assess 2018 savings, the Team applied the nonparticipant savings from 2019. The Team did not apply the 2019 benefits from direct influence adopters to 2018, because both 2018 and 2019 DIPA are included in the 2019 results.

Table 30 shows the estimated cumulative indirect benefits from 2018 and 2019.[15] The table also presents the 2020 targets for indirect energy savings and carbon reduction benefits from the SEM and OsEM programs combined (excluding the targets for RTEM) and the percentage of targets achieved to date.

Table 30. Estimated 2018-2019 Cumulative Indirect Benefits

Indirect Benefits Type	CEI Initiative Program Year			2020 Target for OsEM and SEMa	% of Target Achieved
	2018	2019	Cumulative (2018-2019)		
Total MWh Benefits	4,278	8,378	12,657	15,000	84%
Total MMBtu Benefits	42,784	92,784	135,568	187,500	72%
Total CO_2e Benefits	4,573	9,445	14,018	18,330	76%

[a] *Source: CEI Budget and Benefits workbook, April 2019*

[15] The Team will calculate 2020 and 2021 benefits in 2021. It will use an average of 2019 and 2021 results to determine the 2020 total, depending on available data.

4. Findings and Recommendations

4.1. Key Findings and Recommendations

The Market Evaluation Team has made the following conclusions and recommendations for NYSERDA's CEI initiative and the three programs.

4.1.1. Finding 1

Participants' high retention rates and extension of OsEM and SEM practices to additional facilities validates NYSERDA's hypotheses about the value of these practices to end users. The majority of the facilities the Team interviewed about the OsEM and SEM programs retained at least one key practice adopted during their participation. Five of six OsEM participants retained the OsEM role. Three of eight SEM participants adopted all ten SEM practices measures, while an additional three had adopted nine of ten practices. Several participants found the practices sufficiently useful that they extended them to other facilities in their organization. However, the rate of adoption by these additional facilities was lower than the nonparticipant rate of adoption.

4.1.1.1. Recommendation 1

Disseminating information directly to nonparticipant facilities may be a more effective driver of market transformation than word-of-mouth from participant facilities. NYSERDA should continue to use positive participant experiences to develop detailed case studies and promotional materials. Participants said their primary consideration in maintaining practices or extending them to other facilities was the potential for a return on the investment. Materials should present quantitative details on financial outcomes for participants and highlight participants that extended SEM practices to their other facilities, which shows a high degree of confidence in the approach. To reach a broader audience, NYSERDA should use multiple channels, identified by sector, to distribute case studies and materials. They should also involve organizations viewed as trusted advisors by industry, such as consultants, trade associations, parts suppliers, or business councils, to help generate awareness of the programs and their results. NYSERDA should also consider engaging representatives from participant facilities as trusted messengers to disseminate results.

4.1.2. Finding 2

OsEM participants, as anticipated by NYSERDA, preferred that an internal hire serve as OsEM in a long-term capacity, rather than an outside consultant. Four of five participant facilities that retained the OsEM role did not extend the contract with the consulting firm they worked with during the program, and instead appointed an internal staff person to take over the role. Consultants noted that providing an OsEM presented challenges to their own companies. These challenges include that the OsEM role requires very senior staff, but these staff prefer to work on less time-intensive projects that do not require as much travel. In addition, consultant firms need these staff to engage with numerous clients to build a pipeline of work for their more junior consultants. Both participants and consultants said the OsEM role, to be sustainable, may need to be less time-intensive or be extended over multiple facilities.

4.1.2.1. Recommendation 2

NYSERDA should consider explicitly requiring a transition from the consultant as OsEM to the internal employee during the consultant's contract period, to ensure the internal hire receives training and

mentoring from the consultant, and to help other staff understand that the role is continuing even though the consultant's engagement is ending. For example, consultants may need to specifically integrate staff training activities and incorporate an exit or transition strategy into their scope. With fewer hours needed, the OsEM role would be easier for consulting firms to fill. In addition, ensuring that an internal hire is in place should reassure consultant firms that their engineers would not be poached by the client once the subsidies end (as occurred in one case).

NYSERDA should also consider using marketing materials, including case studies, to raise the profile and awareness of the OsEM role among consultant and engineers.

4.1.3. Finding 3

Both facilities and consultants may need additional training to understand and value all of the SEM subelements. The nonparticipant survey results found that most facilities have adopted some SEM subelements, though only 7% had adopted them all, and few had adopted the practices most indicative of commitment to a continuous improvement management system. Despite taking steps such as expressing a commitment to strategic energy management, identifying an energy manager, and investing in the institutional tools needed to practice CEI, most facilities stopped short of following through on a long-term commitment by not continuing regular meetings, monitoring, reporting, or training. For example, many facilities that completed energy management assessments, energy maps and project plans, failed to adopt performance goals as KPIs, or keep project registers up to date. Some energy consultants also showed a lack of familiarity (or lack of understanding) of the management-oriented characteristics of SEM (as opposed to a series of individual actions or projects).

4.1.3.1. Recommendation 3

Case studies and other materials used to promote SEM should emphasize the business case of adopting SEM as a holistic management system rather than simply the payback from individual project energy savings. For example, case studies should highlight actions and benefits associated with long-term, ongoing, continuous improvement practices such as additional energy savings from processes participants thought were already optimized, from projects identified after the initial treasure hunt, or from facilities that can definitively report progress against production efficiency targets through ongoing data tracking, analysis, and review. Case studies should highlight benefits beyond energy savings, such as greater market competitiveness, lower maintenance and downtime costs, and improvements in health and safety resulting from improved energy management. Finally, materials should be distributed to consultants and other service providers to industrial facilities as well as to end users.

