Commercial Energy Management Market Baseline Evaluation

Final Report

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Acronyms and Abbreviations

(This list uses A&A style)

BMS	Building Management System
CEM	Commercial Energy Management
CATI	Computer-Assisted Telephone Interviewing
CAWI	Computer-Assisted Web Interviewing
DPS	Department of Public Service
EM	Energy Management
EMS	Energy Management System
kW	Kilowatts
kWh	Kilowatt Hours
MW	Megawatts
MWh	Megawatt Hours

NYS	New York State
NYSERDA	New York State Energy Research and Development Authority
REM	Remote Energy Management
RTEM	Real-Time Energy Management

Executive Summary

NYSERDA has contracted with Opinion Dynamics to conduct 2017 market research needed to set appropriate baselines for its Commercial Energy Management (CEM) intervention strategy. This report presents and discusses the initial findings from that market research.

As part of its overall commercial sector investment strategy, NYSERDA has designed and developed a Commercial Energy Management (CEM) intervention strategy to increase the market uptake of energy management (EM) among commercial customers in New York State (NYS). EM is the common name for the management of building energy consumption from a combination of building data collection systems (e.g. meters, sensors, equipment feeds), analytics, and building data information services. While not a direct source of energy reductions, EM is an enabling technology and service that can allow for identification of opportunities to save energy, including both capital and operational improvements.

As part of this strategy, NYSERDA began offering a Real-Time Energy Management (RTEM) initiative in mid-2016. RTEM technology captures discrete data—such as set points, power loads, flow rates, temperature, and humidity—and feeds the information back to building operators with key insights about operations and systems that they then use to fine-tune the building energy system operations and identify capital projects with energy-saving opportunities.

Following the introduction of this initiative, NYSERDA broadened the overall CEM intervention strategy to also include Remote Energy Management (REM). REM is a virtual building assessment tool that can provide a baseline of whole building performance quickly and cost-effectively, detecting energy savings potential and identifying energy efficiency projects.

To monitor the progress of the initiative toward its goals, NYSERDA has developed a wide range of metrics which will be evaluated over time. NYSERDA has contracted with Opinion Dynamics to evaluate the CEM initiative by conducting research on these metrics. The initial step involves research to develop a baseline of market conditions, followed by ongoing research to track progress towards the goals of the EM initiative. As such, research is intended to be conducted over a five-year period, from 2017 to 2021.

This report presents the methodology and results of the initial (2017) market study. The results of this study will be utilized to set baseline metrics; subsequent studies will re-evaluate the same metrics to assess progress of the initiative over time.

Table 1-1, below, presents the key metrics addressed in this evaluation and their overall results. The remainder of the report also presents metrics at the segment level. Additional metrics will be covered throughout the duration of this study.

Table 1-1. Summary of Key Metrics from 2017 Evaluation

Metrics	Outputs/Outcomes	Indicators	Addressed Via	Result
RTEM Metrics				
Awareness & knowledge of RTEM	Increased awareness of RTEM among building owners/managers	Percent of building owners/managers aware/knowledgeable of RTEM*	Building owner & manager survey	23.6% (aware) 12.3% (knowledgeable)
	Increased awareness of RTEM among providers	Percent of EMS providers aware/knowledgeable of RTEM	Non-participating provider interviews	92%
	Customer confidence in RTEM results	Percent of knowledgeable building owners/managers confident in RTEM results*	Building owner & manager survey	72.2%
Customer use of RTEM	Increased use of RTEM	Percent of building owners/managers using RTEM*	Building owner & manager survey	9.2%
	Percent of decision-makers using RTEM data to assess operational risk	Percent of decision-makers using RTEM data to assess operational risk*	Building owner & manager survey[a]	5.0%
RTEM market conditions	Percent of BMS offerings with integrated RTEM capabilities	Percent of BMS offerings with integrated RTEM capabilities*	Non-participating provider interviews	Qualitatively assessed; see Section 3.3.
REM Metrics				
Awareness & knowledge of REM	Increased awareness of REM among building owners/managers	Percent of building owners/managers aware/knowledgeable of REM*	Building owner & manager survey	22.4% (aware) 9.5% (knowledgeable)
	Increased awareness of REM among providers	Percent of EMS providers aware/knowledgeable of REM	Non-participating provider interviews	80% (familiar)
	Customer confidence in REM results	Percent of knowledgeable building owners/managers confident in REM results*	Building owner & manager survey	68.4%
Customer use of REM	Increased use of REM	Percent of building owners/managers using REM*	Building owner & manager survey	5.0%
	Percent of decision-makers using REM data to assess operational risk	Percent of decision-makers using REM data to assess operational risk*	Building owner & manager survey[a]	4.1%

* Metrics denoted with an asterisk were selected as priority baseline metrics by NYSERDA for purposes of reporting to the NYS Department of Public Service (DPS). Initial estimates of these metrics at the population level were reported to the NYS DPS in November 2017; these estimates are refined in this evaluation report.

[a] The initial research plan for this study was to use the building owner & manager survey to determine the number of those using RTEM/REM, and the participant survey to determine the share of RTEM/REM users utilizing the technology to assess operational risk. Due to low levels of participation to date in the RTEM initiative and no participation to date in the REM initiative at the time of sample development, the evaluation team adjusted its evaluation strategy for these metrics to use the building owner and manager survey to answer both items. Due to the low incidence of RTEM and REM usage among the general population, these metrics are based on small sample sizes and should be treated with caution in terms of drawing conclusions. As uptake of RTEM and REM increases, the evaluation team expects to be able to provide estimates of these metrics with increased rigor.

1 Introduction

1.1 Background

NYSERDA has contracted with Opinion Dynamics to conduct 2017 market research needed to set appropriate baselines for its Commercial Energy Management (CEM) intervention strategy. This report presents and discusses the initial findings from that market research.

1.2 CEM Initiative

As part of its overall commercial sector investment strategy, NYSERDA has designed and developed a Commercial Energy Management (CEM) intervention to increase the market uptake of energy management (EM) among commercial customers in New York State (NYS). EM is the common name for the management of building energy consumption from a combination of building data collection systems (e.g., meters, sensors, equipment feeds), analytics, and building data information services. While not a direct source of energy reductions, EM is an enabling technology and service that can allow for identification of opportunities to save energy, including both capital and operational improvements.

The overall CEM intervention strategy has four elements:

- Assisting building owners in identifying EM systems and services that meet threshold qualifications;
- Providing independent technical advising to building owners that invest in EM;
- Investing in EM systems and services to stimulate the current market and leverage the expected natural growth; and
- Gathering, analyzing, and sharing learning and successes to further stimulate investor confidence and growth.

As part of this strategy, NYSERDA began offering a Real-Time Energy Management (RTEM) initiative in mid-2016. RTEM technology captures discrete data—such as set points, power loads, flow rates, temperature, and humidity—and feeds the information back to building operators with key insights about operations and systems that they then use to fine-tune the building energy system operations and identify capital projects with energy-saving opportunities.

Following the introduction of this initiative, NYSERDA broadened the overall CEM intervention strategy to also include Remote Energy Management (REM). REM is a virtual building assessment tool that can provide a baseline of whole building performance quickly and cost-effectively, detecting energy savings potential and identifying energy efficiency projects.

NYSERDA has a broad range of objectives for the CEM interventions, including objectives focusing on EM costs, energy savings, and market adoption of EM. These objectives are summarized below.

- Increase awareness of EM and data analytics capabilities in the market;
- Reduce customer acquisition costs and project development costs for EM;
- Reduce soft costs for a broad segment of building owners interested in obtaining information about their building energy performance;
- Leverage natural market growth by addressing upfront risk and downstream returns through an open enrollment offering and technical support in order to double the year over year growth rate for EM from 16% to 32% over the next five years;
- Improve the predictability of returns from RTEM investments by engaging in studies/pilots which provide replicable approaches and assessment tools; and
- Assist in the development of the capabilities and business models of the RTEM service vendor community through sharing of data, case studies, best practices, and identification of qualifications.

1.3 Purpose of this Research

The overall objective of the EM market study is to develop a baseline of market conditions and track progress towards the goals of the EM initiative. As such, research is intended to be conducted over a five-year period. The data collection and analyses of these metrics will contribute to testing the following hypotheses:

- If NYSERDA provides incentives for EM systems and information services, it will accelerate the growth of the EM market in NYS, helping it to mature faster than currently forecasted. The current NY market for RTEM is estimated at $10 million and forecast to grow to $20 million in five years. As noted above, NYSERDA is attempting to double year over year growth from 16% to 32% during this five-year period.
- If there is easy access to qualified vendors, a simplified implementation process, proof of energy savings, and demonstrated O&M benefits of EM, then commercial customers will incorporate EM into their building operations without need for further NYSERDA incentives.
- If NYSERDA provides education and focused vendor support for operators, the depth and persistence of energy savings will improve and EM will better inform future capital investments.

