Continuous Energy Improvement Evaluation 2017

Final Report

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Acronyms and Abbreviations

CEI	Continuous Energy Improvement
DPS	Department of Public Services
FlexTech	Flexible Technical Assistance
IPE	Industrial Process Efficiency
NYSERDA	New York State Energy Research and Development Authority
OsEM	On-Site Energy Managers
SEM	Strategic Energy Management

Executive Summary

The New York State Energy Research and Development Authority's (NYSERDA) Continuous Energy Improvement (CEI) Initiative seeks to determine whether applying the principles of continuous improvement to energy management will result in substantial, long-term energy savings. This study quantifies the baseline values for four of the six indicators established by NYSERDA to track market progress and provides information about baseline market characteristics.

S.1 Program Description

The CEI Initiative consists of two pilot programs: one promotes the adoption of on-site energy managers (OsEMs); and one promotes the adoption of strategic energy management (SEM). The On-Site Energy Manager Pilot will provide OsEM service to select participants, demonstrating that OsEMs can be employed cost-effectively and integrate efficiency projects with normal operations. The Strategic Energy Management Pilot will provide training to help facilities adopt SEM practices. The pilot's objective is to demonstrate how New York facilities can operate with and benefit from SEM.

S.2 Methods

The Market Evaluation Team used results from an end-user survey of 324 New York industrial facilities to evaluate three of the four indicators and to assess baseline market characteristics. The Team post-stratified the survey sample by the facilities' reported annual energy expenditures: Tier 1 facilities reported energy expenditures greater than $1 million annually; Tier 2 facilities spent between $500,000 and $1,000,000; Tier 3 facilities spent less than $500,000 annually. Interviews with energy management consultants provided information for the fourth indicator—the number of OsEMs offering services in New York. A literature review and interviews with manufacturing association representatives provided supplemental information. Finally, a Delphi panel of CEI experts estimated a baseline market adoption forecast, assuming the absence of programmatic intervention in the market.

S.3 Market Characterization and Assessment Results

Table 1 shows the six progress indicators NYSERDA will assess through annual market evaluations, and the baseline values determined through this study.

Table 1. Baseline Assessment of Key SEM and OsEM Indicators

Market	Indicator	Baseline Estimate	Precision at 90% Confidence
OsEM	1. OsEMs offering services in New York[a]	6 firms, 7 professionals	N/A
	2. Participant industrial sites retaining OsEMs (after pilot engagement ends)	TBD[b]	
	3. Nonparticipant industrial sites hiring an OsEMs	15% (1,021 facilities)	±4%
SEM	4. Facilities that have adopted a system for monitoring, tracking, and making decisions based on their energy use	27% (1,886 facilities)	±4%
	5. Participant industrial facilities that have adopted SEM (after the pilot engagement ends)	TBD[b]	
	6. Nonparticipant industrial facilities that have adopted SEM	0% (17 facilities)	±0%

[a]This value represents the baseline activity level and includes professionals participating in the pilot that indicated they offered OsEM services prior to NYSERDA's RFP soliciting consultants for the OsEM pilot.

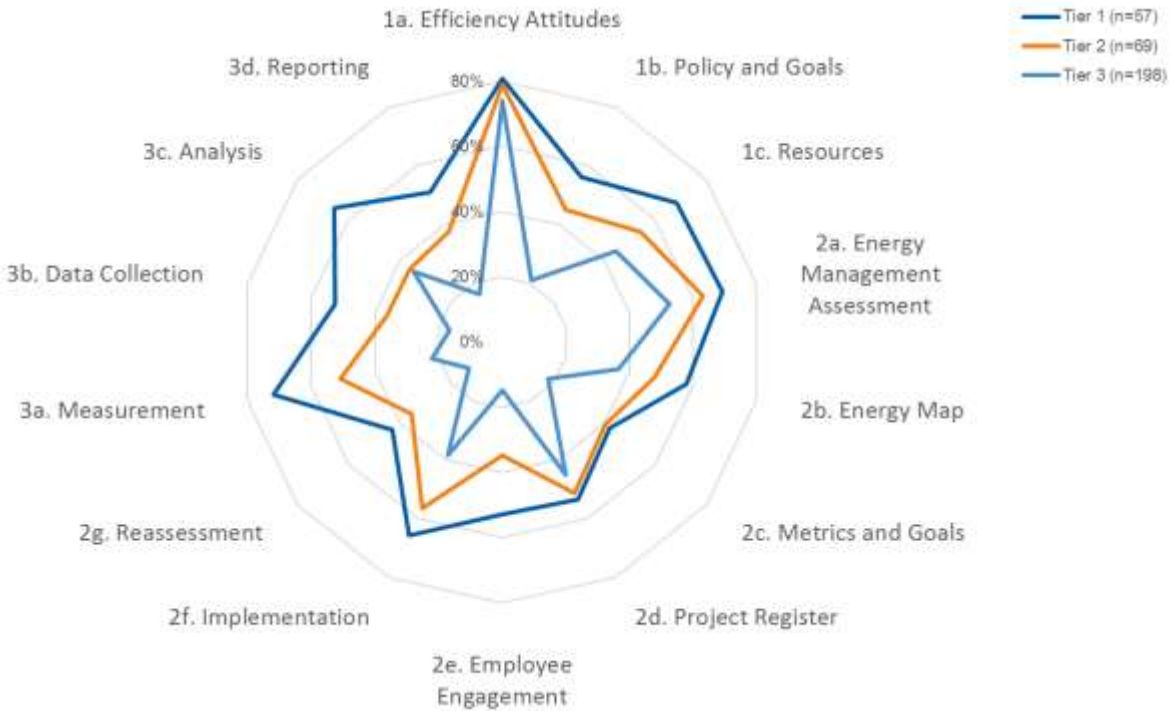
[b]Baseline values for post-pilot performance will be measured after the first round of pilot offerings are complete.

SEM Adoption: Framework for Measurement

The Team determined the current SEM adoption level using results from the industrial end-user survey to assess market adoption per the Consortium for Energy Efficiency's (CEE) definition for SEM. The CEE identified 13 activities (*subelements*), organized into three *minimum elements*—company commitment; planning and implementation; and measuring and reporting—that an industrial site must practice to qualify as adopting SEM. The Team added a 14th subelement to help differentiate among facilities with very low adoption levels. To qualify as an SEM adopter, respondents to the industrial facilities survey had to indicate they had all 14 subelements in place. The Team assessed the overall market's SEM adoption, stratified across three tiers of respondents. Figure 1 shows SEM adoption levels for the 14 subelements by facility tier.

Figure 1. Mean Adoption Levels for 14 SEM Subelement and by Tier

Source: Phase I Survey (n=324)



S.4 Key Findings and Recommendations

Finding 1: While adoption of some energy management practices has become prevalent, adoption of several SEM elements essential to a continuous improvement approach have experienced lower market adoption levels. These include subelement 1b., which requires that a company set, frame, and communicate long-term energy performance objectives through an energy policy and energy reduction goals. In addition, several subelements indicative of adopting a continuous improvement approach have low overall adoption levels (i.e., employee engagement; reassessment; data collection and reporting).

Recommendation 1: The Team recommends that NYSERDA add a progress indicator to track company commitment to continuous improvement of energy performance. This additional SEM progress indicator would allow NYSERDA to measure progress on a minimum element that is on the critical path to SEM adoption, complementing the monitoring and tracking system adoption indicator, and providing greater granularity than the SEM adoption indicator (which will likely increase slowly).

Finding 2: Substantial differences exist in energy management practices among tiers. Tier 1 facilities had a higher rate of adoption than Tier 2 and Tier 3 for both Company Commitment and Measuring and Reporting Energy Performance. Tier 1 average rates of adoption were statistically higher than Tier 3 for all subelements except two (1a. Efficiency Attitudes and 2d. Project Register).

Recommendation 2: NYSERDA should continue to track adoption rates by energy expenditure tiers.

Finding 3: The current OsEM adoption estimate, 15%, quantifies the proportion of facilities assigning energy performance responsibility to an individual, but it does not capture other factors that may reflect the OsEM's efficacy. These factors include the OsEM's accountability level, the importance level assigned to the role, and the skill level that the OsEM brings to the role.

Recommendation 3: The Team recommends continuing to track the OsEM adoption level using the approach applied in this study. The Team should also add questions to the end-user survey to determine: whether energy performance is considered in the OsEM's performance review (accountability); the hours per week that OsEMs dedicate to energy management (importance); the OsEM's education or background (skill level); and whether the OsEM is supported by an outside consultant (technical support to compensate for a lower skill level). Further, the Team should adjust the survey to capture whether teams with energy performance responsibility have a leader that might meet the OsEM definition.

Finding 4: At least six New York firms and 7 professionals offered OsEM services prior to NYSERDA's pilot activity. The total number of OsEM consultants may be greater, but the current sampling method does not allow projection of results to the state level. The Team assembled an energy consultant sample frame composed of 1,336 firms, but 32 of the 34 firms interviewed participated in NYSERDA's FlexTech or IPE programs. Further, possible response bias (i.e., firms engaged in OsEM and SEM consulting services may have been more likely to respond) means that results should not be projected to the subgroup of 107 firms participating in NYSERDA's technical assistance programs.

Recommendation 4: The Team recommends continuing to implement the approach used in this study to track the number of firms and individuals offering OsEM services, with some minor modifications. First, the indicator should be defined as the number of OsEM consultants within the pool of consulting firms offering services through NYSERDA programs. This will provide a defined sample frame. Second, the Team recommends offering an incentive—such as a $30 gift card—to encourage broader participation.

1 Introduction

The New York State Energy Research and Development Authority's (NYSERDA) Continuous Energy Improvement (CEI) Initiative seeks to prove that applying the principles of continuous improvement to energy management will result in substantial, long-term energy savings. This study quantifies the baseline values for four of six performance and market progress indicators NYSERDA will evaluate through the annual market evaluation and provides information about baseline market characteristics.

1.1 Program Description

The CEI Initiative consists of two pilot programs: one promotes the adoption of on-site energy managers (OsEMs) and one promotes the adoption of strategic energy management (SEM). The On-Site Energy Manager Pilot, which launched its first pilot offering in September 2016, seeks to demonstrate the value proposition of hiring an OsEM to champion and implement energy and process efficiency improvement projects, without interfering with facility operations. The Strategic Energy Management Pilot, which launched in July 2017, will provide training and guidance to help facilities adopt the practices necessary for SEM. The pilot seeks to overcome the initial adoption barriers and to demonstrate how New York facilities can operate with and benefit from SEM.

1.2 Summary of Evaluation Objectives and Methods

Table 1-1 lists the study's objectives, the objectives' purpose, and the Market Evaluation Team's techniques to collect the data necessary to address the objectives.

Table 1-1. Objectives, Purpose, and Methods for CEI Market Assessment

Objective	Purpose	Method
Estimate baseline market adoption indicators of SEM and OsEM	Establish baseline market adoption prior to NYSERDA's market intervention activities	Survey of industrial facilities (Phases I and II); interviews with energy management consultants
Identify adoption barriers	Understand which programmatic initiatives could best promote adoption of SEM and OsEM	Survey of industrial facilities (Phases I and II)
Determine existing attitudes and approaches to energy management and capital improvements	Understand how facilities manage energy costs: levels of familiarity with tools and concepts; organizational systems in place; and resources dedicated to energy management	Survey of industrial facilities (Phases I and II); interviews with energy management consultants; interviews with manufacturing association representatives
Establish a baseline adoption curve	Understand the likely adoption rate for SEM and OsEMs without NYSERDA intervention	Delphi panel forecasting exercise

2 Market Characterization and Assessment Results

The Market Evaluation Team used primary research to evaluate the baseline program performance indicators, along with market progress indicators that NYSERDA identified for the CEI Initiative. Over the next five years, these indicators will be evaluated annually and measured against baselines identified in this report to assess the Initiative's progress.

2.1 Baseline Estimates for Market Indicators

The Team used data from the Phase I survey of industrial facilities and from interviews with the energy management consultant to evaluate four of the six performance and market progress indicators established by NYSERDA. NYSERDA will evaluate the two remaining indicators—sustained adoption of OsEMs and SEM practices—after the pilot ends. Table 2-1 presents baseline values for indicators addressed in this study.

Table 2-1. Baseline Assessment of Key SEM and OsEM Performance and Market Indicators

Indicator	Baseline Estimate	Precision at 90% Confidence
OsEM		
7. OsEMs offering services in New York[a]	6 firms, 7 professionals	N/A
8. Participant industrial sites retaining OsEMs (after pilot engagement ends)	TBD[b]	
9. Nonparticipant industrial sites hiring an OsEM	15% (1,021 facilities)	±4%
SEM		
10. Facilities that have adopted a system for monitoring, tracking, and making decisions based on their energy use	27% (1,886 facilities)	±4%
11. Participant industrial facilities that have adopted SEM (after pilot engagement ends)	TBD[b]	
12. Nonparticipant industrial facilities that have adopted SEM	0% (17 facilities)	±0%

[a]This value represents the baseline activity level and includes professionals participating in the pilot that indicated they offered OsEM services prior to NYSERDA's RFP soliciting consultants for the OsEM pilot.

[b]Baseline values for post-pilot performance will be measured after the first round of pilot offerings are complete.

2.1.1 Detailed Indicator Results

This section provides baseline indicator results disaggregated by tier. See section 4.1.1 for a discussion of tier structure.

2.1.1.1 Indicator 1. On-Site Energy Managers Offering Services in New York

Among interviews with representatives from 34 energy management consulting firms, the Team identified seven professionals from six firms that currently provide (or expect to soon provide) OsEM services to 12 clients (excluding five firms and six professionals who offer OsEM services only through the NYSERDA pilot). As shown in Table 2-2, two to four of these firms serve each of the six most energy intensive industries, while two indicated they do not serve any of these six industries. Among firms that do not provide OSEM services (n=28), 10 to 16 firms serve each of the

Table 2-2. OsEM Consultants Serving High Energy Intensity Industries

Source: Interviews with energy management consultants (n=34 firms)

Most Energy Intensive Industries	Firms that Offer OSEM (pre-NYSERDA OSEM Pilot) (n=6)	Other Firms (n=28)
Chemical	2	10
Paper	4	16
Food	3	15
Nonmetallic minerals	2	13
Plastics and rubber	4	12
Fabricated metal	2	13
None	2	7

2.1.1.2 Indicator 3. Nonparticipant Industrial Sites Hiring an On-Site Energy Manager

NYSERDA defines an OsEM as "a dedicated expert stationed in a specific facility who is focused on process efficiency and energy optimization." To identify OsEMs in through the survey, the Team asked if the facility had assigned responsibility for energy performance, whether they had assigned this responsibility to an individual (versus a team), and whether the individual worked on site at least part time. This focus on individuals served to avoid including facilities where a team may have been tasked with improving energy performance, but no one individual has accountability. The definition allows an OsEM to be an internal employee or an external consultant and does not require a full-time role. Overall, 15% of industrial facilities met these criteria and are counted as having an OsEM, with little difference in the percentage across tiers.

An additional 16% of facilities have assigned responsibility for energy performance, but to a team rather than an individual. The Team found that the higher the annual energy expenditure, the more likely the facility was to have assigned responsibility for energy performance. Further, as the incidence of assigning responsibility rose, so did the tendency to assign responsibility to a team rather than to an individual. Table 2-3 shows that 68% of Tier 1 facilities assigned responsibility and were over three times as likely to assign responsibility to a team as to an individual. Tier 2 was less likely than Tier 1 to assign responsibility(45%), but, similar to Tier 1 facilities, was more likely to assign responsibility to a team. Tier 3 had the lowest rate of assigning responsibility (27%). Unlike the other two tiers, Tier 3 facilities more likely to assign responsibility to an individual than to a team.

Table 2-3. Industrial Sites Assigning Energy Performance Responsibility by Tier

Source: Phase I Survey , Question 6. "Does your facility have an individual or team with formal responsibility for energy performance?", Question C6a. "Is this a team or an individual?", Question 7. "Does this employee work onsite, where primary production occurs? (n=324.)

Tier	Assigned Responsibility for Energy Performance	Assigned to Team	Assigned to On-site Individual (OsEM)
Tier 1 (n=57)	68%	53%	16%
Tier 2 (n=69)	45%	33%	12%
Tier 3 (n=198)	27%	12%	15%
Total (n=324)[a]	**31%**	**16%**	**15%**

[a]Numbers may not sum to total due to rounding.

2.1.1.3 Indicator 4. Facilities with a System for Monitoring, Tracking, and Making Decisions

Phase I survey results indicated that 27% of facilities have a system in place that allows them to monitor and track their energy usage. For the study's purposes, the Market Evaluation Team assumed that any facility engaged in monitoring and tracking energy data used these data to inform decisions in some way and therefore should be counted towards this indicator. Table 2-4 shows the percentage of respondents who indicated they use some type of tool for monitoring and tracking their energy usage. Each tier's rate of adoption of a tool to monitor and track energy usage was statistically different. Not surprisingly, facilities with higher energy expenditures were more likely to use an energy tracking tool, with 70% of Tier 1 facilities adopting a system compared to 51% for Tier 2 and 22% for Tier 3.

Table 2-4. Energy Management Tracking Tools by Tier

Source: Phase I Survey (N=324), Question D6, "In what way does your company document potential energy efficiency projects and track progress on these activities over time?" (only response 3, "Energy Management Tracking Software" accepted), Question D7: "Is your facility currently using a tool to track energy use over time?"; D8a. [If D7 = "yes" or "in process"] What type of system are you using?"

Uses Energy Management Tracking Tool	Tier 1 (n=57)	Tier 2 (n=69)	Tier 3 (n=198)	Overall (n=324)
EMIS	9%	0%	3%	2%
MT&R model	5%	10%	2%	3%
Excel Spreadsheet	25%	10%	8%	9%
Energy management tracking software (not specified)	19%	19%	5%	7%
Other/Custom	12%	12%	4%	5%
Facilities Using a Tool[a]	**70%**	**51%**	**22%**	**27%**

[a]Numbers may not sum to total due to rounding

Over half of facilities using a tool specified that they used one of three common types: an energy management information system (EMIS), a monitoring, tracking, and reporting model (MT&R model), or an Excel spreadsheet. Two percent of facilities overall reported using an EMIS, which is a system that collects energy consumption data via utility meters, onsite sub-meters, and manual inputs. An EMIS automatically performs analysis and generates reports based on consumption, using inputs such as interval data, utility bills, weather data, production inputs, and facility schedule. MT&R models, used by at least 3% of facilities overall, provide similar information to an EMIS, but data input is typically a manual exercise, with analysis typically in Excel, and reporting is not automated. MT&R models also require regular maintenance by facility staff, which is not the case for an EMIS. The most common tool specified by respondents was an Excel spreadsheet, used by at least 9% of facilities. Spreadsheet tracking tools are typically designed by the facility and do not offer pre-programmed analysis or reporting.

Another 7% of facilities reported that they used a tool that could be classified as energy management tracking software but did not specify what type of software. This group may include additional facilities using an EMIS or MT&R model but likely does not include facilities using an Excel spreadsheet tool. The last group of respondents, designated as "Other/Custom" in the table, reported they use a tool to track energy usage over time, but they either did not offer additional detail or provided insufficient detail for the system to be more precisely categorized. This group may include any of the other types of tools list above.

2.1.1.4 Indicator 6. Nonparticipant Industrial Facilities Adopting SEM

The Market Evaluation Team assessed the Phase 1 survey respondents' SEM adoption levels using the Consortium for Energy Efficiency's (CEE) definition of SEM. The CEE identified three minimum elements a facility must have in place to effectively and continuously improve its energy performance:

(1) 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;

(2) Planning and Implementation. An energy management plan and evidence of a continuous improvement approach to plan implementation; and

(3) System for Measuring and Reporting Energy Performance. A systematic, ongoing measuring and reporting of energy performance data.