4.1.4. Finding 4

NYSERDA's CEI programs have not been active long enough to impact the nonparticipant market. The nonparticipant market has shown little change in the level of adoption since Year 1 and virtually no change influenced by NYSERDA program activity. Though changes in the adoption rate since 2017 cannot be precisely quantified because of a revision in the survey methodology, qualitative evidence suggests little to no increase in adoption of CEI practices over the last two years. Energy consultants provided mixed reports on the levels of awareness and demand for energy management services among industrial clients and indicated no clear trend for greater energy management activity over the past two years. Survey results also showed that overall adoption levels are low. Any adoption that has taken place

in the nonparticipant market is almost entirely naturally occurring. Since NYSERDA has not yet initiated the information distribution component of the CEI Initiative, this result is not surprising.

4.1.4.1. Recommendation 4

As noted above, in addition to continuing direct program activity, NYSERDA should focus on disseminating compelling materials about the success of CEI programs through credible messengers acting through multiple channels. Some testing and trial and error may be necessary to identify the best channels of information. NYSERDA should maintain detailed records of all outreach activities, including distribution of materials to partner organizations, and, to the extent possible, any outreach activities conducted by those partners (such as speaking at trade association meetings, presenting at conferences, reposting materials or linking to NYSERDA's website.

4.2. Observations on Planning and Evaluation Frameworks

Throughout 2019, the Market Evaluation Team identified opportunities for minor changes to planning and evaluation procedures that could enhance the value of future CEI programs or studies. These observations are presented here as secondary findings and recommendations from the Year 3 research.

4.2.1. Finding 5

Better data collection in 2019 produced values for market indicators that are substantially different but probably more accurate than 2017. Changes in the nonparticipant survey instrument and sampling frame from 2017 to 2019 improved the quality of data collection. Few if any changes will be needed in 2021, which should allow for a rigorous quantitative comparison with 2019. Because anecdotal evidence found little change in the nonparticipant market between 2017 and 2019 and because NYSERDA's activities have not yet had a significant impact on that population, findings from 2019 should be an appropriate baseline for CEI activities.

4.2.1.1. Recommendation 5

Update market progress indicator targets to use 2019 results as baseline values.

4.2.2. Finding 6

Although the Team had sufficient information to complete the indirect benefits analysis for 2019, some information the Team expected to be included in the planning workbooks was not present.. The Team was able to identify the per-unit assumptions needed for the indirect benefits analysis. However, in its review of the planning workbooks, the Team noted that the workbooks generally did not include sources for the assumptions used. In addition, the workbooks use different assumptions and calculations across the two programs, but did not include any discussion of the reasons for the differences. Finally, the workbooks did not address the possibility of overlap across the two programs. This information may be located in other resources that the Team did not request.

4.2.2.1. Recommendation 6

If it has not done so already, the Team recommends NYSERDA consider the following to facilitate future planning and evaluation:

- Though the OsEM and SEM programs achieve savings through similar means, the estimated savings per facility are significantly different. NYSERDA should document the reason for the difference in the savings and assumptions per facility. For example, if the savings assumptions are different because NYSERDA expects that the programs will target different types of facilities, the expected participant characteristics should be documented for each program.
- The SEM workbook provided the decreasing percentage of savings each year over a seven-year period. The OsEM workbook only provided one-year savings estimates. NYSERDA should consider providing estimates for both programs in a similar format, or should document why the savings over time does not apply to the OsEM program.
- NYSERDA should document assumptions about how the SEM and OSEM programs might overlap, and how to incorporate that overlap into savings calculations. For example, many nonparticipants that adopt SEM will have adopted an on-site energy manager. Should these facilities be credited with both the SEM per-unit savings, and the energy manager savings? In addition, facilities may participate in both SEM and OsEM programs. Which savings should be assigned to each participant?
- For all assumptions, NYSERDA should document the source, to allow for easier updates and comparison with other analysis.

4.2.3. Finding 7

The wide range of financial conditions among Tier 3 facilities may be obscuring gradation in facility decision-making. Tier 3 represents 92% of the industrial facilities in New York, and a much wider range in annual energy costs relative to the costs of implementing an OsEM role or SEM, than do Tier 1 or Tier 2. For example, for a facility with $50,000 in annual energy expenditures, an OsEM may never be financially viable. On the other hand, a facility with a $400,000 annual energy budget—eight times larger—may benefit from at least a part-time OsEM. By grouping these facilities in Tier 3, this type of differentiation is lost.

4.2.3.1. Recommendation 7

NYSERDA should consider conducting separate program design, planning, and evaluation for facilities that have annual energy expenditures below $100,000 a year than for facilities with annual energy expenditures between $100,000 and $500,000. Doing so would mirror the approach used to determine tier distinctions in Year 3 and facilitate comparison with the Year 3 analysis.

5. Methodology

5.1. Nonparticipant Survey

The Market Evaluation Team conducted a phone survey with management-level contacts at nonparticipant industrial manufacturing facilities in New York to measure the penetration of key CEI practices as of 2019. The Year 3 survey was the second wave of this survey, originally conducted in Year 1. The 2019 nonparticipant survey instrument is included in *Appendix C*.

