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Using Web-based control systems to manage building utility usage

Root of energy, utility management is data collection, analysis

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Web-based building controls can yield substantial energy savings, if used correctly and in the right applications. Foundry manufacturer Peerless was able to bring its offshore manufacturing back to the U.S. with better energy control and management.

Active energy management plans can reduce energy costs by 15 to 45 percent (ASHRAE Journal, April 2011). With savings like that, why haven't more manufacturers implemented successful energy management plans? The answer is that daily manual monitoring is time-consuming, tedious, and difficult to sustain.

After all, a manufacturer's No. 1 priority is to produce product. The prevailing attitude is that the costs of energy and other utilities required for production are fixed or only slightly improvable. Why spend a lot of time attempting to manage things that cannot be changed? Therefore, even with manufacturers' best of intentions, energy management plans fall to the wayside, and energy leaks simply become part of the daily cost of operations.

Organizations have been around for decades to aid in daily energy and utility management (see **Energy Management Resources** sidebar). All of these organizations reference building automation systems, metering, and submetering to help reduce energy consumption, while incorporating building automation was part of past discussions, it was not a priority. Why? Capital cost is certainly a factor, but also, building automation typically has been limited to setting temperatures and on/off schedules. With proper scheduling, a building automation system can save energy, but it really is not designed to meter, or monitor, actual daily usage of power, water, steam, gas, and oil.

Furthermore, referring to building automation systems as "energy management systems" is fundamentally misleading. One key ingredient is missing, and without it, the entire process can deflate. That ingredient is data collection.

So how can manufacturers collect accurate information in a timely fashion, control energy leaks, and still focus on making products? One option is a high-tech, Web-based monitoring systems.

Today's Web-based Building Energy Management

The good news is that the same technologies used in first-generation building automation systems have evolved to become very powerful weapons to fight costly daily energy leaks. Today's high-tech, Internet-based, programmable technologies such as Tridium's JACE®; Honeywell's WEBs-AX; Johnson Controls' Facility Explorer® (FX); Schneider Electric's PowerLogic™ ION™, and E-Mon/D-Mon's energy software are tireless workhorses.

These Internet-based, programmable technologies are constantly evolving. They incorporate high-tech metering, networking, communications, user-pro-grammable logic, and mathematical functions. When combined with access to data such as ambient temperatures and utility rates available on the Internet, these systems can monitor and collect data every 15 minutes. In addition, they can interpret data, send e-mails, sound alarms, and even make appropriate system adjustments. This way, plant managers and facility operators can stay informed while concentrating on production. These newer Web-based systems are expandable, simple to use, and cost-effective. They are at the forefront of today's energy management plans to produce results.

Steps to Building an Energy Plan

Build a Team. The first step in a successful energy plan is forming the team and identifying key members. Key members typically are an energy manager, department heads, upper management—and the control system.

The energy manager organizes the team, interprets the data, suggests changes, and more or less keeps score. Most plants and processes are continually changing, so the energy manager must continually watch and monitor the data and the system.

Upper management applies the pressure. Just as fluids will not flow without pressure, an energy management program will not work without pressure from upper management. These managers should apply pressure by establishing the rewards for meeting or exceeding the goals and enforcing the penalties for missing the goals.

Department heads must clearly understand their processes and must be authorized to make changes. With upper management support and pressure, knowledgeable department heads begin to dig into processes to find energy savings. This is where processes are truly analyzed, improved, and made more efficient. The results and benefits can be eye-opening. Often these department heads already have ideas to improve a process but never had the motivation, forum, or support to express their opinions.

The final team component, the control system, is a critical key member that does the dirty work, tirelessly collecting data and keeping the rest of the team properly informed.

Define Goals. Once the team is formed, it is important to set up regular meetings to define the energy and utility saving goals. At first meetings might need to be weekly, but in time, monthly or quarterly meetings may be adequate.

The focus of these meetings is to identify and categorize processes, subprocesses, and the related timelines. The key to success is to look at all processes from an energy perspective with clearly defined, quantifiable goals. For example, a good goal is to save 15 percent on all processes in the first year. Keep in mind that the target numbers are expected to change from year to year, but the target numbers should change only once a year.

Select a Utility Rate Structure. A very important step of an energy management plan is to select the correct utility rate structure. Most manufacturers have been approached by deregulated energy providers and have made decisions regarding these suppliers. For instance, time-of-day and market-indexed rate plans can really save money. However, it may be difficult to make the decision to switch to an alternative rate structure plan. This is where the tools available in Web-based automated systems really shine.

For example, a rate structure tool allows a manufacturer to compare and contrast various types of utility plans using the existing energy usage data collected hourly. These sophisticated tools compare, plot, and project future performance. Many have a number of accounting tools as well as energy management tools. Honeywell's Energy Analytics, for instance, has a tool called What-If Analysis, in which the manufacturer mocks up a potential energy conservation measure and the tool plots and records how these mocked-up settings compare to actual usage. This allows the manufacturer to see how an energy conservation measure will perform before it spends money to make the changes.