To be considered a full SEM adopter, a facility must demonstrate it has all three minimum elements in place. (Section 2.2 provides more detail on how the Team scored respondents.) Table 2-5 shows the adoption of minimum elements by tier. Overall, 0% of facilities have fully adopted SEM. One Tier 1 facility did meet the full criteria, representing 2% of Tier 1, and one Tier 2 facility met the full criteria, representing 1% of Tier 2.

Table 2-5. Full SEM Adoption by Tier

Source: Phase I survey, Sections C and D (n=324)

Minimum Elements of SEM Adopted	Percentage of Facilities			
	Tier 1 (n=57)	Tier 2 (n=69)	Tier 3 (n=198)	Overall (n=324)
None	60%	77%	96%	92%
Only Company Commitment	5%	7%	1%	2%
Only Planning and Implementation	0%	1%	0%	0%
Only Measuring and Reporting Energy Performance	16%	10%	4%	5%
Both Company Commitment and Planning and Implementation	0%	0%	0%	0%
Both Company Commitment and Measuring and Reporting Energy Performance	16%	1%	0%	1%
Both Planning and Implementation and Measuring and Reporting Energy Performance	2%	1%	0%	0%
Full SEM Adoption (All three minimum elements adopted)	2%	1%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**

[a]Numbers may not sum to total due to rounding

2.2 Market Progress Toward SEM Adoption

SEM takes a continuous improvement approach to reducing energy intensity over time. As stated previously, the Team adapted the CEE's definition of SEM to establish a consistent framework against which to estimate SEM adoption. The CEE's three minimum elements, each addressing an aspect of SEM implementation, are themselves made up of subelements (a total of 13) that comprise the practices a facility must adopt to achieve continuous energy improvement. The Team translated these subelements into measurable criteria, to enable the precise, consistent assessment of each one through a self-report survey delivered to executive-level staff. In addition, to ensure that the Team could distinguish between facilities (if most facilities failed to meet the subelement criteria), the Team added a subelement—"efficiency attitudes"—to the first minimum element to assess whether the company considered energy efficiency and process efficiency important. The Team considered this a minimum threshold for the path to SEM adoption. Table 2-6 presents the three CEE minimum elements along with their respective subelements (including the fourteenth subelement); it shows specific criteria the Team assessed to determine each facility's compliance level with the subelement.

Table 2-6. Minimum SEM Elements (as adapted for the NYSERDA CEI Market Evaluation from the CEE Minimum Elements)

CEE Minimum Element	CEE Minimum Element Definition	Criteria Assessed for SEM Baseline
Company Commitment	**In an industrial organization, clear commitment is vital for SEM to succeed. Senior managers must undertake the following activities:**	
1a. Efficiency Attitudes	N/A	Management has expressed that energy and process efficiency are at least somewhat important to maintain a competitive advantage.
1b. 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; has communicated goals to staff.
1c. 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; facility has at least minimal staff and funding support needed to manage energy performance.

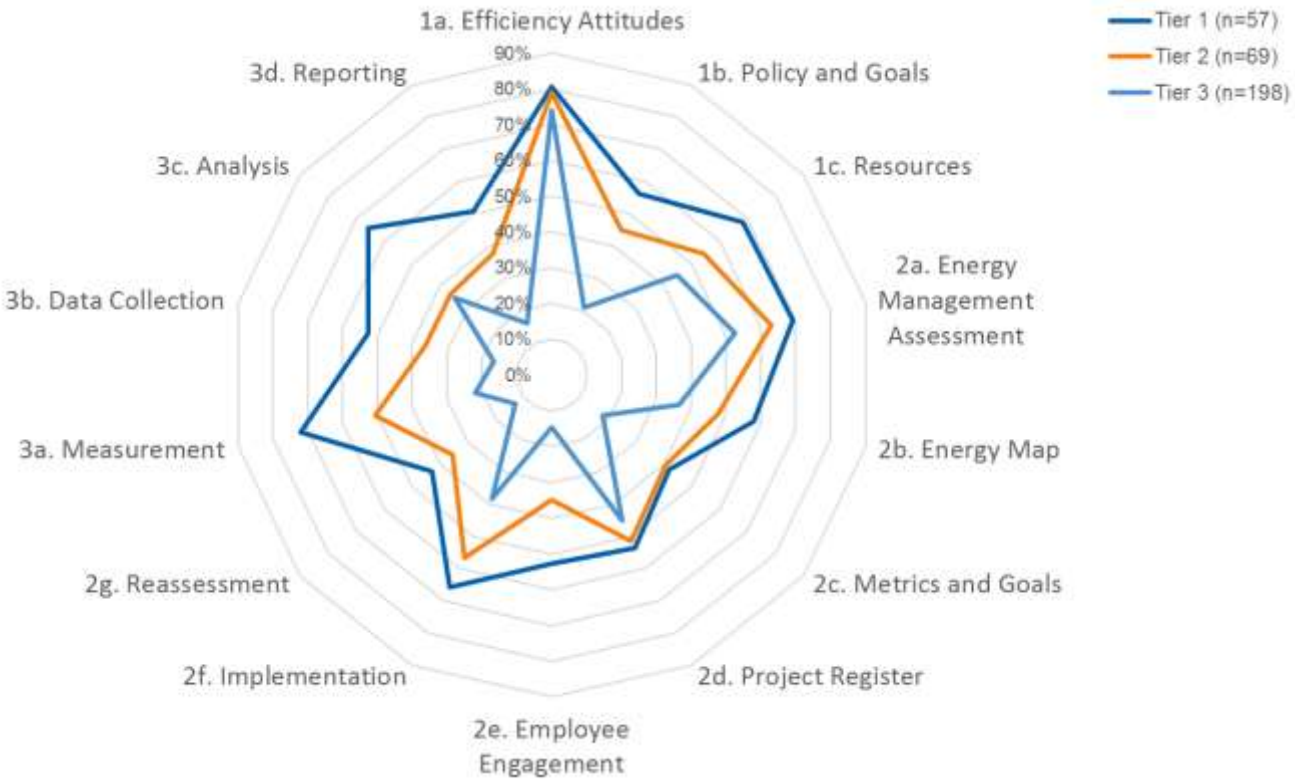
CEE Minimum Element	CEE Minimum Element Definition	Criteria Assessed for SEM Baseline
Planning and Implementation	**Planning provides the foundation for a customer to strategically manage energy. Implementation translates planning into actions that improve efficiency. Planning and Implementation consists of the following activities 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 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.
2d. Project Register	Describe actions to be undertaken over one or more years; these can be behavior or capital improvements	Facility documents potential energy efficiency projects and tracks progress over time.
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 in the last 3 years.
2f. Implementation	Complete measures in the project register	Facility has adopted or is planning to adopt an initiative dedicated to energy efficiency and process optimization, included that initiative in the facility's KPIs, and completed at least one process or energy efficiency project in the last 3 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 energy management project plan at least once.
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**	
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; 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.

To measure SEM adoption consistently, the Team developed a scoring rubric to translate survey responses into a quantitative measure of adoption. The scoring rubric assigned zero, one, or two points for each of the 14 subelements. A score of zero indicated the respondent met none of the criteria; a score of 1 indicated the respondent met some of the criteria, and a score of 2 indicated the respondent met all of the criteria. The maximum score for all 14 subelements was 28—the score required for full SEM adoption. The team converted subelement scores to a percentage (0%, 50%, or 100%) then averaged scores across respondents, by tier, to assess the average adoption level of each subelement (see Appendix F. SEM Adoption Scoring). Figure 2-1 shows the mean percentage of subelement adoption by tier. The figure lists the subelements clockwise around the rings, which indicate mean percentage of adoption (i.e., percentage of the highest subelement score of 2).

See Appendix J. Additional Analysis of SEM Adoption for more detailed results not included in the main report.

Figure 2-1. Mean SEM Adoption by Subelement and by Tier

Source: Phase I Survey (n=324)



Tier 1 showed the highest adoption levels for all CEE subelements (subelement 1a, the minimum threshold subelement added to the CEE definition, was nearly evenly adopted across tiers). Tier 2 had the

next highest rate of adoption for all subelements, followed by Tier 3, indicating that adoption levels correlate well with annual energy expenditure levels (the basis for the tier stratification, as described in Section 4.3).

The Team also analyzed SEM adoption between the facilities in the six most energy intensive subsectors, as identified by NYSERDA and other facilities. Results show virtually no difference in average adoption for any subelements between these two groups.

2.2.2 Company Commitment

Establishing energy and process efficiency as company priorities, setting clear goals for energy performance, and dedicating resources to accomplishing those goals are critical to achieving SEM. The first minimum element, Company Commitment, addresses practices that indicate the existence of the clear, executive-level commitment required for SEM adoption. Although absolute adoption levels vary by tier, the relative adoption level across subelements proved similar for all tiers. For example, in this minimum element, all tiers were more likely to state the importance of energy and process efficiency (subelement 1a.) and to dedicate resources to energy management (subelement 1c.) than to have established an energy policy and concrete goals (subelement 1b.). Table 2-7 shows the average adoption level for each subelement related to Company Commitment, by tier. The table also shows the percentage of facilities in each tier that achieved full adoption of each subelement. These percentages are lower than average adoption rates, because they exclude facilities that received a score of 1 for partially achieving the necessary criteria. (See Appendix F. SEM Adoption Scoring for comprehensive scoring results overall and by tier.)

Table 2-7. Mean Adoption Level of Company Commitment Subelements by Tier)

Source: Phase I Survey, Section C (n=324)

Subelement	Metric	Tier 1 (n=57)	Tier 2 (n=69)	Tier 3 (n=198)	Overall (n=324)
1a. Efficiency Attitude	Mean Adoption	81%	79%	74%	75%
	Full Adoption	65%	59%	52%	53%
1b. Policy and Goals	Mean Adoption	56%	45%	21%	25%
	Full Adoption	44%	33%	10%	14%
1c. Resources	Mean Adoption	68%	54%	45%	47%
	Full Adoption	39%	13%	3%	6%

Among the three subelements for this minimum element, the average adoption scores for all tiers were highest for subelement 1a. Efficiency Attitudes, which required that respondents rate both energy and process efficiency as important to maintaining a competitive edge. The average overall score for this subelement was 75%, and the level of average adoption was not statistically different across tiers. All tiers received their lowest average score for subelement 1b. Policy and Goals; for this subelement, the average adoption score across all facilities was only 25% of the maximum possible score.

To assess subelement 1b., the survey asked respondents about three necessary criteria:

(1) Having a written energy policy or plan,

(2) Setting energy performance goals, and

(3) If goals have been established, communicating goals to staff.

Overall, 62% of facilities met none of the three criteria. Twenty-three percent of facilities met either the first criterion (having a written policy or plan) or the second criterion (having goals in place) but not both. Table 2-8 shows the percentage of facilities with neither a written plan nor established goals, either one or the other, or both. Tiers 1 and Tier 2 were more likely than Tier 3 to have both pieces in place (44% and 35%, respectively, compared to 11%), while Tier 3 was most likely to have neither policy nor goals in place (66%, compared to 32% for Tier 1 and 42% for Tier 2). Survey results indicated that of those setting energy reduction goals, nearly all (96%) met the third criteria—communicating the goals to staff.

Table 2-8. Facilities without Energy Policy or Goals

Source: Phase I Survey, Question C3: "Does your company or facility have a written energy policy or a plan that includes guiding principles for energy management?" and Question C4: "Does your facility set energy performance goals?" (n=324)

	Tier 1 (n=57)	Tier 2 (n=69)	Tier 3 (n=198)	Overall (n=324)
Have neither a written policy nor energy reduction goals	32%	42%	66%	62%
Have a written policy but not energy reduction goals	12%	14%	9%	9%
Have energy reduction goals but not a written policy	12%	9%	14%	13%
Have both a written policy and energy reduction goals	44%	35%	11%	15%
Total[a]	**100%**	**100%**	**100%**	**100%**

[a]Numbers may not sum to total due to rounding

For the subelement 1c. Resources, the survey asked respondents about three factors: whether they had a team assigned to energy performance; how often that team met; and whether the respondent considered that the facility had at least the minimum staffing and funding necessary for energy management (including completing energy projects). The first criterion posed the biggest hurdle for most facilities. Overall, 84% of facilities did not have a team with designated responsibility for energy performance and

therefore could not fulfill the second criterion (having that team meet regularly).[1] Tier 1 was much more likely to have a team (53%) than Tier 2 (33%), and both were more likely to have a team than Tier 3 (12%). Of respondents with a team in place, a minority (37%) said the team met monthly or more often. However, 79% of respondents with teams meeting at least monthly said they had at least the minimal staffing and funding support needed for energy management. Overall, 6% of facilities received a full score of 2 for subelement 1c. Resources.

2.2.3 Planning and Implementation

The Planning and Implementation minimum element, made up of seven subelements, focuses on the facility's operational starting point or foundation for the facility to strategically manage energy.[2] Planning and Implementation subelements measure whether the facility takes the action needed to systematically identify energy savings opportunities, realize those potential savings, and then continuously update its plan to achieve more savings going forward.

As in the first subelement, Tier 1 received the highest average adoption scores, followed by Tier 2 and then Tier 3, and all tiers generally followed a similar pattern with relation to the adoption level across subelements. Table 2-9 shows the average adoption level and the full adoption level for each subelement, by tier.

[1] The criteria OsEM adoption and for subelement 1c. Resources approach a singular concept in different ways. The definition of the OsEM requires that the facility have an individual on site who has responsibility for energy performance to ensure accountability. The CEE subelement, on the other hand, emphasizes the need for an overall commitment of resources and allows a team or individual. To ensure that the facility's team is "committed," the Team required that the facility's energy performance team meet at least once per month.

[2] Consortium for Energy Efficiency. *CEE Strategic Energy Management Minimum Elements.* Accessed online July 27, 2017.

Table 2-9. Mean Adoption Level of Planning and Implementation Subelements by Tier

Source: Phase I Survey, multiple questions (n=324)

Subelement	Metric	Tier 1 (n=57)	Tier 2 (n=69)	Tier 3 (n=198)	Overall (n=324)
2a. Energy Management Assessment	Mean Adoption	69%	63%	53%	54%
	Full Adoption	42%	38%	22%	24%
2b. Energy Map	Mean Adoption	58%	48%	37%	39%
	Full Adoption	56%	48%	36%	38%
2c. Metrics and Goals	Mean Adoption	42%	41%	18%	22%
	Full Adoption	42%	41%	18%	22%
2d. Project Register	Mean Adoption	54%	51%	45%	46%
	Full Adoption	30%	23%	7%	10%
2e. Employee Engagement	Mean Adoption	53%	35%	15%	19%
	Full Adoption	53%	35%	15%	19%
2f. Implementation	Mean Adoption	66%	57%	38%	42%
	Full Adoption	39%	28%	10%	13%
2g. Reassessment	Mean Adoption	43%	36%	13%	17%
	Full Adoption	30%	25%	8%	11%

Energy management assessments (2a), an energy map (2b), and a project register (2d) ensure that companies have the information necessary to identify improvement opportunities. The first subelement in this group, 2a. Energy Management Assessments, requires that facilities have both reviewed their energy consumption data and equipment to identify energy-saving opportunities and have completed an energy management assessment. Just under a quarter (24%) of facilities completed both criteria and received a full score of 2. Facilities were more likely to complete an energy map (i.e., document energy end uses and costs across the company), with 38% of facilities overall saying they completed this or were in the process of doing so, and so receiving the full score. Fifty-six percent of Tier 1 facilities, 48% of Tier 2 facilities, and 36% of Tier 3 facilities met the full criteria for this subelement.

To qualify as having a project register (2d), companies must document potential energy efficiency projects and track the progress of these activities over time, either through a project or opportunity register, a tune-up action item list, or energy management tracking software. Of 10% of facilities meeting the criteria for this indicator, 4% used a project or opportunity register, 2% used a tune-up action item list, and 4% used energy management tracking software. Significantly fewer Tier 3 facilities met these criteria than the other two tiers (Tier 3 had 7% full adoption, compared to 23% for Tier 2 and 30% for Tier 1).

Subelement 2c. Metrics and Goals requires that facilities establish clear, measurable goals for energy performance improvement, based on an analysis of baseline energy consumption and relevant variables. This subelement differs from the one in Company Commitment in that it requires use of quantitative

goals, expressed as an amount of energy usage or a percentage reduction of energy usage or similar metric. Of 22% of facilities that achieved full adoption for this subelement, 15% expressed goals as a percentage reduction of energy use, 6% expressed them as an amount of energy consumption or energy cost, and the remaining 1% used a reduction in energy cost per unit production or combination of methods. Tier 2 used percentage reduction goals significantly more often than Tier 3 facilities.

Subelement 2e. Employee Engagement requires that management communicate with staff about energy management and conservation objectives and engage employees in energy performance improvement activities. Nineteen percent of facilities received a score of 2, reporting that their facility's energy manager or team conducted specific employee engagement activities around energy management or conservation in the past three years. These included activities involving staff outside of an energy team (e.g., engaging staff to turn off equipment not in use, awareness campaigns). The percentage of facilities receiving the full score of 2 for this subelement was statistically different across all three tiers (Tier 1: 53%, Tier 2: 35%, Tier 3: 15%).

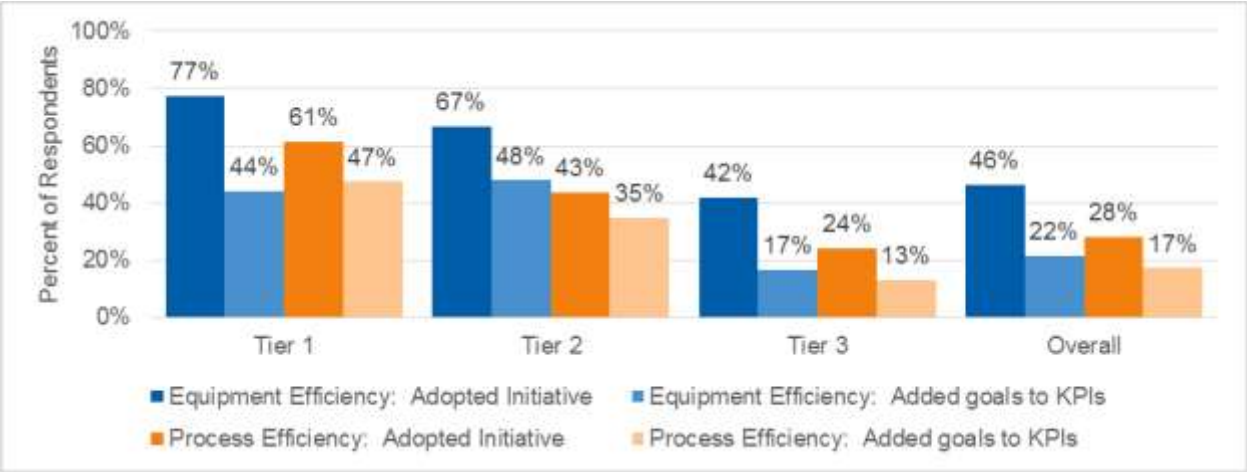
Subelement 2f. Implementation measures whether the company took action to achieve energy savings. To assess this subelement, the survey asked about three possible actions:

(1) Whether facilities adopted any initiatives for equipment efficiency or process efficiency (such as ISO 50001),
(2) Whether the facility incorporated the initiative goals into the facility's KPIs, and
(3) Whether the facility had implemented an energy or process efficiency project in the past three years.

As shown in Figure 2-2, all tiers were slightly more likely to adopt energy efficiency initiatives than process efficiency initiatives, but that difference disappears when considering facilities that both adopted the initiative and added it to the facility KPIs. Tier 1 and Tier 2 showed similar levels of adoption and incorporation in KPIs, both of which were significantly higher than Tier 3.