5.1.1. Sampling

In 2019, the Team made updates to the sample frame and sample sizes established in the Year 1 nonparticipant survey to incorporate new data. The sample frame was also adjusted to accommodate NYSERDA's concurrent Industrial Market Insights (IMI) Research Study, which required interviews with end users in the same sample population as the CEI Market Evaluation.

To develop the sample frame in Year 1, the Team used InfoGroup data purchased and provided by NYSERDA. The population of interest included industrial facilities with the following characteristics:

- Industrial facilities that had not previously participated in NYSERDA's CEI program
- Industrial facilities with 10 or more employees

The Team identified industrial facilities using North American Industry Classification System (NAICS), with three-digit codes beginning in 31 through 33, and removed facilities identified as having fewer than 10 employees.

The Team stratified the population into seven industrial sectors defined by NAICS codes and three tiers of annual energy expenditures within each sector. NYSERDA identified the following six high-priority sectors and an additional category that included the remaining NAICS sectors:

- 311 Food
- 322 Paper
- 325 Chemicals
- 326 Plastics and Rubber
- 327 Nonmetallic Minerals
- 332 Fabricated Metal
- Other (NAICS 312, 313, 314, 315, 316, 321, 323, 324, 331, 333, 334, 335, 336, 337, 339)

Energy expenditures were not included in the Infogroup data, so the Team used the number of employees as a proxy. Using data collected through the survey, the Team post-stratified respondents according to their annual energy expenditure tier, as reported in the survey data. The tier definitions are provided in Table 31.

Table 31. Tier and Proxy Tier Definitions

Tier	Annual Energy Spending Tier	Number of Employees Tier
Tier 1	Annual Energy Spend Greater $1 million	More than 250 employees
Tier 2	Annual Energy Spend $500,000 – $1,000,000	Between 100 and 249 employees
Tier 3	Annual Energy Spend Less Than $500,000	Between 10 and 99 employees

In the 2017 study, the population and the sample frame were the same in each tier. Table 32 shows the distribution of industrial facilities in the resulting sample frame.

Table 32. 2017 Industrial Nonparticipant Population

NAICS	Sector	Tier 1	Tier 2	Tier 3
311	Food Manufacturing	20	45	549
322	Paper Manufacturing	6	39	176
325	Chemical Manufacturing	20	27	204
326	Plastics and Rubber Product Manufacturing	6	30	181
327	Nonmetallic Mineral Product Manufacturing	10	20	180
332	Fabricated Metal Product Manufacturing	15	66	1,010
3··	Other	153	383	3,783
Total		**230**	**610**	**6,083**

2019 Sample Frame Updates

The Team created a new sample frame for the 2019 CEI Market Evaluation nonparticipant survey using a revised dataset provided by InfoGroup in November 2018. These data included notably fewer facilities in each tier, resulting in an overall 11% decrease in the identified industrial population. As with the 2017 sample frame and stratification, the Team defined strata corresponding to three-digit industrial NAICS codes and three tiers, defined by the number of employees as shown in Table 31.

Table 33 shows the distribution of industrial facilities in the updated InfoGroup data for 2019.

Table 33. 2019 Industrial Nonparticipant Population

NAICS	Sector	Tier 1	Tier 2	Tier 3
311	Food Manufacturing	24	20	507
322	Paper Manufacturing	9	7	151
325	Chemical Manufacturing	12	9	208
326	Plastics and Rubber Product Manufacturing	11	9	178
327	Nonmetallic Mineral Product Manufacturing	9	7	172
332	Fabricated Metal Product Manufacturing	33	33	960
3··	Other	173	148	3,607
Total		**270**	**235**	**5,782**

Tier 3 Sample Frame Adjustment

The Team adjusted the 2019 sample frame to accommodate NYSERDA's concurrent IMI Research. Both studies targeted interviews with facilities in the population in Table 33. However, the CEI Market Evaluation targeted the whole population, while the IMI Research focused on specific industrial sectors (NAICS codes 311, 312, 322, 325, 326, 327, and 332) and zip codes that pay the system benefit charge (SBC) that is directed to funding NYSERDA programs.

In Tier 3, population sizes were sufficient to develop separate sample frames for the two studies. The Team split the population by randomly selecting 60% of the facilities within each sector to comprise the CEI Market Evaluation sample frame and 40% to comprise the IMI sample frame, as shown in Table 34. The Team withheld 40% of facilities in sectors and counties not targeted for the IMI Research so sampling weights would not be required in the analysis of the CEI Market Evaluation surveys.

Table 34. Tier 3 CEI and IMI Sample Frame Allocation

Industrial Sectors	Zip Code	Facilities in CEI Sample Frame	Facilities in IMI Sample Frame	Facilities Not in Either Sample Frame
IMI eligible sectors	Pay SBC	60%	40%	0%
	Do not pay SBC	60%	0%	40%
Other industrial sectors	All	60%	0%	40%
		60%	0%	40%

The populations in Tier 1 and Tier 2 sectors were not large enough to develop separate sample frames, so the Team used the full population of Tier 1 and Tier 2 as the CEI Market Evaluation sample frames for those populations.[16]

Table 35 provides the final distribution of facilities, by tier, in the CEI Market Evaluation nonparticipant survey sample frame.

