VOL. 4

# Commercial Baseline Study

## Energy Management System Market Assessment

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

# Final Report



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## Introduction

# 1 Introduction

This volume presents the comprehensive findings from the Energy Management System (EMS) market assessment. The EMS market assessment is one of four market assessments being conducted by Opinion Dynamics (the "Market Evaluation Team") as part of NYSERDA's Commercial Statewide Baseline Study. The main goal of the EMS market assessment was to characterize the market for EMS in New York State's commercial sector. This assessment was designed to (1) help NYSERDA set more accurate baselines for energy efficiency programs, (2) aid public and private innovation in the commercial marketplace, and (3) support estimation of the potential for additional energy efficiency opportunities in New York.

## EMS Definition

For the purposes of this study, EMS is defined as any **technology that can control systems at a building-wide level to optimize energy use and occupant comfort.** These types of technologies are also referred to as BMS (building management systems), BEMS (building energy management systems), or BAS (building automation systems). EMS are **typically integrated software and hardware systems** that monitor and/or control some or all of energy-using building systems, most commonly HVAC and lighting systems. Not included in this study are (1) EMIS (energy management information systems), which are software tools that store, analyze, and display energy use or building systems data but generally do not have the ability to control building systems; and (2) HEMS (home energy management systems), which are residential systems but sometimes used by small businesses.

The Market Evaluation Team worked with NYSERDA to develop twelve key research objectives and related metrics for this study. The Team grouped the twelve research objectives into eight categories, listed in Table 1.

**Table 1 | Key Research Objectives by Category**

| Category | Research Objectives |
|---|---|
| Size of the New York Commercial EMS Market | • Penetration of existing EMS |
| EMS Installation Practices | • Market actor and customer installation practices<br>• Factors that influence customer decision to replace or upgrade their EMS |
| Commonly Controlled Systems and Strategies | • Building systems/functions most commonly controlled by EMS |
| EMS Customer Awareness and Behaviors | • Customer awareness of EMS benefits and capabilities<br>• Customer usage behavior for installed EMS<br>• EMS control strategies used by customers |
| EMS Maintenance Contracts | • Prevalence and characteristics of EMS maintenance contracts |
| Market Drivers | • EMS benefits desired by customers<br>• Marketing tools and information used by market actors to encourage customers to install or upgrade an EMS<br>• Building codes and standards influencing the New York State EMS market |
| Market Barriers | • Customer-level and market-level barriers to EMS installation |
| Market Trends | • Key changes in the EMS market |

The findings from this research are presented in Section 2. The Market Evaluation Team developed these results based on 21 in-depth interviews with market actors, 26 in-depth interviews with EMS customers, and data collected through a telephone/online survey and onsite visits with commercial customers, conducted as part of the Commercial Baseline Study.

# SECTION 2

## Market Characterization and Assessment Results

# 2 Market Characterization and Assessment Results

## 2.1 Size of the New York Commercial EMS Market

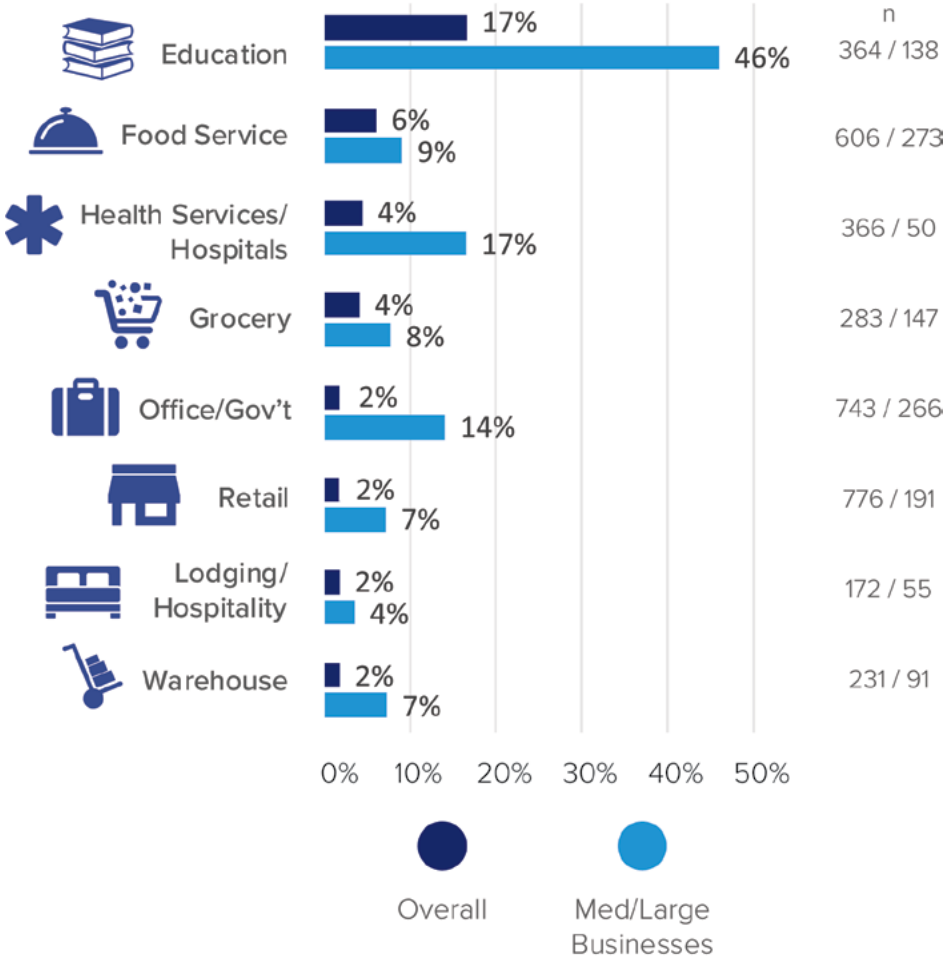
Results of the Commercial Baseline Study show that 3.2% of New York businesses have an EMS. Based on this penetration rate, there are close to 10,000 EMS in New York.[1] On average, EMS control almost 60,000 square feet of commercial space per business with EMS, or 57% of the facility size.