Figure 2-2. Adoption of Initiatives to Achieve Savings and Incorporation in to KPIs

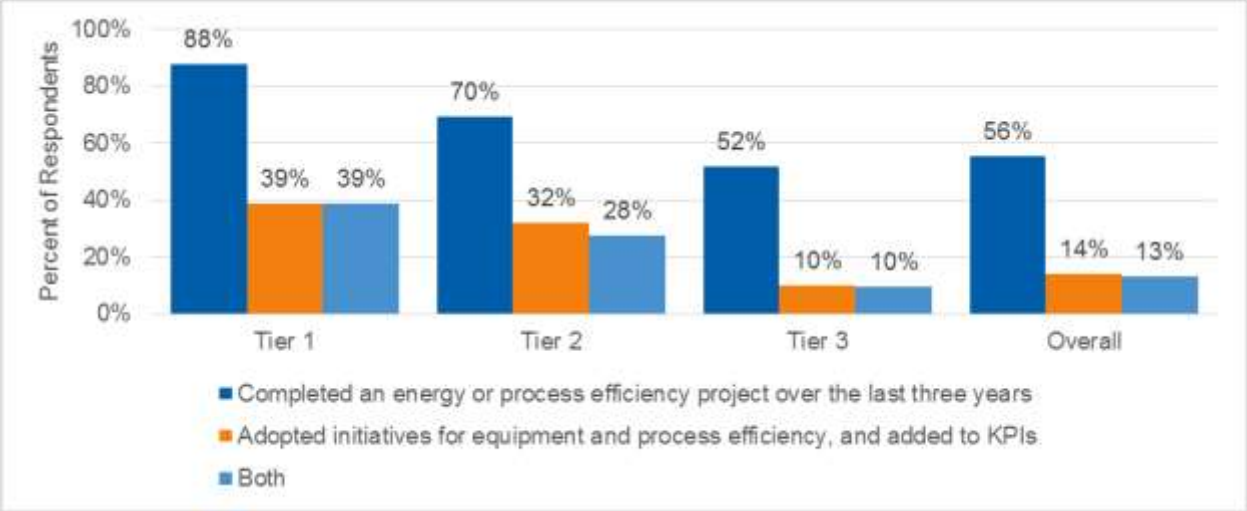
Source: Phase I Survey, Questions D10 through D13 (n=324)



As shown in Figure 2-3, all tiers were more likely to meet the third criterion (completed projects) than the first or second criteria (adopting initiative and incorporating goals in KPIs). But those facilities that did adopt an initiative had almost always also completed a project. Thirteen percent of facilities overall met the full criteria for the 2f. Implementation subelement.

Figure 2-3. Facilities Meeting Initiative Criteria, Project Criterion, and Both for Subelement 2f. Implementation

Source: Phase I Survey, Questions D10 through D14 (n=324)



Finally, subelement 2g. Reassessment measures whether the facility takes a continuous approach to addressing energy and process efficiency. The Team credited a facility with full adoption of this

subelement if they had adopted an energy management plan (as discussed for subelement 1b.) and revisited the plan at last quarterly or whenever operations change. Just 11% of facilities overall met the full criteria for this subelement. Simply having a plan in place presented the most significant barrier to achieving a full score for this subelement: 77% of respondents did not have a plan, and thus received an adoption score of 0 for this subelement. Of those with plans, 44% overall (53% of Tier 1, 53% of Tier 2, and 42% of Tier 3) reported revisiting their plans with enough frequency to receive the full score for this subelement.

2.2.4 Measuring and Reporting Energy Performance

Measuring and Reporting Energy Performance requires specialized expertise, which can fall outside of the resources and tools companies typically require to meet a facility's core mission. To satisfy this minimum element of SEM adoption, a facility employee (or contracted energy manager) must collect energy use data over time using a tool or software, regularly update the data, 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 2-10 shows average adoption level and full adoption level of the Measuring and Reporting Energy Performance subelements by tier. Similar to adoption of the other subelements, Tier 1 exhibited the highest average and full adoption rates.

Table 2-10. Mean Adoption Level of Measuring and Reporting Energy Performance Subelements by Tier

Source: Phase I Survey, multiple questions (n=324)

Subelement	Metric	Tier 1 (n=57)	Tier 2 (n=69)	Tier 3 (n=198)	Overall (n=324)
3a. Measurement	Mean Adoption	72%	51%	22%	28%
	Full Adoption	70%	51%	22%	27%
3b. Data Collection	Mean Adoption	53%	36%	17%	21%
	Full Adoption	51%	30%	11%	15%
3c. Analysis	Mean Adoption	66%	36%	35%	36%
	Full Adoption	61%	29%	22%	25%
3d. Reporting	Mean Adoption	51%	38%	16%	20%
	Full Adoption	51%	38%	15%	19%

Subelement 3a. Measurement requires that a facility have a system in place that allows monitoring of energy use and records it so the data are available to track progress against their energy goals. This subelement uses the same criteria used to evaluate Indicator 4, the percentage of facilities adopting a monitoring and tracking system (see Section 2.1.1.3 for more detail on adoption of this subelement).

Facilities complied with the requirement for Subelement 3b. Data Collection if they reviewed their energy consumption data at least monthly. Despite the seemingly low threshold for compliance, only 15% of facilities overall met the criterion for this subelement. This low rate for full compliance is driven primarily by Tier 3, in which only 11% of facilities received a score of 2 on this subelement. Over half (51%) of Tier 1 facilities received a score of 2, and 30% of Tier 2 facilities received a score of 2.

Subelement 3c. Analysis required that facilities meet two criteria: review energy usage data and equipment to identify energy saving opportunities and set an energy consumption baseline that modeled their facility's energy data and relevant consumption drivers (e.g., facility output to measure potential impacts from energy consumption changes). The first criterion had a very high level of adoption, with 78% of facilities overall indicating they had reviewed their usage and equipment to identify energy-saving opportunities. The second criterion, establishing an energy consumption baseline, was substantially more difficult for all facilities, though especially for Tier 2 and Tier 3 facilities. Sixty-one percent of Tier 1 facilities created a baseline, compared to 29% and 22% of Tier 2 and Tier 3 facilities, respectively. Overall, 25% of facilities received the full adoption score for this subelement.

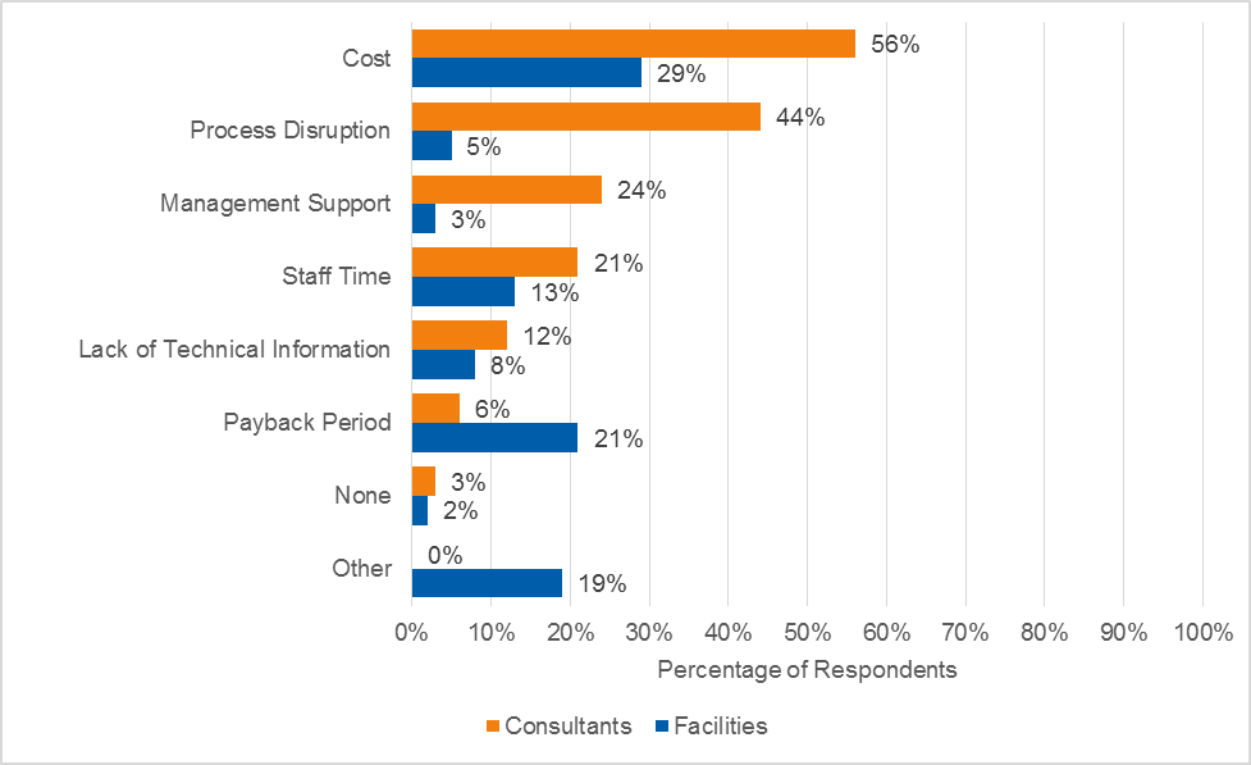
To assess Subelement 3d. Reporting, the survey asked respondents how frequently the facility's energy usage data were shared with stakeholders, such as management or operations staff. To receive a score of 2, facilities needed to share data at least annually. Overall, 19% of facilities met this criterion. Full adoption for this subelement was low overall compared to most other subelements, but Tier 1 and Tier 2 were significantly more likely than Tier 3 to meet this criterion (Tier 1: 51%, Tier 2: 38%, Tier 3: 15%).

2.3 Barriers to Energy Management

Through in-depth interviews with energy consultants and the Phase I survey, the Market Evaluation Team identified several barriers faced by industrial facilities when trying to implement SEM. Figure 2-4 shows the percentage of energy consultants and the percentage of survey respondents that mentioned each barrier.

Figure 2-4. Barriers to Energy Management, as Reported by Consultants and Facilities

Source: Phase I Survey Question E4 (n=63); In-depth Interviews with Energy Consultants Questions E1 and E3 (n=34)



Energy consultants and facilities agreed that the cost of energy management presented the most common barrier: 56% of consultants interviewed and 29% of facilities surveyed mentioned cost as a barrier. Energy consultants found it difficult to convince potential clients to pay for energy management and said that facility staff struggled to justify the cost to management.

The second most common barrier was management support or executive buy-in. Although cited less frequently by survey respondents (3%, n=63), the survey targeted c-suite executives, who may be involved in energy decisions and do not perceive themselves as a barrier. In the interviews, energy consultants and facilities frequently talked about their difficulties obtaining management support for energy management techniques. According to one consultant: "Even though you've got the buy-in at the facilities level, it usually has to elevate. [Getting buy-in at the upper level] requires spending hours working on promoting energy management and then waiting several months." Consultants' main suggestion for overcoming barriers related to management support was to offer an experienced and trusted professional to educate all parties involved on the long-term benefits of energy management.

According to consultants, another major issue faced by facilities arises from implementing energy management without disrupting their core business processes. Five percent of the survey respondents also listed this as a major barrier. The interviews provided a nuanced view of this particular barrier. One consultant said: "Keeping the [facility] up and running at all times is extremely important, anything you are trying to introduce in energy management must keep within the process." This consultant went on to describe how some equipment is sensitive and must be maintained at specific temperatures, saying that "holding [the temperature] at 68 degrees will create energy compromises, and that's a challenge to articulate to clients." Consultants offered some suggestions to address this barrier, including changing company culture and training staff: "Most of the time, changes happen from the bottom because folks learn something from a training."

The barrier mentioned least frequently by energy consultants was the barrier most commonly cited by survey respondents—the payback period for investment in process and energy efficiency—cited by six of the interview respondents and 21% of the survey respondents. As one consultant said: "Payback is key…also many industrials have been burned in the past by wrong estimates of payback." As with other barriers, consultants' main suggestion to overcome this barrier was to provide training.

Since the barriers noted by both parties are interrelated (i.e., process disruption is a barrier because it impacts the total cost to implement SEM), the difference between the frequency with which consultants and facilities mention barriers reflects differences in language and perhaps a different willingness to elaborate, between the two groups, rather than an actual point of discord.

2.4 Baseline Adoption Forecast

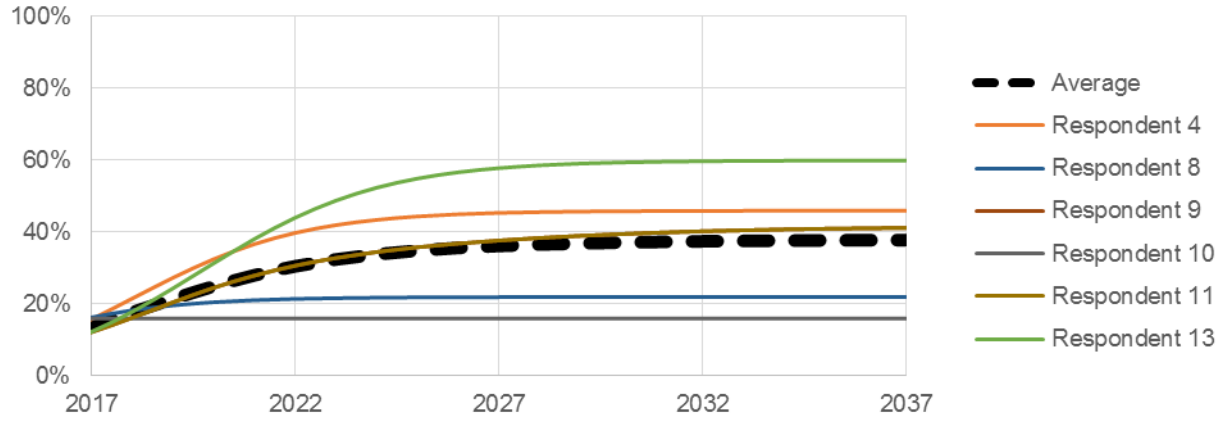
The Market Evaluation Team used a Delphi panel approach to estimate an adoption curve for SEM and OsEM in the absence of NYSERDA CEI interventions. Intended as a qualitative assessment of the baseline, this forecast provides a reference point that, combined with evidence from other sources, could be used to develop a preponderance of evidence against which to evaluate market transformation. To conduct the Delphi panel, the Team recruited 10 CEI subject matter experts, asking them to estimate future market adoption and to provide a rationale for their estimates in two iterations. For the second iteration, panelists were instructed to review other panelists' initial responses and update or maintain their original responses. Following the second iteration, the Cadmus Market Adoption Tool (CMAT) calculated a consensus curve, representing the average market adoption forecast by panelists. Section 4.3 provides more detail on the Bass curve forecast and the Delphi panel selection and process.

2.4.5 Baseline Adoption Forecast for OsEMs

The consensus curve for the OsEM market forecast shows maximum adoption at 38%, achieved in 2037. The curve indicates "followers" adopt the practice slowly and show little response to early adopters. Figure 2-5shows the final curves submitted by each respondent and the consensus curve.

Figure 2-5. Market Adoption Forecast through 2037 for OsEMs[a]

Source: CMAT

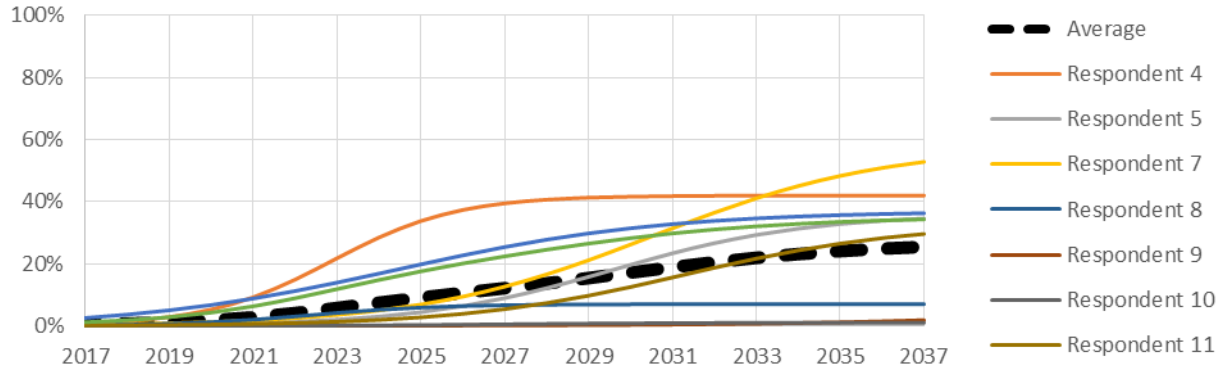


[a]The line for respondent 9 is not visible because it follows exactly the line for respondent 11. Both respondents chose the average response from Round 1 as their final response.

SEM's consensus curve shows maximum adoption of 25% in 2037. As with OsEM, the curve indicates followers adopt the practice slowly and early adopters have limited influence. Figure 2-6 shows the final curves from each respondent and the consensus curve. (See Appendix H. Analysis of Delphi Panel Comments for detail on the respondent assumptions, and the response retention analysis.)

Figure 2-6. Market Adoption Forecast through 2037 for SEM

Source: CMAT



3 Findings and Recommendations

The Market Evaluation Team identified the following key findings from the analysis conducted for this study. The recommendations associated with each key finding are intended to improve the quality and utility of the remaining market evaluation studies for the CEI Initiative.

3.1 Finding One

While adoption of some energy management practices has become prevalent, adoption of several SEM elements essential to a continuous improvement approach have experienced lower market adoption levels. These include subelement 1b., which requires that a company set, frame, and communicate long-term energy performance objectives through an energy policy and energy reduction goals. In addition, several subelements indicative of adopting a continuous improvement approach have low overall adoption levels (i.e., employee engagement; reassessment; data collection and reporting).

3.1.1 Recommendation(s) Based on Finding One

The Team recommends that NYSERDA add a progress indicator to track company commitment to continuous improvement of energy performance. This additional SEM progress indicator would allow NYSERDA to measure progress on a minimum element that is on the critical path to SEM adoption, complementing the monitoring and tracking system adoption indicator and providing greater granularity than the SEM adoption indicator (which will likely increase slowly).

3.2 Finding Two

Substantial differences exist in energy management practices among tiers. Tier 1 had a higher rate of full adoption than Tier 2 and Tier 3 for both Company Commitment and Measuring and Reporting Energy Performance. Tier 3 had statistically lower rates of full adoption than the other tiers for the same minimum elements. Tier 1 average rates of adoption were statistically higher than Tier 3 for all subelements except two (1a. Efficiency Attitudes and 2d. Project Register), and all three tiers had different rates of average adoption for subelements 3a. Measurement and 3b. Data Collection. At many levels of analysis, the data show good correlation to the energy expenditure stratification.

3.2.2 Recommendation(s) Based on Finding Two

NYSERDA should continue to track adoption rates by energy expenditure tiers.

3.3 Finding Three

The current OsEM adoption estimate, 15%, quantifies the proportion of facilities assigning energy performance responsibility to an individual, but it does not capture other factors that may reflect the OsEM's efficacy. These factors may include the OsEM's accountability level, the importance level assigned to the role, and the skill level that the OsEM brings to the role.

3.3.3 Recommendation(s) based on Finding Three

The Team recommends continuing to track the OsEM adoption level using the approach applied in this study. The Team should also add questions to the end-user survey to determine whether energy performance is considered in the OsEM's performance review (accountability); the hours per week that OsEMs dedicate to energy management (importance); the OsEM's education or background (skill level); and whether the OsEM is supported by an outside consultant (technical support to compensate for a lower skill level). Further, the Team should adjust the survey to capture whether teams with energy performance responsibility have a leader that might meet the OsEM definition.

