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By David Bovankovich



With rising energy prices, today's savvy facility managers seek new ways to reduce energy costs without compromising energy supply needed to keep production lines operating smoothly and efficiently. Energy was previously considered a fixed cost of manufacturing a product, but that's not the case anymore.

The truth is energy does not need to be a fixed cost of doing business, and opportunities frequently exist to increase operational efficiency by simply looking beyond your facility's electric bill.

Here are multiple ways you can reduce energy, save money and increase efficiency in your facility.

**1. An energy audit can identify areas of inefficiency and potential conservation.** According to the EPA, energy is the single largest non-human operating expense for industrial buildings and facilities, accounting for as much as 25% to 35% of operating costs. You probably already know there are ways you can save money through energy efficiencies and conservation, but don't know specifics and haven't gotten started.

First, schedule an energy audit, which is a detailed walk-through by energy management professionals who can evaluate potential energy conservation measures (ECMs). Causes for inefficiencies can include a particular piece of equipment, a specific process or even the utility's power lines coming into your facility.

To combat the inefficiencies and promote cost savings, the energy management professional might recommend measures such as lighting retrofits, infrared scanning of heavy equipment, advanced metering or energy management systems (EMS).

The energy management professional should also provide a cost-benefit analysis for each, including payback guidelines.

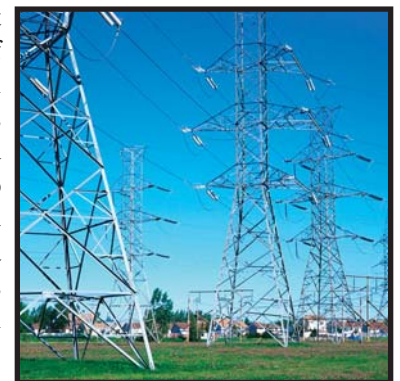
For example, the process of retrofitting a facility's lighting system involves an up-front investment to purchase newer, more efficient bulbs and electrical parts. And the amount of energy saved can provide a sizable payback in a short amount of time, anywhere from one to five years.

Similarly, infrared scanning of heavy machinery, which provides photographic proof of hot spots that cause energy drains and unnecessary stress on moving parts, can provide a similar payback. In fact, some insurance companies are starting to require regular equipment scans. These scans can be worthwhile as a preventative safety and cost-saving measure. The savings are based on lower energy costs and avoiding the frequent replacement of expensive, sometimes custom-built machinery.

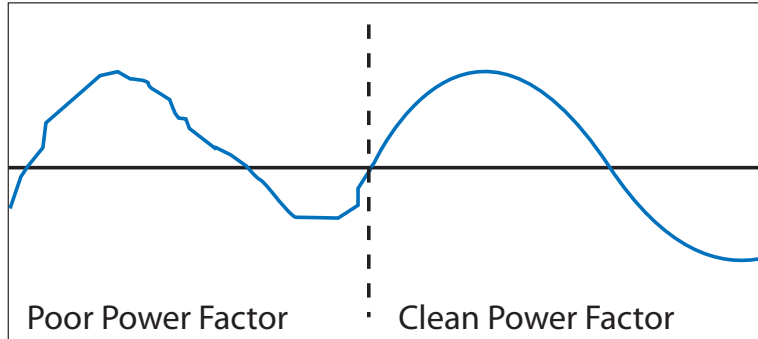
Another recommendation by an energy management professional might be advanced metering or an EMS system, both of which are outlined in more detail below. These technologies allow manufacturers to monitor and analyze energy usage and take preventive measures when energy consumption is too high.

**2. Power quality can extend the life of long-term equipment.** Unexplained electrical issues such as breakers tripping unexpectedly, lights flickering, increases in electrical usage and frozen computers are just a few signals that a facility may have power quality problems. Simply put, the electrical supply to your facility may be causing wasted energy and damage to your most critical equipment.

Three components of power quality are harmonics, transients and grounding. The most typical byproduct of harmonics is electrical distortion, which affects transformer efficiency and can cause circuit breakers to malfunction. The accepted amount of distortion in a typical electrical system is 5%, but facilities often run at between 7% and 9%.



Harmonics and distortion can be identified through an energy audit by a third-party provider or a utility, in some rare cases. The solution is often installing special transformers to reduce distortion.



Transients typically occur when lightning strikes and tries to find a conductor, flowing to the path of least resistance. A power surge is a transient. Transients often seek an electrical load as an exit, meaning the worst-case scenario could involve fire and injury. This is typically addressed with proper surge and spike protection at multiple levels of the operation.