EMS penetration shows the following differences by business size, ownership, business segment, and region:

- **BUSINESS SIZE:** There is a large difference in the penetration of EMS between small and medium/large businesses (1% vs. 13%, respectively). This is expected, as small businesses generally do not have the size and complexity of energy-using systems that would require an EMS.
- **PENETRATION BY FACILITY OWNERSHIP:** Fifty-six percent of the commercial facilities in New York State are occupied by owners, while the rest are rented or leased. The penetration of EMS is higher in owner-occupied (or partially owner-occupied) businesses compared to those that are rented or leased (4.4% vs. 2.2%).
- **BUSINESS SEGMENT:** There are notable differences in the penetration of EMS by business segment, with education facilities having the highest penetration (46% among medium and large businesses, see Figure 1). Customers from the education segment indicated that they tend to consider the long-term benefits of facility upgrades – which reduces upfront cost as a barrier to EMS installation. The penetration of EMS among medium and large businesses in other segments is much lower, ranging from 4% to 17%.
- **REGION:** The penetration of EMS is highest in the Upstate region (3.5%), while Long Island/Hudson Valley and Downstate regions share similar penetration rates of EMS (3.1% vs. 3.0%, respectively).

[1] The unit of analysis of the NYSERDA Commercial Baseline Study is the "business," which is defined as a unique company/organization at a unique location. Based on Commercial Baseline Study results, there are over 367,000 businesses in the segments included in the study (i.e., office/government, retail, grocery/convenience, warehouse, lodging/hospitality, food service, health services/hospitals, and education).

Figure 1 | **Penetration of EMS by Segment**




## Penetration Definition

**PENETRATION** is a percentage that represents the proportion of facilities that have one or more of a particular piece of equipment. It is calculated by dividing the number of facilities with one or more of a piece of equipment by the total number of customers responding to that question.

## 2.2 EMS Installation Practices

Interviewed market actors reported that about three-quarters (76%) of new EMS installations are in existing buildings while nearly a quarter (24%) are in new construction. They found this trend to be consistent with the real estate market in New York State where there is more construction work in existing buildings than new construction.

According to 12 interviewed market actors, more than half (53%) of EMS are sold as packaged solutions installed with other energy efficiency upgrades while the remaining 47% are sold or installed as standalone solutions, defined as a one-time purchase of an EMS outside a broader set of energy efficiency upgrades.

In addition to installing new systems, some market actors also offer upgrades to existing systems. EMS upgrades include expanding existing EMS to control additional building operations and replacing malfunctioned hardware such as sensors. Interviewed market actors and customers provided different perspectives on the frequency of EMS upgrades:

- According to market actors, it is uncommon for customers to upgrade their existing EMS. In their experience, customers usually install completely new EMS or replace their existing EMS once it reaches the end of its useful life (15 to 30 years). Expanding existing EMS is often challenging because some suppliers intentionally design proprietary EMS platforms, which prevents integration of different systems.
- Interviews with customers suggest that upgrades to EMS are more common: one-third said they had upgraded their EMS, which involved integrating additional energy-using equipment to their existing EMS such as heating and cooling units, heat recovery ventilators,[2] and lighting systems. Customers made changes to EMS hardware in conjunction with other building renovation or expansion work, while the software was upgraded more frequently, depending on the availability of updates. A few interviewed customers experienced challenges with upgrading EMS hardware by itself as the installed controllable equipment must be compatible with the EMS.

### EMS Vendor Feedback

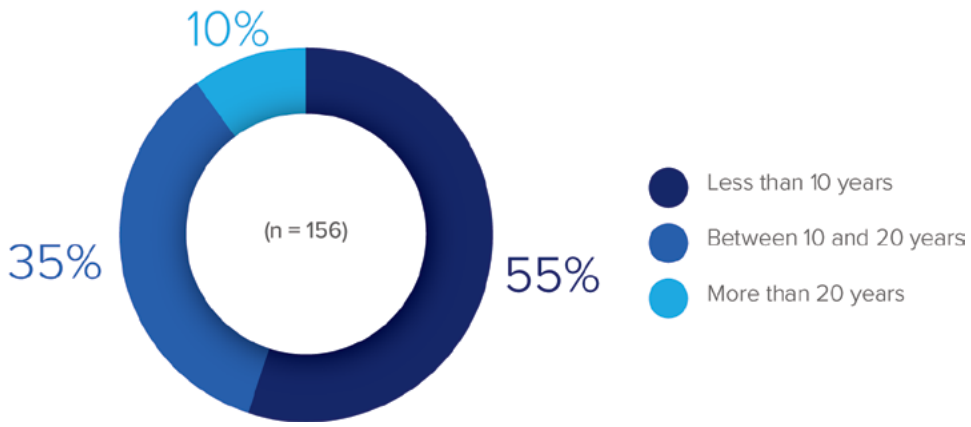
"There is very little proper new construction in upstate New York...The vast majority of what we've been seeing over the last five years is renovation work including like super heavy renovation work where the building is stripped down to its core structural components and completely redone."

"Once those [energy management] systems are installed, they are hardly ever upgraded or maintained, they kind of live out their time in that facility."

[2] A heat recovery ventilator reduces heating and cooling demands of buildings by using the heat from outgoing stale air to warm up incoming fresh air.

