Building Support for an Energy Management System

Jerry Zolkowski, PE CEM – Global Energy Leader, Dow-Corning
Gary Nichols, PE CEM – Energy Manager, Shaw Industries

ABSTRACT

There is excellent guidance from several sources on how to implement an energy management system. There is also information on how to obtain savings from various energy systems. However, little is said about how a company or organization reaches a point where the commitment to energy management is made. Before senior managers choose to make a commitment to energy optimization, there needs to be an understanding of how it benefits the organization. That understanding and commitment does not come from a meeting where someone shows why it is a "good idea," but from a belief that the organization can achieve such goals because efforts have demonstrated that savings can be achieved.

The steps on the path to getting energy management accepted at an organization are as follows:

1. Prerequisite
2. Finding opportunities
3. Selling and implementing the initial projects
4. Demonstrating success
5. Expansion to doing more
6. Selling it to the top
7. Next steps

Most examples in this article are from Shaw Industries, which is the nation's largest carpet producer and second largest flooring supplier, with up to $5 billion in annual sales. The company is vertically integrated from fiber extrusion through distribution, and it has over 50 manufacturing plants, including hardwood production, wood laminate, nylon production from caprolactam, fiber extrusion, fiber processing, and carpet production, as well as one nylon recycling plant. However, these lessons can apply to many organizations on a different scale.

PREREQUISITE

The prerequisite to selling an energy program is that at least something must be in place. There must be someone in the organization that can devote time and effort to working on energy improvements.

This commitment may include someone responsible for energy purchases (e.g., buying wellhead gas or negotiating electric contracts), assigned responsibility for energy consumption (e.g., production units are accountable for energy budgets), an energy manager, and/or a conservation engineer.

At Shaw Industries there was already an energy department. The department was responsible for natural gas acquisition (wellhead + delivery), making natural gas nominations to local distributors, utility invoice review and approval for all locations, and fuel oil purchases. The department was also responsible for budgeting energy spending for manufacturing plants, but inaccuracies and market swings made budgeting useless as a tool for the energy-consuming manufacturing plants. In 2004 a conservation engineer was added to the department. The company was committed to managing energy prices, but other than the addition of the conservation engineer, there was no commitment to manage or reduce energy consumption.

Other large manufacturing organizations may find a similar story in that there is a commitment where savings are known to exist (e.g., managing prices) but little or no commitment where such savings are uncertain or harder to understand.

A small organization such as a building operator may have assigned energy management to maintenance without any expectations other than paying the bills promptly. The challenge for maintenance is to show how energy management can be worthwhile.

FINDING OPPORTUNITIES

Finding opportunities is essentially an audit or similar activity. This can be done by staff in the organization with sufficient expertise to identify and evaluate an opportunity, or it can be done by a source external to the company. External resources may include consultants, university-based assessments from DOE's Industrial Assessment Centers (IAC), utility audits, and/or vendor services such as a lighting supplier.

Opportunities from these outside sources are generally trustworthy, but one should always review the recommendations carefully. Vendors have something to sell, utilities may focus only on certain technologies, and some sources spend insufficient time due to funding limits.

Energy opportunities may include improved pricing through superior purchasing methods (e.g., interruptible vs. firm natural gas) as well as conservation projects (e.g., upgrade lighting). The goal is to obtain a list of several reasonable choices with good financial returns. At this point, projects with a high probability of completion, low risk, and good financial returns should be selected to pursue.

There are many factors that go into a high probability of completion. Those include the availability of staff resources, availability of capital, and the opportunity to perform the change (e.g., a plant shutdown may be required). Low-risk projects include those incorporating mature technologies, such as a boiler economizer, or minimal cost if it does not work out as expected, such as a lower compressed air pressure having to be reversed.

At Shaw the conservation engineer had worked in DOE's Industrial Assessment Center. As part of that work there were assessments that had been done at Shaw plants, so there was a starting point. One project in particular stood out as a strong candidate—put an existing waste water heat exchanger back into service. The project was not as easy as perceived in the IAC audit, since new warm water delivery lines were added in the plant and the repairs were challenging. However, the project was low-risk since it did not impact production; it merely reduced the amount of steam used to heat water. It offered a strong financial return with over $300,000 a year in annual savings, and it was easy for people to understand how it worked and saved money. Long after it was running, the energy department learned that it had a big enough impact that plant management noticed whether it was operating in weekly budget variance analyses.

SELLING AND IMPLEMENTING INITIAL PROJECTS

Failing to deliver on the first projects will doom the effort to gain acceptance for an energy management program; therefore, the first projects should focus on low risk and strong returns, even if the magnitude is modest. When the projects deliver as expected, the credibility of the energy department and staff will grow.