Table 35. CEI Nonparticipant Survey Sample Frame

NAICS	Sector	Tier 1	Tier 2	Tier 3
311	Food Manufacturing	20	39	288
322	Paper Manufacturing	5	34	82
325	Chemical Manufacturing	12	22	117
326	Plastics and Rubber Product Manufacturing	7	29	96
327	Nonmetallic Mineral Product Manufacturing	5	23	98
332	Fabricated Metal Product Manufacturing	14	61	559
3··	Other	123	344	2,008
Total		**186**	**552**	**3,248**

[16] These also served as the IMI project Tier 1 and 2 sample frame: end users were asked to participate in both studies. The CEI Market Evaluation survey was completed first, so that the interview questions did not bias the survey results.

Sample Sizes

As in the 2017 CEI Market Evaluation, the Team calculated sample size targets using the Neyman optimal allocation to allocate total sample sizes to tier and sector strata.[17] The Team assumed maximum variability in survey responses among customers within each stratum, used finite population corrections, and set 90% statistical confidence with 10% precision (90/10) targets for measuring CEI adoption in 2019 and changes over time within each tier. The target sample sizes are provided in Table 36.

Table 36. 2019 Target CEI Sample Sizes

NAICS	Sector	Tier 1	Tier 2	Tier 3
311	Food Manufacturing	11	12	18
322	Paper Manufacturing	5	12	10
325	Chemical Manufacturing	9	9	11
326	Plastics and Rubber Product Manufacturing	6	11	10
327	Nonmetallic Mineral Product Manufacturing	6	9	10
332	Fabricated Metal Product Manufacturing	9	15	25
3··	Other	29	37	47
Total		**75**	**105**	**131**
Approximate Response Rate Needed		**40%**	**19%**	**4%**
Expected Precision at 90% Confidence		**10%**	**10%**	**10%**

The CEI Market evaluation survey collected information on each facility's annual energy expenditure. When the number of employees did not align with annual energy expenditure according to Table 31, the Team reassigned respondents to the correct tiers. For analysis, the Team adjusted the population of facilities based on the proportion of facilities reassigned in the sample.

Post-Stratification

The Team determined that basing the analysis on post-stratified tiers representing actual energy expenditures (collected through the survey) provided more interesting results than the pre-stratified tiers. That is, post-stratification resulted in more homogeneous strata with respect to SEM adoption. Consequently, the Team used this stratification in survey sample estimation rather than the original strata (defined by the number of employees). Because data on energy expenditures were unavailable for 10% of the sample, the Team estimated population sizes based on the relationships between the number of employees and energy expenditures. Table 31 above provides the definition of the post-stratification tiers.

Additionally, the Team examined if sector-level stratification weights were necessary. As with the Year 1 evaluation, the Team did not find significant evidence that sector-level weights were necessary.

Table 37 shows the 2019 population and sample sizes, with the expected confidence and precision for tier-level and sample-level results.

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[17] The Neyman optimal allocation is defined as $n_h = n * \frac{(N_h * S_h)}{\sum(N_h * S_h)}$ where n_h is the sample size for stratum h, n is the total sample size, N_h is the population size for stratum h, and S_h is the standard deviation of stratum h

Table 37. Survey Sample Plan

Tier	Estimated Nonparticipant Population	Sample Size	Expected Confidence and Precision within Tier
Industrial facilities Tier 1	270	46	90/10
Industrial facilities Tier 2	235	26	90/15
Industrial facilities Tier 3	5,782	223	90/10
Industrial facilities Total	**6,287**	**295**	**90/5**

Implementation

NYSERDA's survey partner, APPRISE, fielded the survey from February 2019 through June 2019. Contacts identified as Tier 1 or Tier 2 (using the pre-stratification tier based on number of employees) were simultaneously recruited for in-depth interviews for a parallel market research study. To ensure survey data were not corrupted by the interview experience, respondents completed the survey first.

5.2. Participant Interviews

The Team reached out to representatives from seven facilities that participated in the NYSERDA OsEM program and 15 facilities that participated in the SEM program. The Team conducted structured interviews with participants by telephone during August and September 2019 and completed interviews with six OsEM and eight SEM participants. Only one representative from a company that participated in SEM was unavailable. The interview guide is available in *Appendix D*.

5.3. Energy Consultant Interviews

In August and September 2019, the Team conducted in-depth telephone interviews with 23 energy consultants. This was the second wave of interviews with energy consultants, following the first wave from Year 1. For the Year 3 interviews, the Team adjusted the interview guide and the target population. Instead of recruiting energy consultants in general, the Team exclusively recruited firms that had participated with NYSERDA in the FlexTech or Industrial Process Efficiency programs. These consultants were selected based on the Team's assumption that consulting firms that are active in the energy efficiency space are likely to have registered for these programs. The Team also screened for firms with industrial clients. The interview guide is presented in *Appendix E*.

5.3.1. Indirect Impacts and Identification of Unit Energy Benefits

The Team calculated the indirect impacts of the OsEM and SEM programs using the methodology and algorithms described in the NYSERDA CEI Market Evaluation report for Year 2. The Year 2 Market Evaluation report, Appendix B, presents a detailed discussion of how the indirect benefits algorithm was developed.

Appendix A. Changes from 2017

As noted earlier in this document, changes to the survey instrument, the population data, and the choice architecture associated with the survey question used to assign respondents to tiers prevent any meaningful quantitative comparison of nonparticipant adoption from 2017 to 2019. This appendix presents 2019 adoption rates compared to 2017 adoption rates as anecdotal results from the Year 3 research, with a summary describing the survey and analysis changes impacting results. Readers should note that the changes to the population and tier assignments are also affecting all comparisons.