Key considerations when deciding whether to replace or upgrade an EMS include the age of the EMS, the scope of building renovations/retrofits, cost, and vendor recommendation. The results of the Commercial Baseline Study show that nearly half (45%) of the EMS in service are 10 years or older (Figure 2):

Figure 2 | **Age of EMS in Service**



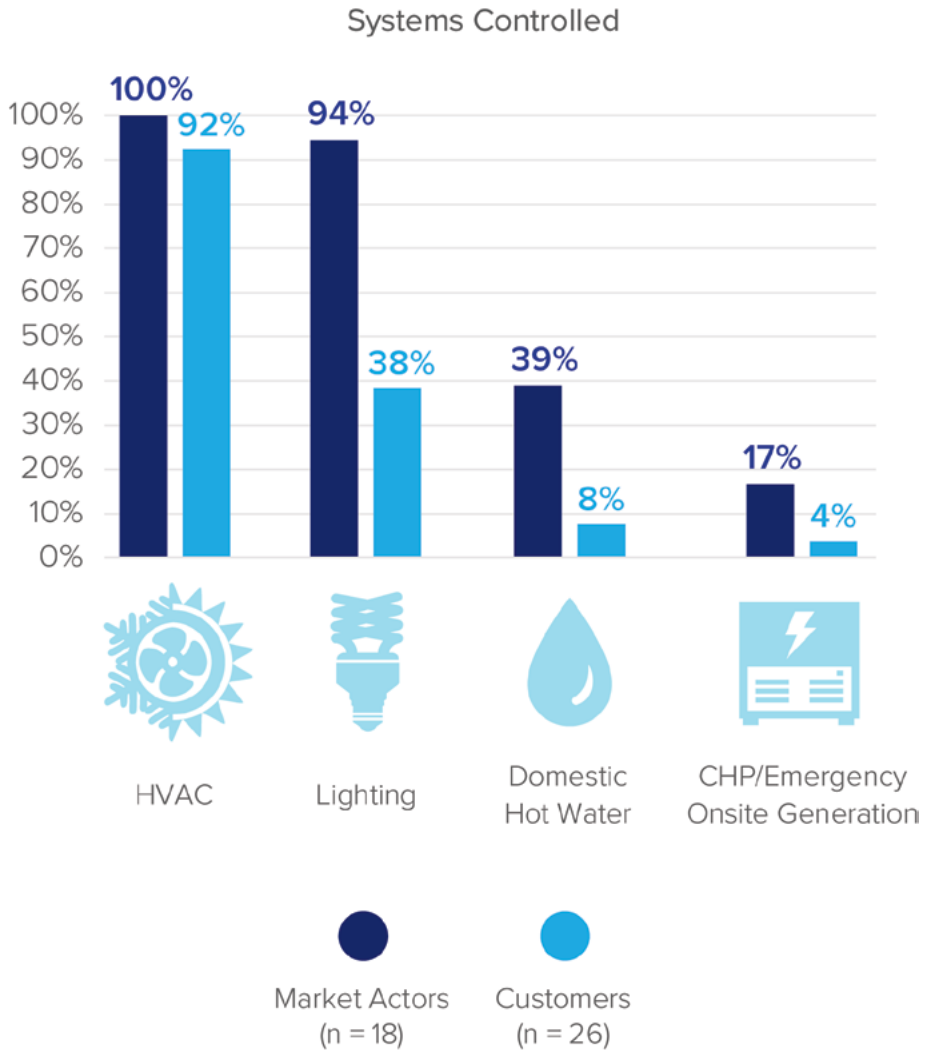

## Customer Feedback

"I would say that there are two approaches. One is if we are doing a major building renovation then we are going to automatically upgrade our EMS at that time. The other criteria would be that as the system (sic) age and start to become harder to service, then we try to schedule that into our capital plans so that we can replace them before we have major issues."

## 2.3 Commonly Controlled Systems and Strategies

EMS can automate the performance of various types of equipment in buildings. Figure 3 shows a comparison of the most commonly controlled building functions as reported by market actors and customers. All market actors and the vast majority of customers (92%) identified HVAC as the most commonly controlled system. While lighting was the second most commonly controlled system reported by market actors, less than half of customers (38%) reported using their EMS to control lighting equipment. Fewer market actors and customers reported domestic hot water and Combined Heat and Power (CHP)/ emergency onsite generation as systems controlled by EMS. Interestingly, while security/fire protection systems were identified by six market actors as a system controlled by EMS, this was not mentioned by any of the interviewed EMS customers.

Figure 3 | **Commonly Controlled Building Functions**



EMS have a wide range of control strategies that vary from simple capabilities such as scheduling to more sophisticated automation such as optimal start and stop and demand ventilation control:

**SCHEDULING** is a control strategy that allows end users to implement multiple scheduling scenarios with various on/off times and set points.

**TEMPERATURE SETBACK** is a strategy in which indoor temperatures are set to drift away (cooler or warmer) from the temperature setpoints during occupied periods. This strategy minimizes the difference between interior and exterior temperatures to reduce heating and cooling consumption when the building is unoccupied.

**OCCUPANCY-BASED CONTROL** strategies use occupancy sensors to determine if a space is occupied. Controllers adjust HVAC, lighting, and other devices according to occupancy.

**AN OPTIMAL START AND STOP** strategy uses different data inputs such as outside air temperature and building conditions to automatically determine when an HVAC system should turn on and off based on desired temperature range and occupancy. This strategy ensures that HVAC equipment turns on and off just in time at the beginning and end, respectively, of periods of occupancy, but not significantly earlier or later.

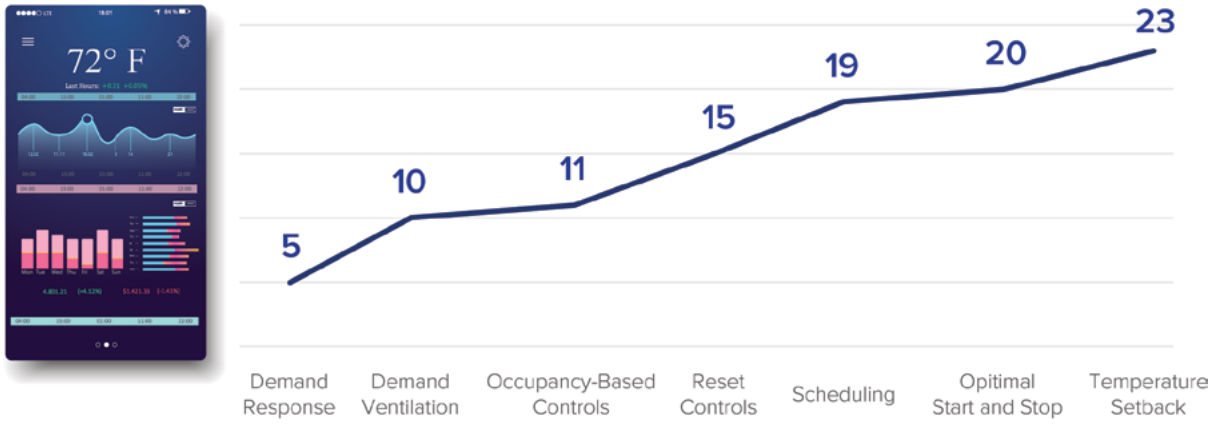
**RESET CONTROLS** include a variety of strategies that adjust set points based on actual demand. Common reset controls are: supply air temperature reset (supply temperature is adjusted based on the temperature of air returning from cooled spaces) and static pressure reset (static pressure is adjusted based on airflow demand in a ducted cooling system).