To monitor the progress of the initiative toward these goals, NYSERDA has developed a wide range of metrics which will be evaluated over time. NYSERDA has contracted with Opinion Dynamics to evaluate the CEM initiative by conducting research on these metrics. The initial step involves research to develop a baseline of market conditions, followed by ongoing research to track progress towards the goals of the EM initiative. As such, research is intended to be conducted over a five-year period, from 2017 to 2021.

This report presents the methodology and results of the initial (2017) market study. The results of this study will be utilized to set baseline metrics; subsequent studies will re-evaluate the same metrics to assess progress of the initiative over time.

1.4 Evaluation Scope

To address NYSERDA's research objectives, Opinion Dynamics is conducting four types of research activities over the study period (2017-2021), summarized below:

- **Building owner and manager interviews.** Opinion Dynamics is conducting quantitative interviews with building owners, managers and decision makers to assess their knowledge of EM, participation in EM programs, and better understand their ability for improved capital investment planning and asset management because of EM.
- **Program participant research.** Opinion Dynamics is conducting a web survey with customers participating in NYSERDA's EM initiatives. These surveys explore a variety of participant-specific metrics, including the persistence of RTEM service contracts (i.e., how many customers extend their subscription with an RTEM provider beyond 5 years), percentage of EM projects that institute an energy efficiency goal and the percentage of EM projects that use services for non-energy benefits (e.g., long-term asset management, capital investment strategies, risk mitigation analyses), as well as characterize other effects of the program. This survey will allow for the characterization of EM program participants and will be replicable in future years with a minimum of effort.
- **Qualified provider research.** Opinion Dynamics is conducting web surveys with qualified RTEM Service and System providers and qualified REM providers. These interviews include discussion of awareness of EM amongst building owners and managers, the number and type of energy efficiency opportunities identified by EM providers, estimates of sales that indicate market growth, and other items to characterize the effect of the program on the market for EM equipment and services.
- **Non-program EM provider research.** Opinion Dynamics is conducting in-depth interviews with EM providers who are not program qualified providers. These interviews will assess awareness of EM, the existence and use of methods for calculating costs and savings from EM, use of programmatic criteria by providers, EM sales, and other topics. In 2017, Opinion Dynamics leveraged the EMS market actor interviews being conducted as part of the NYSERDA Commercial Baseline Study to reduce costs for this effort.

1.5 Schedule of Research Activities

Table 1-1 outlines the timing of primary research activities that we plan to conduct throughout each year of this evaluation. If approved by the NYSERDA Project Manager, we will conduct follow-up research in 2018, 2019, 2020, and 2021.

We will conduct a full refresh of the building owner and manager survey in 2019 and 2021. Additionally, we will conduct a limited building owner and manager survey refresh in 2018 and 2020, consisting of

number of completed interviews sufficient to provide a population-level estimate of the metrics being tracked, while not providing segment level results.

As discussed earlier in this report, we are not reporting on results from participating customer or participating provider research in 2017. Instead, we plan to conduct research in 2018 once participation in these initiatives increases. Timing of follow-up research with participants and participating providers will be determined through discussions with NYSERDA.

Table 1-1. Primary Research Activities by Year

Data Collection Activity	2017	2018	2019	2020	2021
Building Owner and Manager Survey	✓	✓	✓	✓	✓
RTEM Participant Survey	✓		TBD	TBD	TBD
REM Participant Survey	✓		TBD	TBD	TBD
Participating RTEM Provider Survey	✓		TBD	TBD	TBD
Participating REM Provider Survey	✓		TBD	TBD	TBD
Non-Participating EM Provider Interviews	✓		✓		✓

1.6 2017 Study Challenges and Scope Adjustments

The 2017 CEM evaluation faced a number of challenges requiring mid-stream adjustments to project scope. We summarize these challenges and the scope adjustments made as a result below to indicate places where the study work plan differs from the materials presented in this report.

- **Challenge:** At the launch of this baseline research activity, the REM initiative did not yet have any participants or approved providers.
  - **Resolution:** While our evaluation plan included research with these groups, we did not conduct any research focusing in these areas due to the lack of an eligible population to survey. As discussed with the NYSERDA project manager, pending approval of our research in the 2018 evaluation cycle, we will conduct initial REM participant provider research at that time.
- **Challenge:** At the launch of this baseline research activity, the RTEM initiative had a relatively small number of participants. We conducted a web-based participant survey with this population (N=21). However, despite multiple rounds of outreach from Opinion Dynamics and NYSERDA staff, we achieved only two completed surveys with this population. Furthermore, NYSERDA program staff note that many of the evaluation metrics chosen for research require some time after project implementation to determine whether or not an effect is seen (e.g., whether or not a customer uses RTEM implementation to provide non-energy benefits).
  - **Resolution:** Due to the small number of completes achieved in this research and the timeline of RTEM project implementation, NYSERDA decided not to report results from 2017 research in this report. Instead, we will conduct additional participant research in 2018 and provide initial results in the 2018 evaluation report. We will also work with NYSERDA staff

to change the mode of this research to include phone outreach (to the degree possible) in an attempt to increase response and cooperation rates.

- **Challenge:** Similar to our participant survey, we conducted a web-based survey with approved RTEM providers (N=48) and achieved only a small number of completes (n=6) despite multiple rounds of outreach from the evaluation team and NYSERDA staff.
    - **Resolution:** Due to the small number of completes achieved in this research, the timeline of RTEM project implementation (mentioned above), and to more appropriately align the results of this research with participant research, NYSERDA decided not to report results from 2017 research in this report. Instead, we will conduct additional provider research in 2018 and provide initial results in the 2018 evaluation report. We will also work with NYSERDA staff to change the mode of this research to include phone outreach (to the degree possible) in an attempt to increase response and cooperation rates.

Due to these challenges, results in this evaluation report focus solely on baseline metrics for the initiative, determined via general population research and non-participating provider interviews.

2 Methodology

This section summarizes the metrics selected for the CEM initiative and describes the data collection methods that the evaluation team used to develop the findings presented in this report.

2.1 Evaluation Metrics

In support of the CEM initiative, NYSERDA developed a number of key performance metrics and indicators to establish a baseline of market conditions and track progress toward (1) market adoption of EM technology and (2) transformation of the EM market with respect to the costs and benefits of EM projects. In the study planning phase, NYSERDA and the evaluation team worked together to determine how each metric should be addressed. Table 2-1 presents all metrics for this study that were planned to be assessed by the evaluation team. As noted above, this report contains only results from the building owner and manager research and non-participating provider interviews; metrics presented in Table 2-1 that are addressed via other research efforts are not reported on in the findings section of this report.

The evaluation team designed all research around addressing the metrics below. Additionally, the evaluation team added additional questions to research instruments, where appropriate and feasible, to collect other information for NYSERDA.

Table 2-1. Metrics for Assessment

Metrics	Outputs /Outcomes	Indicators	Addressed Via
Overall EM Initiative Metrics			
Market transformation	EM market matures more quickly than currently forecasted	Number of EM providers	Non-participating provider interviews
EM methods	Methods for calculating/analyzing costs & savings are standardized	Existence of standardized methods for calculating/analyzing costs & savings	Non-participating provider interviews
		Use of standardized methods for calculating/analyzing costs & savings	Non-participating provider interviews
	Programmatic criteria become industry standard (not addressed in first year)	Use of programmatic criteria by providers	Non-participating provider interviews

Metrics	Outputs /Outcomes	Indicators	Addressed Via
RTEM Metrics			
Awareness & knowledge of RTEM	Increased awareness of RTEM among building owners/managers	Percent of building owners/managers aware/knowledgeable of RTEM*	Building owner & manager survey
	Increased awareness of RTEM among providers	Percent of EMS providers aware/knowledgeable of RTEM	Non-participating provider interviews
	Customer confidence in RTEM results	Percent of knowledgeable building owners/managers confident in RTEM results*	Building owner & manager survey
Customer use of RTEM	Increased use of RTEM	Percent of building owners/managers using RTEM*	Building owner & manager survey
	Percent of decision-makers using RTEM data to assess operational risk	Percent of decision-makers using RTEM data to assess operational risk*	Building owner & manager survey[a]
	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving (not addressed in first year)	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving	Non-participating provider interviews
	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving (not addressed in first year)	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving	Participant survey
	Percentage of RTEM projects that institute an energy efficiency goal	Percentage of RTEM projects that institute an energy efficiency goal	Participant survey
	Percent of RTEM projects that use services for non-energy benefits (e.g., long-term asset management, capital investment strategies, risk mitigation analyses)	Number of RTEM projects that use services for non-energy benefits	Participant survey
	Demonstrated energy savings/O&M benefits from RTEM activities	Ratio of ECMs identified: ECMs implemented	Participant survey
	Improved capital investment planning and asset management	Percent of RTEM projects that are a part of a larger building management portfolio	Participant survey