Throughout the survey, the Team made numerous small adjustments to improve the clarity of questions, put questions in a more intuitive order, incorporate additional question for subjects such as RTEM system adoption and indirect benefits estimation, and correct skip logic and scoring that produces results that were obfuscated or unnecessarily difficult to comprehend. For a question-by-question review of the changes to the survey instrument and scoring, see the Year 2 Market Evaluation report.

2017 and 2019 Results

OsEM Adoption

Table A-1 compares OsEM adoption by tier and the overall market in 2019 and 2017. The most significant change to the measurement of OsEM adoption was a change to the survey scoring analysis. In 2019, facilities that had assigned responsibility for meeting energy performance goals to a team (rather than an individual) could still be identified as OsEM adopters if they had designated a team leader with primary responsibility. Because this allowed more facilities to meet the conditions for OsEM adoption, the rate of adoption increased.

Table A-1. 2019-2017 OsEM Adoption Comparison by Tier

Tier	2019	2017
Tier 1	54%[a]	16%
Tier 2	31%[a]	12%
Tier 3	20%	15%
Overall	**22%**	**15%**

[a] Indicates statistically significant difference.

Adoption of Monitoring and Tracking Systems

Table A-2 compares MT&R adoption by tier and the overall market in 2019 and 2017. The Market Evaluation Team also made a scoring adjustment to this measurement. In 2019, the Team eliminated skip logic that had prevented respondents that indicated they used "energy management tracking software" as their energy management plan (question D6) from responding to additional questions about adoption of monitoring and tracking systems (D7 and D8). The logic was intended to shorten the survey for respondents, but it resulted two separate sets of responses that were difficult to analyze together. The 2019 survey presented D7 and D8 to all respondents that had adopted energy performance goals, and used only responses to those questions to analyze adoption of monitoring and tracking systems.

Table A-2. 2019-2017 MT&R Adoption Comparison by Tier

Tier	2019	2017
Tier 1	35%[a]	70%
Tier 2	35%[a]	51%
Tier 3	14%[a]	22%
Overall	**16%**	**27%**

[a] Indicates statistically significant difference.

SEM

Because it involves so many questions, the analysis of SEM adoption may include, cumulatively across all subelements and minimum elements, the most survey and scoring changes from 2017.

Company Commitment

Table A-3 shows 2019 and 2017 results for Company Commitment subelements and the minimum element, by tier. The Team altered this minimum element scoring primarily by not including the efficiency Attitude in the score in 2019. The Market Evaluation Team also separated a question that asked about adoption of a written energy policy or energy plan into two separate questions to prevent a possible double-barreled question. These changes appear to have had limited impact on the results, and Year 3 adoption levels are not statistically different from Year 1.

Table A-3. 2019-2017 Comparison of Full Adoption—Company Commitment

Subelement	2019			2017		
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Efficiency Attitude	50%	46%	35%[a]	65%	59%	52%
1a. Policy and Goals	35%	23%	9%	44%	33%	10%
1b. Resources	35%	15%	6%	39%	13%	3%
Minimum Element Adoption (Max Score of 4 in 2019; max score of 6 in 2017)	20%	8%	1%	23%	10%	1%

[a] Indicates statistically significant difference between years.

Planning and Implementation

Table A-4 shows 2019 and 2017 results for Planning and Implementation subelements by tier. The Market Evaluation Team made at least minor changes to the questions or scoring for each subelement, except **2b. energy map**. However, the statistically significant changes in the scores for energy map that occurred only in Tier 2 and Tier 3 may be a result of the overall shift from Tier 2 to Tier 3 as a result of the change in choice architecture for the question about energy expenditure.

Significant changes to the survey included removing questions about KPIs for energy efficient equipment and process efficiency from subelement **2f. implementation**, and incorporating them in the scoring for subelement **2c. metrics and goals** instead. Other changes included changing all reference to "past three years" to "past two years" to reflect the period of time since the baseline survey, and changing the scoring for **2g. reassessment** to give full credit for quarterly review, instead of requiring monthly or more frequent review, among others. Although the changes caused statistically significant changes in adoption

for individual subelements, 2019 adoption of the Planning an Implementation minimum element was not statistically different from 2017 for any tier.

Table A-4. 2019-2017 Comparison of Full Adoption—Planning and Implementation

Subelement	2019			2017		
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
2a. Energy Management Assessment	33%	19%	14%[a]	42%	38%	22%
2b. Energy Map	52%	19%[a]	24%[a]	56%	48%	36%
2c. Metrics and Goals	13%[a]	4%[a]	3%[a]	42%	41%	18%
2d. Project Register	28%	8%	8%	30%	23%	7%
2e. Employee Engagement	35%	12%[a]	8%[a]	53%	35%	15%
2f. Implementation	70%[a]	65%[a]	45%[a]	39%	28%	10%
2g. Reassessment	22%	8%	3%[a]	30%	25%	8%
Minimum Element Adoption (Max Score of 14)	**9%**	**0%**	**1%**	**4%**	**1%**	**0%**

[a] Indicates statistically significant difference between years.

Measuring and Reporting Energy Performance

Table A-5 shows the 2019 and 2017 results for Measuring and Reporting Energy Performance by tier. Most of the adjustments to scoring for the measuring and reporting subelements affected whether facilities were score as no adoption or some adoption, rather than the full adoption score. For subelement 3d., we removed skip logic that prevented several respondents from answering this question. Other results were not statistically different across years.