**PEAK DEMAND LOAD CONTROL** strategies monitor electric peaks at various intervals (hourly, daily, and monthly) to actively shed load of core components during peak demand periods.

**DEMAND CONTROL VENTILATION (DCV)** uses carbon dioxide sensors on the return stream of the air handler to reduce outdoor air intake during periods of low occupancy.

Half of the interviewed market actors reported temperature setback as a strategy used by EMS customers. One-third also mentioned optimal start and stop, and occupancy-based controls as common strategies used to optimize energy-using equipment. As for customers, most reported using temperature setback, optimal start and stop, and scheduling for optimizing their EMS (see Figure 4).

Figure 4 | **Control Strategies Used by Customers**




# EMS for Demand Response Purposes

While EMS can facilitate peak demand management, interviewed market actors voiced different opinions about the frequency of EMS being installed for demand response (DR) purposes:

- Some interviewed market actors (5) reported that it was fairly to very common for customers to install EMS because of their participation in utility DR programs while others (5) said that they have not encountered that situation or that it is not common in the market.
- Two interviewees noted that participation in DR programs was dependent on utility demand charges.
- One interviewee noted that DR program incentives have dropped considerably in upstate New York but have been relatively high in downstate New York, especially the New York City metropolitan area. This suggests higher potential application of EMS for DR purposes in the Downstate region.

Based on the Commercial Baseline Study, few customers use their EMS for peak demand load control and most of those who do did not originally install the EMS for DR purposes. A more common use of EMS' peak demand load control abilities is to set internal limits on peak energy use.

Customers in the health services/hospitals segment noted that it is not possible for them to participate in DR programs due to the critical nature of their services. Similarly, interviewees from the education and hospitality sectors explained that they are highly unlikely to participate in DR programs because they do not want to risk their occupants' comfort.

## ESCO Feedback

"If you are going to take part in a demand response program, you definitely would need to have an EMS system for sure."

## 2.4 EMS Customer Awareness and Behaviors

### 2.4.1 EMS Awareness and Familiarity

Interviewed market actors and customers agreed that customers are generally familiar with the basic capabilities of their EMS, including automation and control, but are less knowledgeable of more advanced functions. Many customers do not adjust EMS settings and most do not analyze EMS data to further optimize building operations. According to interviewed market actors, key reasons for low familiarity with EMS functions and capabilities include lack of time and resources.

On EMS Customer Awareness and Familiarity:

| Market Actors | | Customers |
|---|---|---|
| A majority of interviewed market actors (62%) find customers at least somewhat aware of EMS benefits and capabilities. | Awareness | Customers indicated an awareness of EMS and their benefits. |
| Facility staff have only a middling level of familiarity with the functionality of their EMS. They tend to focus on the core benefits, which include automation and control, instead of using and analyzing data generated by their EMS to further optimize building operations. | Familiarity | A majority of interviewed customers (67%) said that EMS facility operators are very or extremely familiar with the capabilities of EMS. But nearly half of them (42%) also said they rarely or never adjust the EMS settings, override the settings, or commission their EMS. |
| It is difficult for facility staff to retain the learned knowledge over time if they do not use their EMS regularly. | Decreasing familiarity over time | Customers use some controls regularly but do not use all the EMS capabilities. |

## 2.4.2 Usage Behavior

Market actors provided different opinions about whether customers actively use their EMS to optimize energy consumption: Approximately half (54%) of interviewed market actors thought that customers actively use their EMS. Market actors believe these customers are generally knowledgeable of their system's capabilities and building energy usage. While customers who do not actively use their EMS are knowledgeable of the basic functionalities of their system, market actors believe they do not want to pursue additional training to learn the full capabilities of their EMS. Interviewees also added that some customers are less inclined to learn more about their EMS because they are mainly concerned with using EMS to improve occupant comfort. Although it is beneficial for customers to actively use their EMS, it is unclear how much additional energy savings can be achieved if customers do take full advantage of all EMS capabilities since the systems are most likely programmed to target the largest energy savings opportunities.

### Engineer Feedback

"A lot of the operators, they do receive a training. They understand how [BMS] are generally operated too, and they find the 10 or 15 things that they're familiar with, and they'll track those things. They'll operate it based on those 10 or 15 things, but then there's a comfort zone they have to get out of in order to really maximize the capability of the BMS."

# EMS Training

All interviewed manufacturers, vendors, and service providers offer trainings – often both in-person and remote – to help customers maximize the value of their EMS:

- Training sessions vary in length depending on the complexity of trainings – from two to three hours to two to three days.
- The core objective of onsite trainings is to walk the customer through their EMS and help them navigate the system and understand its functionalities.
- Some service providers also provide additional assistance after the initial installation such as monitoring building operations to ensure that the EMS functions efficiently and discussing optimization strategies with customers.

Staff turnover may contribute to lack of customer awareness of EMS capabilities, which is prevalent despite the training opportunities offered by market actors.

- A majority of customers (70%) reported that they received some kind of training from their EMS vendor. The rest were not present when the original EMS was installed – they either joined the company later or did not install the EMS themselves and had to spent hours learning the most basic functions.
- Few interviewed customers (4 of 26) reported receiving ongoing training from vendors on their EMS.
- Most of the interviewed customers who received training and provided feedback about their experience (10 out of 14) were satisfied with the information they received about getting the most out of their systems, beyond just basic use. The rest found their training inadequate and had to teach themselves most of the functions.