3.4 Finding Four

At least six New York firms and seven professionals offered OsEM services prior to NYSERDA's pilot activity. The total number of OsEM consultants may be greater, but the current sampling method does not allow projection of results to the state level. The Team assembled an energy consultant sample frame composed of 1,336 firms, but 32 of the 34 firms interviewed participated in NYSERDA's FlexTech or IPE programs, indicating possible response bias (i.e., firms engaged in OsEM and SEM consulting services may have been more likely to respond), which means that results should not be projected to the subgroup of 107 firms participating in NYSERDA's technical assistance programs.

3.4.4 Recommendation(s) based on Finding Four

The Team recommends continuing to implement the approach used in this study to track the number of firms and individuals offering OsEM services, with some minor modifications. First, the indicator should be defined as the number of OsEM consultants within the pool of consulting firms offering services through NYSERDA programs. This will provide a defined sample frame. Second, the Team recommends offering an incentive—such as a $30 gift card—to encourage broader participation.

4 Methods

4.1 End-User Survey

In two phases, the Market Evaluation Team issued the end-user survey to two overlapping but slightly different audiences. Phase I was a phone survey, delivered to executive-level contacts for industrial facilities identified through a purchased dataset of all industrial facilities in New York. Phase II was an online survey issued to facility managers identified during the Phase I survey. For the Phase I survey, the Team surveyed a representative sample of industrial facilities, stratified by the number of employees (a proxy for energy usage), and estimated the distribution of the sample within the six North American Industry Classification System (NAICS) codes identified by NYSERDA.

4.1.1 Sample Design and Estimation for Phase I

The Team used data obtained from InfoGroup to develop a sample frame and design for the phone survey sample of nonparticipant industrial facilities. NYSERDA anticipated CEI and SEM adoption (and subsequent changes over time) would vary by energy usage tier. As information on energy usage was unavailable in the InfoGroup data, the Team used employee size as a proxy.

4.1.1.1 Sample Design and Sample Sizes

The Team used a stratified sample design, with strata defined by tier to select a representative sample of facilities, spanning the NAICS categories of interest. The Team assigned facilities in the sample frame to strata based on their number of employees in the InfoGroup data. Because a small subset of facilities did not include tier information, the Team input the missing tiers at random.

To calculate sample sizes, the Team assumed maximum variability in survey responses among customers within each stratum, accounted for finite population corrections, and set targets with 90% confidence and 10% precision for measuring baseline CEI and SEM adoption in 2017 as well as for changes over time (which will be estimated by comparing future CEI and SEM adoption with the baseline). Sample sizes were calculated within each tier and were estimated within NAICS categories proportionally to the number of facilities in each category from the InfoGroup data (with tiers defined by the number of employees at the facilities). Table 4-1 provides target sample sizes.

Table 4-1. Nonparticipant Sample Sizes—Original Stratification

Subpopulation	Tier Definition (Number of Employees)	Population[a]	Phase I Sample Size
Industrial facilities Tier 1	250 employees or more	230	88
Industrial facilities Tier 2	100 to 249 employees	610	115
Industrial facilities Tier 3	Up to 99 employees	6,083	121
Industrial Facilities Overall		6,923	324

[a]*The formal process utilized is provided in Chapter 11 of the Uniform Methods Project; https://energy.gov/sites/prod/files/2013/11/f5/53827-11.pdf*

4.1.1.2 Post-Stratification

After collecting the survey data, the Team determined that analysis based 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 6% of the sample, the Team estimated population sizes based on the relationships between the number of employees and energy expenditures. Table 4-2 provides the definition of the post-stratification tiers and the sample sizes in each post-stratum.

Table 4-2. Nonparticipant Sample Sizes—Post Stratification

Subpopulation	Tier Definition (Annual Energy Expenditure)	Estimated Population	Phase I Sample Size[a]
Tier 1	Greater than $1 million	293	57
Tier 2	$500,000 to $1,000,000	830	69
Tier 3	Less than $500,000	5,800	198
Overall		**6,923**	**324**

[a]For the 21 sampled facilities did not provide expenditure information, the Team implemented an imputation process to distribute the unknown samples into the three tiers, as used in the process to impute missing employee information in the InfoGroup population data.

4.1.1.3 Estimation and Sampling Weights

The Team calculated sample weights based on estimated population and sample sizes in each stratum, N_h and n_h (where h represents a tier in the post-stratified design):

$$w_h = \frac{N_h}{n_h}$$

The Team determined the sampling weight for each facility and applied this in survey data analysis to calculate population estimates and associated precision at the 90% confidence level (as shown in Table 2-1).[3]

4.1.2 Fielding

APPRISE, a professional survey research firm based in New York, fielded the Phase I survey over a period from April 3 to July 3, 2017. APPRISE provided weekly extracts of survey data, including email addresses provided to the Market Evaluation Team for the Phase II survey. This allowed the Phase II survey to be fielded over a timeframe similar to the Phase I survey. The Team fielded the Phase II survey from May 11 through July 12, 2017.

4.2 Interviews

4.2.3 Energy Consultant Interviews

NYSERDA estimated 35 FlexTech consultants would potentially offer OsEM services. The workplan required that the Market Evaluation Team interview a census of this population. As requested by NYSERDA, the Team employed several techniques to grow the sample beyond the list of NYSERDA partners. These techniques included "snowballing" contacts (requesting peer contacts from interviewees), requesting contacts from manufacturing trade association interviews, conducting online research, and incorporating all firms with NAICS code 541330, engineering services. As shown in Table 4-3, the Team completed 34 interviews. The majority of interviewees were FlexTech or IPE partners, despite the additional contacts that the Team obtained.

Table 4-3. Distribution of Completed Interviews

Contact Source	Number of Firms	Number of Interviews
FlexTech Contractor	13	13
IPE Technical Reviewer	6	6
FlexTech Contractor & IPE Technical Reviewer	10	13
Purchased registry of New York engineering services firms	2	2
Total	**31**	**34**

[3] The formal process utilized is provided in Chapter 11 of the Uniform Methods Project; https://energy.gov/sites/prod/files/2013/11/f5/53827-11.pdf

4.2.4 Manufacturing Association Interviews

The Team interviewed representatives from industry-specific manufacturing associations and regional trade associations representing industrial facilities in New York to obtain a high-level understanding of energy management practices across a variety of New York State industries.

4.3 Delphi Panel and Bass Curve Estimation

To establish the baseline adoption forecast for SEM adoption and OsEM adoption, the Team assumed that market adoption over time could be characterized with an exponential diffusion curve (i.e., the S-shaped Bass curve). Market studies commonly have used the Bass model to forecast the market diffusion of technologies and products. Appendix G. Description of Bass Curve provides a description of the Bass curve function.

The Team worked with NYSERDA to convene a panel of experts to estimate a Bass Curve for each practice (OsEMs and SEM) through a Delphi panel approach. A Delphi panel is a method used to synthesize and stabilize expert opinion on a particular question or topic to improve the precision and quality of the responses. The method allows participants to refine their responses to a research question through data sharing and multiple iterations of estimation. In this case, each panelist provided an estimated Bass curve for each practice (OsEMs and SEM) then refined this estimated curve in a second iteration. To submit their estimated curves, the panelists used CMAT, a convenient, flexible, web-based application developed by the Team.

The CMAT provided background on each practice, including the precise definitions for SEM and OsEMs. After reviewing the background information, panelists navigated to the tool's estimation page and used interactive slider bars to adjust the Bass curve's shape, according to their adoption prediction. In the second iteration, the CMAT produced a new page that showed all panelists' estimated curves in addition to an average of the first-iteration curves. Each panelist could review comments from other panelists (presented anonymously) that identified assumptions behind each curve. Panelists could then revise their original estimate, adopt the Round 1 average estimate, or make no changes.

The Market Evaluation Team set certain parameters for the estimated curves: the years over which to estimate the adoption rate and the baseline adoption level in 2017. As no easily identifiable year could be

defined in which the SEM or OsEM concepts were introduced to New York facilities, the Team set 2012 as the start date for both practices, representing a compromise date between the onset of SEM and continuous energy programs around the country (roughly a decade ago) and the lack of active programming or outreach related to the concepts in New York.

The 2017 adoption level for each practice was based on preliminary Phase I survey results available when the panel was convened (approximately 65% of the final sample). For OsEM, the baseline was 16%; for SEM, the baseline was 0%. The Team provided background information in the CMAT that included all of these parameters and programmed the CMAT to only allow estimates over the allotted timeframe. Although the CMAT allowed panelists to adjust the 2017 adoption level as they created their estimated curve, the Team requested they recognize the 2017 value.

The Team worked with NYSERDA to develop the panelists pool. The Team required that all panelists be recognized experts on New York industry or on industrial energy use. The final panel included several subject-matter experts and researchers known to NYSERDA and the Team as well as engineers whom the Team selected from the pool of energy consultant interview respondents. Table 4-4 describes the final set of panelists, the response rate, and the retained responses.

Table 4-4. Composition of Delphi Panel

Category	Number of Panelists	Round 1 Responses	Round 2 Responses	Responses Retained (OsEM)	Responses Retained (SEM)
Energy Consultant (Interviewee)	3	3	2	1	1
Industry Trade Association Representative	1	1	1	1	1
Program Implementer	1	1	1	1	1
Researcher, Consultant	3	3	3	1	3
Researcher, Market Policy Institution	1	1	1	1	1
Utility Staff	1	1	1	1	1
Total	**10**	**10**	**9**	**6**	**8**

Appendix A. Energy Consultant Interview Guide

Industrial Energy-Consultant Interview

Interviewee Name: _____

Interviewee Company: _____

Interviewee Email: _____

Interview Date/Time: _____

These interviews will collect information to assess the market for energy management services in New York. Table A-5. Question Mapping maps the interview guide questions in this document to specific research topics for the market evaluation of continuous energy improvement adoption.

Data collection Method:	Phone interview
Estimated Time to Complete:	45-60 minutes
Population Description:	Industrial Process Consultants

Table A-5. Question Mapping

Section	Research Objective	Interview Question
Consultant Services	• Understand energy consultant service offerings • Understand origination and structure of energy management services contracts • Understand how energy managers define SEM • Understand how energy managers define "on-site energy management" • Determine baseline number of on-site energy managers offering services in New York	Section C
SEM Delivery	• Gauge awareness and adoption of on-site energy manager and SEM practices • Identify how energy managers define successful SEM for their clients • Identify how SEM delivery has changed in the last 5 years	A10, A11, A15 Section D
Market Adoption and Barriers	• Identify barriers to market adoption	Section E
Interest in Energy Management	• Assess ability and interest of consultants in delivering services under the CEI initiative • Assess interests and plans of those not providing CEI/SEM	A16, Section F

A. Recruiting Script

4.3.5 Phone

[If participating in Flex Tech]

Hi. My name is [NAME]. I am calling because your firm is listed as participating in the NYSERDA FlexTech program. Are you familiar with your firm's participation in the FlexTech program, specifically with regard to work you are doing with industrial clients? **[If no, ask to speak to someone familiar with FlexTech and with industrial client activity]**.

[If participating in IPE]

Hi. My name is [NAME]. I am calling because your firm is listed as one of the technical reviewers for the NYSERDA Industrial and Process Efficiency or "IPE" program. Are you familiar with your firm's participation in that program? **[If no, ask to speak to someone familiar with IPE]**.

[if Engineering Services]

Hi. My name is [NAME]. I am calling because your firm is listed as an industrial leader in New York by NYSREDA (**if needed: NYSERDA is the New York State Energy Research and Development Authority**). Are you familiar with energy management services your firm provides for industrial facilities? **(if the firm doesn't provide energy management services to industrial facilities: thank and terminate.**

If they are unfamiliar, ask to speak to someone familiar with industrial client activity)

[All]

My firm is conducting a market baseline study for NYSERDA, to assess the awareness and adoption of continuous energy management practices among New York industrial facilities. NYSERDA will use this baseline study to evaluate several programs they plan to offer to support continuous energy management in the state.

As part of our study, we are interviewing industrial energy-consultants to gather insight about the state of the market for energy management consulting services. Your participation will be completely anonymous, and we will not use your name or the name of your firm in our report. Would you be willing to participate?

[If yes] Great! We expect these interviews to be about 45-60 minutes. Could we schedule a time in the next week?

[If email: Send calendar invite

If no email: Schedule and add to Anna's or Morgan Richmond's calendar]

4.3.6 Email

Dear [NAME],

I received your contact information from NYSERDA, as one of the technical firms that works with industrial clients through their [FlexTech/IPE] Program.

My firm, Cadmus, is conducting a market baseline study for NYSERDA, to assess the adoption of energy management practices among New York industrial facilities. As part of our study, we are interviewing industrial energy-consultants in the state to learn more about the existing demand for energy consulting services.

This email invites you to be one of the professionals interviewed for this important study. NYSERDA will use this baseline study to evaluate the need for programs that could help you offer energy management services to your customers.

I expect this phone interview to last from 45-60 minutes. Your participation will be completely anonymous, and we will not use your name or the name of your firm in our report.

To make this as convenient as possible for you, I will follow up this email with a phone call in the next day or so. Or, if you prefer, you can respond to this message.

Thank you in advance for your help!

Regards,

[NAME]

If you have questions about this study, please contact myself or Carley Murray, NYSERDA Project Manager, at carley.murray@nyserda.ny.gov.

B. Introduction

Thank you for making the time to speak with me today. My firm has been hired by NYSERDA to assess the market for industrial energy management services in New York state. As part of that evaluation, we are speaking with firms like yours to better understand the current level of awareness and adoption of strategic energy management practices and on-site energy manager services.

We will not use your name, or the name of your firm, in our final report. The interview will take from 45-60 minutes.

Do you have any questions before we begin?

C. Consultant Services

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

A1. Please tell me a little bit about your role as an industrial energy consultant and your main responsibilities? (PROBE FOR: How long have you been an industrial energy consultant? How long in NY?)

What industries do you primarily work with? (LIST ALL THAT APPLY; PROBE FOR: Chemical Manufacturing, Paper Manufacturing, Food Manufacturing, Nonmetallic Mineral Product

Manufacturing, Plastics and Rubber Product Manufacturing, and Fabricated Metal Product Manufacturing, other (please specify).)

A2. Can you give an idea of the range of types of clients that you work with? I'm interested in whatever factors you would use to characterize your clients, but these might include items such as facility size, annual or monthly energy budget, energy usage or intensity, etc.

A3. What type of energy management services does your company provide for your industrial clients? (IF NEEDED: This could include services through ISO 50001, SEM program, CEI, lean, six sigma, kaizen, total quality management (TQM) or another continuous improvement initiatives) (IF NONE, SKIP TO SECTION F)

A4. Do you or any consultants at your firm serve as on-site energy managers for clients? We define an on-site energy manager as a dedicated expert stationed in a specific facility, who is focused on process efficiency and energy optimization.

1. (If yes) Probe: How many hours per week do they work on-site? How long will this engagement last?

A5. [FOR ANY COMPONENTS NOT ALREADY MENTIONED] Do you or your company offer: (LIST:

1. Energy performance goal setting (READ IF NEEDED: THIS IS OFTEN EXPRESSED AS A PERCENT OR AN ABSOLUTE NUMBER OF ENERGY REDUCTION PER QUANTITY PRODUCT OVER TIME, FOR EXAMPLE, 5% REDUCTION IN ENERGY USE IN 3 YEARS.)

2. Energy Management Assessments ? [READ IF NEEDED: THIS IS AN ASSESSMENT OF THE ENERGY MANAGEMENT STRUCTURE THAT IDENTIFIES HOW MANAGEMENT CAN BETTER SUPPORT ENERGY EFFICIENCY EFFORTS.]

3. Development of energy maps [READ IF NEEDED: THIS IS A BREAKDOWN OF PROCESSES FROM RAW MATERIALS TO FINAL DISTRIBUTION, AND ALL THE ENERGY END USES, SUCH AS LIGHTING OR HOT WATER, REQUIRED TO PRODUCE THE END PRODUCT.]

4. Development of a list of potential energy projects (IF NEEDED: THIS IS A LIST OF POSSIBLE ENERGY SAVINGS ACTIVITIES INCLUDING EQUIPMENT UPGRADES, O&M OR PROCESS IMPROVEMENTS, OR BEHAVIORAL CHANGES THAT COULD BE TAKEN BY THE FACILITY TO REDUCE ENERGY INTENSITY.)

5. Creation of an energy tracking and/or monitoring system, to support measurement toward targets, and reporting at the facility [READ IF NEEDED: THIS IS TYPICALLY A SOFTWARE-DRIVEN SYSTEM THAT MONITORS ENERGY CONSUMPTION ACROSS END-USES. SOME ALSO CALCULATE AND REPORT ENERGY SAVINGS.]

6. Energy team building (IF NEEDED: AN ENERGY TEAM TYPICALLY INCLUDES DEDICATED STAFF AT A FACILITY INCLUDING AN ENERGY CHAMPION OR ENERGY MANAGER (A STAFF MEMBER RESPONSIBLE FOR LEADING THE EFFORT) AT THE FACILITY.) (PROBE: DOES THE EM CREATE OR LEAD THE TEAM?)

7. Development of employee engagement plans, identifying how staff at different levels can participate in managing energy? [IF NEEDED: EMPLOYEE ENGAGEMENT PLANS CAN INCLUDE ANY ACTIVITIES THAT INVOLVE STAFF OUTSIDE AN ENERGY TEAM, SUCH AS ENGAGING STAFF TO TURN OFF EQUIPMENT WHEN NOT USED, AWARENESS CAMPAIGNS, ETC.]

A6. The rest of my questions are going to be more focused on strategic energy management, or "SEM". We define "Strategic Energy Management" as the practice of taking a holistic approach to managing energy use in order to continuously improve energy performance, by achieving persistent energy and cost savings. SEM focuses on business practice change 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." [4]

1. Is Strategic Energy Management a term that you use, or do you have a different term that you think has a similar meaning?

2. (IF YES) How is our definition for Strategic Energy Management similar or different from your definition? [OPEN END]

A7. Do you offer SEM as a service, or package of services, to your clients?

1. (IF THEY OFFER SEM) How do you present this to clients – is it a single service, or a menu of services?
2. (IF THEY OFFER SEM) Do you use in-house methodology, Department of Energy, or some other framework?

A8. Do clients request SEM, or is it a service you suggest? Do you ever cold call clients to propose this service? If so, what response do you get?

1. What percent of your SEM business is from new versus repeat clients?

A9. (IF THEY OFFER SEM) How long have you offered SEM as part of your services? How long in New York? Do you offer these services outside New York?

1. (IF THEY DON'T OFFER SEM) Why not?
2. (IF THEY OFFER SEM BUT NOT IN NEW YORK) Why not?

A10. What proportion of New York industrial firms do you estimate are aware of strategic energy management services? How aware are firms of the concept of an on-site energy manager?

A11. How many industrial strategic energy management clients in NY do you have right now?

[4] https://library.cee1.org/system/files/library/11283/SEM_Minimum_Elements.pdf

A12. For how many of these industrial clients does your firm provide an on-site energy manager? [IF NEEDED: AN ON-SITE ENERGY MANAGER IS A DEDICATED EXPERT STATIONED IN A SPECIFIC FACILITY, WHO IS FOCUSED ON PROCESS EFFICIENCY AND ENERGY OPTIMIZATION]

A13. Can you describe how a typical industrial energy management services contract is structured? For example, how long is the typical contract or engagement? Do you tend to have repeat or one-time clients?

A14. What percent of your annual revenue would you say comes from industrial energy management services? An estimate is fine.

A15. How has the demand for industrial energy management services in New York changed in the last…

1. 5 years?
2. 10 years?

A16. Are you aware of the continuous energy improvement pilot programs for strategic energy management and On-site energy managers being offered by NYSERDA? Do you intend to participate in any of these programs? (IF NO, why not?) (IF NEEDED: Over the next two to three years, NYSERDA will conduct multiple pilots, each with approximately 10-15 large and medium industrial facilities, to guide manufacturers through the process of establishing and implementing an SEM system or to match manufacturers with a cost-shared On-site Energy Manager. More details are available in the funding opportunities section of NYSERDA's website.)