The final component of power quality is having the proper grounding system or grid. Grounding prevents live current from damaging equipment and causing injury to personnel. Symptoms of a grounding problem can include burned motors, frequent breaker tripping or a worker getting zapped on the job. Grounding is especially important in computer/data networks where it is necessary to assure data transmission and in preventing equipment damage.

Any facility manager facing energy efficiency problems should probably have the facility audited for power quality issues, especially if the manager is seeing penalties from the utility for having a high power factor. Power factor is essentially electrical loss, meaning energy is being converted to heat and wasted. There is an acceptable amount of power factor that cannot be avoided, but a higher power factor is generally a sign of a larger power quality problem.

**3. The more you know about your energy usage, the more you can save.** One of the first ways that you can learn more about your daily energy usage is to install advanced metering to monitor power usage. Utility meters are used to generate energy bills for commercial buildings based on the facility's total energy usage. But with today's technology advancements, advanced meters are being leveraged in manufacturing facilities to analyze and manage industrial energy usage, in addition to tracking and allocating energy costs. Their ease of installation allows the meters to be placed on virtually any load in the building, giving increased data on energy use.

The first advanced meters required large and bulky pieces of equipment that took up valuable space within an industrial facility, and, until recently, a service interruption was required to install an advanced metering system. For most managers, voluntarily turning off power and shutting down operations, even for a short while, is not an option. A service interruption results in idle workers, wasted wages and compressed deadlines for products and services — all of which are costly propositions. Fortunately, today's advanced meters take up far less space and do not require an interruption of service when installed with split-core current sensors anywhere desired.

By using advanced metering in conjunction with an EMS that records and analyzes energy data, you are armed with vital data on energy usage, power quality and peaks, or shifts in power supply, that can help you address these power trends with your utility provider. And, the data can be used for tracking and allocating energy consumption costs across departments and manufacturing lines.

**4. An EMS can identify areas of inefficiency.** An EMS ties all of the energy usage data together. Its components include the following.



- *Advanced Meters* — Measure actual electrical, gas and water use after the main utility meter to assist in proactively managing utility costs and determine the drivers of excess use.

- *Utility Data Recorders* — Track total load within a facility to benchmark usage patterns and uncover out-of-tolerance energy use at individual points. Will provide the most meaningful ROI for advanced metering systems and help facilities that require improved energy efficiency practices.

- *Energy Intelligence Software* — Makes information available to individuals across the enterprise that need it in a timely fashion. Data communicated through dial-up, cellular, Ethernet and the Internet enable decision makers to take actions, including infrastructure improvements, shifting minor operational schedules and even implementing cost-center utility bills, to manage both energy usage and cost overruns.

Tied together, these systems provide valuable information gleaned from metering technology. These elements are critical for learning when, where and how you're using energy in your facility.

By analyzing the data, you might find out that a piece of equipment that is supposed to be shut down at the end of the shift is not being shut down. Or, you might learn too much of your equipment is running at one particular period. To save money, you may simply need to stagger when the equipment runs.

Following are two real-world case studies where facility managers used advanced metering and an EMS system to better allocate energy costs and gain valuable information on how to save energy dollars.

#### Case Study 1: Facility Reduces energy costs by \$324,000.

Two corporate divisions shared a location with only one electric utility meter, so they split the energy bill 60/40. Compared to other locations within the corporation that manufactured the same products with similar equipment, the facility paying 60 percent — we'll call it F60—was experiencing unusually high energy costs.



As a result, preliminary plans were made to shut down the facility and move the manufacturing operation to a facility located in another area of the country that had lower tariffs for electrical power. In a final attempt to solve the problem without having to move the business elsewhere, managers installed advanced meters to separate the energy usage of the two divisions and an automated meter reading (AMR) system to read the master utility meter and several advanced meters.

Energy consumption and demand were plotted on charts and graphs for the two divisions. Managers found that F60 was actually using less than 41 percent of the complex's total energy. The statistics also showed that a heat-treating process used once a week was causing a 175 KW spike in energy usage. To solve its problems, F60 worked with accounting to reallocate its percentage of the energy bill and moved its heat-treating process to a time of day when electricity wasn't as costly. As a result, F60 reduced its energy allocation by \$324,000 per year. Eliminating the spike in electricity usage for the heat-treating process saved F60 \$2,100 per month. The facility closure plans were cancelled, local jobs were preserved, and the utility maintained its \$634,547-per-year income from the site.