## 2.5 EMS Maintenance Contracts

Most service providers (93%) offer maintenance plans with various lengths of contracts (one, three, five, and fifteen years), depending on project size and customer needs. Interviewees agreed that shorter service plans are more common for smaller installations. Interestingly, two market actors in the lighting EMS market said that their customers lack interest in service agreements. One interviewee cautioned that the lack of interest in ongoing maintenance for lighting EMS can be problematic because these systems are growing in their complexity and capabilities.

Market actors differed on how frequently customers choose to enter into maintenance contracts. About half of interviewees (55%) said that they are common, and customers generally renew contracts unless building owners have trained and knowledgeable staff on hand. Service providers can troubleshoot issues remotely or provide in-person assistance, as needed. The rest (45%) felt that these contracts are not as common. Once an EMS has been installed and commissioned, it is very unlikely for the system to require recommissioning. They seldom have to go back for changes or additions unless the customer has expanded their existing EMS.

Consistent with the split in market actor experience, half of the interviewed customers said that they have a contract to maintain their EMS, with 70% of these being annual contracts and almost all (93%) of these being with the original EMS vendor. These contractors provide technical support for customers, which allows the customers to take advantage of their EMS and maximize energy savings. Smaller businesses tend to be satisfied with using the basic capabilities of their EMS because an annual maintenance contract is another added cost.

## 2.6 Market Drivers

Interviewees identified three drivers influencing the adoption of EMS in New York State: benefits of EMS, marketing tools and information, and building codes and standards.

### 2.6.1 EMS Benefits

According to market actors, there are six key benefits of using an EMS desired by customers:

**ENERGY SAVINGS**
Allow customers to use computerized controls to operate equipment efficiently by meeting the actual demand and thereby reducing energy waste.

**REMOTE MONITORING AND MANAGEMENT**
Allow operators to use smart devices such as iPads and smart phones to monitor and control building operations: This maximizes operator time especially when staff is limited.

**OPERATIONAL EFFICIENCY**
Simplify and streamline building operations by allowing facility staff to monitor operations and control equipment across multiple buildings through a centralized interface.

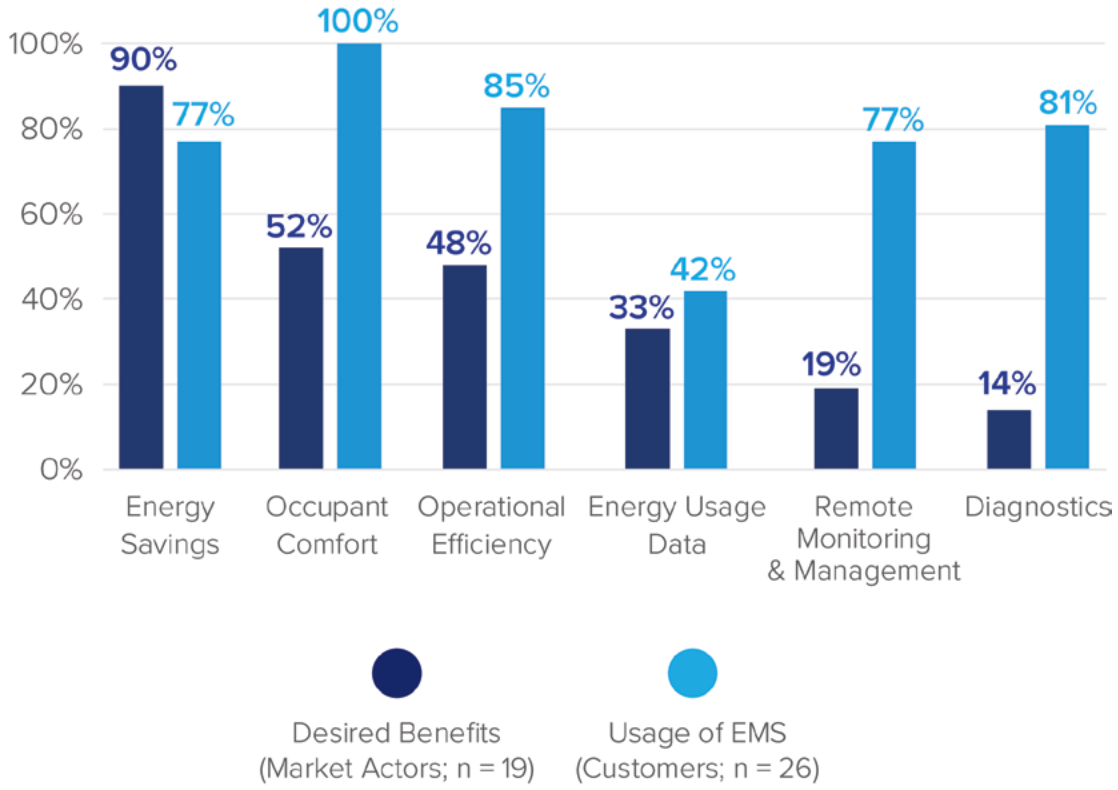
**ENERGY USAGE DATA**
Allow customers see how much energy they use, when they use it, and how to reduce energy usage.

**OCCUPANT COMFORT**
Allow building operators to maintain consistent temperatures and lighting levels without disrupting occupant comfort.

**DIAGNOSTICS**
Provide building operators with early warnings on system malfunctions or operational issues: Being able to identify and correct issues sooner will help increase equipment reliability, reduce repair and maintenance costs, and reduce occupant complaints.

