

Quantifying the Benefits of an Energy Management System

White Paper | July 23, 2013

Introduction

Leaders in the retail industry have long recognized the role that energy efficiency can play in reducing operating costs, increasing asset value, and improving occupant comfort. However, nearly every retail building offers some opportunity for energy efficiency improvements. In fact, on average, 30% of the energy used in commercial buildings is wasted, according to the U.S. Environmental Protection Agency. A building's most energy-intensive assets – HVAC and Lighting – typically make up more than three quarters of a retail building's energy use.

Most existing facilities were built without sustainability as a priority, and retrofitting these buildings can be very costly and unfeasible for retailers who are trying to control costs and maximize profitability. Without the need to rip out and replace existing equipment or go through an intrusive, laborious retrofit project, an Energy Management System is (EMS) a cost-effective and straightforward way to curb energy consumption. A fully integrated, centrally controlled EMS identifies abnormalities and improves the efficiency of the highest energy-demand equipment in a facility:

- Heating/Ventilation/Air Conditioning (HVAC)
- Indoor/Outdoor Lighting and Signage
- Walk-In Refrigerators/Freezers

With an EMS, primary savings are achieved through reduced energy bills. Peripheral functions, such as HVAC mechanical diagnosis, provide additional gains throughout the life of the system. Return on investment is targeted for less than two years with many installed customers seeing payback in a shorter period. The savings a company can achieve, however, is dependent on the level of automation that is selected.

An EMS provides a unique strategy for retailers, with some companies curtailing up-front costs and offering pay-as-you-go programs. Most importantly, when executed correctly, EMS companies conduct an in-depth Measurement and Verification (M&V) process using a handful of pilot locations that accurately represents how much money a company could save by implementing EMS controls across their entire chain. M&V is the practice of measuring, computing and reporting the results of energy saving projects. This article describes the key steps for completing a rigorous M&V analysis that will withstand the scrutiny of even the most skeptical CFO or Capital Committee.



Retail buildings in the U.S. are second only to office buildings in total energy consumption.

How to properly measure and verify the savings an EMS can deliver

Timeline and Procedure

Many companies believe that a 12-month period is required to get representative M&V data in order, collecting month-to-month figures around all possible temperatures, operating hours, and more. However, this process actually damages the accuracy of the data since so many variables can change within a one-year period, such as degradation of existing equipment, installation of new equipment or more efficient light bulbs, different operating hours, or new management that is more (or less) cognizant of energy costs than the prior. Since all of these factors can negatively impact the quality and accuracy of data, leading EMS providers have begun performing M&V over a much shorter period, often completing the process in two months or less. The shorter timeframe gives the EMS provider or engineering firm the ability to look at the energy usage

data from a daily perspective, instead of month-to-month, so more effective adjustments can be made for differences in temperature throughout the month.

Energy management professionals should use services like Weather Underground as part of their analysis to find out daily changes in average temperature and try to adjust the differences for days within the month. Also, it's important to provide incremental usage every 15 minutes over a 24-hour period so that on days with similar temperatures, the difference before and after energy controls are implemented is visible and the retailer can see when EMS is making the most difference: during the night? At the peak of the day? Is EMS keeping peak usage in the middle of the day lower than it was before controls were put in place? Many utilities are beginning to penalize customers with excessive peak usage, so this information is important to know.

There are six key steps for any successful M&V analysis:

Step 1: Site Selection

Ideally, the M&V process will begin tracking data for approximately four to five of a retailer's sites. One site does not provide representative data, since different geographic regions and managers can have a huge impact on a store's energy usage level. Selecting multiple sites will allow the EMS provider to get a more representative sample of what the retailer's savings might be if they implemented controls across their chain, since the ROI will be based on the average savings across a variety of locations.

Step 2: Install Logging System

Some EMS providers will simply look at a year's worth of utility records to see how much energy the retailer is using and when. However, this resurfaces the problem of looking at data month-to-month instead of daily, and it's important to ensure that the utility meter is tracking usage accurately. Ideally, the EMS provider should install its own energy meter to track the site's usage and perform a meter match against the utility's meter. This is key, since it enables the EMS provider to validate that the meter it is using to track the data and potential savings is completely accurate and that there are no questions as to the reliability of the results that will be presented regarding cost savings and ROI.

Additionally, using a separate meter that is independent from the utility's meter can sometimes reveal that the utility is actually overbilling the customer because it is not tracking correctly. In one case, a popular fitness club brought in an EMS provider and could not understand why its energy bills were so high – after doing a meter match, they discovered that the utility was using an incorrect multiplier in its billing and the club had been overbilled by almost \$250,000 in a 9 month period – five times what they should have been billed based on usage and rates. After discovering the discrepancy through working with the EMS team, the club was able to get all of this excess refunded.

Step 3: Establish Baseline Metrics and Log Data

In this stage of the M&V process, the EMS provider collects a variety of temperature data each day throughout the baseline period – ideally including days that are above and below the average annual temperature for that site. When closely tracking data in real time over a two-month period, it's important that the retailer does not make any unnecessary operational changes during the baseline period, such as retrofitting/adding new equipment or changing store hours. Business rules must remain consistent throughout the entire baseline and control periods.