Metrics	Outputs /Outcomes	Indicators	Addressed Via
RTEM market conditions	Percent of BMS offerings with integrated RTEM capabilities	Percent of BMS offerings with integrated RTEM capabilities*	Non-participating provider interviews
	Persistence of RTEM service contracts (i.e., how many customers extend their subscription with an RTEM provider beyond 5 years)	RTEM service contracts that are longer than 5 years in duration	Participant survey
	In-house data sets are large enough that RTEM service providers no longer need to partner with NYSERDA & QPL is rendered obsolete (not addressed in first year)	Non-participating providers use/refer to published NYSERDA data/standards	Non-participating provider interviews
	Extent of use of qualified provider list by the market (% increase in NY RTEM revenue by listed vendors)	Percent of Revenue increase for providers on Qualified Provider List	Provider survey
		Attribution of increase to qualified provider list	Provider survey
	In-house data sets are large enough that RTEM service providers no longer need to partner with NYSERDA & QPL is rendered obsolete (not addressed in first year)	Providers cease to apply to get listed on the Qualified Provider List	Provider survey
		Participating providers no longer feel the need for NYSERDA assistance	Provider survey
	RTEM providers identify & act on energy efficiency opportunities	Number/type of energy efficiency opportunities identified by RTEM providers	Provider survey
	RTEM providers identify & act on energy efficiency opportunities	Number/type of energy efficiency opportunities acted on by RTEM providers	Provider survey
REM Metrics			
Awareness & knowledge of REM	Increased awareness of REM among building owners/managers	Percent of building owners/managers aware/knowledgeable of REM*	Building owner & manager survey
	Increased awareness of REM among providers	Percent of EMS providers aware/knowledgeable of REM	Non-participating provider interviews
	Customer confidence in REM results	Percent of knowledgeable building owners/managers confident in REM results*	Building owner & manager survey

Metrics	Outputs /Outcomes	Indicators	Addressed Via
Customer use of REM	Increased use of REM	Percent of building owners/managers using REM*	Building owner & manager survey
	Percent of decision-makers using REM data to assess operational risk	Percent of decision-makers using REM data to assess operational risk*	Building owner & manager survey[a]
	Percentage of REM projects that institute an energy efficiency goal	Percentage of REM projects that institute an energy efficiency goal	Participant survey
	Percent of REM projects that use services for non-energy benefits (e.g., long-term asset management, capital investment strategies, risk mitigation analyses)	Number of REM projects that use services for non-energy benefits	Participant survey
	Demonstrated energy savings/O&M benefits from REM activities	Ratio of ECMs identified: ECMs implemented	Participant survey
	Improved capital investment planning and asset management	Percent of REM projects that are a part of a larger building management portfolio	Participant survey
REM market conditions	Extent of use of qualified provider list by the market (% increase in NY REM revenue by listed vendors)	Percent of Revenue increase for providers on Qualified Provider List	Provider survey
		Attribution of increase to qualified provider list	Provider survey
	REM providers identify & customers act on energy efficiency opportunities	Number/type of energy efficiency opportunities identified by REM providers	Provider survey
		Number/type of energy efficiency opportunities acted on by REM providers	Provider survey

* Metrics denoted with an asterisk were selected as priority baseline metrics by NYSERDA for purposes of reporting to the NYS Department of Public Service (DPS). Initial estimates of these metrics at the population level were reported to the NYS DPS in November 2017; these estimates are refined in this evaluation report.

[a] The initial research plan for this study was to use the building owner & manager survey to determine the number of those using RTEM/REM, and the participant survey to determine the share of RTEM/REM users utilizing the technology to assess operational risk. Due to low levels of participation in the RTEM initiative and no participation to date in the REM initiative at the time of sample development, the evaluation team adjusted its evaluation strategy for these metrics to use the building owner and manager survey to answer both items. Due to the low incidence of RTEM and REM usage among the general population, these metrics are based on small sample sizes and should be treated with caution in terms of drawing conclusions. As uptake of RTEM and REM increases, the evaluation team expects to be able to provide estimates of these metrics with increased rigor.

2.2 2017 Research Activities

The initial research activities conducted in 2017 included a review of program data and materials, a survey with building owners and managers in NYS, a survey with RTEM participants, a survey with RTEM providers, interviews with non-participating providers, and. As mentioned in Section 1.4, we do not present findings from surveys with RTEM participants and providers in this report, and therefore we do not include methodology around these activities in this report, which focuses on baseline metrics.

2.2.1 Building Owner and Manager Survey

2.2.1.1 Background

The evaluation team conducted a quantitative survey with building owners, managers, and decision makers to assess their knowledge of EM and participation in EM programs, and to gauge their ability to improve capital investment planning and asset management because of EM. The survey was conducted using computer-aided telephone interviewing (CATI) technology.

The initial target for the CEM initiative was commercial sector verticals with significant existing penetration of Building Management Systems – Commercial Office, Retail, University/College, Healthcare, and Hotels. These segments also have large buildings or portfolios being centrally managed and, therefore, are more likely to have the human resources necessary to capitalize on the potential of EM. Therefore, the research focused on these segments. In addition, the research included some interviews with commercial customers in other market segments.

2.2.1.2 Sampling Plan

The sample of commercial building owners/managers in New York was drawn from the InfoGroup database provided by NYSERDA. Per NYSERDA's request, we stratified the sample by segment, focusing on segments NYSERDA expects to be crucial to the early success of the program, as well as by facility size to provide more detail around EM relative to customer size.

The sample sizes were designed to provide 10% relative precision at 90% confidence (90/10) around the baseline estimates by segment. This precision will allow NYSERDA to accurately assess whether it has reached its targets for each specified outcome metric by 2019, by segment. Assessing progress toward these targets in intermediate years is a challenging task and requires large sample sizes, if increases in values are expected to be small from year to year. Per the work plan for this study, we expect that the combined sample size across all segments being studied will be sufficient to make a statistically significant assessment of whether a change at the market level occurred on a yearly basis, but we do not expect to be able to determine year-to-year whether statistically significant changes occurred at the segment level.

The sample sizes do not necessarily achieve 90/10 by customer size, but our stratification was designed to produce the most robust estimates possible by size within evaluation constraints. We planned to conduct 380 interviews as part of this survey, summarized by segment in Table 2-2 below.

Table 2-2. Building Owner & Manager Survey by Stratum

Segment	Size	Planned Completes	Completes Achieved
Commercial Office	Small	35	36
	Large	35	35
Retail	Small	35	35
	Large	35	35
University/College[a]	Small	35	30
	Large	35	34
Healthcare/Hospitals[a]	Small	15	1
	Large	15	4
Hotels	Small	35	41
	Large	35	39
Other	Small	35	36
	Large	35	35
Total		**380**	**361**

[a] We attempted a census of all customers in these segments.

We attempted a census of all customers in the University/College and Healthcare/Hospitals segments but were unable to achieve our targets due to low response rates. Our research in the University/College segment came close to achieving our targets and, given that no sampling error exists for a census attempt, we are confident reporting these results by subgroup. However, due to a small population and relatively low response rate, we achieved a total of only five completes in the Healthcare/Hospitals segment. We present results for Healthcare/Hospital at the overall segment level throughout this report, rather than attempting to present results by size. Furthermore, we urge caution in interpreting results due to the small sample size.

2.2.1.3 Survey Outcomes & Dispositions

We completed 871 interviews as part of the building owner & manager survey. To meet evaluation objectives, we screened out any respondents who were tenants in their buildings (and therefore may not conduct energy management at their sites), which reduced our count of valid completes to 361. However, per request of NYSERDA, before screening out these tenants, we asked them a number of questions to determine whether or not they can be used in another upcoming NYSERDA research effort.

Table 2-3 presents the complete list of our survey outcomes with their respective disposition codes.

Table 2-3. Dispositions Summary for Building Owner & Manager Survey

Disposition	Total
Completes	871
Non-Tenant Completes	361
Eligible Incomplete Interview	66
Undetermined Survey Eligibility	5,847
Busy/No Answer/Private/Not Used	2,079
Not Building Owner or Manager	80
Residential Phone/Computer Tone/Wrong Number/Disconnected Phone	2,853
Called Already	17
Total	**11,813**

Table 2-4 presents response and cooperation rates for the building owner & manager survey.

Table 2-4. Building Owner & Manager Survey Response and Cooperation Rates

AAPOR Rate	Percentage
RR3	11%
CR3	26%

The formulas for the response and cooperation rates are presented in Appendix B.

2.2.1.4 Weighting

When aggregating the results of the Building Owner & Manager survey to the segment or population level, we weighted the results for each stratum (defined by segment and size[1]) by the share of building owners/managers in the population in relation to the share of responses in the final completes. Table 2-5 presents the population sizes, completes, and the weights applied for each stratum.

[1] Except for Healthcare/Hospital, where our small number of completes does not allow for reporting on the size level.