D. SEM Delivery

Now I'd like to get into a little more detail about what industrial energy management services you offer, how you measure outcomes, and what kind of data you use.

A17. What are the most common energy saving strategies that you recommend to industrial clients? (IF THEY WORK IN MORE THAN ONE INDUSTRY, ASK IF THESE VARY BETWEEN INDUSTRIES OR CLIENT TYPE; PROBE FOR BEHAVIORAL, O&M, AND EQUIPMENT UPGRADES)

A18. How have the energy savings opportunities you identify for industrial clients changed since you started offering energy management services?

A19. When starting with a new energy services client, how do you engage with facility staff? Who do you generally communicate with? (PROBE FOR: FACILITY managers, executive level staff, engineers, maintenance staff)

1. What kinds of information do you provide each type of person? (PROBE FOR DIFFERENCES BETWEEN CUSTOMER'S TYPES (INDUSTRY, FACILITY SIZE, ETC.))

2. How do clients typically react to energy management suggestions? (PROBE FOR DIFFERENCES BETWEEN ENGINEERS, MANAGERS, SENIOR MANAGEMENT; PROBE FOR DIFFERENCES BETWEEN BEHAVIORAL, O&M, AND EQUIPMENT SUGGESTIONS)

A20. Do you quantify potential energy savings benefits for clients as part of your process? If so, what metrics do you provide? (PROBE FOR: energy savings as kWh or dollar savings, GHG, energy intensity (per units), other)?

A21. A key objective of SEM is to influence behavior throughout the organization. How do you measure progress against that objective? What data do you collect for these metrics?

A22. Have your methods for monitoring and tracking energy use changed since you started offering energy management services?

A23. Do you use an Energy Management Assessment tool with your clients? (IF NEEDED: review the business management processes as they relate to energy efficiency projects.)

1. [IF YES] What do you like about that tool compared to other tools? Are there any limitations to that tool?

2. [Record if not familiar with EMA tools]

A24. Are there any metrics that you are interested in but don't track? [PROBE: Why not tracked?]

E. Market Adoption and Barriers

Now I have a few questions about the market in New York and about challenges and barriers you have experienced in industrial energy management.

A25. What challenges have you experienced introducing energy management to your industrial clients?

A26. How have you overcome these challenges?

A27. What challenges do your industrial clients have implementing energy management?

A28. How have your industrial clients overcome these challenges?

A29. Do you know of other firms or consultants, outside of your company, that do industrial energy management consulting in NY? IF YES:

1. What would you estimate to be the number of consultant/firms doing this type of work in NY?

2. In your experience, has the number of consultants doing this type of work in New York changed over the past 5 years? If yes, how has it changed? (INCREASE? DECREASE?)

3. Who do you consider the leading energy management consultants/firms in New York?

4. Do you have a contact at another firm who we could reach out to? (GET PHONE NUMBER)

F. Interest in Energy Management

ASK THIS SECTION ONLY TO THOSE WHO SAID THEY DO NOT CURRENTLY OFFER ENERGY MANAGEMENT SERVICES

A30. Why do you not offer energy management services? [PROBE: would training be helpful?]

A31. Do you have any plans to incorporate energy management into your services to industrial clients?

A32. Are you aware of the continuous energy improvement initiatives being offered by NYSERDA? Do you have any interest in participating in those initiatives? (IF NEEDED: These have been marketed through Industrial and Process Efficiency (IPE), FlexTech Programs, and OsEM & SEM and pilots) Why or why not?

G. Wrap up

We are almost finished, I just have a couple more questions about your experience as an energy manager and about your hopes for the future.

A33. What changes, if any, do you expect in the demand for (industrial) energy management services in the next five years? Why do you say that?

A34. [FOR THOSE OFFERING ENERGY MANAGEMENT SERVICES] Do you have any energy management case studies or industrial client testimonials you would be willing to share?

Thank you for talking with me today.

To learn more about NYSERDA's ongoing Continuous Energy Improvement initiatives, please visit NYSERDA.com.

Appendix B. Energy Consultant Interview Coding

To analyze the consultant interviews, Cadmus developed a set of coding references that facilitate identifying and documenting trends in the interview responses, and preserving that analysis for future reference. Table B-6 shows the codes we created for analysis.

Table B-6. Energy Consultant Interview Codes and Descriptions

Name	Description	References
Client Firm Size	Size of the energy consultant's typical customer base expressed either in terms of number of employees or square footage of the facility	11
Energy Budget	Typical client monthly or yearly energy budge in $ amount or kWh or Therm amount.	27
C6_1 - SEM Definition	Response to the Cadmus provided SEM definition, ""Strategic Energy Management" as the practice of taking a holistic approach to managing energy use in order to continuously improve energy performance, by achieving persistent energy and cost savings. SEM focuses on business practice change 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."	34
C6_2 - SEM Definition Differences	Different definitions for SEM held by the energy consultants	34
Other terms for SEM	Different names used by the energy consultants that fit the Cadmus definition for SEM	26
Challenges	Challenges faced by both energy consultants and their clients in implementing SEM. Also contains how they overcome challenges.	154
E1 - EM Challenges	This code is based on interview question E1 - E1. What challenges have you experienced introducing energy management to your industrial clients? The child nodes include the challenges faced by the energy consultants. See individual codes for descriptions.	49
Client Trust	Indicates that the client doesn't trust the energy consultant or the method.	18
Overcome	Ways the energy consultant overcomes the challenge of client trust	5
Clients understanding EM	The client doesn't understand energy management	6
Overcome	This is how the energy consultant overcomes the issue of clients not understanding energy management	3
Executive Buy-in	The energy manager found executive buy-in to be a challenge.	12
Overcome	This is how the energy consultant overcomes the issue of executive buy in	4
Low Energy Costs	If market energy prices are a challenge to implementing SEM	3
Paypack	Long term equipment, energy manage salary, or other payback or ROI was listed as a challenge for the energy consultant in implementing SEM	10
Overcome	How energy consultants overcome payback barriers	13

Name	Description	References
E2 - EM Overcome Challenges	Verbatim answers to E2. How have you overcome these challenges?	34
E3 - Client Challenges	Challenges faced by clients to implement SEM	34
Attitude	Internal attitudes pose a problem	2
Cost	Internal or external competition for funding	18
Priorities	Company direction and priority	1
Process Disruption	Being able or willing to handle an upset in operations	15
Time	Facility managers have little time to work on energy	4
E4 - Client Overcome Challenges	Verbatim answers for how clients overcome challenges	34
C8_1 - New v Repeat Clients	% or number of clients that are new or repeat	34
Client Initiated	If clients propose SEM	4
Cold Calling	If EM firm cold calls to recruit	8
Direct Selling	If EM suggests SEM to clients	12
Word of Mouth	If word of mouth is used to get SEM contracts	4
D3 - Communication - Who	Who the EM communicates with	34
D3_1 - Communication - What	What information the EM gives during the pitch	34
D3_2 - Communication - Reactions	How people react to the pitch	34
Data Centers	"Other" industry	2
Pharmaceutical	"Other" industry	4
Wastewater or Waste	"Other" industry	6
C11 -# of Clients	Number of current SEM clients	28
C13 - Contracts	Description of typical contract	34
C14 - % Annual Revenue	Percent of annual company revenue from EM	34
C16 - NYSERDA Pilot Awareness	Awareness of NYSERDA SEM/OsEM pilots	36
C1-Role	Description of firm	34
C3 - EM Type	Methodology/Type of energy management services offered	34
C7_1 - Menu or Single Service	If SEM is a menu or a single service	34
C7_2 - SEM Methodology	Formal SEM methodology used, if any	29
Don't offer EM	if they don't offer EM as we described it	3
Currently Have OsEM customers	If the EM currently offers OsEMs	12
Future plans to OsEM	Plan to offer OsEMs in the future	3
Offered OsEM in the past	Offered in the past but no longer do	2
Opinions about OsEMs	Opinions about OsEMs	1
OsEM Hours	How many hours they do or will offer OsEMs to clients	16
# years EM NY	Number of years offering EM in NY	31
C10 - Industrial Firm Awareness	General industry awareness of EM	34
E5 - Awareness - Other Firms	Specific other firms that do EM	36
E5_1 - # of other firms	Estimate of # of firms doing EM in NY	34
Decrease	Perception of if there is or decrease in EM firms	1
Increase	Perception of if there is an increase in EM firms	15
No Change	Perception of if there is no change in EM firms	4
E5_3 - Leading Firm	Opinion of leading firm in EM in NY	0

Name	Description	References
Features of Leading Firms	Rather than give a name for another firm, some respondents gave a description of what a leading firm would look like, in their opinion. This node is a compilation of those factors.	8
Name of Firm	This node excludes references of the respondent's company. almost all of the respondents thought their own company was a leader, but I didn't think it was appropriate to include that in the list of leading firms.	27
10 years	10 year demand change expectation	17
5 years	5 year demand change expectation	32
Energy Savings		0
D4 - Energy Savings - Quantify	How much EM saves energy	34
D5 -Behavior Change - Quantify	How they track behavior change	34
D6 - Energy Savings - Tracking - Changes over time	Tools used to track energy savings, and how that has changed over time	34
D7 - EMA tool	EMA tools used	34
D7_1 - EMA tool - Features	Features of good EMA tools	34
D8 - Energy Savings - Metrics not tracked	Metric they want to track but don't	34
Negative	Negative attitudes about anything	11
NYSERDA	Explicit references to NYSERDA	6
D1 - Opp Reg Strategies	How they track energy savings projects	34
D2 - Opp Reg Changes	How projects have changed over time	34
Positive	Noticeably positive statements	7
Quotables	Quotable turns of phrase	10
Suggestions	Suggestions for NYSERDA	7

Appendix C. Manufacturer Association Representative Interview Guide

NYSERDA CEI Trade Association Interview Guide

NYSERDA is conducting a series of in-depth interviews with manufacturing groups and trade associations representing the most energy intensive industrial sectors in New York State. These interviews will allow Cadmus to assess each trade association's awareness of energy management practices, specifically CEI programs like SEM and OsEM, knowledge about promotion or adoption of energy management practices and specific SEM elements within the trade groups' membership, knowledge of members that employ on-site energy managers, and the energy savings potential of these measures. This research will help inform the market indicator evaluation. In addition, the interviews with association staff will provide an opportunity to request assistance to recruit respondents for the market evaluation industrial end-user survey. This guide will serve as the basis for interviews with trade association staff, but allows for free-flow discussion. Interviews will be recorded to reference them at a later point in time.

Data collection Method:	In-person and phone interviews
Estimated Time to Complete:	45-60 minutes
Population Description:	Manufacturing groups/ trade associations

Table C-7. Research Objectives and Question Key

Research Topic	Research Objectives	Question Map
How does industry manage energy (i.e. as a resource?)	Assess range of member attitudes toward industrial energy management and approaches to energy management	B1-B3
What is industry awareness and attitude toward SEM and OsEMs?	Assess association interest in promoting or enabling SEM and OsEM adoption	A4
	Document organization's current SEM and OsEM activities and resources	A5-A6
To what extent are industry facilities implementing SEM or using OsEM?	Understand members' awareness of and attitude toward SEM and OsEM	D1, E1
	Quantify the extent of SEM and penetration of OsEMs in New York	D1-D2, E1-E2
What barriers do industry facilities face regarding adoption of SEM and OsEM?	Understand market adoption influencers and barriers	Sections C, D, E
	Identify any existing solutions to common barriers	C4-C5, D2c-D2d, E2b
What is industry capacity for energy tracking and monitoring?	Assess proportion of industry adopting energy savings targets, and tracking progress	Section F
	Identify key performance metrics and effective savings quantification techniques	F1c, F1d, F2a
What is the potential for growth in SEM or OsEM adoption?	Assess factors likely to influence SEM or OEM adoption in the future	Section G

Interview Guide

Respondent Details

Name: _____

Email: _____

Group: _____

Interview date/time: _____

Recruitment Script (Phone)

My name is **[NAME]**. My firm is conducting a market baseline study for NYSERDA, to assess the adoption of energy management practices among New York industrial facilities. We are particularly interested in the baseline in **[ORGANIZATION'S INDUSTRY]**, since it is an energy intensive sector. To help guide our research, I would like to speak to someone at your organization who is most familiar with how your members view their energy use, and energy efficiency improvements. Are you that person, or can you direct me to the right contact?

[WITH APPROPRIATE CONTACT] I would like to schedule a time for a formal interview with you to collect your insights on how strategic energy management affects your members. If possible, I would like to meet with you in person at your office in **[LOCATION]**.

[IF NEEDED] We define "Strategic Energy Management" as the practice of managing energy use through process and behavior improvements in order to continuously improve energy performance, by achieving persistent energy and cost savings. Strategic Energy Management focuses on business practice change 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." [5]
NYSERDA will use this baseline study to evaluate several programs they plan to offer to support continuous energy management by your members and other industrial facilities in the state.

[IF YES, SET A TIME]

We will also be conducting a survey of industrial facilities in New York in April. I wanted to discuss with you the possibility of getting your help to recruit your members for participation in the survey. NYSERDA is seeking to better understand this sector, and these learnings could assist them to offer programs that directly benefit your members. This request is secondary to the interview.

[5] https://library.cee1.org/system/files/library/11283/SEM_Minimum_Elements.pdf

Background Research

Prior to the interview, the Cadmus team will conduct some background research on each organization. Research will include the following topics:

What is the organization's mission statement?

- How long has it been in existence for?
- What is the membership profile?
- Is the organization industry-specific?
- What are the member company sizes?
- What geographic areas do they cover?
- Are there subsets or tiers of memberships (i.e. paid)?

Introduction (2 minutes)

[READ VERBATIM] Thank you for taking the time to speak to me today about **[ORGANIZATION]**'s experience with and thoughts on industrial energy management practices, specifically strategic energy management and the use of on-site energy managers. As I mentioned previously, my firm is conducting a market baseline assessment of continuous energy management practices among New York industries for NYSERDA. As part of our evaluation, we are talking to several trade organizations throughout New York State about their members' awareness and adoption of strategic energy management practices, and use of dedicated on-site energy managers.

Your responses today will be kept anonymous. We will not use your name in our report, nor will quote any of your direct statements without your permission. Do you mind if I record the interview? It will not be published anywhere – this is just so I can refer back to it later while writing up my findings.

The interview will take 45 – 60 minutes to complete. Do you have any questions before we begin?

A. Association Background, Awareness, Interest (10 minutes)

Ok, now I'd like to talk about some background information on your organization.

A1. Please tell me a bit about your role with **[ORGANIZATION]**. How long have you been in your current role?

A2. After viewing your website, I understand that your organization… **[QUICK SYNOPSIS ON BACKGROUND RESEARCH]**. Is this accurate? Are there any details you would like to add?

A3. How, if at all, have the organization's priorities evolved over time? What are currently the top 3 priorities for the organization? [ask top 3, but take as many as they mention; probe for energy-related values]

A4. [If not specifically mentioned in A4] To what extent, if at all, is industrial energy management of interest to, or a priority for **[ORGANIZATION]**? [Probe: Why do you say that? Can you say more about that?]

A5. Do you/have you offered any services, resources, or activities to your members related to industrial energy management? [Probe as appropriate: please describe; any others? Until offerings have been exhausted. Probe as needed to fully understand the activity, if any.]

A6. [If not already covered:] Have you contemplated or discussed any/any other membership activities or resources related to industrial energy management? [Probe as appropriate to fully understand areas of interest, barriers, etc.]

B. Member Energy Management Awareness, Interest, and Activity (15 minutes)

Thanks. My next questions address attitudes and behavior related to energy usage among your members.

B1. To what extent, if at all, would you say that managing energy usage, energy intensity, and energy cost is a priority for your members? [Probe: Can you tell me why you say that? Has the organization received direct member feedback, seen this issue as topic at conferences or industry events, or in industry publications, etc.]

B2. Do members try to optimize energy usage in the same manner they optimize other production inputs?

B3. How much of a priority for your members would you say energy efficiency is for the following areas: [Probe, as needed: Why do you say that?]

a. Managing their monthly or annual expenditures

b. Their overall production processes?

c. When replacing or upgrading equipment? [Probe, as needed: Is this more of a concern for specific types of equipment?]

d. Organizational “culture” and processes (i.e. how employees view energy and sustainability)?

Now I’d like to ask you about a few specific areas of energy management.

C. Member CEI Current Practices (15 minutes)

C1. In general, what approach do your members take to managing energy usage and cost? [Probe as needed: equipment replacement, process improvements, energy audits or assessments? Listen for terms related to continuous energy improvement: energy management, strategic energy management, on-site energy managers, six sigma, kaizen, ISO 50001, total quality management, etc.)]

C2. What proportion of your members would you estimate have adopted any energy management practices?

a. What types of energy management practices have your members implemented? *[Probe for: energy management assessments, energy map, cohort knowledge shares, trainings, employee engagement, on-site energy managers]*

b. Are some practices more common than others? Why are these the most common?

c. Which members, or types of members have been the most successful at implementing energy management practices? Why do you say that?

d. Do you have any insight as to why some members are implementing energy management practices?

e. Do you have any insight as to why some members are NOT implementing energy management practices?

f. What barriers have members identified for not adopting energy management practices, if any? [Probe for: resource constraints (staff time, budget), senior level buy-in, cost-effectiveness, lack of information or technical support]

g. In your opinion, are there specific energy management practices that members view as less useful, or have more trouble implementing? If so, which ones?

C3. Strategic Energy Management. We define strategic energy management as an institutional commitment to continuously improve energy performance, by identifying and achieving persistent energy and cost savings. Typically, strategic energy management techniques involve senior management through shop floor staff, and require setting internal policies and goals to reduce energy waste and improve energy intensity through behavioral and operational change.

a. To the best of your knowledge, how familiar are your members with strategic energy management, also known as SEM, practices? [Probe, as needed: Why do say that? Please say more about that?]

b. How interested are your members in SEM? What specifically are they interested in? [Probe for: energy management assessments, energy map, cohort knowledge shares, trainings, employee engagement, etc.]

c. Is there variation within your member base? If so, how would you characterize members who tend to be more familiar or interested, relative to those who are less familiar or interested? [Probe on any specific topics listed in B3, B4, and B5b.]

C4. What proportion of your members would you estimate have adopted any or all SEM practices?

a. What types of SEM practices have your members implemented? *[Probe for: energy management assessments, energy map, cohort knowledge shares, trainings, employee engagement]*

b. Are some practices more common than others? Why are these the most common?

c. Which members, or types of members have been the most successful at implementing SEM? Why do you say that?

d. Do you have any insight as to why some members are implementing SEM?

e. Do you have any insight as to why some members are NOT implementing SEM practices?

f. What barriers have members identified for not adopting SEM practices, if any? [Probe for: resource constraints (staff time, budget), senior level buy-in, cost-effectiveness, lack of information or technical support]

g. In your opinion, are there specific SEM practices that members view as less useful, or have more trouble implementing? If so, which ones?

D. On-site Energy Manager

C5. We define an on-site energy manager as a dedicated, on-site resource/expert, focused on driving the institutional commitment to improve process efficiency and energy optimization.

a. To the best of your knowledge, how familiar are your members with the concept of an on-site energy manager? [Probe, as needed: Why do say that? Please say more about that?]

b. How much interest do your members have in an on-site energy managers? For example, do you ever get any questions about how to find an on-site energy manager, or how to work with one?

c. How have members' attitudes and awareness toward on-site energy managers changed over time?

d. Is there variation within your member base? If so, how would you characterize members who tend to be more familiar or interested, relative to those who are less familiar or interested? [Probe on any specific topics listed in B3, B4, and B6b.]