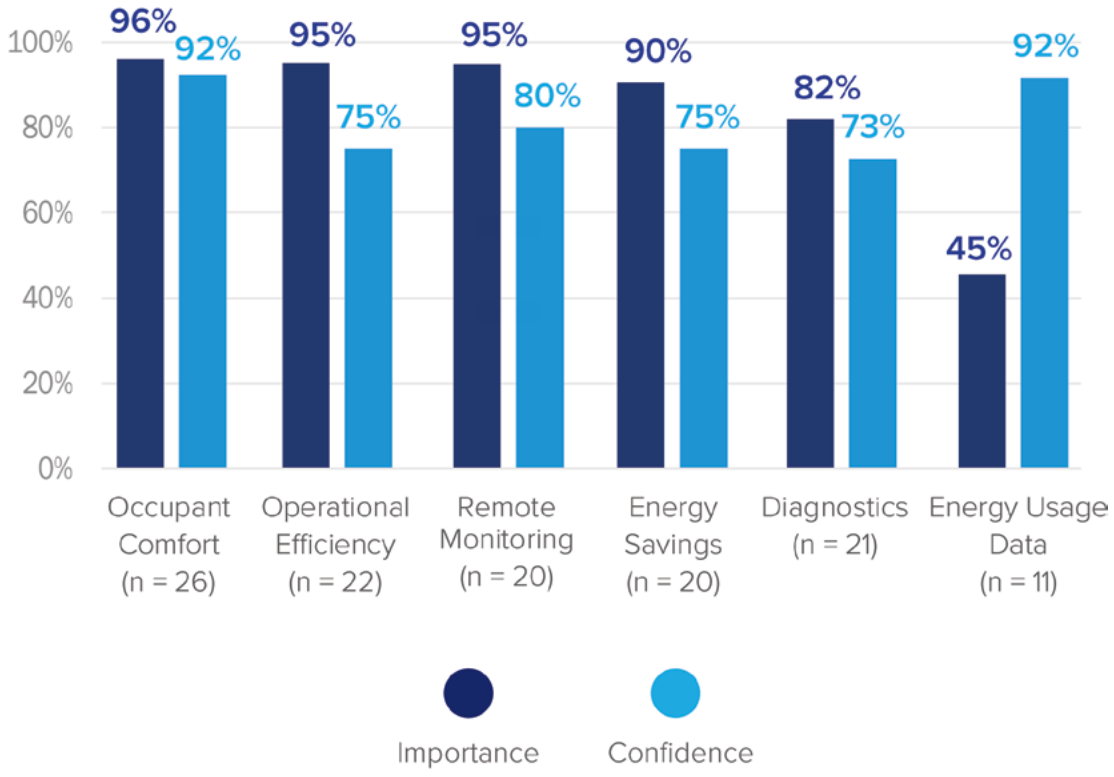
Interestingly, there is a difference in EMS benefits market actors think customers desire and how customers report using their EMS, i.e., the benefits they try to achieve (see Figure 5). According to market actors, achieving energy savings is the most desired benefit for customers, but it is not the main goal of EMS usage. Instead, all interviewed customers reported using their EMS to achieve occupant comfort and 85% to achieve operational efficiency.

Figure 5 | **Market Actor Perception of Desired Benefits vs. Customer Usage of EMS**



Customers who use their EMS to achieve a benefit also reported on the importance[3] of the benefit and their confidence[4] in having achieved it (see Figure 6). Occupant comfort, remote monitoring and operation efficiency were the most important benefits achieved by customers. While they care about achieving energy savings with their EMS, collecting energy usage data is less important to them. They are also the most confident that they are able to achieve occupant comfort and remote monitoring with their EMS. Customers are less confident about diagnosing system malfunctions or operational issues with their EMS.

Figure 6 | **Customer Confidence In and Importance of Having Achieved EMS Benefits**




[3] A benefit was considered important if the customer rated it as either "very important" or "somewhat important."
[4] A customer was considered confident in having achieved the benefit if they rated themselves as either "very confident" or "somewhat confident."

# Summary of Key EMS Benefits

- **ENERGY SAVINGS:** Typical EMS energy savings targeted by market actors and achieved by customers range from 20% to 50%. However, customers are not very confident about having achieved these.
- **REMOTE MONITORING AND MANAGEMENT:** Most customers (80%) have access to their EMS through any device connected to the internet, while the rest had to use system-specific applications. Nearly three-fourths (73%) of customers trusted a third party such as their installer or maintenance company with remote access to their EMS.
- **OPERATIONAL EFFICIENCY:** Most interviewed customers (84%) use their EMS to streamline or simplify building operations and it's important for almost all these users (95%) to achieve operational efficiency.
- **ENERGY USAGE DATA:** Less than half (42%) interviewed customers monitor their energy use. The rest, mainly smaller businesses, hope to track their energy usage data but lack the necessary time or resources to accomplish it, with around 41% of the respondents not having a dedicated energy management staff.
- **OCCUPANT COMFORT:** Almost all interviewed customers (96%) reported that occupant comfort is a very/extremely important benefit to them, and they were similarly confident of having achieved it.
- **DIAGNOSTICS:** A few interviewed market actors (14%) perceived that customers desire the ability to diagnose operational issues through their EMS, but most interviewed customers (64%) reported this as an important use of their EMS.

## Respondent Feedback

"If there is any situation that arises on the weekend, they don't have to run to the building, they can actually look on the phone or log in on their own computer, check out the system first before they run out there."

*- ESCO*

"It doesn't just say a gas problem. It will say your gas valve has failed or something like that, it will give you options for troubleshooting."

*- Customer*

## 2.6.2 Marketing Tools and Information

The most common marketing tool used by market actors to target customers is calculations of energy and cost savings (14 of 19 interviewed market actors). Few market actors use other tools, such as case studies or incentives (see Figure 7).

Figure 7 | **Strategies Used by Market Actors to Target Customers (n = 19)**

## 2.6.3 Building Codes and Standards

Overall, a majority of market actors (74%) believe that building codes and standards have some to great levels of influence in the New York State EMS market. In New York City the New York City local laws are a key driver because of their reporting and sub-metering requirements that influence customers to install EMS (see Table 2). Local Law 87 of 2009 also requires buildings to obtain energy audits, which are useful for energy benchmarking purposes.