Table 2-5. Building Owner & Manager Survey Weights

Segment	Population Size (N)	Sample Completes (n)	Weight[a]
Commercial Office - Small	79,236	36	1.145
Commercial Office - Large	58,995	35	0.876
Retail - Small	77,117	35	1.146
Retail - Large	55,594	35	0.826
University/College - Small	871	30	0.015
University/College - Large	551	34	0.008
Healthcare/Hospital	416	5	0.043
Hotel - Small	1,587	41	0.020
Hotel - Large	1,211	39	0.016
Other - Small	217,178	36	3.137
Other - Large	201,481	35	2.993

[a]Weights are rounded to three decimal places

2.2.2 Non-Participating Provider Interviews

2.2.2.1 Background

Under a separate agreement, NYSERDA contracted with Opinion Dynamics to conduct NYSERDA's Commercial Statewide Baseline and Potential Study. A component of this study is a market assessment focusing on energy management systems (EMS). The evaluation team conducted in-depth interviews with market actors involved in the distribution or implementation of EMS to support this market assessment. The interviews were conducted by trained Opinion Dynamics consultant staff. Given the close overlap between firms focusing on EM and firms working with EMS, NYSERDA and Opinion Dynamics agreed to leverage this research to support the baselining activities for the EM initiative in 2017. In future years, Opinion Dynamics will conduct stand-alone non-participating provider interviews to update metrics produced from these interviews.

2.2.2.2 Sampling Plan

The sample of EMS market actors in New York was developed by Opinion Dynamics and included 195 market actors that we identified via a variety of sources, including secondary research and recommendations from the NYSERDA Market Team. Additionally, we applied a "snowball" sampling approach where we asked interviewed market actors to identify and recommend other important firms and individuals with whom we should speak as part of the study.

2.2.2.3 Interview Outcomes

Opinion Dynamics completed in-depth interviews with 21 market actors, including 3 manufacturers, 14 vendors and service providers, and 4 engineering firms and ESCOs. The interviews included both

structured questions to gather quantitative data and open-ended questions that covered a variety of topics related to the research objectives.

2.3 Program Material Review

As an initial step in the approach to this study, existing materials relevant to the research objectives outlined in the Work Plan were reviewed. The reviewed materials included:

- Program materials from NYSERDA PON 3309: Real Time Energy Management and RFQ 3164: Real Time Energy Management Qualified Vendor
- InfoGroup database
- Secondary data utilized by NYSERDA in program development, implementation, and EM&V

3 Results

This section presents results from our 2017 CEM research, organized by topic area. To discuss topics of RTEM and REM with building owners and managers, our survey included a detailed description of both strategies, as developed in concert with NYSERDA staff, to ensure that respondents correctly understood NYSERDA's definition of the concepts.

3.1 Awareness and Knowledge of Energy Management

Table 3-1 presents baseline awareness levels of EM, RTEM, and REM at the segment and population level. As described in Section 2.1, these results are based on our interviews with building owners and managers. Overall, less than a quarter of owners and managers are aware of EM (22%). We see the greatest awareness of EM among universities and colleges (approximately half of respondents report awareness). Across all segments, we observe greater awareness of EM at larger sites than at smaller sites.

Table 3-1. Awareness of EM in NYS by Segment

Category		Metric	2017 (Baseline)	
Sector	**Size**	**Awareness of…**	**n**	**Percentage**
Overall	N/A	EM	360	22.0%
		RTEM	360	15.4%
		REM	358	18.5%
Commercial Office	Small	EM	35	17.1%
		RTEM	35	11.4%
		REM	35	11.4%
	Large	EM	35	34.3%
		RTEM	35	28.6%
		REM	35	28.6%
Retail	Small	EM	35	14.3%
		RTEM	35	11.4%
		REM	35	11.4%
	Large	EM	35	20.0%
		RTEM	35	11.4%
		REM	35	17.1%
University/ College	Small	EM	30	46.7%
		RTEM	30	43.3%
		REM	30	40.0%
	Large	EM	34	55.9%
		RTEM	34	41.2%
		REM	34	50.0%
Healthcare/ Hospital***	All	EM	5	60.0%
		RTEM	5	60.0%
		REM	4	50.0%

Category		Metric	2017 (Baseline)	
Hotel	Small	EM	41	22.0%
		RTEM	41	17.1%
		REM	41	17.1%
	Large	EM	39	33.3%
		RTEM	39	30.8%
		REM	39	17.9%
Other	Small	EM	36	16.7%
		RTEM	36	11.1%
		REM	35	14.3%
	Large	EM	35	28.6%
		RTEM	35	20.0%
		REM	35	25.7%

*** While we present this data for completeness, we note that our sample size for this metric is small due to survey non-response and urge caution in drawing inferences from a small sample size.

Table 3-2 presents baseline knowledge of EM, RTEM, and REM by segment and overall. Overall, approximately half of those aware of EM (10% overall) consider themselves knowledgeable of EM.[2] As with awareness, we observe high knowledge of EM reported for universities and colleges. The remaining segments typically fall below 15% for knowledge among large building owners and managers and below 10% for small building owners and managers.

Table 3-2. Knowledge about EM in NYS by Segment

Category		Metric	2017 (Baseline)	
Sector	**Size**	**Knowledgeable about…**	**n**	**Percentage**
Overall	N/A	EM	360	9.8%
		RTEM	359	7.9%
		REM	357	6.6%
Commercial Office	Small	EM	35	8.6%
		RTEM	35	5.7%
		REM	35	5.7%
	Large	EM	35	14.3%
		RTEM	35	11.4%
		REM	35	11.4%
Retail	Small	EM	35	8.6%
		RTEM	35	5.7%
		REM	35	5.7%
	Large	EM	35	5.7%
		RTEM	35	5.7%
		REM	35	0.0%

[2] Knowledge of RTEM and REM was measured on a zero to seven scale (where zero is "not at all familiar" and seven is "very familiar"). Respondents were considered knowledgeable if they gave a rating of five or higher. Knowledge of EM was generated as a composite metric of both RTEM and REM; if a respondent indicated they were knowledgeable of either RTEM or REM, we considered them knowledgeable of EM.

Category		Metric	2017 (Baseline)	
University/ College	Small	EM	30	30.0%
		RTEM	30	26.7%
		REM	30	26.7%
	Large	EM	34	32.4%
		RTEM	34	26.5%
		REM	34	23.5%
Healthcare/ Hospital***	All	EM	5	60.0%
		RTEM	5	60.0%
		REM	4	0.0%
Hotel	Small	EM	41	9.8%
		RTEM	40	5.0%
		REM	41	4.9%
	Large	EM	39	15.4%
		RTEM	39	15.4%
		REM	39	7.7%
Other	Small	EM	36	5.6%
		RTEM	36	5.6%
		REM	35	0.0%
	Large	EM	35	14.3%
		RTEM	35	11.4%
		REM	34	14.7%

*** While we present this data for completeness, we note that our sample size for this metric is small due to survey non-response and urge caution in drawing inferences from a small sample size.

Table 3-3 presents baseline levels of confidence in EM, RTEM, and REM at the population level for customers already knowledgeable of EM. Over two-thirds (69.8%) of knowledgeable customers are confident[3] in RTEM and over half are confident in REM (57.7%). Because only customers already aware of EM were asked this question, sample sizes for these responses are quite low, and we do not present results for this metric at the segment level.

Table 3-3. Overall Confidence in EM in NYS

	2017 (Baseline)	
Metric	n	Percentage
Confidence in…		
EM	34	76.6%
RTEM	36	69.8%
REM	19	57.7%

Through our interviews with EMS providers, we also assessed the level of familiarity with REM and RTEM among non-participating service providers. Eleven of 12 providers (92%) indicated that they were

[3] This was measured on a zero to seven scale (where zero is "not at all confident" and seven is "extremely confident"). Respondents were considered confident if they gave a response of five or higher.

familiar with RTEM. Four of five providers (80%) indicated that they were familiar with REM. A number of providers were not asked questions about REM due to time constraints in conducting these interviews.

3.2 Participant Use of Energy Management

Table 3-4 presents the level of use of EM in NYS at the segment and population level. Currently, 5% of building owners and managers in NYS are implementing EM, with 5% using RTEM and only 2% using REM.[4] Consistent with our results around awareness of EM, universities and colleges are currently implementing EM at higher rates than the other business segments. In addition, implementation rates are higher for large buildings than small buildings across all business types. The retail segment has the lowest use of EM of all segments.