#### Case Study 2: A small investment saved thousands.

In a similar example, a food manufacturer processed one of its more popular snack brands out of a single building within a much larger manufacturing complex. Each tenant company paid for energy based on an estimated percentage of complex-wide energy usage.

The snack food facility manager suspected that his product line's portion of the energy bill was too high. The facility manager decided he needed a better way to allocate true energy usage costs among the various snack brands and companies conducting manufacturing operations within the complex.



To help the manager more accurately gauge energy consumption, advanced meters were installed after the utility meter without an interruption in power. After analyzing the data, the manager's suspicions were confirmed when he learned actual use was less than the amount for

which the product line was billed.

The result was a reduction in his electric bill from an estimated 11 percent of the overall facility electricity bill to an actual 7 percent. For a \$5,000 investment in advanced metering equipment and software, the snack food line saved thousands of dollars per month in energy costs. As a result, the investment paid for itself within 60 days.

**5. Use an EMS to participate in your utility's demand response program.** Either of these businesses could have faced stiff financial penalties from their utilities for peaks in energy usage during high-demand hours. This might be something you face on a monthly basis. With an EMS system, facility managers can observe patterns in their energy use, such as when it is peaking and why. It's the first step in determining the solution to the problem.

The heat treatment process mentioned is a great example. Managers at the facility didn't realize that their energy usage was spiking. Once they did, they saved \$2,100 per month.

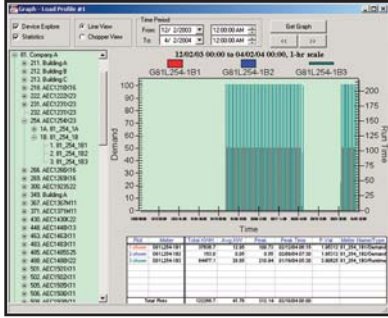
Many utilities offer industrial customers various incentives to reduce energy demand during peak times of constrained electricity supply. These "demand response" programs vary by utility, but you should know that there can be high rewards. The highest rewards, for example, are interruptible tariffs where the utility can shift the energy load (e.g., perhaps slightly alter your thermostat remotely for a 15-minute period) with little or no notice at all.

With most interruptible tariffs, you can contract electricity at a lower price if you agree to curtail your load when asked. If you chose to do nothing when requested, you would receive penalties that would most likely be higher

than if you chose to agree to load curtailment measures. You should check with your utility to get a comprehensive overview of any demand response programs it may offer to see what potential savings may be available.

In any case, an EMS system can be used to keep the facility in check to ensure it is playing by the utility's demand-response rules for the highest-possible cost savings.

The best thing to do is check with your utility to get a comprehensive overview of your utility's demand response programs. You can then match its programs to your facility's needs, making sure that you get the electricity you need to run your operations. Plus, your EMS can provide you with the data to determine how much money you are saving.



**6. Energy management programs can supplement predictive maintenance/diagnostic programs.** Evaluating the performance of pumps, compressors, heaters, chillers, conveyors and other electrically-powered equipment requires accurate, real-time status feedback that can only be provided by measuring how much energy it consumes. By analyzing energy usage data gathered with advanced meters and interval data recorders, you can see which equipment is deteriorating or developing problems.

It's better to replace less expensive parts in maintenance mode than wait, thereby causing larger, more expensive infrastructure replacement problems. An identifier might be when your electrical load suddenly increases or is heavier during certain specific manufacturing processes. If the load changes, you should always ask why to help determine the cause.

For example, during maintenance on a heating and cooling system, one facility manager noticed an odd pattern in the system's electrical load changes. It turned out that the HVAC equipment was "short-cycling," or cycling at a greatly increased frequency, due to a decrease of coolant in the system. The equipment was a significant distance from the main building, so no one was aware it was happening. Thanks to an advance warning provided by meter data, the manager was able to repair the equipment before it had a chance to break down.

To get started, the prudent approach is to utilize an energy management professional to perform an energy audit. This will help you find out if there are financial incentives for energy conservation measures you might be missing out on, as well as help you learn more about your facility's energy requirements and their impacts on your operations. By paying more attention to your energy usage and getting to know your utility provider and its programs, you can begin to take advantage of many energy-saving opportunities.



David Bovankovich, assistant vice president of product design for Hunt Power, has more than 20 years of electrical engineering, facility management, design and metering expertise. As a utility industry liaison, Bovankovich participated in the U.S. Energy Association's Energy Efficiency Forum. For more information on energy management issues, call (800) 334-3666 or email [dbovankovich@huntpower.com](mailto:dbovankovich@huntpower.com).