Also, if set up properly, the tool can alert the energy manager when utility rates rise above acceptable limits. A good energy manager understands and uses these tools to maximize daily energy and utility cost savings.

Include Water, Other Resources. Energy and utility savings are most commonly thought to apply to power only. A solid energy management plan considers all utilities, even if they are considered inexpensive today, like water. Many U.S. states have clean water problems. Globally, clean water is considered to be the No. 1 desired future resource —even more than oil.

Modern building management systems can meter, monitor, record, and trend power, water, gas, oil, steam—just about anything that flows. Today's systems are expandable, so adding future metering and controls is usually only a matter of adding programming and meters to the network.

In addition, these systems are custom-programmable as required per facility. The system should be customized to monitor all the critical utilities with consideration for future resource requirements and future expansion.

Putting the Plan in Action

The first year mostly consists of 24/7 data collection, establishing baselines for energy and utility usage, and setting goals. Day-to-day, week-to-week, and month-to-month trends begin to become apparent. Ever-present anomalies, such as outside lights in use during the day, high usage at night, or high compressor usage because of leaks, will become apparent too.

The next year it is the energy manager's job to set the appropriate alarms, watch the trends, monitor the data, and keep score. The number and type of trends typically are customized, based on individual processes. These can be anything from seven-day local trends to energy cost per product to energy cost per day-per-process. The energy manager works with the team to establish which trends are most valuable. Department heads should have daily access to detailed usage information via connection to the local area network.

Awareness is critical for all staff, not just the team members. Department heads and all the employees should have something visible that shows where energy usage is at any given moment of the day. The system has the data, so why not present it?

A simple light tree strategically placed and connected to the system can create awareness of energy usage for the entire facility. That alone can help change behavior. Combined with the right planning and pressure to improve, a plan for proper system adjustments or corrections can be in place and ready to execute.

Ultimately, there will be successes, failures, anomalies, and great opportunities to reduce energy and utility costs significantly. The goals for each department will change, and new baselines will be set every year.

At some point the goals for any given process might be to improve only slightly, but the goals to improve should not be allowed to stagnate.

Energy Management Resources

Institutions such as the American Society of Heating, Refrigerating & Air-Conditioning Engineers (ASHRAE), Association of Energy Engineers (AEE), and the U.S. Department of Energy (DOE) have published clear guidelines for establishing an energy management plan, forming a team, and following up with the results. A program that has recently focused on manufacturing is Energy Star®, a joint program of the U.S. Environmental Protection Agency (EPA) and the DOE. The techniques presented by all these institutions are excellent and time-tested.

For example, the chapter on energy use and management published in the 2011 ASHRAE Handbook gives detailed information on procedures for implementing an energy management plan. This chapter also references Energy Star's model (see Figure 1), which is today's standard for setting up an energy management plan.

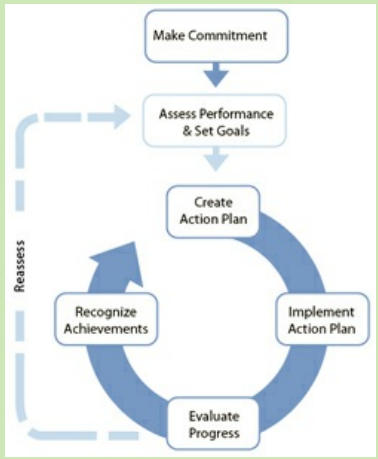
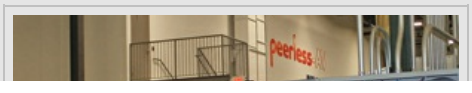


Figure 1
Energy Star's Energy Management Model The U.S. DOE and U.S. EPA's ENERGY STAR program offers a model for energy management which has become today's standard. Image courtesy of ENERGY STAR, www.energystar.gov.

Peerless Industries Inc.

In 2010 Peerless Industries decided to relocate and centralize its manufacturing operations from two locations—one in China and one in the U.S.— to one



central location in Illinois. This decision was made to reduce operating costs through consolidation and increased efficiency and to bring jobs back to the U.S.

One approach the manufacturer took to reduce operating costs was to curb rising energy costs. Peerless installed new, high-efficiency lighting; invested in more efficient manufacturing equipment; and had an energy-monitoring system installed.

The energy-monitoring system covers 15 different departments and comprises 29 energy meters. The system allows Peerless to allocate production costs precisely and provides the backbone to establish an energy management plan. The meter data and energy analysis software quickly identify energy-saving opportunities. Some caught by the system and addressed by the Peerless energy team were:

- Sequence multiple large air compressor systems in proper order
- Shut down compressor systems during unoccupied hours
- Schedule office HVAC and lighting to match occupancy hours
- Run plant air rotation heating units during occupied hours only
- Shut off plant lighting during unoccupied hours
- Recharge forklifts during off-peak hours only

Peerless has made a commitment to reduce energy consumption by 15 percent in the coming year. There will be rewards for successes and penalties for failures. Peerless most likely will exceed this goal because of its active energy management plan, its Web-based energy management system, and its commitment to being a green manufacturer.

Additional Information

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