Table 3-4. Use of EM by Segment

Category		Metric	2017 (Baseline)	
Sector	**Size**	**Use of…**	**n**	**Percentage**
Overall	N/A	EM	360	5.3%
		RTEM	358	4.5%
		REM	356	1.7%
Commercial Office	Small	EM	35	5.7%
		RTEM	35	2.9%
		REM	35	2.9%
	Large	EM	35	11.4%
		RTEM	34	5.9%
		REM	35	5.7%
Retail	Small	EM	35	0.0%
		RTEM	35	0.0%
		REM	35	0.0%
	Large	EM	35	2.9%
		RTEM	35	2.9%
		REM	35	0.0%
University/ College	Small	EM	30	26.7%
		RTEM	30	23.3%
		REM	30	16.7%
	Large	EM	34	35.3%
		RTEM	33	30.3%
		REM	33	18.2%
Healthcare/ Hospital***	All	EM	5	40.0%
		RTEM	5	40.0%
		REM	4	0.0%

[4] Note that some respondents report using both.

Category		Metric	2017 (Baseline)	
Hotel	Small	EM	41	9.8%
		RTEM	41	2.4%
		REM	40	7.5%
	Large	EM	39	12.8%
		RTEM	39	12.8%
		REM	39	0.0%
Other	Small	EM	36	2.8%
		RTEM	36	2.8%
		REM	35	2.9%
	Large	EM	35	8.6%
		RTEM	35	8.6%
		REM	35	0.0%

*** While we present this data for completeness, we note that our sample size for this metric is small due to survey non-response and urge caution in drawing inferences from a small sample size.

Table 3-5 presents baseline levels of EM, RTEM, and REM use to assess operational risk at the segment and population level. Currently, 7% of building owners and managers in NYS are using EM to assess operational risk, including 5% who use RTEM and 4% who use REM for this purpose. With the exception of the University/College segment, we observe very few building owners and managers using EM for this purpose in 2017.

Table 3-5. Use of EM for Assessing Operational Risk by Segment

Category		Metric	2017 (Baseline)	
Sector	**Size**	**Assessing Operational Risk with the Use of…**	**n**	**Percentage**
Overall	N/A	EM	324	2.2%
		RTEM	299	>0.1%
		REM	293	2.1%
Commercial Office	Small	EM	34	2.9%
		RTEM	31	0.0%
		REM	32	3.1%
	Large	EM	29	6.9%
		RTEM	26	0.0%
		REM	27	7.4%
Retail	Small	EM	32	0.0%
		RTEM	31	0.0%
		REM	31	0.0%
	Large	EM	33	0.0%
		RTEM	32	0.0%
		REM	29	0.0%
University/ College	Small	EM	26	26.9%
		RTEM	22	22.7%
		REM	22	18.2%
	Large	EM	29	24.1%
		RTEM	25	24.0%
		REM	25	12.0%

Category		Metric	2017 (Baseline)	
Healthcare/ Hospital***	All	EM RTEM REM	4 4 4	25.0% 25.0% 0.0%
Hotel	Small	EM RTEM REM	37 34 36	2.7% 0.0% 2.8%
	Large	EM RTEM REM	35 31 32	8.6% 9.7% 0.0%
Other	Small	EM RTEM REM	34 33 31	2.9% 0.0% 3.2%
	Large	EM RTEM REM	31 30 26	0.0% 0.0% 0.0%

*** While we present this data for completeness, we note that our sample size for this metric is small due to survey non-response and urge caution in drawing inferences from a small sample size.

3.3 EM Market Conditions

Our interviews with EMS market actors also included questions around the RTEM capabilities available in building management systems (BMS) in NYS. All responding BMS providers indicated that their products have the hardware/software features necessary for RTEM (100%). However, most market actors indicated that only a small percentage of installations currently are used in such a manner. Market actors were unable to provide rigorous, quantitative estimates of what percentage of systems are used for RTEM purposes, but most market actors indicated that this would be a very small percentage.

4 Future Research/Upcoming Planned Activities

Table 4-1 outlines the primary research activities that we plan to conduct throughout each year of this evaluation. If approved by the NYSERDA Project Manager, we will conduct follow-up research in 2018, 2019, 2020, and 2021.

If approved, we plan to conduct a full refresh of the building owner and manager survey in 2019 and 2021. Additionally, we plan to conduct a limited building owner and manager survey refresh in 2018 and 2020, consisting of number of completed interviews sufficient to provide a population-level estimate of the metrics being tracked, while not providing segment level results.

As discussed earlier in this report, we are not reporting on results from participating customer or participating provider research in 2017. Instead, we plan to conduct research in 2018 once participation in these initiatives increases. Timing of follow-up research with participants and participating providers will be determined through discussions with NYSERDA.

Table 4-1. Primary Research Activities by Year

Data Collection Activity	2017	2018	2019	2020	2021
Building Owner and Manager Survey	✓	✓	✓	✓	✓
RTEM Participant Survey	✓		TBD	TBD	TBD
REM Participant Survey	✓		TBD	TBD	TBD
Participating RTEM Provider Survey	✓		TBD	TBD	TBD
Participating REM Provider Survey	✓		TBD	TBD	TBD
Non-Participating EM Provider Interviews	✓		✓		✓

Appendix A. Table of All Metric Results

Table of All Metric Results

Theme	Outputs/Outcomes	Indicators	Addressed Via	2017 Result
Overall EM Initiative Metrics				
Market transformation	EM market matures more quickly than currently forecasted	Number of EM providers	Non-participating provider interviews	Not assessed[a]
EM methods	Methods for calculating/analyzing costs & savings are standardized	Existence of standardized methods for calculating/analyzing costs & savings	Non-participating provider interviews	Non-participating providers were unable to provide this information
		Use of standardized methods for calculating/analyzing costs & savings	Non-participating provider interviews	Non-participating providers were unable to provide this information
	Programmatic criteria become industry standard (not addressed in first year)	Use of programmatic criteria by providers	Non-participating provider interviews	Not assessed[a]
RTEM Metrics				
Awareness & knowledge of RTEM	Increased awareness of RTEM among building owners/managers	Percent of building owners/managers aware/knowledgeable of RTEM*	Building owner & manager survey	23.6% (aware) 12.3% (knowledgeable)
	Increased awareness of RTEM among providers	Percent of EMS providers aware/knowledgeable of RTEM	Non-participating provider interviews	92%
	Customer confidence in RTEM results	Percent of knowledgeable building owners/managers confident in RTEM results*	Building owner & manager survey	72.2%
Customer use of RTEM	Increased use of RTEM	Percent of building owners/managers using RTEM*	Building owner & manager survey	9.2%
	Percent of decision-makers using RTEM data to assess operational risk	Percent of decision-makers using RTEM data to assess operational risk*	Building owner & manager survey[a]	5.0%
	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving (not addressed in first year)	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving	Non-participating provider interviews	Not assessed[a]
	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving (not addressed in first year)	Utilization of RTEM data sets to advance efforts at demand reduction & peak load shaving	Participant survey	Not assessed[a]

	Percentage of RTEM projects that institute an energy efficiency goal	Percentage of RTEM projects that institute an energy efficiency goal	Participant survey	Not assessed[a]
	Percent of RTEM projects that use services for non-energy benefits (e.g., long-term asset management, capital investment strategies, risk mitigation analyses)	Number of RTEM projects that use services for non-energy benefits	Participant survey	Not assessed[a]
	Demonstrated energy savings/O&M benefits from RTEM activities	Ratio of ECMs identified: ECMs implemented	Participant survey	Not assessed[a]
	Improved capital investment planning and asset management	Percent of RTEM projects that are a part of a larger building management portfolio	Participant survey	Not assessed[a]
RTEM market conditions	Percent of BMS offerings with integrated RTEM capabilities	Percent of BMS offerings with integrated RTEM capabilities*	Non-participating provider interviews	Qualitatively assessed; see Section 3.3.
	Persistence of RTEM service contracts (i.e., how many customers extend their subscription with an RTEM provider beyond 5 years)	RTEM service contracts that are longer than 5 years in duration	Participant survey	Not assessed[a]
	In-house data sets are large enough that RTEM service providers no longer need to partner with NYSERDA & QPL is rendered obsolete (not addressed in first year)	Non-participating providers use/refer to published NYSERDA data/standards	Non-participating provider interviews	Not assessed[a]
	Extent of use of qualified provider list by the market (% increase in NY RTEM revenue by listed vendors)	Percent of Revenue increase for providers on Qualified Provider List	Provider survey	Not assessed[a]
	Extent of use of qualified provider list by the market (% increase in NY RTEM revenue by listed vendors)	Attribution of increase to qualified provider list	Provider survey	Not assessed[a]
	In-house data sets are large enough that RTEM service providers no longer need to partner with NYSERDA & QPL is rendered obsolete (not addressed in first year)	Providers cease to apply to get listed on the Qualified Provider List	Provider survey	Not assessed[a]
		Participating providers no longer feel the need for NYSERDA assistance	Provider survey	Not assessed[a]
	RTEM providers identify & act on energy efficiency opportunities	Number/type of energy efficiency opportunities identified by RTEM providers	Provider survey	Not assessed[a]
	RTEM providers identify & act on energy efficiency opportunities	Number/type of energy efficiency opportunities acted on by RTEM providers	Provider survey	Not assessed[a]
REM Metrics				