Table A-5. 2019-2017 Comparison of Full Adoption—Measuring and Reporting

Subelement	2019			2017		
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
3a. Measurement	52%	54%	22%	70%	51%	22%
3b. Data Collection and Analysis	46%	23%	10%	51%	30%	11%
3c. Analysis	61%	58%[a]	28%	61%	29%	22%
3d. Reporting	76%[a]	85%[a]	54%[a]	51%	38%	15%
Minimum Element Adoption (Max Score of 8)	**24%**	**8%**	**4%**	**35%**	**14%**	**4%**

[a] Indicates statistically significant difference between years.

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Appendix B. SEM Definitions and Scoring

Table B-1. SEM Definitions and Scoring Criteria

CEE Minimum Element	CEE Minimum Element Definition	Criteria Assessed for Market Evaluation
Company Commitment	**In an industrial organization, clear commitment is vital for SEM to succeed. Senior managers must undertake three activities.**	
1a. Policy and Goals	Set, frame, and communicate long-range energy performance objectives through an energy policy and energy reduction goals.	Facility has a written energy plan or policy, has set energy reduction goals, or has communicated goals to staff.
1b. Resources	Ensure that SEM initiatives are properly resourced for goal attainment, including assigning responsibility or accountability to an individual energy champion, energy team, or support of employee engagement activities.	Facility has a team with responsibility for energy performance that meets at least once per quarter and facility has at least minimal staff and funding support needed to manage energy performance.
Planning and Implementation	**Planning provides the foundation for a customer to strategically manage energy. Implementation translates planning into actions that improve efficiency. Planning and Implementation consists of seven activities conducted by the energy champion or team.**	
2a. Energy Management Assessment	Assess current energy management practices by using a performance scorecard or facilitated energy management assessment.	Facility has completed a review of equipment and energy bills to identify savings opportunities and has completed an organizational assessment for SEM.
2b. Energy Map	Develop a breakdown or map of energy end uses and costs across the company.	Facility has developed an energy map to identify the key energy drivers and end uses.
2c. Metrics and Goals	Establish clear, measurable goals for energy performance improvements based on analysis of baseline energy consumption and relevant variables of energy consumption.	Facility has defined energy performance goals in terms of energy consumption quantities or a percentage reduction in use and has committed to goals as part of facility key performance indicators for both equipment and process.
2d. Project Register	Describe actions to be undertaken over one or more years; these can be behavior or capital improvements.	Facility has list of potential projects and revisited the list or energy management project plan at least once.
2e. Employee Engagement	Develop and implement a plan to educate employees about their activities' energy impacts.	Facility has conducted any employee engagement activities related to energy or conservation at least annually.
2f. Implementation	Complete measures in the project register.	Facility has completed at least one process or energy efficiency project in the last two years.
2g. Reassessment	Periodically review energy performance by comparing actual consumption to expected consumption, and use this information to reassess goals, metrics, and planned projects.	Facility has revisited the project register at least once.

CEE Minimum Element	CEE Minimum Element Definition	Criteria Assessed for Market Evaluation
System for Measuring and Reporting Energy Performance	**Industrial organizations should monitor and report energy performance according to their goals and should regularly analyze actual consumption against estimated consumption. A System for Measuring and Reporting Energy Performance consists of four activities that may involve multiple departments or individuals within a facility.**	
3a. Measurement	Regularly collect performance data to understand energy use; this subelement should capture all relevant energy consumption variables including production and weather.	Facility uses a tool that tracks energy use over time.
3b. Data Collection	Collect and store energy performance measurements versus goals in commonly available formats.	Facility reviews energy performance at least monthly.
3c. Analysis	Create a baseline of energy consumption and a model to predict energy consumption, then regularly update the model.	Facility has established an energy consumption baseline.
3d. Reporting	Provide internal and external stakeholders with the results of energy initiatives and achievements compared to goals.	Facility shares facility energy use with stakeholders such as management or operations staff.

Table B-2 shows the scoring rubric used to generate SEM adoption scores in 2019.

Table B-2. Year 3 Scoring Rubric for SEM Adoption

CEE Minimum Element	Subelement	Year 3 Survey Questions	Full Adoption (2 points = 100%)	Some Adoption (1 point = 50%)	No Adoption (0 points = 0%)
1. Company Commitment	1a. Policy and Goals	C3, C4, C5	AND (C3=1, C4=1, C5=1)	Any other combination	AND (C3>1, C4>1, C5>1)
	1b. Resources	C6, C8-C10	AND (C6=1, C6a="team," C8<5, C9<3, C10<3)		AND (C6>1, C6b="No," C8>6, C9=NR, C10=NR)
2. Planning and Implementation	2a. Energy Management Assessment	D1, D2	AND (D1<3, D2<3)	Any other combination	AND (D1>3, D2>3)
	2b. Energy Map	D3	D3<3		D3>3
	2c. Metrics and Goals	D4, D4a, D4b, D11, D13	AND (D4<3 OR (D4a<3, D4b<3), D11=1, D13=1)		AND (D4>2, D11>1, D13>1)
	2d. Project Register	C4a, D6, D6a	AND ((C4a=1, D6<5) OR (D6a=1, D6a=99))		AND (C4a>1, D6>4)
	2e. Employee Engagement	(C6), D15, D15a	AND (D15<3, D15a<5)		D15>2
	2f. Implementation	D14	D14<3		D14>3
	2g. Reassessment	D16	OR (D16=1,2,3,6)		OR(D16=98,99)
3. Measuring and Reporting Energy Performance	3a. Measurement	D7	D7<3	Any other combination	D7>3
	3b. Data Collection and Analysis	C4, D17	AND (C4=1, D17<4)		AND (C4>1, D17≥8)
	3c. Analysis	D1, D18	AND (D1=1, D18<2)		AND (D1=1, D18>3)
	3d. Reporting	D19	D19<7		D19>8