Table 2 | **New York City Local Laws**

| Local Codes and Standards | Requirements |
|---|---|
| LL84: Benchmarking[5] | Requires large building owners to submit yearly energy and water consumption |
| LL87: Energy Audits & Retro-commissioning[6] | Requires large building owners to conduct energy audits and retro-commissioning and submit the Energy Efficiency Report every ten years |
| LL88: Lighting Upgrades & Submetering[7] | Requires large non-residential buildings to upgrade lighting to meet New York City Energy Conservation Code standards and sub-meter large non-residential tenant space |

Some market actors suggested that stricter building standards and enforcement could have a greater influence on EMS adoption:

- Some interviewees (3) thought that building codes and standards do not have much influence on EMS adoption, particularly in the lighting market, because the existing laws only require the bare minimum such as occupancy sensors.
- Another two interviewees said that building codes had no influence because building owners have already picked the "low-hanging fruit" such as more efficient lighting and lighting controls. Additional upgrades would have a longer return on investment of about 15 years.
- One interviewee commented that LL87 is not very stringent because it only requires data to be submitted every ten years.
- One market actor thought that "the penalties aren't strong enough."
- Another market actor reported a lack of code enforcement in upstate New York.

[5] Added article 309 to Section 1. Chapter 3 of Title 28 of the New York City Administrative Code.
[6] Added article 308 to Section 1. Chapter 3 of Title 28 of the New York City Administrative Code.
[7] Added articles 310 and 311 to Section 1. Chapter 3 of Title 28 of the New York City Administrative Code.

## 2.7 Market Barriers

Interviewees reported a range of customer- and market-level barriers to the adoption of EMS in New York State.

### CUSTOMER-LEVEL BARRIERS:

- **UPFRONT COST:** A majority of market actors (74%) and customers (62%) identified upfront cost as a barrier. EMS installations require a large investment, and it is a barrier for some customers to come up with the funds to perform these installations or upgrades. Two market actors also noted that lack of incentives can further prevent customers from overcoming financial constraints.

- **LACK OF KNOWLEDGE OF EMS FUNCTIONALITIES AND BENEFITS:** Interviewed market actors and customers also consider the lack of customer awareness and knowledge of EMS capabilities, especially at the upper management level or among the decision makers, as a barrier to adoption. Interviewed energy management staff who understand the benefits of EMS said that they had a difficult time convincing their superiors of an expensive investment that they had never heard of. About half of interviewed market actors (10) and four of sixteen interviewed customers who responded to this question agreed that lack of understanding of EMS functionalities and benefits remains a large challenge in the market.

- **LACK OF KNOWLEDGEABLE BUILDING STAFF:** Approximately one-quarter of market actors (26%) identified lack of knowledgeable facility staff as a barrier for customers. Some building owners do not have trained operators who can work with the EMS. Facility management turnover is another issue that adds to the challenge.

- **SPLIT INCENTIVES:** Split incentives are another barrier to the adoption of EMS, identified by three customers. Split incentives occur when building owners make capital investment decisions that can impact tenants who are responsible for paying energy bills.[8]

### Respondent Feedback

"The problem is 99.9% of people don't even know what it is. So when I go and say I need $40,000 for something people are like [why should] we do that? They don't understand what the value of it is."

- Customer

"A lot of times, organizations will get stuck with systems that are much more complex than they have the in-house capability to manage or monitor and this could end up with the system being abandoned because... nobody knows how to use it; when they try to use it they get so many complaints from people [that] they decide this isn't even worth it."

*- EMS Vendor & Service Provider*

[8] Based on responses to the Commercial Baseline Study survey, 39% if businesses with EMS rent or lease the facility.

- **SECURITY CONCERNS:** Two market actors reported that some customers are worried about their EMS being hacked. As a result of this concern, service providers are not able to gain remote access to systems that would allow them to troubleshoot errors quickly. In these situations, EMS customers may incur additional costs because technicians will have to travel to their facility to fix the issue. Interestingly, a majority of customers (76%) did not seem to be concerned with these security issues and allowed vendors remote access to their EMS so that issues can be resolved quickly.

**MARKET-LEVEL BARRIERS:**

- **LACK OF STANDARDS AND GUIDELINES:** Two interviewees reported that a main challenge in the industry is the lack of standards and protocols for designing and installing EMS. As a result, manufacturers and vendors have created their own (sometimes proprietary) platforms, causing compatibility issues between different EMS products. One engineer also pointed out that the industry currently lacks standards for quantifying energy savings from EMS installations, which makes it challenging for engineers and service providers to present achievable and practical energy savings estimates for the client.

- **LOW ENERGY PRICES:** Two market actors reported that low energy (oil, gas, and electricity) prices have reduced the growth in the EMS market. When energy prices are low, companies tend to be less interested in saving energy and therefore budget less money for fuel and energy improvements in subsequent years. This creates a problem when energy prices rise because owners do not have the budget to install energy efficiency upgrades.

## EMS Service Provider Feedback

"[There is a] lack of policy, guidelines, and codes in New York and it has resulted in the vast proliferation of nonstandard control systems and EMS systems."

## 2.8 Market Trends

EMS technology has transformed building automation from the traditional pneumatic[9] and analog controls to direct digital controls (DDC) that use microprocessors to digitally control equipment. In addition to this transformation, market actors also foresee the following key changes in EMS market moving forward:

- **FUTURE GROWTH:** Some of the interviewed market actors (39%) predicted that there will be increased demand for EMS in New York State. The demand will be driven by a wide range of factors including utility incentives and increased consumer demand for data analytics.
- **INTEGRATED YET NOT INTEGRATED:** Standard communication protocols such as ASHRAE BACnet®, Modbus®, and LonWorks® have improved the interoperability of EMS by allowing systems from different suppliers to be integrated at the server level into a single-operator interface. Despite these advancements, the industry is still far away from full compatibility where EMS components and devices from different manufacturers and vendors can be combined with each other.

[9] Pneumatic controls use compressed air as a medium to control air flow.

- **CLOUD-BASED PLATFORM AND WIRELESS CONTROLS:** Another technological trend identified by interviewed market actors is the transition to cloud-based platforms[10] and wireless controls. While these technological advancements will improve customer access to EMS and ease of installation, some market actors warned of potential challenges due to security concerns by their customers. One market actor reported that as EMS software programs become more advanced and complex, it requires building operators to develop more information technology knowledge.