Where there are several candidate projects or sites, focus on those where the project may support other goals. For example, an energy efficient lighting project may be proposed in an application that has poor quality lighting. The upgrade will save money as well as provide superior illumination. Similarly, an aging air compressor could be replaced with a new compressor that would be more reliable and also provide improved part load efficiency. Sites may also have keen interest in efforts to reduce cost due to fierce competition from sister plants or other companies.

Shaw Industries was able to implement several projects as plants with similar processes competed with each other when production volumes declined with the housing bust that started in late 2008. Dow Corning was able to upgrade a needed air compressor and dryer to energy efficient versions since the incremental cost had a strong cost justification from energy savings, and it also improved reliability and compressed air quality.

DEMONSTRATING SUCCESS

It is crucial to have successful projects early in the effort, which is why a low risk/high return project or practice should be selected. This success must be supported with proof in order to sell the concept of energy management to the project sponsor and others. Some type of measurement and verification (M&V) is required.

M&V can have many forms. A method that provides sufficient evidence, even if the method is not extremely accurate, or a long-term form of monitoring is needed. It is of benefit to have long-term, accurate measurement of energy systems, but the expense to get the measurement must be considered.

It may be possible to obtain adequate measurement from a utility meter if the savings are great enough in magnitude. A warehouse that converts from mercury HID lamps to high bay fluorescent lamps on motion sensors may experience a 75% reduction in lighting energy and a 30-50% reduction in total facility electric consumption. The utility meter may provide enough accuracy to prove that the lighting system obtains the savings expected.

Another inexpensive method of M&V is to perform sampling. Data loggers and current transformers (CTs) can be used to record the

load on an electric circuit or power feed to a machine. For that same warehouse lighting conversion, a single circuit can be monitored for a week before and a week after conversion to show the change in electricity use. One supplier (Onset) can provide a logger, CT, and software for under $300.

Shaw Industries and Dow Corning both have found that data loggers and CTs are useful for compressed air projects. Compressors seldom have a separate meter, but a temporary CT can be used on the power feed to the compressor. In these cases a baseline period is recorded (3-7 days), the compressed air project is completed (e.g., leak repairs), and then the compressor load is recorded again for the same length of time. Problems can arise if the manufacturing plant is operating at a different level, so the samples should be timed so they can provide a fair comparison.

The best form of verification is to use permanent meters connected to a site data collection system. The data system may be part of other manufacturing systems or a building management system. These will typically store a history and sample on regular intervals. The effects of improvements can be compared before and after the change, as well as during other periods when production levels or weather conditions were the same. Permanent meters can be used to maintain the performance of systems. The one drawback is that the metering, installation, and programming can add to the project cost if not already in place.

EXPANSION TO DOING MORE

With successful energy projects completed and verified, it will be time to do more. At this juncture the concept must be sold again. This time the goal will be to perform another low-risk project, which could be a similar project at a sister site or another low-risk project at the same site. A pattern showing that energy conservation success is not a fluke is critical. Those benefiting from the success will want more, and they will tell others in the organization about it. Some time will pass in order to collect the savings generated. If the company has a single location, the idea would be to perform a follow-on project or move on to the next step.

There is a history of companies which only do energy projects in response to a crisis. They repeatedly follow a pattern of improve-

decline-improve as energy use is first perceived as important and then as "fixed." With the perception that nothing is "wrong" with the energy use, inefficient practices and equipment find their way back into use. Therefore, a consistent energy management approach is required, and proving that energy use can be managed the same way as other process inputs is crucial.

At Shaw, individual plants chose to pursue low-risk projects in order to meet Six Sigma savings targets and compete against sister plants. With everyone expected to contribute to savings, the plant engineers saw energy conservation as their contribution, but as projects verified savings, the interest in getting savings from energy grew throughout the organization.

SELLING IT TO THE TOP

With general recognition that something has value, those that run the company will want to make sure the value-added activity continues by allocating resources to it. As managers and senior mangers see benefit from energy conservation and energy management activities, they will want to see those practices cemented into the organization's operation.

One reason behind the need to demonstrate the management of energy is that many people have a perception that energy cannot be managed. They see energy as part of the overhead, much like paying the depreciation on a capital asset. Their experience has taught them that utility bills are just part of doing business and that nothing can be done about it. However, energy costs can account for 2%, 5%, 10%, or more of total costs. While materials, capital, and labor costs are tightly managed, energy is often left to be the largest unmanaged cost. Actively managing energy and implementing energy conservation makes good business sense.