Appendix C. Nonparticipant Survey Instrument

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Appendix D. OsEM and SEM Participant Interview Guide

These interviews will allow Cadmus to evaluate the level of retention of OsEM services and SEM practices among pilot participants following pilot engagement. Cadmus will use the interviews to address the specific MPIs for OsEM and SEM retention shown in Table D-1, as well as assess the level of retention for aspects of the OsEM role and individual components of SEM. We will also use these interviews to gather data to quantify DIPA. DIPA is one component of the indirect impact algorithm, and results from participant implementation of OsEM or SEM, during or following the pilot, in facilities that did not receive direct assistance from NYSERDA. Finally, interviews will collect participant feedback on the pilot experience. (NOTE: These interviews are NOT intended to evaluate direct energy savings, or the persistence of energy savings.)

Table D-1 maps the interview guide questions in this document to specific research topics for the Market Evaluation of continuous energy improvement (CEI) adoption.

Table D-1. Question Mapping

Topic	Research Objective	Interview Question
Market Progress Indicators[a]	Determine the number of industrial sites retaining OsEM Determine the number of industrial sites continuing to participate in SEM (after program has ended) Number of energy teams maintained beyond the cohort (indicating executive support for SEM)	OsEM – Sec B SEM – Sec C
Indirect Impact Assessment	Quantify additional facilities, beyond the participating facility, where the participant firm has employed an OsEM, or adopted SEM practices not in place prior to participation	OsEM – A.B8 SEM – A.C8
Participant Experience		

[a] CEF Industrial Chapter, Revised November 2017.

Data Collection Method: Phone interview
Estimated Time to Complete: 15-20 minutes
Population Description: Participants that ended engagement with the program approximately 6 months prior to the interview date

Analysis Approach

Cadmus proposes to evaluate the MPIs as stated in the CEF Industrial Chapter, and the units of DIPA, as shown in Table D-2. Cadmus will also report more granular information on adoption or enhancement of individual components of the OsEM role, and SEM practices.

Table D-2. Approach to Quantification of Market Progress Indicators and DIPA

OsEM	
Continued OsEM adoption	Participant facility retains OsEM role (single staff person assigned as energy champion) and/or continues to engage with energy consultant
OsEM Indirect Impacts (DIPA)	OsEM role (could be same served by individual) extended to additional facilities that did not participate in the pilot
SEM	
Continued SEM adoption	Facility adopted an energy team by end the pilot, and continues to use energy team Facility adopted all SEM practices by end of pilot, and continues to implement all SEM practices
SEM Indirect Impacts (DIPA)	All 14 SEM practices extended to additional New York facilities that did not participate in the pilot

A. Introduction

Thank you for joining me today. My firm is assisting NYSERDA to monitor the market adoption of continuous energy improvement practices, such as use of On-Site Energy Managers and Strategic Energy Management. In this interview, I would like to ask a few questions about your experience in the [PROGRAM], how your experience in the program is affecting your company practices today. NYSERDA will use the information we collect through these interviews to assess whether their program design is having a long-term impact on participant firms, and whether there are improvements that could increase the program's impact - so we encourage you to be candid. Your responses will be anonymous. This interview should take no more than 20 minutes. Do you have any questions before we begin?

First, I'll ask some basic questions about your company and how you engage with the market.

A1. Please tell me about your role at your company, and your relationship to the facility that participated in the [PROGRAM].
A2. What do you produce at the participating facility?
A3. How many facilities does your firm operate in New York? What products do these facilities produce?

B. OsEM Market Progress Indicator [OsEM Participants only]

B1. How familiar were you with energy management, or continuous energy improvement concepts, before your facility participated in the OsEM Program?
B2. Prior to participating, did you have any staff assigned to identify energy efficiency or energy cost reduction opportunities? If yes, can you describe which staff, what their energy efficiency responsibilities were, and how much of their time was allocated to those activities?
B3. Can you describe the OsEM role at your facility during your participation in the program? What consultant or staff filled this role, what did their job entail, and how many hours per week did they dedicate to the role?
B4. Does your facility continue to engage the OsEM consultant, or a different consultant?
B5. Does your facility currently have any internal staff in the role of an OsEM? If yes, what staff (title) serve this function, and how many hours per week do they dedicate to it?

[If not engaging consultant and no internal OsEM, skip to Section D]

B6. [If retaining OsEM consultant or internal staff] How has the role of the OsEM changed, if at all, since your participation in the program ended? Does the current OsEM continue to perform all of the functions of the OsEM funded by the pilot? Does the current OsEM dedicate the same amount of time to the role? [If changes have occurred] Can you explain why the OsEM role has changed since the pilot ended?

B7. Do you foresee any future changes to this role at your facility in the coming months or years?