C6. What proportion of your members would you estimate use an on-site energy manager, or have used one in the past?

a. Do your members that use on-site energy manager tend to engage with an on-site energy manager on a short or long term basis?

b. How would you characterize members who have adopted an on-site energy manager, relative to those who have not? Have any members described to you why they chose to work with an on-site energy manager, or why they have NOT chosen to work with an on-site energy manager?

c. Do you perceive that members face any barriers when considering hiring an on-site energy manager?

d. How do your members find the on-site energy manager that they use? Have any members had trouble finding an on-site energy manager?

e. Do you have a sense of how many on-site energy managers there are in New York State?

E. Energy Savings Targets and Tracking (10 minutes)

E1. What proportion of your members would you estimate set specific energy usage or savings targets? What about the proportion that track energy usage or savings?

a. What motivates your members to set these goals and track their progress?

b. Do you know what systems your members use to quantify, track, or report savings?

c. What key performance metrics are used for monitoring energy usage or energy savings?

d. Are these metrics common across the industry?

E2. Can you think of specific examples where members have successfully set and met their energy savings goals?

a. What factors do you think contribute to a facility being able to successfully reduce energy use?

E3. What obstacles have facilities encountered when they try to reduce energy use? How have facilities addressed these obstacles?

F. Future of Energy Management (5 minutes)

F1. How do you see your industry's approach to energy management changing in the next 3-5 years? What factors do you think will drive that change?

F2. What do you think is the biggest obstacle is to increased energy management practice adoption going forward?

a. Do you see any potential solutions for overcoming that obstacle?

F3. How do you think usage of on-site energy managers will change among your membership in the next 3-5 years? Why do you say that?

F4. What do you see as the most significant obstacles to increased adoption of on-site energy managers among your members?

a. Do you see any potential solutions for overcoming that obstacle?

G. Conclusion (5 minutes)

F1. Is there anything else you want to mention that we didn't go over today?

F2. Is there anyone else you'd recommend we speak with?

F3. I will not use your name in our report, but is it okay if we name your organization as having participated in the study?

As mentioned in our initial conversations, we will be launching a survey of industrial customers to help quantify current practices related to energy management. This research will be critical for NYSERDA's evaluation of its programs in this area. We have found that companies are more likely to participate in this type of survey when it is promoted by a trade association. If we provide you with draft copy that can be tailored to your specific member base and engagement vehicles, would you be willing to communicate with your members about this survey? [Probe for details on what they can commit to do.]

Additionally, do you think your members would be interested in attending information sessions about the programs that NYSERDA is planning to offer?

Thank you very much for your time.

[https://projects.cadmusgroup.com/sites/6681-P01/Shared%20Documents/Manuf%20Interviews/Guide/NYSERDA%20Trade%20Assication%20Interview%20Guide_Final_clean.docx]

Appendix D. Nonparticipant Survey Instrument: Phase I

NYSERDA Continuous Energy Improvement Baseline Study, Phase 1

This survey instrument is the first part of the two-part industrial end-user survey that will provide the information needed to meet NYSERDA's market baseline research objectives. The Phase 1 survey will be administered by telephone to management respondents, and is designed to assess the baseline penetration of continuous energy improvement (CEI), as defined by the CEE minimum elements. It also addresses other key research questions available only from company decision makers. Table D-8 shows the survey questions mapped to research objectives from Table 7 and Table 8 in the CEI market evaluation work plan.

Table D-8. Research Question Mapping

Topic Category	Research Questions	CEE Minimum Elements	Phase 1 survey items
Energy Management Attitudes	Assess importance of Energy Efficiency, Process Efficiency and other sustainability topics		C1, C2
Company Commitment	Baseline SEM Adoption	1a. Policy and Goals	C3, C4, C5
		1b. Resources	C6-C10
		2a. Energy Management Assessment	D1, D2
Planning & Implementation		2b. Energy Map	D3
		2c. Metrics and Goals	D4, D5
		2d. Project Register	D6
		2e. Employee Engagement	D15
		2f. Implementation	D9-D14
		2g. Reassessment	D16
		3a. Measurement	D7, D8
System for Measuring and Reporting Energy Performance		3b. Data Collection and Analysis	D17
		3c. Analysis	D18
		3d. Reporting	D19
Barriers and Interest	Identify current participation		E1, E2
	Determine consideration of SEM		E3
	Assess challenges with SEM		E4, E5
	Identify interest in SEM information		E6, E7
Business Decision Making	Decision factor importance		F1 (a-f)
	Energy cost considerations		F2, F3
	Goal planning timing		F4
	Budget planning timing		F5

Table D-9 shows the target sample size by tier, based on the final sampling plan submitted February 27, 2017.

Table D-9. Survey Sample Plan

Subpopulation	Estimated Population	Sample Size*	Expected Confidence and Precision within Tier
Industrial facilities Tier 1	230	81	90/10
Industrial facilities Tier 2	610	107	90/10
Industrial facilities Tier 3	6,083	132	90/10
Industrial facilities Total	**6,923**	**320**	**90/5**

*Sample sizes reflect telephone survey completes. It is expected that a maximum of 90% of telephone survey respondents will complete a more detailed online survey, resulting in less than 300 online survey completes.

Data Collection Method: Phone survey
Estimated Time to Complete: 15 minutes
Population Description: Management-level respondents (CEO, COO, owners, presidents, general managers) who are familiar with the energy practices of the company

Survey Instrument

Interviewer instructions are in green.

CATI programming instructions are in red.

Answer options in parenthesis are not read

4.3.7 Screener for Inbound Calls

Hi, this is a survey line for an energy use study in New York industrial facilities. We are conducting a study with company energy decision makers with industrial or manufacturing facilities in New York state.

IBS1. First, I just need to confirm that your company has a manufacturing or production facility in New York state. Is this correct?

[If yes], please confirm the following:

- Company Name
- Primary business category (industrial, manufacturing, …)
- What is your name and title? [Contact Name, Title]

[If no or don't know], ask for company name, industrial type, to match a company on the sample list. Collect:

- Primary business category (industrial, manufacturing, …)
- What is your name and title? [Contact Name, Title]

Before we get started, I'd like you to know that we will keep your responses anonymous. They will be aggregated with other people's responses in our report. Your responses will not be linked to you or your company, so please feel free to speak as candidly as you like.[Skip to B2]

4.3.8 Screener For Outbound Calls

[Variables from sample]

[CONTACT NAME]

[TITLE]

[COMPANY]

[ADDRESS]

Introduction

A1. *May I speak with [CONTACT NAME]? [IF THAT PERSON IS NOT AT THIS PHONE NUMBER, ASK FOR NAME AND PHONE NUMBER AND START AGAIN]

1. (Yes)
98. (Don't know) [ASK TO SPEAK WITH SOMEONE WHO IS INVOLVED IN ENERGY DECISIONS AT THIS COMPANY AND BEGIN AGAIN]
99. (Refused) [THANK AND TERMINATE]

A2. *Hello, I'm [INSERT NAME] calling from Cadmus on behalf of NYSERDA, the New York State Energy Research and Development Authority. We are conducting an important study about energy use with executives of industrial companies in New York state. NYSERDA is assessing current energy management practices and needs for industrial companies and will use the collective input to design supporting resources for companies like yours. These resources are very important to the state's economic future. Are you involved with decisions about your company's energy use and management practices?

1. (Yes)
2. (No, person is able to come to phone) [ASK FOR PERSON WHO IS A DECISION MAKER AND START AGAIN]
1. (No, person is not able to come to phone) [GET NAME, PHONE NUMBER, AND SCHEDULE CALLBACK]
98. (Don't know) [ASK FOR PERSON WHO WOULD KNOW AND START AGAIN]
99. (Refused) [THANK AND TERMINATE]

A3. Is this a good time for you to answer a few questions about energy practices for your company?

1. (Yes) [Continue]
2. (No [ASK: When would it be a good time for me to call back?] [SCHEDULE CALLBACK])
98. (Don't know) [ASK TO SPEAK WITH SOMEONE ELSE AND START AGAIN]
99. (Refused)

Back-up information, not to be programmed:

[If "No – Not a convenient time," ask if Respondent would like to arrange a more convenient time for us to call them back or if you can leave a message for that person.]

[IF RESPONDENT ASKS HOW LONG, SAY: "APPROXIMATELY 15 MINUTES."]

[IF NEEDED:] This survey is for research purposes only and this is not a marketing call. This is the primary way for NYSERDA to gather information about industrial company energy use and practices. Your participation in this study is important so that NYSERDA can include your perspectives in how energy efficiency initiatives are offered in New York.

[**Only if asked** for a NYSERDA contact to verify the survey authenticity, offer

Carley Murray, Project Manager

NYSERDA

carley.murray@nyserda.ny.gov

READ: Great. We appreciate your time and willingness to respond to this survey. Before we get started, I'd like you to know that we will keep your responses anonymous. They will be kept confidential and aggregated with other people's responses in our report. Your responses will not be linked to you or your company, so please feel free to speak as candidly as you like.

B. Screeners

B1. ***What is your title? [READ LIST ONLY IF NECESSARY]**

1. (Owner)
2. (President)
3. (Chief Executive Officer [CEO])
4. (Chief Operating Officer [COO])
5. (Chief Financial Officer [CFO])
6. (Facility or Property Manager)
7. (Finance Manager)
8. (Building operator)
9. (Building engineer)
10. (Other [SPECIFY:_____])[If an office manager or similar administrator type, ask whether they are involved in company management decisions. If not, ask for someone else who is involved in management decisions.]

98. (Don't know) [ASK FOR SOMEONE ELSE INVOLVED IN MANAGEMENT DECISIONS. IF NO ONE THEN THANK AND TERMINATE.]
99. (Refused) [ASK FOR SOMEONE ELSE INVOLVED IN MANAGEMENT DECISIONS. IF NO ONE THEN THANK AND TERMINATE.]

B2. How many production facilities [buildings] does your company operate within New York state? [If needed: Production facilities are buildings where your company produces, manufactures, or processes goods. We are particularly interested in facilities with medium to high energy use.]

1. [Record number: ____][If none or 0, THANK AND TERMINATE]

B2a. [If B2>1] Our records indicate you are located at the facility at: [ADDRESS]. If that is not correct, what is the address of the facility where you are located? [_____]

B3. Our records indicate your company has approximately [NO. of EMPLOYEES] employees in the facility where you are stationed. Does this sound about right?

1. (Yes)
2. (No) [What is the correct number of employees? _____]
98. (Don't know)
99. (Refused)

B4. What category best represents your facility's annual spend on energy (electric and natural gas)?

1. Less than $500,000
2. Between $500,000 and $1,000,000
3. More than $1,000,000
4. (Don't know)

C. Energy Management Commitment

Thank you for confirming those details. I'd like to start by understanding the role energy management has in your facility operations and priorities. Recognizing that companies may have multiple facility types, I'd like you to think about how these questions apply to your particular facility, where possible. If some of the terms are unfamiliar or used in many different ways, let me know and I will provide further clarification. We are most interested in what these terms and concepts mean for your facility.

C1. Using a 1-5 scale where 1=not at all important and 5=extremely important, How important to your facility are the following for maintaining a competitive advantage:

1. Energy Efficiency [Record 1-5 rating, DK, Unfamiliar]
2. Process Efficiency practices [Record 1-5 rating, DK, Unfamiliar]
3. Demand Reduction [Record 1-5 rating, DK, Unfamiliar]
4. Distributed Energy Generation [Record 1-5 rating, DK, Unfamiliar]
5. Renewable Energy Technologies [Record 1-5 rating, DK, Unfamiliar]

C2. Has your company's top management expressed verbal support for energy management? [1a.PG]

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

C3. Does your company or facility have a written energy policy or a plan that includes guiding principles for energy management? [IF NEEDED: This may be part of a broader sustainability plan with other goals such as recycling, waste reduction, water use, etc.] [1a.PG]

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

C4. Does your facility set energy performance goals? [1a.PG]
1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

C5. [If C4=1] Have those goals been communicated to operations staff? [1a.PG]
1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

C6. Does your facility have an individual or team with formal responsibility for energy performance? [1b. Res]
1. (Yes) [C6a. Is this a team or an individual?(team, individual)]
2. (No) [C6b. Does your company have plans to identify an energy manager? (yes, no, don't know)]
98. (Don't know)
99. (Refused)

C7. [If C6a=individual] Is this individual a company employee or an outside contractor? [1b. Res]
1. Employee [C7a. Does this employee work on-site, where primary production occurs? (yes, no, don't know)]
2. Contractor
98. (Don't Know)
99. (Refused)

C8. [If C6a=team] How frequently does the team meet? [1b. Res]
1. (Daily)
2. (Weekly)
3. (Monthly)
4. (Quarterly)
5. (Twice a year)
6. (Annually)
7. (Varies or "as needed")
8. (Other), Specify_____
9. (Does not meet)
98. (Don't know)
99. (Refused)

C9. Which best describes your facility's level of support for dedicating **staff resources** to energy management? [Read response options] [1b. Res]
1. Optimal level
2. Minimal level
3. No support
98. (Don't know)
99. (Refused)

C10. Which best describes your facility's level of support for approving and **providing funding** for energy projects or initiatives? [Read response options] [1b. Res]
1. Optimal level
2. Minimal level
3. No support
98. (Don't know)

99. (Refused)

D. Planning and Implementation

D1. Has your facility ever conducted a review of energy-using equipment and energy bills to identify savings opportunities? [2a.EMA]

1. (Yes)
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

READ: Now I'd like to talk about ways your facility may be engaged in and implementing **strategic energy management**. You may have heard this referred to as SEM or continuous energy improvement (CEI). Because there are several aspects to a formalized SEM approach, your answers to the following questions will help us classify how your company manages energy compared to other companies in New York.

D2. Has your facility undergone an organizational assessment for *strategic* energy management activities? [READ IF NEEDED: This is an assessment of the energy management structure that identifies how management can better support energy efficiency efforts.] [2a.EMA]

1. (Yes)
2. (In process)
3. (planning to)
4. (No)
99. (Don't know)
99. (Refused)

D3. Has someone at your facility developed an energy map to identify the key energy drivers and end uses? [READ IF NEEDED: This is a breakdown of processes from raw materials to final distribution, and all the energy end uses, such as lighting or hot water, required to produce the end product.] [2b.EMAP]

1. (Yes)
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

D4. [If C4=1] You mentioned earlier that your facility has energy performance goals. How are the goals defined; and what are they? (READ IF NEEDED: This is often expressed as a percent or an absolute number of energy reduction per quantity product over time, for example, 5% reduction in energy use in 3 years.) [2c.MG]

1. Defined as: percentage energy reduction; D4a. [Specify percent and period]
2. Defined as: absolute number energy reduction [Specify number and period]
3. Defined in some other way [Specify]
98. (Don't know)
99. (Refused)

D5. [If C4=1] When did your facility first adopt energy performance goals? [2c.MG]
1. [RECORD YEAR]
98. (Don't know)
99. (Refused)

D6. [If C4=1] In what way does your company document potential energy efficiency projects and track progress on these activities? [2d.PR]
1. (Project or opportunity register)
2. (Tune up action item list)
3. (Energy management tracking software)
4. (Updating Energy Management plan/policy)
5. (Does not document potential energy efficiency projects)
6. (Other [Specify])
7. (Don't know)

D7. [If D6≠3] Is your facility currently using a tool to track energy use over time? [READ IF NEEDED: This is typically a software-driven system that monitors energy consumption across end-uses. Some also calculate and report energy savings.] [3a.MS]
1. (Yes)
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

D8. [If D7=1,3] What type of system are you using (or plan to use)? [Can select more than one option if mentioned] [3a.MS]
1. (Monitoring, Targeting and Reporting model (MT&R))
2. (Energy Management Information System (EMIS))
3. (Microsoft Excel-based spreadsheet tool)
4. Other [Specify]
98. (Don't know)
99. (Refused)

D9. [Blank]

D10. Has your facility adopted initiatives (such as ISO 50001, etc.) that contribute to energy **process** optimization? [2f.I] [T811]
1. (Yes) [Specify]
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

D11. [If D10=1] Are these energy process optimization initiatives included in facility key performance indicators or Key Performance Indicators? [2f.I] [T811]
1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

D12. Now focusing more on the energy using equipment, has your facility adopted initiatives (such as ISO 50001) that contribute to energy **efficiency** equipment optimization? [2f.I] [T810]

1. (Yes)
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

D13. [If D12=1] Are these equipment optimization initiatives included in facility key performance indicators or Key Performance Indicators? [2f.I] [T810]

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

D14. Has your facility completed any energy or process efficiency projects or initiatives within the past 3 years? [2f.I]

1. (Yes)
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

D15. [If C6=1] Has the energy manager or team conducted any specific employee engagement activities around energy management or conservation in the past 3 years? [IF NEEDED: INCLUDES ANY ACTIVITIES THAT INVOLVE STAFF OUTSIDE AN ENERGY TEAM, SUCH AS ENGAGING STAFF TO TURN OFF EQUIPMENT WHEN NOT USED, AWARENESS CAMPAIGNS, ETC.] [2e.EE]

1. (Yes)
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

D16. [If C3=1] How often do you revisit your energy management project plan? [2g.Rmt]

1. (Weekly)
2. (Monthly)
3. (Quarterly)
4. (Annually)
5. (Less frequently than annually)
6. (When operations change)
7. (Have not revisited plan)
8. (Plan is too recently established to warrant review)
9. (Other [Specify])
98. (Don't know)
99. (Refused)

D17. [If C4=1] How frequently is energy performance reviewed? [3b.DCA]

1. (Daily)
2. (Weekly)
3. (Monthly)
4. (Quarterly)
5. (Twice a year)

6. (Annually)
7. (Varies or "as needed")
8. (Other), Specify_____
98. (Don't know)
99. (Refused)

D18. [If D1=1] Has your facility established an energy consumption baseline? [If needed: This is an analysis of your facility's energy data and relevant drivers of energy consumption such as facility output, used for measuring potential impacts from energy consumption changes.] [3c.An]

1. (Yes)
2. (In process)
3. (planning to)
4. (No)
98. (Don't know)
99. (Refused)

D19. [If D6≠4] How often is your facility's energy use data shared with company stakeholders, such as management or operations staff? [3d.RP]

1. (Daily)
2. (Weekly)
3. (Monthly)
4. (Quarterly)
5. (Twice a year)
6. (Annually)
7. (Varies or "as needed")
8. (Other), Specify_____
9. (Does not meet)
98. (Don't know)
99. (Refused)

E. Barriers and Interest

My next questions are about your facility's interest in strategic management solutions and possible challenges your facility may have experienced when considering energy management.

E1. Are you currently participating in a strategic energy management program or system with guidance from an external consultant or organization?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

E2. [If E1=1] What is the name of the program or program sponsor? [RECORD RESPONSE]

E3. [If E1≠1] Have you considered participating in a Strategic Energy Management program at any time within the past three years?

1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

E4. [If E3=1] What, if any, challenges has your facility faced when considering a Strategic Energy Management plan or program? [DON'T READ LIST. RECORD ALL THAT APPLY]

1. (High initial cost)
2. (Budget limitations)
3. (Long payback period)
4. (Enough return on investment)
5. (Lack of technical knowledge about energy efficiency equipment)
6. (Lack of staff time to dedicate to pursuing energy efficiency upgrades)
7. (Funding competition from other company priorities)
8. (Age/condition of building)
9. (Management support)
10. (None, no challenges)
11. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

E5. [If E4≠10, 98,99] What do you see as the most significant challenge to adopting a Strategic Energy Management Plan? [RECORD ONE ANSWER; DO NOT READ LIST]

1. (High initial cost)
2. (Budget limitations)
3. (Long payback period)
4. (Enough return on investment)
5. (Lack of technical knowledge about energy efficiency equipment)
6. (Lack or inadequate resources, approaches, or tools tailored to the industrial industry)
7. (Lack of staff time to dedicate to pursuing energy efficiency upgrades)
8. (Funding competition from other company priorities)
9. (Age/condition of building)
10. (Management support)
11. (Other [SPECIFY:_____])
98. (Don't know)
99. (Refused)

E6. What kind of information on energy management practices would be most useful to you in the future? [RECORD ANSWER]

E7. Do you have any additional comments or suggestions regarding energy management practices or NYSERDA's efforts to encourage energy reduction in industrial companies? [RECORD ANSWER]

F. Business Decision Making and Drivers

Now I have a few questions about factors important to business decisions at your facility.