Awareness & knowledge of REM	Increased awareness of REM among building owners/managers	Percent of building owners/managers aware/knowledgeable of REM*	Building owner & manager survey	22.4% (aware) 9.5% (knowledgeable)
	Increased awareness of REM among providers	Percent of EMS providers aware/knowledgeable of REM	Non-participating provider interviews	80% (familiar)
	Customer confidence in REM results	Percent of knowledgeable building owners/managers confident in REM results*	Building owner & manager survey	68.4%
Customer use of REM	Increased use of REM	Percent of building owners/managers using REM*	Building owner & manager survey	5.0%
	Percent of decision-makers using REM data to assess operational risk	Percent of decision-makers using REM data to assess operational risk*	Building owner & manager survey[a]	4.1%
	Percentage of REM projects that institute an energy efficiency goal	Percentage of REM projects that institute an energy efficiency goal	Participant survey	Not assessed[a]
	Percent of REM projects that use services for non-energy benefits (e.g., long-term asset management, capital investment strategies, risk mitigation analyses)	Number of REM projects that use services for non-energy benefits	Participant survey	Not assessed[a]
	Demonstrated energy savings/O&M benefits from REM activities	Ratio of ECMs identified: ECMs implemented	Participant survey	Not assessed[a]
	Improved capital investment planning and asset management	Percent of REM projects that are a part of a larger building management portfolio	Participant survey	Not assessed[a]
REM market conditions	Extent of use of qualified provider list by the market (% increase in NY REM revenue by listed vendors)	Percent of Revenue increase for providers on Qualified Provider List	Provider survey	Not assessed[a]
	Extent of use of qualified provider list by the market (% increase in NY REM revenue by listed vendors)	Attribution of increase to qualified provider list	Provider survey	Not assessed[a]
	REM providers identify & customers act on energy efficiency opportunities	Number/type of energy efficiency opportunities identified by REM providers	Provider survey	Not assessed[a]
	REM providers identify & customers act on energy efficiency opportunities	Number/type of energy efficiency opportunities acted on by REM providers	Provider survey	Not assessed[a]

[a] These metrics were not assessed in the 2017 evaluation, either due to the need to allow the market to develop before assessment or due to the research activity not being completed as discussed earlier in this report.

Appendix B. Survey Response Rate Methodology

This appendix presents the equations used to calculate the response rate (RR) and the cooperation rate (CR) for the Building Owner and Manager Survey. The definitions of the letters used in the formulas are shown in the table below.

Table B-1. Dispositions Summary for Building Owner & Manager Survey

Disposition	Input	Total
Completes	I	871
Non-Tenant Completes	-	361
Eligible Incomplete Interview	N	66
Undetermined Survey Eligibility	U1	5,847
Busy/No Answer/Private/Not Used	U2	2,079
Not Building Owner or Manager	X1	80
Residential Phone/Computer Tone/Wrong Number/Disconnected Phone	X2	2,853
Called Already	X2	17
Total	**N/A**	**11,813**

The survey RR is the number of completed interviews divided by the total number of potentially eligible respondents. We calculated Response Rate 3 (RR3) using the standards and formulas set forth by the Association for Public Opinion Research (AAPOR):[5]

Equation B-1. AAPOR Response Rate 3

$$RR3 = \frac{I}{\left(I \ + \ N \ + \ e1(U1 \ + e2 * U2)\right)}$$

Where:

$$e1 \ = \frac{(I + N)}{(I + N + X1)}$$

$$e2 \ = \frac{(I + N + X1 + U1)}{(I + N + X1 + U1 + X2)}$$

[5] *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, AAPOR, 2011. http://www.aapor.org/AM/Template.cfm?Section=Standard_Definitions2&Template=/CM/ContentDisplay.cfm&ContentID=3156.

The survey CR is the number of completed interviews divided by the total number of eligible sample units. We used AAPOR Cooperation Rate 3 (COOP3), which is calculated as:

Equation B-2. AAPOR Cooperation Rate 3

$$COOP3 = \frac{I}{((I + P) + R)}$$

Appendix C. Indirect Impacts Methodology

Background

As part of Opinion Dynamics' evaluation of the NYSERDA CEM Initiative, we plan to assess indirect impacts from the Initiative.

Indirect impacts are defined as market effects that are expected to accrue over the long term from follow-on market activity that results from NYSERDA's investments but are not *directly* attributable to NYSERDA's investments. Market effects are inclusive of short-term, clearly definable actions specific to individual customers in NYS, as well as longer-term structural market changes that result from investments.

Indirect impacts attributable to the CEM Initiative are those resulting from actions taken by initiative participants and initiative non-participants (end-users) or market actors that were influenced by the initiative. We will measure indirect impacts in terms of energy efficiency savings (MWh, MMBtu) and emissions reductions (tons of CO2e). At a high level, indirect savings from the CEM Initiative result from the effects of the NYSERDA offering on accelerating the growth of the energy management (EM) market in New York State, increasing energy savings across commercial sectors.

NYSERDA expects to realize significant indirect impacts from the CEM Initiative (Table C-1).

Table C-1. Estimated Indirect Market Impact

Indirect Impact		2020	2025	2030
Energy Efficiency	MWh Cumulative Annual	416,000	1,720,000	1,970,000
	MMBtu Cumulative Annual	150,000	640,000	706,000
Renewable Energy	MWh Cumulative Annual	0	0	0
	MW	0	0	0
CO2e Emission Reduction (metric tons) Cumulative Annual		227,000	937,000	1,070,000

Source: CEF Investment Plan (May 15, 2017)

This evaluation will assess indirect impacts by quantifying energy savings and emissions reductions that result in the market from effects of the CEM Initiative but are not directly incented nor quantified by it. It is anticipated that these effects will result from O&M improvements stemming from use of EM that would not have occurred in the absence of the initiative, e.g., when participating customers or EM providers apply knowledge and/or data from the initiative at other facilities or with other customers. However, indirect impacts can occur at a customer facility that has directly participated in a NYSERDA initiative if the impact is not a direct result of a NYSERDA intervention. For example, if incentives

provided through a NYSERDA initiative directly targeted optimization of a given portion of a facility, but a customer also chose to make improvements to a separate portion of the same facility, those impacts could be considered indirect.

Because this evaluation does not include assessment of direct impacts from the Initiative and the methodology for direct impact assessment is not currently available to us, our indirect impact assessment runs some risk of "double counting" impacts that the initiative might later claim as direct impacts. To mitigate this risk, we will attempt to quantify indirect impacts associated with Initiative participants at the most granular level possible to allow for later disaggregation of impacts if it is determined our assessment is counting impacts that will be claimed directly by the initiative.

The CEM work plan clearly states that indirect impacts are not necessarily additive across Initiatives, so we do not believe that there is a risk inherent in double counting impacts that could have been motivated by other NYSERDA interventions.

Our evaluation will quantify indirect impacts resulting from both the RTEM and REM Initiatives, but our overall goal will be to estimate total indirect impacts resulting from the CEM Initiative.

Underlying Theory Behind Indirect Impacts

The underlying concept behind indirect impacts is that the NYSERDA initiative creates market transformation that leads to further energy savings without direct NYSERDA intervention.

The logic model for the CEM Initiative contains a number of specific outcomes the evaluation team believes are likely to lead to indirect impacts. They include, but are not limited to, the items in Table C-2 below.

Table C-2. CEM Initiative Logic Model Outcomes Likely to Lead to Indirect Impacts

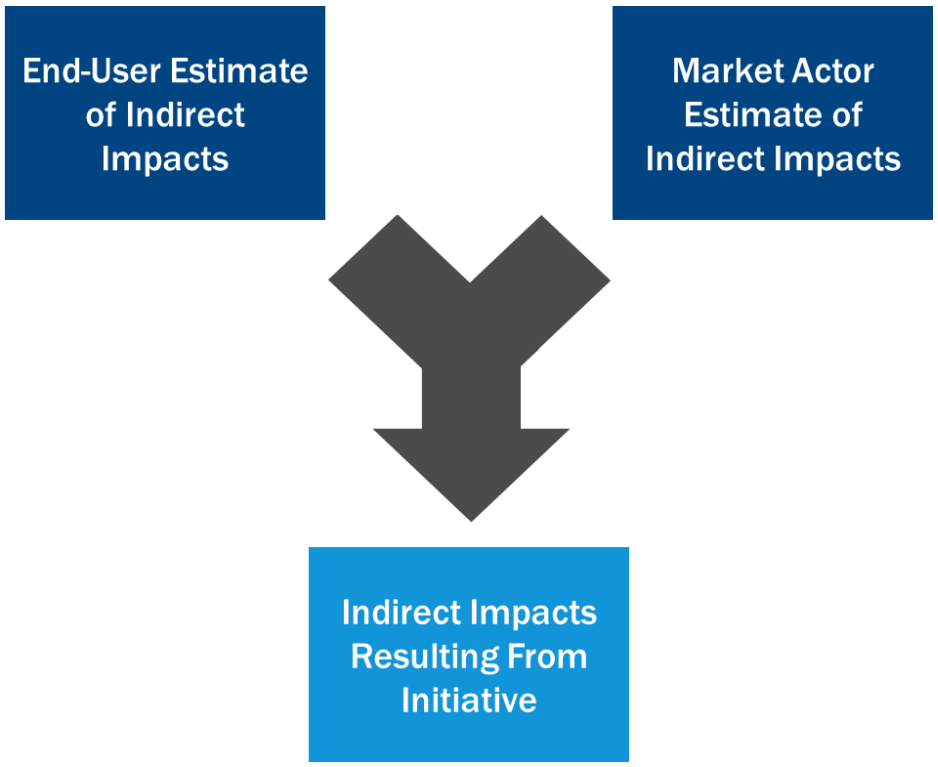
CEM Initiative Outcomes
Assistance in the development of vendor capabilities & business models
Programmatic criteria become industry standard
Methods for calculating/analyzing costs, savings, and O&M benefits
Reduction in customer acquisition & project development costs
Assistance in the development of vendor capabilities & business models