Even though it makes good business sense to manage energy, sometimes even that is not enough. If the costs are low enough (1-2% of total cost) it may not be worth spreading energy management through the entire organization; however, there can be other drivers. In this age of sustainability, most have come to realize that a large part of their environmental footprint is measured through their energy use. As customers drive their suppliers to improve environmental performance, energy

conservation emerges as a low-risk way to meet customer demands and save money at the same time.

The effort to take this to the top at Shaw Industries had a head start. The Vice President of Manufacturing had long been interested in energy conservation. He was instrumental in getting a conservation engineer position funded, and after many plants had successful projects he was in a position to relate that success to other executives. By then it was possible to show that the projects progressed as intended and collected savings as expected. Senior management was willing to devote some resources to energy management and conservation.

When the "green" movement came to the carpet industry, Shaw and competitors were looking for ways to portray themselves as environmentally friendly. The carpet business is very competitive, so costs matter. Energy conservation was embraced as a way to improve sustainability. This lowers environmental impact and saves money, both of which are company goals.

NEXT STEPS

This roadmap seems neatly laid out in an article, with no timelines assigned, but it can take years to follow this path. While a few projects may be able to be found quickly, the reality is that capital cycles may only allow the initial project(s) to be done one year, and expansion projects the next year or two. It also takes time for projects to collect savings before there is a realization that energy can be managed.

Once senior management is behind the concept of energy management and devotes some resources, then another journey begins. Just as the first years are spent working toward acceptance, the next years will be spent in implementation. There are never enough resources to do everything (metering, auditing, monitoring, setting standards, training, etc.). The pieces of energy management with the highest value should be implemented first, with the expectation that success will secure the commitment to retain and improve the energy management program.

There are several guides in energy management systems from consultants and standards organizations such as ANSI/MSE 2000 or ISO 50001. Unless the organization makes the commitment to implement the entire program, the key is to understand what is offered and choose elements that offer the greatest benefit to the company.

SUMMARY

Energy management principals are widely known and recognized, but for an organization to make such a commitment managers must believe that energy management is worthwhile. Convincing people requires proof that energy management and energy conservation do work.

Before trying to "sell" the idea, there is a prerequisite that some resources are available to go through this process. Staff has to devote some time and effort into identifying opportunities, running projects, and verifying results. If some resources are available, the first step is to identify opportunities.

From the opportunities discovered, a low-risk project is then selected for completion. That project must demonstrate its success through some type of measurement and verification. This process of identification-completion-demonstration must be repeated enough to show that the process works and is a part of good business practices.

Although it may take time to gain acceptance, managers will recognize the value in energy management. Resources such as capital or staff will be allocated to the function. Upon formal recognition and acceptance, the improvements must continue, but the emphasis shifts to selecting the most valuable portions of energy management to implement within the company.

References

"Achieving Superior Energy Performance," http://www.superiorenergyperformance.net/

Jackson, Jerry, "Selling Energy Efficiency: The Energy Engineer as Investment Advisor," Energy Engineering Vol. 108 No. 4. 2011.

"Making the Business Case for Energy Management in Healthcare," http://www.energystar.gov/index.cfm?c=healthcare.business_case

Meffert, Bill, "ANSI/MSE 2000:2005 A Management System for Energy," http://www.superiorenergyperformance.net/pdfs/MSE_2000_GATECH.pdf

Sheihing, Paul, "Energy Management Standards," http://www1.eere.energy.gov/industry/pdfs/webcast_2009-0122_energy_mngmnt_stnds.pdf

Wulfinghoff, Donald R., "The Four Steps of Effective Energy Management," http://www.energybooks.com/pdf/FOUR_STEPS_of_Energy_Management_for_EIP_Website_071025.pdf

---

ABOUT THE AUTHORS

Jerry Zolkowski, PE CEM, has been finding and evaluating energy conservation opportunities for Dow Corning since 2010. Dow

Corning has over 40 plants worldwide and is the largest silicones supplier. Jerry's prior employment includes energy conservation for Shaw Industries, as well as industrial extension service, energy conservation, environmental compliance, and plant & design engineering for Georgia Tech, Pratt & Whitney, and Harris Press. He has a BS in mechanical engineering from the University of Rochester and an MBA from Columbus State College.

Jerry.zolkowski@dowcorning.com

Gary Nichols, PE CEM, is the energy manager for Shaw Industries. Shaw has over 50 manufacturing plants and is the country's largest carpet producer. Gary's education includes a BS in electrical engineering from the University of Tennessee at Chattanooga.

Gary.nichols@shawinc.com