Sustain the Gain by Filling Gaps in Your Energy Management Program

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ABSTRACT

Most industrial companies are, to varying degrees, aware that they can better manage their energy resources. Some companies, however, simply do not have the time, know-how or senior management support to do so effectively. For other companies, some elements of an energy management program already exist, they just aren't recognized as such. In either case, a well-structured energy management program that is proportional in scope to energy use can be generated using existing company resources in conjunction with Practical Energy Management© (PEM).

PEM, developed for Wisconsin's Focus on Energy Industrial Program, includes tools for identifying, quantifying, prioritizing and implementing energy saving projects. It also includes sample documents, procedures and strategies for integrating energy management into existing business practices.

This paper presents our experiences and the results of delivering PEM in each of three formats: a half-day overview seminar; a series of five classroom sessions over the course of nine weeks; and an intensive on-site session with an individual company. We will illustrate the challenges faced in establishing effective energy management in industrial organizations and how Practical Energy Management can be used to overcome those challenges.

Energy Awareness Precedes Management Change

A recent survey of its members by the Association of Energy Engineers found that a majority of energy professionals viewed improving energy efficiency and energy management as the single most important component of any potential federal energy policy (Marie, et al. 2004). The next highest priority, cited by less than a quarter of the respondents, was improving transmission and distribution. Just ten percent of respondents cited research and development as the most important component of a national energy policy.

Clearly, energy professionals recognize the value of greater energy efficiency and more effective energy management as a means to address our nation's energy future. Yet, when asked about the effectiveness of their own energy management program, less than half of the respondents felt they had actually improved the effectiveness of their efforts in comparison to the year before. And these are the professionals who work for companies that actually have formal energy management programs.

A December 2002 survey of Wisconsin manufacturers found that fewer than 5 percent of respondents even had a formal energy management program. In most cases, respondents viewed their utility bill as an invoice for an overhead cost rather than a key to more effective analysis and management of energy as a variable cost. They reported that their "energy person" was

typically selected by default and usually had little or no training, or interest, in the energy profession. Still, any company that at least has such an "energy person" should be given some credit for recognizing that energy matters do in fact need attending. Chances are they may also be aware that they can do better.

Regardless of its current level of program development, any organization can be more effective in managing their energy use and costs by adopting a continual improvement approach to energy management. The first order of business in applying a continual improvement approach is assessing the current level of performance or development of an energy management program against some measure of excellence. This assessment, or gap analysis, generates an awareness of current performance and indicates what changes are needed en route to developing a more effective program that is commensurate with the needs of the organization.

Standards for Energy Management

There are several definitions or models of what constitutes a comprehensive and effective energy management program. For instance, the energy management program of a "best-in-class" company has five characteristics which distinguish it from a more typical program which tends to address energy efficiency only in facility operations, not production (Kamen 2002). Those characteristics are:

- Strong corporate leadership and resource allocation;
- Integrated energy management process from board room to boiler room;
- Production sub-metering of energy use and budget allocation of energy cost;
- Consideration of energy in process and facility design; and
- Fine tuning operating parameters during production to minimize energy use.

It is estimated that companies with best-in-class energy management practices can achieve 30 percent more in energy savings beyond that of less rigorous energy management efforts.

Other models of an effective energy management program incorporate these and other characteristics or elements. For example, the One-2-Five® Energy software program suggests 10 key elements of energy management (EnVINTA 2005). Some provide specific administrative prescriptions for things such as management responsibility, data acquisition and distribution, and document development and control. One such model is the MSE 2000: A Management System for Energy (GTRC 2000). MSE 2000 invokes a continual improvement approach and is patterned after the ISO standards for quality (9000) and environment (14000). The MSE 2000 model was formally adopted by the American National Standards Institute (ANSI) as a national standard in April 2000. It is currently undergoing an evaluation and revision.