These outcomes are likely to lead to indirect impacts. However, assessing the energy/greenhouse gas impacts of each of these particular outcomes is not feasible given our planned evaluation activities. Therefore, as specified in our evaluation plan, we plan to focus on the actual impacts, or market effects, as perceived by the following parties:

- End-users (NYS customers)
    - Initiative participants
    - Initiative non-participants
- Market actors (energy management providers)
    - Participating market actors
    - Non-participating market actors[6]

Our methodology will develop independent estimates of indirect impacts from both groups, and triangulate a final result (Figure C-1):

Figure C-1. Indirect Impact Estimation Method



We describe the conceptual framework and methodology behind the indirect impacts resulting from Initiative activities by party, or "perspective", below.

[6] To the degree possible. We have not planned for statistically valid research covering non-participating market actors as part of the scope of the CEM evaluation, and therefore, quantification of impacts among these parties will be complex. At minimum, this evaluation will include a qualitative assessment of the degree to which non-participating market actors may have been influenced by the NYSERDA Initiative.

Methodology

To capture these effects, this evaluation will be designed to add modules to the surveys to be fielded in 2019 and 2021. We will assess these changes and savings from the participant, non-participant, and market actor perspectives to provide a robust estimate of overall indirect impacts resulting from the Initiative. Estimates of impacts from the participant and non-participant perspectives will be used to develop an estimate independent from estimates of impacts from the market actor perspectives and results will be triangulated.

A challenging component of indirect impact assessment is ensuring that the impacts captured in our methodology are attributable to the Initiative. We will include a series of questions on Initiative influence to ensure that each case of indirect impacts we capture can be directly connected to the NYSERDA Initiative.

Another important factor that the evaluation needs to appropriately deal with is consideration of the appropriate level of rigor to use for indirect impact assessment by perspective. Each perspective has different considerations associated with it. We detail these considerations and the resulting level of rigor below.

End-User Perspective

The actual actions leading to indirect impacts are primarily taken at the customer, or "end-user" level, and are expected to largely be improvements in energy management and operations made by end-users. End-users might also make significant energy-saving capital investments (e.g. replacement of energy-using equipment with more efficient equipment) as a result of the Initiative; we will assess the degree to which this occurs, but do not expect this to be a primary contributor to indirect impacts.

Participant Perspective

From the CEM participant perspective, impacts directly associated with an RTEM or REM project are claimed as direct impacts. However, impacts that might result from actions a CEM participant takes that are not directly associated with a RTEM or REM project may be able to be claimed as indirect impacts.

For example, a participant managing multiple facilities across NYS might complete a RTEM project through the NYSERDA initiative focusing on one facility. After experiencing the benefits of the initiative, the participant might complete projects at other facilities without NYSERDA incentives.

If we can determine that the participant's actions are taken as a result of their engagement with the NYSERDA initiative, we can assess these actions and quantify them as indirect impacts.

To assess indirect impacts associated with Initiative participants, we plan to add questions on indirect impacts to the RTEM and REM participant surveys to be fielded in 2019 and 2021. We are aware that participants are familiar with RTEM/REM actions, and in fact have taken these actions through the Initiative for which direct impacts have been claimed. As a result, we need to estimate indirect impacts for participants at a relatively granular level to ensure that we are not "double-counting" impacts that have already been claimed as direct.

Furthermore, because we know participants are familiar with these actions and, by virtue of participating in the NYSERDA Initiative, should be more receptive to evaluation research, we are comfortable placing more of a burden on these customers to answer important questions.

We will use a multi-step process to determine indirect impacts associated with participants:

- First, we will determine whether or not participants took energy-saving actions that are in addition to those they might have taken as a direct result of their participation in the Initiative (and, at a very high level, what these actions were). These actions could be at the same facility for which they participated in the Initiative, or at another facility altogether.
- We will determine the degree of influence that NYSERDA's Initiative had on the actions taken by the participant.
- If we determine that participants took action as a result of the influence of NYSERDA's Initiative, we will ask followup questions to 1) determine more specifically what the actions taken were and to 2) characterize these actions in a manner that will allow us to calculate resulting energy savings.
- Resulting energy savings will be determined through rigorous, defensible estimation of impacts that rely on agreed-upon frameworks for energy savings wherever possible. For example, if we determine that participants take discrete, easily measurable actions such as installation of energy saving measures, we will leverage the New York TRM.[7] Changes in operation of equipment will leverage New York specific parameters and custom, site-specific parameters wherever possible.
- Resulting savings will be determined at the specific action level among surveyed participants (Table C-3 provides a potential example of what indirect impacts might look like).

[7] The New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs - Residential, Multi-Family, and Commercial/Industrial.

Table C-3. Example - Estimation of Indirect Impacts from Initiative Participants

Participant	Action	Savings (kWh)
1	Reset thermostat setpoints	1,700 kWh
	Decrease in lighting operating hours	1,500 kWh
2	None	0 kWh
3	Installation of lighting controls	2,500 kWh
4	None	0 kWh
Average Savings Per Participant		**1,425 kWh**

- Finally, we will extrapolate these results to cover any participants who did not complete our evaluation by assuming impacts are similar across participants, adjusting for size and segment as necessary.

Non-Participant Perspective

Non-participating customers are, by definition, not associated with direct impacts from the NYSERDA Initiative. However, it is possible (and, in fact, desired by NYSERDA) that the Initiative's actions may result in non-participating customers completing RTEM/REM projects outside of the Initiative. These projects, like projects completed as part of the Initiative, yield energy savings that can be quantified as indirect impacts.

To assess indirect impacts resulting from non-participants, we plan to add questions to the full refreshes of the Building Owner & Manager survey, currently planned to be conducted in 2019 and 2021.

There are a significant number of different considerations that must be taken into account when assessing indirect impacts from program non-participants. Non-participants are likely less familiar with the exact terminology NYSERDA uses to describe CEM results, are less willing to spend time discussing their energy use (given that they have not received CEM Incentives) and are less likely to have taken actions that can be directly attributable to the NYSERDA Initiative. These challenges are similar to those faced in the assessment of metrics as part of the CEM evaluation effort.

To mitigate these challenges, we will assess indirect impacts associated with non-participants at a higher level than those associated with participants.

- First, we will estimate the number of potential RTEM/REM projects completed by non-participating customers
- We will then determine the likelihood that these projects were influenced by the NYSERDA Initiative to estimate the number of projects that were potentially caused by the existence of the NYSERDA Initiative.

- Finally, we will then apply a standard savings multiplier to these projects to determine total indirect impacts from non-participating customers. This multiplier will be based on results from the future assessment of direct impacts from the Initiative (not part of the scope of this evaluation). Similarly to our approach for indirect impacts associated with participants, this will be adjusted for customer size and segment as necessary. Resulting savings will therefore be quantified at the customer level, as shown below in 1.

Equation C-1. Example - Estimation of Indirect Impacts from Non-Participants

$$Indirect\ Impacts = Non-participating\ projects\ influenced\ by\ NYSERDA\ Initiative * Average\ Savings\ per\ Project$$

$$Indirect\ Impacts = 6{,}700\ projects * 1{,}425\ kWh = 9{,}547{,}500\ kWh$$

Market Actor Perspective

While the actual actions leading to indirect impacts (e.g., energy management improvements) are primarily taken at the end-user level, assessment of these actions among customers provides only one perspective on the influence of the Initiative. Many of the planned outcomes of the Initiative (see Table C-2) are transformation of the market for commercial energy management in NYS that will primarily directly affect market actors delivering energy management services.