- **INCREASED COMPETITION:** Some interviewed market actors predicted increased competition in the market. One interviewee pointed out that there is a growing number of companies manufacturing EMS systems focused on lighting, due to the lighting industry's shift toward LEDs. There is also an influx of products from overseas, which makes it harder for customers to navigate the market. According to this interviewee, multiple players in the lighting market create confusion for customers, engineers, and even sales representatives who do not take the time to do their own research to determine what the best EMS solution is for their customers. The interviewee also noted that this observation in the lighting market is different in the HVAC industry where there is only a fairly small number of market players who have a strong grasp on the industry, which allows for a centralized and direct message to customers.

## Respondent Feedback

"While there's been some good movement in the EMS field in order to help us standardize and remove some of the proprietary nature of some of these software, there still are systems out there that are proprietary in nature, and that's a real headache for a lot of our clients. It's a headache because if you choose a proprietary system, you have to go to that manufacturer for repairs and other services."

*- Engineer*

"As the systems become more network-based or internet-based, communication languages become standardized, which more allows for completion. More vendors can now sell product that will talk to each other which is a huge value to the building owner."

*- EMS Vendor and Service Provider*

[10] Cloud- or web-based EMS platforms allow customers to access and interact with their EMS using Internet connection.

# SECTION 3

## Summary of Key Findings

# 3 Summary of Key Findings

## 3.1 Barriers to EMS Adoption

Interviewed market actors and customers shared some challenges that they thought delayed the wider adoption of EMS. According to customer interviews, there is a general lack of awareness about EMS and their benefits among commercial businesses, especially at the upper management level. Energy management staff, who are knowledgeable about EMS, may understand the benefits of adopting EMS but find it challenging to convince the decision makers of investing in this. Most businesses that have an EMS are overall very or extremely satisfied with the energy savings or non-energy related benefits of their EMS (e.g., improving occupant comfort or diagnostics). Despite the benefits of EMS, the penetration of EMS in New York State is low (13%) among medium and large businesses.

The majority of market actors (74%) and customers (62%) agreed the high upfront cost of EMS is one of the key barriers to adoption. Customers who are aware of the benefits and are interested in installing a new EMS or upgrading their existing system are often discouraged by the large upfront investment needed. Those that lack the knowledge about EMS benefits, are even further discouraged to install EMS after learning about the costs. As such, it is not surprising to see that the penetration of EMS for medium and large businesses in most business segments, except education, is not very high (18% or lower).

## 3.2 Limitations of EMS Training

All interviewed manufacturers, vendors, and service providers said that they provide some form of training to their customers. Yet, only 70% of the customers said that they were trained in operating the EMS. The rest were not present when the original EMS was installed – they either joined the company later or did not install the EMS themselves. Further, 33% of those who were trained were dissatisfied with what they had learned. Even for those who were satisfied, most of them did not remember their training over time and utilized only a small number of routine functions. So, manufacturers, vendors, and service providers are offering the requisite training, but it seems that customers feel they could use some more regular guidance to get the most out of their EMS.

## 3.3 EMS Benefits

There is a large difference in the interviewed market actors' perception of EMS benefits desired by customers and functions for which interviewed customers use their EMS. The starkest difference is for diagnostics, where only 14% of the market actors feel that customers desire it, but 81% of the interviewed customers use their EMS to diagnose operational issues. Also, almost all interviewed market actors (90%) felt that energy savings is one of the key benefits desired by customers. But almost all interviewed customers (96%) said that EMS is important for them to maintain their occupants' comfort, while only 70% of them said that its important to achieve energy savings.

# SECTION 4

Methods

# 4 Methods

## 4.1 Secondary Research and Data Review

The Market Evaluation Team reviewed a wide range of materials to better understand the New York State EMS Market, inform the data collection instruments, and provide context around the results. The Team conducted secondary review of EMS market assessment reports, evaluation reports, industry webinars, and building codes and standards.

## 4.2 Market Actor In-Depth Interviews

The Market Evaluation Team conducted in-depth interviews with 21 market actors, including 14 vendors and service providers, 3 Energy Service Companies (ESCOs), 3 manufacturers, and 1 engineering firm. 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.

The Market Evaluation Team developed a sample of 195 market actors from a variety of sources, including secondary research and recommendations from NYSERDA. The Market Evaluation Team also applied a "snowball" sampling approach where interviewed market actors were asked to identify and recommend other important firms and individuals who the Market Evaluation Team should speak to as part of the study.

## 4.3 EMS Customer In-Depth Interviews

The Market Evaluation Team conducted in-depth interviews with 26 commercial businesses that own an EMS. The sample frame was developed using data gathered from the Commercial Baseline Study and included a total of 328 customers with EMS. The sampling for this effort was completed in two phases (in November 2018 and January 2019) due to ongoing commercial baseline survey efforts. For both waves of sampling, all customers who indicated having EMS technology were included. The sample points were randomly sorted, but customers with contact information (phone number or email address) and customers who had not completed an on-site visit were prioritized.

The purpose of these interviews was to characterize EMS usage, understand drivers of and barriers to installing EMS, and identify ways in which customers maximize benefits from these systems. The Market Evaluation Team explored topics such as usage behaviors for installed EMS, savings achieved, customer satisfaction with these savings, awareness of and confidence in benefits of EMS, and customer experience with market actors. These interviews were qualitative in nature, and responses were used to identify any patterns or stories that emerged from customer experiences using an EMS. They also provided context to the topics covered in the other data collection activities.

## 4.4 Baseline Study Survey and Onsite Visits

The Market Evaluation Team used primary data collected through a telephone/online survey and onsite visits, as part of the Commercial Baseline Study, to inform this market assessment. The Commercial Baseline Study provided information on the penetration and characteristics of existing EMS.

The methodologies for the baseline study survey and onsite visits are described in detail in Volume 1 of the overall Commercial Baseline Study report.