Companies can strive for best-in-class status by adopting MSE 2000 as the standard against which they measure their energy management program. Yet, achieving best-in-class status or adopting the structure of formal standard may not be suitable for all companies seeking greater energy efficiency and more effective energy management. The most likely candidate companies for full standard adoption are those with high overall energy use and costs, those with

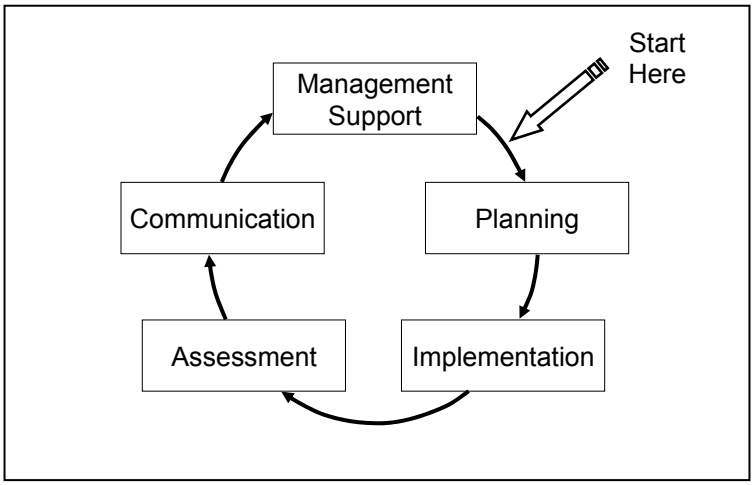
energy costs relative to other manufacturing costs in excess of 20 percent or those with a strong commitment to environmental stewardship (Brown et al. 2003).

Practical Energy Management (PEM)

Whereas MSE 2000 provides the structure of an effective energy management program, Practical Energy Management was designed to provide the substance. PEM is a turnkey set of spreadsheets, document templates and strategies that organizations can adopt in whole or in part to bring their existing energy management program up to the MSE 2000 standard. If an organization does not intend to fully adopt the energy standard, PEM affords that organization the flexibility to adopt only those items it needs to achieve a level of program development commensurate with its energy use.

Like MSE 2000, PEM applies a continual improvement approach to energy management program development (see Figure 1). Key elements of an energy management program are addressed within each phase of the continual improvement process. Figure 2 (next page) outlines these key elements. PEM provides tools for energy benchmarking, tracking key performance indicators, setting energy policy, estimating energy savings from facility and process opportunities, and prioritizing among those opportunities. Strategies are included for setting and tracking energy goals, identifying potential communication and reporting opportunities, and allocating energy costs to end users. A suggested implementation timeline is also provided.

Figure 1. Continual Improvement for Practical Energy Management



It is important to note that PEM is not intended to displace the valuable process of organizational "self-discovery" that often accompanies implementation of a continual improvement process. Instead, it is designed to short-circuit the costly and time-consuming task of inventing new document formats or devising new strategies for implementing the critical elements of energy management program. In short, PEM enables companies to quickly and effectively identify and fill in the gaps between where they currently stand on energy management and where they would like to be.

Figure 2. Key Elements of PEM

Energy Policy – Create an energy policy to demonstrate commitment to energy efficiency and effective energy management. Sample policy statements are provided for reference.

Goals and Targets – Set quantifiable targets such as amounts, percents or dates to gauge progress toward both technical and management goals. Document templates are provided.

Project Management – Prioritize and management projects in a way that is compatible with existing company practices. Document for prioritizing projects is included.

Energy Purchasing – Match utility rate structure to facility energy use to optimize power costs.

Facility Profile – Puts energy use in the context of other business indicators such as production and accounting. Document format provided.

Equipment & Process Profile – Estimate energy use by major facility equipment and production processes using sub-meter or best estimate calculations. Calculation spreadsheets provided

Best Practices – Identify opportunities by comparing Best Practices conditions against existing energy uses. Calculation spreadsheets provided.