F1. Please tell me how important the following items are to you when planning energy efficiency projects and practices. The first statement is [INSERT STATEMENT]. Is this very important, somewhat important, not very important, or not at all important when planning energy efficiency goals and practices? [RECORD 1 FOR VERY IMPORTANT, 2 FOR SOMEWHAT IMPORTANT, 3 FOR NOT VERY IMPORTANT, 4 FOR NOT AT ALL IMPORTANT, 97 FOR NOT APPLICABLE, 98 FOR DON'T KNOW, AND 99 FOR REFUSED or Have not planned any energy efficiency projects]

F1a. Return on investment (ROI)
F1b. Payback period
F1c. Production efficiency
F1d. Total cost [IF NEEDED: of adopting energy efficiency projects]

F1e. Marketing and brand positioning
F1f. Company profit

F2. Are your facility's energy costs considered using the same criteria as the costs of other production inputs ?
1. (Yes)
2. (No)
98. (Don't know)
99. (Refused)

F3. What other financial or business goals impact the reduction of energy in your facility? [RECORD ANSWER]

F4. How are capital investment decisions typically initiated at your facility? (Read responses)
1. Through an established, formal capital expenditure process
2. Management responds to a need
3. Management proposes to act proactively
4. Executives issue directive for capital investment solutions
5. Outside or unplanned forces dictate the investment
6. Other, (Specify)
98. (Don't know)

F5. What is the typical timing for capital investment goal setting and budget planning for your facility?
1. Quarterly
2. Semi-Annually
3. Annually
4. Something else (Specify)
98. (Don't know)
99. (Refused)

F6. What trends do you see regarding energy management within the industrial industry? [RECORD ANSWER]

G. Closing and Recruitment for Phase 2

I have a just a couple final questions.

G1. We have a few more facility-level questions in an online survey that may be more appropriate for an energy manager or facilities manager. This information would be tremendously valuable to NYSERDA in designing its programs and providing resources to companies like yours. Who would be best able to answer these facility-specific questions from your facility?
1. [RECORD NAME, PHONE, AND EMAIL ADDRESS]
2. (No name provided/Respondent is the most appropriate/Don't know/Refused)

G2. [If G1=2] Would you be willing to complete a short online survey to help fill in a few more details?
1. Yes [RECORD EMAIL ADDRESS] We will send an email invitation to take the survey online.
2. No

On Termination: Thank you for your help. We appreciate your time and opinions.

]

Appendix E. Nonparticipant Survey Instrument: Phase II

NYSERDA Continuous Energy Improvement Baseline Study, Phase 2 Online Survey

This survey instrument is the second part of the two-part industrial end-user survey that will provide additional detail to support NYSERDA's market baseline research objectives. The Phase 2 survey will be administered online to energy and facility managers referred by Phase 1 respondents. This survey is designed to provide details about SEM activities and facility-specific characteristics that may influence SEM adoption as provided in research objectives found in Table 8 of the CEI market evaluation work plan. Table E-10 provides Phase 2 survey questions mapped to the Table 8 objectives.

Table E-10. Research Question Mapping

Topic Category	Research Questions	Table 8 Objectives	Phase 2 Survey Items
Introduction	Job title and duties		A1, A2
Familiarity & Interest	Awareness and interest in SEM and NYSERDA programs	T827	B1- B20
Energy Management Implementation (for respondents with energy management goals)	Goal documentation	CEE 2.d	C2
	Savings targets for installed equipment	T819	C3
	Savings targets for process improvements	T820	C4
	Types of projects/activities implemented	CEE 2.f	C5
	Extent of energy manager costs covered by energy initiatives	T821	C6
	Confidence in ability to achieve goals		C7
Technical support	Internal staff skill level	T816	D1
	Engagement in external tech support	T818	D2
	Term of external support	T817	D3
Decision Factors	What factors evaluated		E1
	Criteria for energy reduction strategies	T81	E2
	Tradeoffs when evaluating upgrade	T84	E3
	Facility cost assessment	T87	E4
	Planning and budget cycle	T831, T812	E5
	Commitment of resources to energy management	T813, T814	E6, E7, E8
Facility Characteristics	Facility ownership	T815	F1
	Size, Age, Renovations		F2-F4
	Production processes		F5
	Large energy load equipment		F6
	Production schedules		F7

Table E-11 shows the target sample size by tier. Sample targets for the Phase 2 survey are based on Cadmus' expectation that up to 90% of Phase 1 phone surveys will result in a Phase 2 online survey complete.

Table E-11. Survey Sample Plan

Subpopulation	Estimated Population	Sample Size*	Expected Confidence and Precision within Tier
Industrial facilities Tier 1	230	Up to 73	90/11
Industrial facilities Tier 2	610	Up to 96	90/11
Industrial facilities Tier 3	6,083	Up to 119	90/11
Industrial facilities Total	**6,923**	**Up to 288**	**90/6**

* It is expected that a maximum of 90% of telephone survey respondents will complete a more detailed online survey, resulting in less than 300 online survey completes.

Data Collection Method: Online survey
Estimated Time to Complete: 15 minutes
Population Description: Industrial facilities and energy managers who are familiar with facility level detail

Survey Instrument

Programming instructions are in red.

Welcome Screen

This is the second part of a survey with energy decision makers at New York industrial facilities to provide additional facility-level detail about energy management. The New York State Energy Research and Development Authority (NYSERDA) is assessing current energy management practices and needs for industrial companies and will use the collective input to design supporting resources for companies like yours. These resources are very important to New York's economic future. Cadmus is conducting this study on behalf of NYSERDA.

Please update the following, if needed.

[CONTACT NAME]

[COMPANY NAME]

[ADDRESS]

We will keep your responses anonymous. They will be aggregated with other people's responses in our report. Your responses will not be linked to you or your company, so please feel free to respond candidly. If you need to leave and finish later, you should be able to pick up where you left off prior to submitting the survey, provided you access it from the same device.

A. Introduction

Our questions for this survey refer to the production facility in [Address]. If your company has more than one New York production facility, please respond to the following questions for the

facility in [Address]. We would like to follow up with a separate survey for the other facility/facilities about which you may also be familiar.

A1. What is your title? [_____] [FORCE RESPONSE]

A2. How do your job duties relate to energy use at your facility? [_____]

A3. What category best represents your facility's annual spend on energy (electric and natural gas)?

1. Less than $500,000
2. Between $500,000 and $1,000,000
3. More than $1,000,000
4. Don't know

B. Familiarity with and Interest in NYSERDA programs or Federal Initiatives

Using a 1-5 scale, where 1=not at all familiar and 5=very familiar, how **familiar** are you with the following:

	Rating 1-5, DK
B1. NYSERDA FlexTech program	
B2. NYSERDA Industrial and Process Efficiency Program	
B3. NYSERDA pilot for On-site Energy Manager support	
B4. NYSERDA pilot for Strategic Energy Management support	
B5. SEM Initiatives such as ISO50001	
B6. Department of Energy's Superior Energy Performance standards	
B7. Department of Energy's Advanced Manufacturing standards	

[For B1 – B7 rated 3 or less; repeat for each program]

B8. How interested are you in finding out more about the [Program Name]? [T827]

C. Energy Management Implementation

C1. Does your company set energy performance goals?

1. Yes
2. No [Ask C1a and C1b]
   - C1a. Do you anticipate establishing energy reduction goals in the future?
   - C1b. When do you anticipate doing this in the future?
     1. Within 6 months
     2. In 6-12 months
     3. In 12-24 months
     4. More than 24 months
     5. Timing uncertain
     98. Don't know
3. Don't know

[If C1≠1 Skip to Section E]

The next questions are designed to provide additional or more detailed information about your energy management goals and performance outcomes.

C2. How are the goals documented? [_____]

C3. Does your company have a target or anticipated energy savings volume associated with **installed equipment or building features**? [T819]

1. Yes [C3a. What is the anticipated energy savings from installed equipment or building features? (Please indicate the amount and unit—whether in terms of MWh, percent of savings (year over year), percent reduction in energy intensity, or something else)]
2. No
98. Don't know

C4. Does your company have a target or anticipated energy savings volume associated with **process improvements**? [T820]

1. Yes [C4a. What is the anticipating energy savings from process improvements? (Please indicate the amount and unit—whether in terms of MWh, percent of savings (year over year), percent reduction in energy intensity, or something else)]
2. No
98. Don't know

C5. What types of projects or activities have you implemented towards energy reduction goals within the past year? [Indicate all that apply] [Multiple responses accepted]

1. Equipment replacement/upgrades
2. Off-peak production scheduling
3. Process efficiency improvements
4. Staff training for energy conservation
5. Use an energy management system for monitoring and controlling energy use
6. Energy assessment of facility consumption
7. Building envelope improvements (insulation, windows, doors)
8. Have not implemented anything in past year
9. Something else [SPECIFY]

C6. If your facility has an energy manager, what proportion of all costs associated with the energy manager's salary are covered by all savings generated from those activities? (For example, activities could include efficiency improvements, process improvements, O&M, scrap reduction or others.) [T821]

1. Less than 25%
2. 25% to 49%
3. 50% to 74%
4. 75% to 99%
5. 100%
6. Greater than 100%
7. Don't have energy management staff
98. Don't know

C7. How confident are you that your company will be able to achieve its energy performance goal(s) in the coming year? [Rate 1-5, where 1=not at all confident and 5=very confident]

D. Technical Support

D1. How would you classify the skill level of your company's current employees to identify and implement energy projects? [T816]

1. No direct skills among current employees for this type of activity
2. Some skills (for smaller projects or projects highly specific to primary job function)

3. High skill level for this activity in current employees (able to identify and successfully implement energy projects without external support)

D2. To what extent has your company engaged external technical support for diagnosing, designing and engineering energy solutions? [T818]

1. Have not engaged external support
2. Have engaged external technical support for a **single point** in time solution
3. Have engaged external support for a **limited** period of time (up to 6 weeks)
4. Have engaged technical support on an **episodic** basis to address more than one event or on multiple occasions
5. Have engaged external technical support on an **ongoing** basis with a longer term commitment (more than 6 weeks)

98. Don't know

D3. [D2=5] How many months is the technical support committed for your company? [_____months past; _____months in the future] [T817]

E. Decision Factors

E1. What factors does your company evaluate when maintaining or replacing existing equipment? (Select all that apply) [T81,4]

1. Current production efficiency of existing equipment
2. Up-front equipment costs for replacement
3. Equipment energy consumption costs
4. Equipment maintenance costs
5. Pay-back period on energy savings
6. Long term energy savings
7. Equipment expected useful life
8. Other factors [Specify:_____]
9. None of the above

98. Don't know

E2. [If E1≠9, 98] Are your company's investments in energy reduction strategies subject to the same financial criteria as other inputs of industrial production? [T81]

1. Yes
2. No
3. Don't know

E3. How often does your company replace or upgrade working equipment PRIMARILY in order to reduce energy costs? [T84]

1. Never, other factors are always more important
2. It has happened, but usually other factors are more important
3. Sometimes
4. Frequently

98. Don't know

E4. Does your company assess facility energy costs in comparison to total costs? [T87]

1. Yes
2. No
3. Don't know

E5. What is the typical timing for capital investment goal setting and budget planning for your facility? [T831, T812]

1. Quarterly
2. Twice a year

3. Once a year (Annually)
4. Something else (Specify)
98. (Don't know)

E6. In general, is it more important for your facility to manage peak electricity demand, or to manage total electric consumption?
1. Peak demand (kW)
2. Total consumption (kWh)
3. Both are equally important/no difference
4. Don't know

E7. Does your company ever adjust its operations to avoid triggering a higher electric rate for usage or demand above a certain threshold? (For example, this may be a consideration for companies with tiered rates or demand charge rates.)
1. Yes, we have a tiered electric rate and this is a frequent consideration for my company
2. We have a tiered electric rate, and we sometimes consider this, but it is not a primary driver for our production decisions
3. We have a tiered electric rate, but this is not a typical consideration for us
4. We do not have a tiered electric rate
98. Don't know

F. Facility Characteristics

F1. Does your company own, lease, or both own and lease the facility?
1. Owns only – does not lease
2. Leases only – does not own
3. Owns and leases property
4. Other [SPECIFY:_____]

F2. What is the approximate square footage in the facility?
1. [_____SQUARE FEET]

F3. In what year was this facility built?
1. [YEAR:_____]

F4. Has the facility undergone any major renovations since it was built?
1. Yes
   F4c. When? [YEAR:_____]
   F4d. Please briefly describe the type of improvements made to the facility. [_____]
2. No
3. Don't know

F5. What are the key processes used for producing your primary product? [_____]

F6. What type of equipment requires the largest energy load for standard operations? [_____]

F7. Does your operation vary seasonally over the year?
1. Yes
2. Depends on product demand
3. No

F8. [IF F7=1,2] Please indicate which months are your "peak" production months (Select from list of 12 months)

F9. How many hours per day is the facility in operation? [For both options below, show grid with seven days, and space to indicate average hours of operation for each day]
1. Typical (non-peak) weeks
2. Peak (high demand) weeks

F10. On average over the year, what percentage of the total production capacity of this facility do you use? [RECORD RESPONSE %]

G. Closing

G1. Do you have any additional comments or suggestions regarding energy management practices or NYSERDA's efforts to assist industrial managers in reducing energy use? [_____]

G2. Can we contact you in the future for other research studies?

1. Yes
   - G2e. Name
   - G2f. Company
   - G2g. Phone
   - G2h. Preferred Email Address
2. No

Closing: Thank you for your help. We appreciate your time and opinions. For more information on NYSERDA programs, go to https://www.nyserda.ny.gov/All-Programs. Click the button below to submit your survey responses.

Appendix F. SEM Adoption Scoring

The scoring rubric used to generate SEM adoption scores is shown in Table F-12. Summary tables showing SEM adoption scores across tiers and in summary are shown below the table.

Table F-12. Scoring Rubric for SEM Adoption

CEE Minimum Element	Subelement	Phase I Survey Questions	Full Adoption (2 points = 100%)	Some Adoption (1 point = 50%)	No Adoption (0 points = 0%)
1. Company Commitment	1a. Attitude	C1, C2	C2=1, C1a>2 C1b>2	Any other combination	C2>1, C1a<4 C1b<4
	1b. Policy and Goals	C3, C4, C5	C3=1, C4=1, C5=1		C3>1, C4>1, C5>1
	1c. Resources	C6,C8-C10	C6=1, C6a="team", C8<4, C9<3, C10<3		C6>1 AND C6b="No", C8>8, C9>2, C10>2
2. Planning & Implementation	2a. Energy Management Assessment	D1, D2	D1<3; D2<3	Any other combination	D1>3; D2>3
	2b. Energy Map	D3	D3<3		D3>3
	2c. Metrics and Goals	D4	D4<3		D4>2
	2d. Project Register	D6_1, D6_2, D6_3, D6_4, D6_5, D6_95	D6_1=1 OR D6_2=1 OR D6_3=1		D6_4=1 OR D6_5=1 OR D6_95=1
	2e. Employee Engagement	D15	D15<3		D15
	2f. Implementation	D9-D14	D10<3; D11=1, D12<3; D13=1, D14<3		D10>3; D11>1, D12>3; D13>1, D14>3
	2g. Reassessment	D16	D16=1,2,3,6		D16=5,99,98
3. System for Measuring and Reporting Energy Performance	3a. Measurement	D6_3, D7	D6_3=1 OR D7<3	Any other combination	D6_1>1,D7>3
	3b. Data Collection and Analysis	D17	D17<4		D17=>8
	3c. Analysis	D18	D1=1, D18<2		D1=1, D18>3
	3d. Reporting	D19	D19<7		D19>8

One hundred percent of surveyed facilities had some SEM adoption in their facility (meaning they at least received a score of 1 on one subelement). Three percent of facilities had full adoption of the subelements for Company Commitment, and 0% of facilities fully adopted all of the subelements in Planning and Implementation. Overall, more facilities met the full criteria for the subelements in Measuring And Reporting Energy Performance than the other CEE minimum elements, with 6% of facilities showing full adoption of the four required subelements. Table F-13 shows the percentage of facilities that scored as achieving full adoption, some adoption, or no adoption across all of the subelements and minimum elements.

Table F-13. SEM Adoption By Score—Overall

Total SEM Adoption Scores (n=324)	Subelement	Full SEM Adoption	Some SEM Adoption	No SEM Adoption)
		Maximum score for each row	***Between minimum and maximum score for each row***	***Minimum score for each row***
1. Company Commitment	1a. Attitude	53%	44%	3%
	1b. Policy and Goals	14%	23%	63%
	1c. Resources	6%	82%	12%
	Cumulative (Max score of 6)	**3%**	**96%**	**2%**
2. Planning & Implementation	2a. Energy Management Assessment	24%	60%	16%
	2b. Energy Map	38%	1%	60%
	2c. Metrics and Goals	22%	0%	78%
	2d. Project Register	10%	74%	17%
	2e. Employee Engagement	19%	0%	81%
	2f. Implementation	13%	57%	30%
	2g. Reassessment	11%	13%	77%
	Cumulative (Max score of 14)	**1%**	**99%**	**0%**
3. Measuring and Reporting Energy Performance	3a. Measurement	27%	1%	72%
	3b. Data Collection and Analysis	15%	12%	74%
	3c. Analysis	25%	23%	52%
	3d. Reporting	19%	2%	79%
	Cumulative (Max score of 8)	**6%**	**57%**	**37%**
Total SEM Adoption (Max of 28)		**0%**	**100%**	**0%**

Table F-14 shows the percentage of facilities that scored as achieving full adoption, some adoption, or no adoption across the CEE minimum elements and subelements. Two percent of Tier 1 facilities (1 respondent) received the maximum possible SEM adoption score of 28, indicating that they had fully adopted every subelement.

Table F-14. Tier 1 SEM Adoption Scores

Tier 1 SEM Adoption Scores (n=57)	Subelement	Full SEM Adoption	Some SEM Adoption	No SEM Adoption)
		Maximum score for each row	***Between minimum and maximum score for each row***	***Minimum score for each row***
1. Company Commitment	1a. Attitude	65%	32%	4%
	1b. Policy and Goals	44%	25%	32%
	1c. Resources	39%	60%	2%
	Cumulative (Max score of 6)	**23%**	**77%**	**0%**
2. Planning & Implementation	2a. Energy Management Assessment	42%	54%	4%
	2b. Energy Map	56%	4%	40%
	2c. Metrics and Goals	42%	0%	58%
	2d. Project Register	30%	47%	23%
	2e. Employee Engagement	53%	0%	47%
	2f. Implementation	39%	54%	7%
	2g. Reassessment	30%	26%	44%
	Cumulative (Max score of 14)	4%	96%	0%
3. System for Measuring and Reporting Energy Performance	3a. Measurement	70%	4%	26%
	3b. Data Collection and Analysis	51%	4%	46%
	3c. Analysis	61%	9%	30%
	3d. Reporting	51%	0%	49%
	Cumulative (Max score of 8)	**35%**	**56%**	**9%**
Total SEM Adoption (Max of 28)		**2%**	**98%**	**0%**

Table F-15Table shows the SEM adoption scores for Tier 2 facilities. One percent of Tier 2 facilities (one facility) received maximum score of 28 points.