B8. [IF MULTIPLE FACILITIES IN NY] Since you first applied to participate in the NYSERDA OsEM pilot, have any of your other facilities in New York adopted an OsEM, or does your current assigned OsEM serve multiple facilities within your company, in New York? If so, which ones? [RECORD NAME/CITY and annual energy expenditure FOR EACH FACILITY THAT HAS ADOPTED, OUTSIDE PILOT PARTICIPANT]

Facility Name	City	Estimated annual expense for energy (electricity, gas, and any other fuels)			
		Less than $500,000	Between $500,000 and $1 Million	More than $1 Million	Don't know

B9. Does the OsEM regularly spend time on-site at each of those facilities? If yes, can you describe amount of time they spend at each facility on a weekly or monthly basis? [RECORD HOURS PER WEEK OR MONTH FOR EACH FACILITY]

Facility Name/City	Hours (Weekly/Monthly)

C. SEM Market Progress Indicator [SEM Participants Only]

C1. How familiar were you with strategic energy management, or continuous energy improvement concepts, before your facility participated in the SEM training program?

C2. What motivated your facility to join the SEM program?

C3. Prior to participating, what energy management practices did you already employ at your facility?

C4. How, if at all, did your approach to energy management change after you began participating in the pilot?

C5. What SEM practices did you employ by the end of your participation? Even if you are no longer employing that practice, I'm interested in what you tried out. [USE TABLE TO RECORD. ADDRESS EACH PRACTICE.]

C6. Which of these practices do you continue to employ? [USE TABLE TO RECORD.]

C7. [SEM, IF SOME PRACTICES DISCONTINUED] Why are you no longer employing the practice of [PRACTICE]?

Participant Facility			
SEM Practice	**Before [Not a priority to record]**	**During/ End of Pilot**	**Present**
Ex: Company energy policy and energy reduction goals	*Policy, goals in place*	*Goals more rigorous, detailed*	*Same*
Company energy policy and energy reduction goals			
Budget available for energy management activities			
Designated energy champion			
Staff assigned to energy team			
Assessment of existing energy management practices, assessment (map) of energy use by end-user system			
Maintaining a register of energy improvement opportunities, and scheduling and tracking implementation			
Employee training			
Energy management software in place			
Regular review of usage performance against goals			
Reporting energy performance to key stakeholders across the organization (facility management, operations, line engineers, accounting, senior mgmt., etc.)			

C8. [IF MULTIPLE FACILITIES IN NY] Since you first applied to participate in the SEM program, has your firm extended any of the SEM practices that you learned through the program to any of their other facilities in New York? If so, which facilities have adopted some or all of these practices? [RECORD NAME/CITY FOR EACH FACILITY THAT HAS ADOPTED, OUTSIDE PILOT PARTICIPANT]

Additional Facility #1: _____ [NAME/CITY] _____	
SEM Practice	Adopted (X)
Policy and usage goals	
Staff assigned to energy team, or as energy champion	
Assessments of existing energy management practices, assessment (map) of energy use by end-user system	
Maintaining a register of energy improvement opportunities, and scheduling and tracking implementation	
Employee training	
Energy management software	
Regular review of performance against goals	
Reporting energy performance to key stakeholders across the organization (facility management, operations, line engineers, accounting, senior mgmt., etc.)	

Additional Facility #2: _____ [NAME/CITY] _____	
SEM Practice	Adopted (X)
Policy and usage goals	
Staff assigned to energy team, or as energy champion	
Assessments of existing energy management practices, assessment (map) of energy use by end-user system	
Maintaining a register of energy improvement opportunities, and scheduling and tracking implementation	
Employee training	
Energy management software	
Regular review of performance against goals	
Reporting energy performance to key stakeholders across the organization (facility management, operations, line engineers, accounting, senior mgmt., etc.)	

C9. For each additional facility mentioned above, please estimate their annual energy expenses (including electricity, natural gas, and any other fuels).

Facility Name/City	Estimated annual expense for energy (electricity, gas, and any other fuels)			
	Less than $500,000	Between $500,000 and $1 Million	More than $1 Million	Don't know

D. Participant Experience with the Program

D1. How satisfied are you with the experience overall? What aspects of the program did you think worked best, and why?

D2. Can you recommend any changes to the program that would make it easier for facilities to participate, or provide a better experience?

D3. [OsEM] How effective was the OsEM in your facility? Was the OsEM more effective at some tasks than others? Can you provide any examples?

D4. [OsEM] Thinking back on your participation in the OsEM program, do you have any lessons learned or recommendations for other firms that participate, to make the experience more beneficial or easier?

D5. [SEM] How did the information your team learned compare with your expectations, in terms of the technical level of the content, and the relevance for your facility?

D6. [SEM] How did the amount of time that staff dedicated to participating in the trainings, and implementing SEM practices, compare with your expectations?

D7. [SEM] About how much time, as a percentage of a full-time employee, do your staff currently spend on activities connected with SEM? A rough estimate is fine.

D8. Would continued training be helpful to your firm, to retain the skills and experience gained through the pilot? [If yes] What type of training would be helpful, and for which staff? (If needed: types of training might include *online, in person, etc. for topics such as review of pilot materials, more advanced certification such as CEM, or continuing ed credits, etc.)*

D9. Do you think participating in the program was a worthwhile investment for your firm? Why or why not?

D10. If you had known when you signed up what you know now, do you think your firm would have made the same decision to participate in the program?

E. Conclusion

Those are all of the questions I had prepared. Is there anything about the program that we haven't discussed that you would like to mention, or anything you think I should keep in mind?

Thank you for talking with me today.

Appendix E. Energy Consultant Interview Guide

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