Continual Improvement – Create an administrative infrastructure for your energy program including a system audit capability, a measurement & verification effort, and appropriate procedures for things such as operating training, project prioritization and energy information reporting.

Delivering PEM

PEM material has been delivered to commercial, industrial and institutional organizations in several formats including a half-day overview, a series of five workshops providing general implementation assistance, and intensive implementation assistance with individual organizations. A web-based version of the implementation series is currently in development.

Half-Day Overview

The most widely used format for delivering PEM training is the half-day overview session with relatively large groups of energy managers (usually between 20 and 30) from different companies across a wide range of industries. Twenty sessions have been conducted to date for Wisconsin's Focus on Energy program involving over 500 participants representing nearly 400 organizations. The goal of the PEM overview sessions is to introduce participates to the PEM approach, including the principles of continual improvement, while giving them the tools and insights they can use to build support for additional improvement efforts.

Each participant receives a three-ring binder containing a hard copy of all PEM material and a compact disc containing the electronic version of the material. Participants are guided through the material in the order in which it would most likely be implemented at their facility.

Given the limited time available during the overview session, those elements of energy management which are likely to garner the most support for additional improvement efforts are emphasized. This includes developing a facility energy profile of historical energy use which enables users to put energy costs in the context of those business parameters most likely to be of interest senior company managers, such as sales, profits or manufacturing costs. A particularly effective way of highlighting the importance of energy efficiency is showing the impact on company profits of a give reduction (say 5 percent) in energy use.

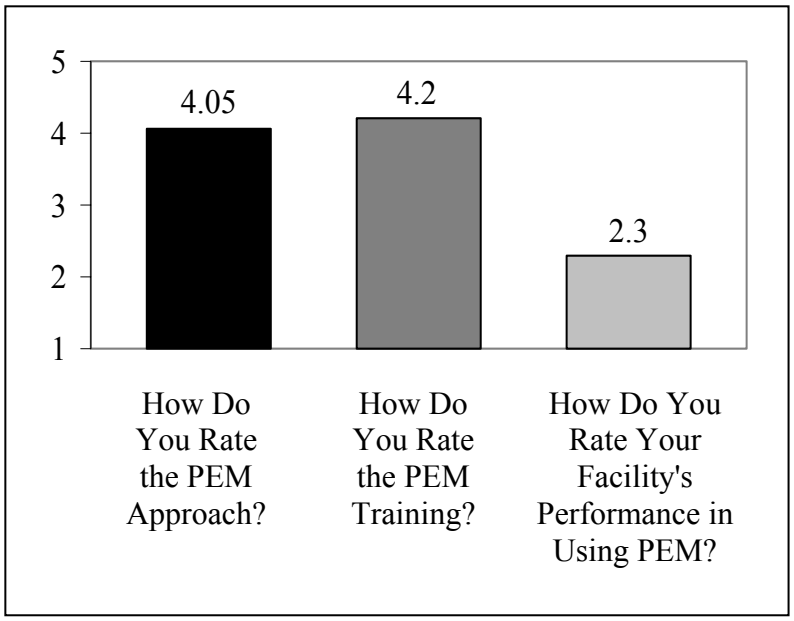
Other PEM elements emphasized in the overview session include quantifying existing facility and production energy end uses, and identifying opportunities for energy savings through application of best practices to those end uses. Participants also receive instruction on applying the PEM project prioritization template. This tool helps participants apply decision-making criteria, such as return on investment, project capital cost and confidence in cost and savings estimates , when determining the order in which energy projects should be addressed.

Before the overview session ends, participants are encouraged to complete the program implementation timeline tool. This gives them a rough idea of what steps they must go through to apply PEM to their energy programs and an approximate timeframe for doing so.

The survey of 2003 overview session participants indicated that the PEM material has been effective in stimulating both actual energy savings and furthering the development of energy management programs (O'Brien 2004). More than 60 percent of those surveyed stated that they used PEM in developing their energy programs including tracking utility costs, forming energy teams, monitoring energy using equipment and prioritizing among energy efficiency projects. Thirty percent of survey participants completed one or more energy saving projects as a result of applying PEM material.