The baseline period generally takes three to five weeks, but the engineer assigned to the M&V should not call for controls to be implemented until enough baseline data has been collected. The retailer should always be confident that its EMS provider is not rushing through the M&V process simply to get paid. Additionally, the energy management engineer must ensure that certain variations in temperature and other variables are met before the controls are put in place.

Step 4: Implement Controls and Log Data

Even just a day or two after controls are installed; the EMS provider begins looking for a step-function in energy usage. It should be very apparent that something has changed from the baseline to the control period. The level of energy usage overnight should be consistent since the energy controls have now taken over. Night energy usage would no longer depend on what a manager did or did not do in their shift close, but instead should stay consistently low. It is important to look for changes based on temperature versus those affected heavily by schedule changes. For example, turning lights on 45 minutes later each day is a change that should remain consistent year-round – so the amount of savings for this particular change should be constant throughout the year.

Changes influenced by temperature should be analyzed as well – again, using real-time data collected every 15 minutes so the retailer is not relying on monthly temperature averages that are inaccurate due to a few atypically extreme weather days. Instead, the retailer knows exactly what the operational conditions and temperatures are at any given time, every day throughout the control period.

Also during this time, the engineering team analyzes the data constantly to see what they could be doing differently to achieve greater savings. An EMS provider should not simply put controls in place, start collecting the data, and walk away until the control period is over. Refining the controls is critical to maximizing cost savings, since particular controls may have been misinterpreted or misconfigured initially. For example, the control may turn a retailer's HVAC on 45 minutes before opening to get the store to the right temperature. However, the store may have very efficient HVACs and only needs to turn them on 15 minutes prior to the store opening – the savings based on this subtle change alone could be very substantial over a year. Additionally, each time a control is refined by the

EMS's engineering team, the retailer has the ability to see the change that was made and the reason for it in the EMS's web-based data center. The important takeaway is that energy management is not a "set it and forget it" initiative – it's an ongoing process that must be managed to be most successful.

Step 5: Compare the Baseline and Control Results

In this phase, the EMS provider presents a figure that the customer can depend on as the average savings across its enterprise after installing the energy controls equipment. The customer should realize going in that some sites will produce more dramatic changes and savings than others, since each store is managed and operated differently and in different conditions. Even with sites that previously were more productive than others in energy efficiency, implementing the best EMS solutions can still provide the opportunity for additional savings.

Step 6: Approve Cost-Savings Validation and ROI Analysis

At this step, the EMS provider should go back to the retailer with a comprehensive ROI analysis. Once the retailer reviews and approves the validation of cost savings across the test sites, it may decide to select another set of sites to begin installing. An EMS provider should always be able to back up their initial M&V process. Some providers even offer to perform additional M&V in further roll-outs to continue proving that the technology can continue delivering the kind of results and ROI that was initially presented. The retailer can rest assured that the EMS provider was not being more thorough in the initial M&V simply to get the sign-off on additional sites.

Additional quantitative factors that increase the ROI

It is also important to remember that, in addition to the energy savings the M&V process proves, there are additional quantitative factors that increase the ROI of implementing energy management technology. Retailers gain valuable visibility through EMS that can reduce maintenance costs and identify equipment that is not working to get it fixed

quickly. If the system highlights an exception that a piece of equipment has stopped running correctly, the EMS provider could try rebooting the equipment remotely and avoiding a service call altogether. This often solves the problem and saves the retailer a costly service visit. EMS providers also often work with utilities to enroll their joint customers in demand response programs in which the utility pays its participating customers to reduce their load during peak times.

Other "soft benefits" of implementing EMS that are not necessarily part of the M&V process include enhanced brand image and environmental sustainability, as well as consistent customer comfort. While these factors can't be easily quantified, they are certainly significant contributors to the strategic value of implementing EMS.

It is important to isolate the effects of variables such as outside temperature and store operating hours when calculating the energy reductions achieved by EMS using advanced techniques such as linear regression.

Conclusion

In today's competitive retail environment, the number one priority is saving money. Operators of most large chains find energy to be among their biggest expenses. In fact, retail buildings in the U.S. are second only to office buildings in total energy consumption. An Energy Management Systems (EMS) is a cost-effective and straightforward way to curb energy consumption without a huge upfront capital investment or an intrusive, lengthy implementation. This generates cash that can be re-invested directly back into the company.

When the CEO and CFO asks "Will it save us money? Can you prove it?" – retailers can point to energy management technology and confidently answer "Yes." The level of accurate ROI measurement and verification that EMS providers can do – when they do it well – is unmatched in the retail technology industry.

Siemens Industry, Inc.
Building Technologies Division
Retail & Commercial Systems
 9225 Bee Cave Road, Bldg. B, Ste. 100
 Austin, Texas 78733
 Tel. (512) 306-9400
 Fax. (512) 306-9445
siemens.com/sitecontrols

All rights reserved. Printed in USA 434-5837P10
 ©2013 Siemens Industry, Inc.