Table F-15. Tier 2 SEM Adoption Scores

Tier 2 SEM Adoption Scores (n=69)	Subelement	Full SEM Adoption	Some SEM Adoption	No SEM Adoption)
		Maximum score for each row	***Between minimum and maximum score for each row***	***Minimum score for each row***
1. Company Commitment	1a. Attitude	59%	39%	1%
	1b. Policy and Goals	33%	23%	43%
	1c. Resources	13%	83%	4%
	Cumulative (Max score of 6)	**10%**	**88%**	**1%**
2. Planning & Implementation	2a. Energy Management Assessment	38%	51%	12%
	2b. Energy Map	48%	0%	52%
	2c. Metrics and Goals	41%	0%	59%
	2d. Project Register	23%	57%	20%
	2e. Employee Engagement	35%	0%	65%
	2f. Implementation	28%	58%	14%
	2g. Reassessment	25%	22%	54%
	Cumulative (Max score of 14)	**1%**	**99%**	**0%**
3. System for Measuring and Reporting Energy Performance	3a. Measurement	51%	0%	49%
	3b. Data Collection and Analysis	30%	12%	58%
	3c. Analysis	29%	14%	57%
	3d. Reporting	38%	0%	62%
	Cumulative (Max score of 8)	**14%**	**61%**	**25%**
Total SEM Adoption (Max of 28)		**1%**	**99%**	**0%**

Tier 3 SEM adoption rates by score are shown in full in Table F-12. No tier 3 facilities fully adopted the planning and implementation minimum element, with lowest adoption in project register and reassessment. Because full adoption is required in each minimum element and subelement to fully adopt SEM, no tier 3 facilities fully adopted SEM. Note that 40% of Tier 3 facilities had no adoption in the CEE minimum element for System for Measuring and Reporting Energy Performance.

Table F-16. Tier 3 SEM Adoption by Score

Tier 3 SEM Adoption Scores (n=198)	Subelement	Full SEM Adoption	Some SEM Adoption	No SEM Adoption)
		Maximum score for each row	***Between minimum and maximum score for each row***	***Minimum score for each row***
1. Company Commitment	1a. Attitude	52%	45%	4%
	1b. Policy and Goals	10%	23%	68%
	1c. Resources	3%	83%	14%
	Cumulative (Max score of 6)	**1%**	**97%**	**2%**
2. Planning & Implementation	2a. Energy Management Assessment	22%	62%	17%
	2b. Energy Map	36%	2%	63%
	2c. Metrics and Goals	18%	0%	82%
	2d. Project Register	7%	77%	16%
	2e. Employee Engagement	15%	0%	85%
	2f. Implementation	10%	58%	33%
	2g. Reassessment	8%	11%	82%
	Cumulative (Max score of 14)	**0%**	**100%**	**0%**
3. System for Measuring and Reporting Energy Performance	3a. Measurement	22%	1%	78%
	3b. Data Collection and Analysis	11%	12%	77%
	3c. Analysis	22%	25%	53%
	3d. Reporting	15%	2%	83%
	Cumulative (Max score of 8)	**4%**	**56%**	**40%**
Total SEM Adoption (Max of 28)		**0%**	**100%**	**0%**

Table F-17 presents the average level of adoption of each tier and facilities overall for each subelement, minimum element, and total SEM adoption. This information summarizes the average adoption scores discussed in the main text.

Table F-17. Average SEM Adoption by Tier

Category	CEE Minimum Elements	Mean SEM Adoption Level (average score as a percentage of the row maximum score)			
Minimum element	**Subelement**	**Tier 1**	**Tier 2**	**Tier 3**	**Overall**
1. Company Commitment	1a. Efficiency Attitude	81%	79%	74%	75%
	1b. Policy and Goals	56%	45%	21%	25%
	1c. Resources	68%	54%	45%	47%
	Cumulative (Max score of 6)	**68%**	**59%**	**47%**	**49%**
2. Planning & Implementation	2a. Energy Management Assessment	69%	63%	53%	54%
	2b. Energy Map	58%	48%	37%	39%
	2c. Metrics and Goals	42%	41%	18%	22%
	2d. Project Register	54%	51%	45%	46%
	2e. Employee Engagement	53%	35%	15%	19%
	2f. Implementation	66%	57%	38%	42%
	2g. Reassessment	43%	36%	13%	17%
	Cumulative (Max score of 14)	**54%**	**46%**	**31%**	**34%**
3. Measuring and Reporting Energy Performance	3a. Measurement	72%	51%	22%	28%
	3b. Data Collection	53%	36%	17%	21%
	3c. Analysis	66%	36%	35%	36%
	3d. Reporting	51%	38%	16%	20%
	Cumulative (Max score of 8)	**60%**	**40%**	**22%**	**26%**
Total SEM Adoption (Max of 28)		**59%**	**11%**	**6%**	**9%**

Appendix G. Description of Bass Curve

The CMAT model used in the market adoption curve forecast relies on a standard Bass curve, which can be represented by the following equation:

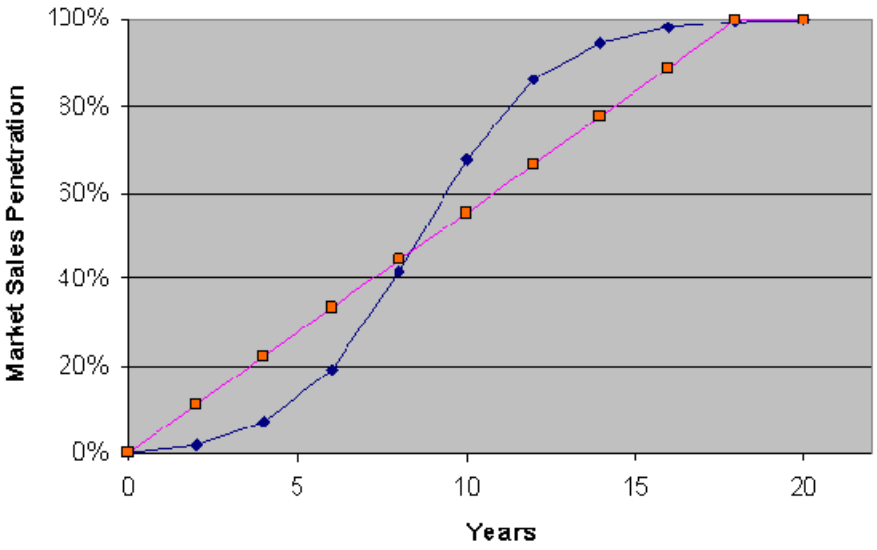
$$F(t) = \frac{1 - e^{-(p+q)t}}{1 + (q/p)e^{-(p+q)t}}$$

Where:

F(t)	=	the cumulative fraction of adopters,
p	=	coefficient of innovation,
q	=	coefficient of imitation, and
t	=	elapsed time

The coefficient of innovation (p) captures the effect of consumers who are not influenced by the behavior of others, and the coefficient of imitation (q) captures the effect of consumers who are influenced by prior adopters. In the literature on this function, innovation is often called "leading" behavior and imitation is called "following" behavior. Figure G-7 illustrates the differences between the linear and S-shaped adoption curves in comparing a Bass curve that produces 99% market penetration in 18 years to a linear curve.

Figure G-7. Comparison of Typical Bass and Linear Curves for 18-Year Market



In the earliest years, penetration rates based on the Bass curve were slightly less than those based on the linear curve, while they exceeded the linear rates in later years. In this example, the naturally occurring adoption adjustment would be less with the Bass curve for about eight years, but more thereafter.

Mathematically, three of the following five parameters are required to estimate the Bass curve:

13. Time (tmax) when maximum adoption rate will occur
14. Maximum adoption rate
15. Cumulative adoption at the maximum rate
16. Coefficient of innovation (p)
17. Coefficient of imitation (q)

Appendix H. Analysis of Delphi Panel Comments

In each iteration of the Delphi Panel forecasting exercise, panelists provided comments to explain the assumptions behind their estimate. The Team reviewed the comments to gain insight into the adoption forecast estimates, and to ensure that all panelists had correctly understood the market they were to forecast. Where panelists did not appear to understand the practice or the market they were asked to assess, the team removed their response from the final consensus curve.

Three responses were discarded from Round 2 of the OsEM forecast. Two respondents did not observe the baseline market saturation of 16%, and did not provide any explanation for the much lower baseline that they applied. One respondent's comments indicate the respondent was assuming adopting with market intervention, which appeared to disregard the counterfactual assumption that NYSERDA would not be intervening in the market. This panelist again disregarded the counterfactual assumption in the SEM forecast, according to their comments, and so was the only response discarded from the SEM forecast.

Table H-14 shows the panelist comments from Round 2 of the OsEM forecasting exercise, along with the Team's analysis of whether to retain or discard the response. Table H-19 provides the same information for Round 2 of the SEM forecasting exercise.

Table H-30. OsEM Market Forecast: Panelist Comments from Round 2 and Retention Analysis

Source: CMAT

Panelist	Round 2 Response	Panelist Comments	Discarded?	Notes
5	New Estimate	My Round 1 response assumed the OsEM was a full-time role. As a part-time or sub-contracted role I believe market penetration will be higher than my initial estimate, but that adoption will be relatively slow.	Yes	Did not observe baseline of 16%, and did not account for this discrepancy in either Round 1 or Round 2
7	New Estimate	Slower adoption rate in my revised estimate to reflect the slower anticipation of energy price increases requiring companies to devote the resource focus.	Yes	Did not observe baseline of 16%, and did not account for this discrepancy.
12	Adopted Round 1 Average	I would agree with the round one average in that market intervention would result in slightly less than a 45% market share for OsEM. Without significant market intervention I suspect the number would be well below 20%.	Yes	Did not observe counterfactual assumption, according to comment that indicates respondent assumed market intervention. (Respondent selected the average baseline from Round 1, which had a max saturation of 41%).
4	Maintained Round 1 Estimate	Same comments and predictions as Round 1 response. My round 1 response was pretty close to average response so I feel it is pretty close to opinions of other experts.	No	
8	Maintained Round 1 Estimate	My prediction remains the same. Without program intervention, there are not strong enough market drivers to cause much change. Sustainability goals are the only driver in the market I see that could cause the hiring of more OsEMs, and with the current administration pulling out of the Paris Agreement, that driver may have disappeared. I am trying to be optimistic in predicting a 5% increase.	No	
9	Adopted Round 1 Average	SEM/ CEI mandate needs to be integrated into Energy Managers deliverables	No	
10	Maintained Round 1 Estimate	Without market intervention coupled with the quoted SEM market penetration rate in NY in 2016 is close to 0%, my prediction of increased market penetration of on-site energy managers by 2035 would be 0%, to slightly negative. This graph is difficult to shape while maintaining the entry point into 2017 with the quoted 2016 16% penetration rate. The 16% itself is interesting as it would indicate, according to marketing gurus such as Geoffrey Moore, NY industrial facilities have crossed the 15% early adopter chasm. Congratulations, NY is now moving into early majority adoption cycle which could be an argument against any further need for NYSERDA market DSM intervention. As a personal opinion, the quoted 16% 2016 penetration rate most likely represents an optimistic bias	No	

Panelist	Round 2 Response	Panelist Comments	Discarded?	Notes
		associated to a general misunderstanding of what the defined role and performance objectives of an on-site energy manager should be. This takes us back; in a nice segue, to SEM. In Ontario, we invest in our funded energy managers with training and support services that are influenced around SEM. If energy manager roles were closely associated to SEM principles, I feel the penetration rate of NY on-site energy managers would be closer to the 0% penetration rate of SEM. If it is a narrative that you are looking for to fill in the rates for 2022, 2027 and so on , then I may change the way this graph currently looks.		
11	Adopted Round 1 Average	Agree with average.	No	
13	New Estimate	I reduced the max market share to above 50%. I think as organizations will continue to learn about the benefits of how some level of energy manager engagement. I think it would show better results that the SEM program overall.	No	

Table H-19. SEM Market Forecast: Panelist Comments from Round 2 and Retention Analysis

Source: CMAT

Panelist	Round 2 Response	Panelist Comments	Discarded?	Notes
12	Maintained Round 1 Estimate	I am comfortable with my round one response.	Yes	Did not observe counterfactual assumption, according to comment that indicates respondent assumed market intervention. (Round 1 comment: "Incentives and subsidies will likely play a critical role in the adoption of SEM in industrial facilities." Incentives and subsidies could mean programs other than NYS. However, given the assumption about response for the OsEM, assume that is the meaning of this reference as well.")
4	New Estimate	Again, energy prices are low and non-volatile currently. For industrial customers who spend a relatively large percentage of their operating dollar on energy I believe over time will address SEM as a necessity to staying competitive.	No	
5	New Estimate	I updated my response from Round 1 slightly down in terms of total penetration based on the instructions that adoption means completing all 13 SEM Minimum Elements. I think that is a high bar that only highly-motivated facilities in competitive industries are likely to achieve without program support.	No	
7	New Estimate	Adjustments showing a slight decrease in original estimate of full adoption and lower adoption rates in the initial years until energy price increases and federal programs take root.	No	
8	Maintained Round 1 Estimate	Again, SEM and ISO 50001 have been around for 10 and 6 years respectively, and New York has a 0% penetration rate. Without program intervention in the future, not much will change. I think I am being an optimist by predicting the largest 7% will adopt in the next 10 years.	No	
9	Maintained Round 1 Estimate	I have not seen the market push this up as a priority among normal business	No	
10	Maintained Round 1 Estimate	Without intervention, and assuming the number of facilities in NY considered for SEM is approximately the same as today at 3472 facilities, and technology such as Artificial Intelligence enhanced energy management control systems, and energy input costs remain relative to today's costs, I would forecast less than 1% adoption of all 13 commitments for SEM market	No	

Panelist	Round 2 Response	Panelist Comments	Discarded?	Notes
		penetration. This 1% forecast assumes market intervention is another way of defining some form of DSM sponsored SEM initiative. However I would argue the benefits/objectives of SEM, not the prescriptive 13 commitments, would have a higher market penetration rate in 2035 for NY industrial facilities. The industrial market which is always looking to drive waste out of their facilities will always pursue natural conservation/energy efficiency. The main objectives of SEM will naturally be adopted at higher market penetration rates as changes in technology and specifically system controls with neural networked machine learning provide industrial facilities with competitive advantages. I suspect we will see in the next 15 to 20 years market adoption of technology advances in affordable digital sensors, machine control, enhanced cyber security, and as mentioned before autonomous facility and process control systems embedded with artificial intelligence such as being demonstrated now with IBM's Watson and Google's Deepmind. It's obviously very challenging to forecast market adoption given the variable, non-linear and non-correlated effects of multiple associated variables associated to specific future states. Since this particular request is to baseline market adoption of facilities adopting all 13 commitments associated with SEM without market intervention I'll stick with my 1%. As an old marketing professor lectured once, anyone can achieve 1% market penetration.		
11	Maintained Round 1 Estimate	Most of the companies that I am in contact with are SMEs. They typically do not have the staff to make energy management a huge part of their focus, unless they are in an industry that Energy is a larger part of their annual spend. How much attention it is given will be dramatically influenced by the behavior of the market. The incentives through NYSERDA makes the risk less and is likely a big influence. Giving enough financial assistance can create the pain necessary to shift the efforts. At some point it will become the norm, but that is a long development cycle.	No	
13	Adopted Round 1 Average	In the absence of NYSERDA participation, I could see market share staying below 50% and adoption taking longer.	No	

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Appendix J. Additional Analysis of Phase I Survey Results

This section contains additional analysis of SEM adoption at the minimum element level and overall.

Figure J-8 shows the percentage of facilities in each tier that falls in each quartile of full SEM adoption. Tier 1 facilities have the highest overall levels of adoption, and therefore Tier 1 has the highest percentage of facilities in the 76% to 100% quartile. Tier 3 has the lowest percentage of facilities in this quartile.

Figure J-8. Percentage of SEM Adoption in Quartiles, by Tier

Source: Phase I Survey (n=324)

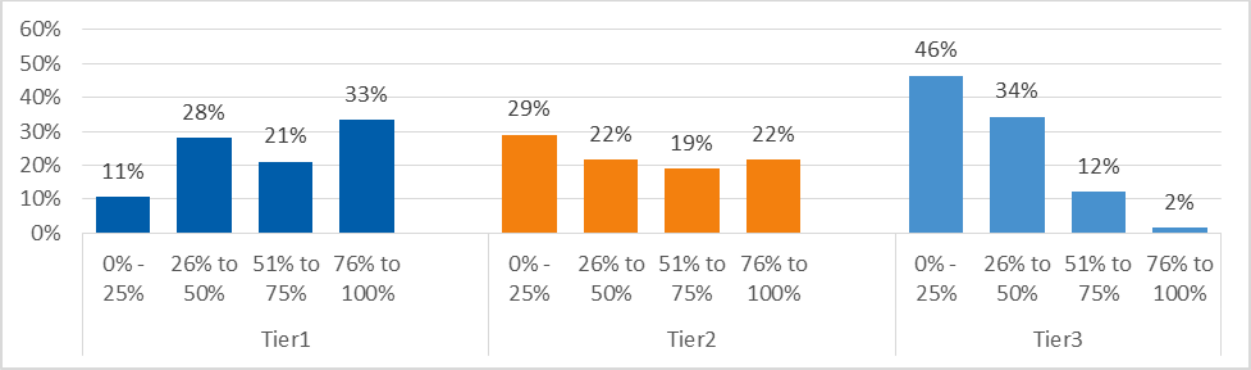

Figure J-9 shows the overall percentage of facilities that have achieved each possible score for SEM adoption, from 0 to 28. Although most facilities are clustered in the lower scores (60% of facilities received a score of 9 or lower), all facilities received a score of at least 2.

Figure J-9. Percentage of Facilities Achieving SEM Adoption Scores from 0 to 28

Source: Phase I Survey (n=324)

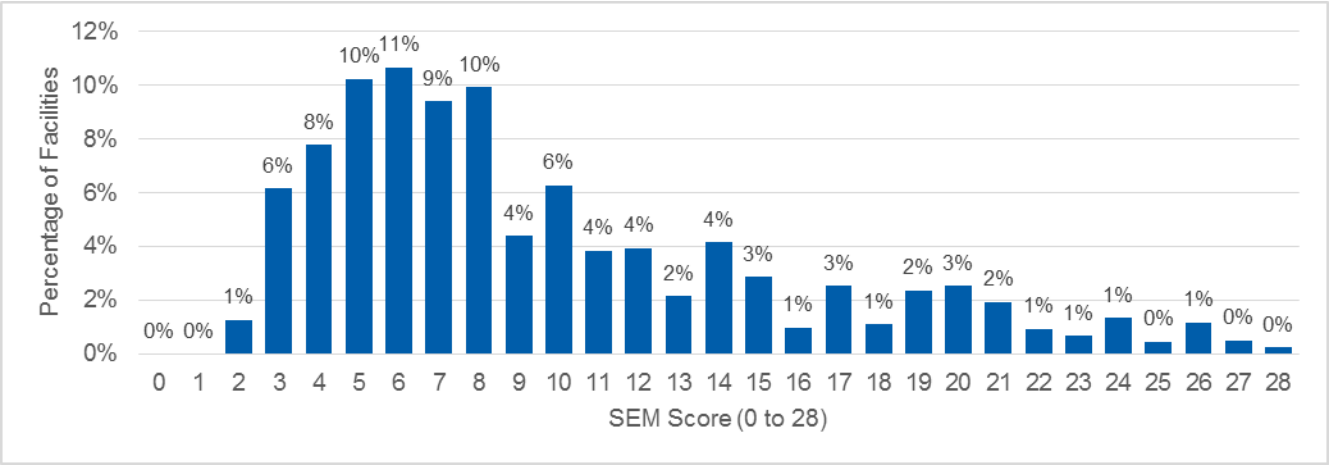

Figure J-10 shows the percentage of all facilities achieving each quintile of mean adoption of each minimum element. Measuring and Reporting has the lowest average mean score. Fifty-five percent of facilities have 20% adoption or less of this minimum element. At the same time, 17% of facilities have above 60% mean adoption, which is comparable to the Planning and Implementation minimum element.

Figure J-10. Mean Adoption Level, by Quintile, by Minimum Element

Source: Phase I Survey (n=324)