Because the Initiative may affect market actors in this way even when it does not direct touch end-users, end users may be unaware that NYSERDA's investments have a relationship to their decision to invest in energy management. For example, if availability of standardized methods for calculating energy savings from EM projects encourage additional market actors to pursue business in NYS, competition will be increased and prices for EM services may decline, which could encourage additional end-users to complete EM projects.

However, these end-users will not indicate via the methods we have indicated above that they chose to complete an EM project as a result of the Initiative.

As a result, we also need to assess market actor perceptions of how the Initiative has affected their delivery of EM services in NYS to fully capture indirect impacts. We will assess this in three steps:

- Using some of the existing questions planned for market actor research, plus some new question, we are already assessing the change in EM sales in NYS for market actors (both in terms of percentages and raw numbers)
- In addition, we will use a counterfactual scenario presented to market actors to estimate the Initiative's influence on this change in terms of the number of projects

- Finally, we will then apply a standard savings multiplier to these projects to determine total indirect impacts from the market actor perspective. This multiplier will be based on results from the future assessment of direct impacts from the Initiative (not part of the scope of this evaluation). Combining these questions with this multiplier will allow us to determine indirect impacts associated with the Initiative from the market actor perspective, as shown in the example below:

Equation C-2. Example - Estimation of Indirect Impacts from Market Actor Perspective

$$Indirect\ Impacts = Increase\ in\ EM\ Projects * \%\ Attribution\ to\ NYSERDA\ Initiative * Average\ Savings\ per\ Project$$

$$Indirect\ Impacts = 10{,}000\ projects * 50\%\ Attributable\ to\ NYSERDA\ Initiative * 1{,}425\ kWh = 7{,}125{,}500\ kWh$$

We will use this approach to estimate indirect impacts from the market actor perspective for both participating and non-participating market actors. We expect to combine these estimates arithmetically using a simple mean but will assess the need to weight results based on those market actors interviewed as part of this process. If needed, we may utilize structured expert judgement to combine results in a defensible manner.

Combining Perspectives to Estimate Overall Level of Indirect Impacts

As shown in Figure C-1, our methodology will develop independent estimates of indirect impacts from end-users and market actors and triangulate a final result.

In general, we expect that both end-user and market actor perspectives will be imperfect estimates of indirect impacts. Triangulating a final result incorporating both perspectives will allow us to ensure that our estimate is robust and combines results from multiple perspectives. We plan to use a simple average to combine indirect impacts from end-users and market actors. However, if our research indicates that one perspective likely covers a significant amount of indirect impacts that are missed in another perspective, we may use structured expert judgement to combine our results in a manner that will more effectively represent the various perspectives.

Appendix C. Survey Batteries for Indirect Impacts

The following questions will be added to the surveys being fielded as part of the CEM Initiative evaluation research in 2019 and 2021 in support of indirect impact estimation.

Building Owner & Manager Survey

The building owner & manager survey currently contains all the questions we require to proceed through the methods detailed above. However, we do plan to add two supplemental questions to the survey to provide context around the relationship between market actor recommendations and participant actions that may inform our combination of end-user and market actor results.

These questions will be sequenced after question RT3e in the building owner & manager survey instrument

RT3f. Recommendation from a contractor or vendor (e.g., a company that provides RTEM services)

These questions will be sequenced after question RE3e in the building owner & manager survey instrument

RE3f. Recommendation from a contractor or vendor (e.g., a company that provides REM services)

RTEM & REM Participant Survey

These questions will be sequenced after question PO5a in the RTEM & REM participant survey instrument

Next, I am going to ask you some questions about your energy use.

II1. Since you began participating in the <RTEM program/REM program/RTEM and REM programs>, have you made any energy-efficient changes to your facility at <ADDRESS>? (IF NEEDED: These could include operational improvements, like changes in scheduling of heating and cooling, or changes to equipment in your facility, like installation of new efficient systems)

1 Yes

2 No

8 Don't know

[ASK IF II1 = 1, ELSE SKIP TO II4]

II2. How important was your experience with the <RTEM program/REM program/RTEM and REM programs> in your decision to make these changes at the facility at <ADDRESS>? Please use a scale of zero to 10 where zero is "not at all important" and 10 is "extremely important." [NUMERIC OPEN END, 0 TO 10; 98=Don't know]

II3. If you had not participated in the <RTEM program/REM program/RTEM and REM programs>, how likely do you think you would have been to make these changes at the facility at <ADDRESS>? Please use a scale of zero to 10 where zero is "not at all likely" and 10 is "extremely likely."
[NUMERIC OPEN END, 0 TO 10; 98=Don't know]

[CALCULATE INFLUENCE_SAME = (II2 + II3)/2]

[ASK IF INFLUENCE_SAME > 5]

II4. What types of energy efficient changes did you make to the facility at <ADDRESS>? Please select all applicable responses. [MULTIPLE RESPONSE UP TO 5]

1 Changed operational practices, like hours of facility operation

2 Changed equipment settings, like temperature setpoints or lighting schedules

3 Replaced energy-using equipment with more efficient equipment

4 Installed new equipment to help manage energy use

5 Something else [OPEN END, SPECIFY]

II5. We'd like to learn more about the energy efficient upgrades you made at <ADDRESS>. What is the best way to reach you to learn more about these upgrades?

1 Email

2 Phone [OPEN END, SPECIFY PHONE NUMBER]

SAME. Thank you. One of our engineers will be contacting you in the near future to learn more about these upgrades.

II6. Since you began participating in the <RTEM program/REM program/RTEM and REM programs>, have you made any energy-efficient changes to **any other facilities**? (IF NEEDED: These could include operational improvements, like changes in scheduling of heating and cooling, or changes to equipment in your facility, like installation of new efficient systems)

1 Yes

2 No

8 Don't know

[ASK IF II6 = 1, ELSE SKIP TO F1]

II7. How important was your experience with the <RTEM program/REM program/RTEM and REM programs> in your decision to make these changes to your other facilities? Please use a scale of zero to 10 where zero is "not at all important" and 10 is "extremely important."
[NUMERIC OPEN END, 0 TO 10; 98=Don't know]

II8. If you had not participated in the <RTEM program/REM program/RTEM and REM programs>, how likely do you think you would have been to make these changes to your other facilities? Please use a scale of zero to 10 where zero is "not at all likely" and 10 is "extremely likely."
[NUMERIC OPEN END, 0 TO 10; 98=Don't know]

[CALCULATE INFLUENCE_OTHER = (II7 + II8)/2]

[ASK IF INFLUENCE_OTHER > 5]

II9. What types of energy efficient changes did you make to your other facilities? Please select all applicable responses. [MULTIPLE RESPONSE UP TO 5]

1 Changed operational practices, like hours of facility operation

2 Changed equipment settings, like temperature setpoints or lighting schedules

3 Replaced energy-using equipment with more efficient equipment

4 Installed new equipment to help manage energy use

5 Something else [OPEN END, SPECIFY]

II10. We'd like to learn more about the energy efficient upgrades you made at your other facilities. What is the best way to reach you to learn more about these upgrades?

1 Email

2 Phone [OPEN END, SPECIFY PHONE NUMBER]

OTHER. Thank you. One of our engineers will be contacting you in the near future to learn more about these upgrades.

RTEM & REM Qualified Provider Survey

These questions will be sequenced after question PO5 in the RTEM & REM qualified provider survey instrument

II1. How many <RTEM/REM> projects have you completed overall since you began participating in the NYSERDA Initiative?
[NUMERIC OPEN END, 0 TO 100; 98=Don't know]

II2. In percentage terms, how has the number of <RTEM/REM> projects you have completed increased since you began participating in the NYSERDA Initiative?
[NUMERIC OPEN END, 0 TO 100; 96=Decreased, 98=Don't know]

II3. How important has your participation in the NYSERDA Initiative been on the increase in projects you have completed? Please use a scale of zero to 10 where zero is "not at all important" and 10 is "extremely important."
[NUMERIC OPEN END, 0 TO 10; 98=Don't know]

II4. If you had not participated in the NYSERDA Initiative, how likely do you believe it is that this increase would have occurred? Please use a scale of zero to 10 where zero is "not at all likely" and 10 is "extremely likely."
[NUMERIC OPEN END, 0 TO 10; 98=Don't know]

Non-Participating Provider Survey

These questions will be added to stand-alone interviews conducted with non-participating RTEM/REM providers

1. Are you familiar with NYSERDA's CEM Initiative?

2. Do you believe the NYSERDA Initiative has affected the market for energy management in NYS? In what way? Why do you say that?

3. Approximately how many RTEM/REM projects have you completed per year between 2017 and 2019?
    a. In 2017, how many projects did you complete?
    b. In 2018, how many projects did you complete?
    c. In 2019, how many projects did you complete?

4. How many projects do you believe you would have completed per year if NYSERDA'S CEM Initiative had not been available? Why do you say that? Please answer in raw numbers or percentage terms.
    a. In 2017
    b. In 2018
    c. In 2019