In general, the PEM material as presented in the half-day overview session has been well-received by participants. PEM users found the material to be practical, comprehensive, organized and easily adaptable to their existing energy management efforts. The calculation tools supported efforts to justify energy efficiency investment to management. Yet, participants where not satisfied with their own performance in applying the PEM approach at their facilities (see Figure 3). They cited the usual suspects, such as lack of time and too many other responsibilities, as factors in limiting their ability to develop a more affective energy management program. Survey respondents felt more hands-on follow-up support for PEM implementation would be useful.

Figure 3. Rating PEM by FY03 Overview Session Participants



Source: O'Brien 2004

Implementation Series

The PEM Implementations Series was developed in response to the request for more hands-on implementation support for PEM users. A pilot program was conducted with six companies (five industrial and one commercial) from February 15th to April 12th of this year. The number of participating companies was limited during the pilot program to promote greater one-on-one interactions among participants and the PEM facilitator.

Five sessions each lasting approximately 90 minutes were held over the course of the nine weeks. Each session focused on only one or two elements of PEM. The first session began with a brief review of the PEM approach and material in the context of a continual improvement process. Subsequent sessions began with a brief review of the discussion topics and "homework" assignments from the previous session, followed by a discussion of additional PEM elements and the next round of homework assignments. The topics for each session include:

- Session 1 – Creating a facility energy profile and developing reporting mechanisms for energy information
- Session 2 – Estimating facility equipment & production process energy use and generating support for energy management
- Session 3 – Identifying energy projects and allocating energy costs to energy users
- Session 4 – Prioritizing energy projects and setting energy management goals & targets
- Session 5 – Selling management on energy efficiency and assessing project & program effectiveness

Homework assignments were designed to help participants determine if existing organizational documents and practices could be utilized for energy management or if a PEM tool was more suitable. For instance, one homework assignment asked participants to identify existing mechanisms for reporting or communicating various types of information (e.g. production data or financial information) within their organization. Bulletin boards, newsletters, daily e-mail alerts for managers, weekly production meetings, and annual reports were just some of the existing mechanisms identified by participants. Participants then selected the most suitable mechanisms for communicating energy-related information to the appropriate levels within their organization and began negotiating with the person responsible for those mechanisms for the inclusion of energy-related information.

For many of the assignments, participants were, in fact, able to identify an existing document or practice within their organization which could be utilized for energy management purposes. In those instances where no suitable document or practice existed, participants were offered assistance to integrate the corresponding PEM tool into their energy management program.

Most participants found the project prioritization template particularly useful (see Figure 4). The template enables users to rank energy efficiency projects according to how project score on criteria selected by the user. Homework assignments required participants to review previously completed energy assessments for possible projects and to apply the PEM best practices calculation sheets to identify other potential projects. These projects were then added to the prioritization template and scored based on the selected criteria.

Figure 4. Selected Portions of Project Prioritization Template with Sample Data

Proj. No.	Project Description	Prioritization Criteria			
		Simple Payback	% of Capital Budget	% of Energy Goal	Priority Rank
	criteria weight =>	50%	35%	15%	100%
002	Use blower, not C.A. in mixing tanks	100	100	75	96.25
010	Motion sensor for cooler 1 & 3 lights	100	100	25	88.75
007	Eliminate over-venting in clean room	75	1	100	52.85
005	Shed load in refrig. cooler 1 & 2	50	25	50	41.25

Criteria: Smpl. Payback
Value: NA
Weight: 50%

Years	Score
less than 1	100
less than 2	75
less than 3	50
less than 5	25
more than 5	1
no data	-10

Criteria: % Cap Bud.
Value: $300,000
Weight: 35%

% of Budget	Score
1% or Less	100
2% or Less	75
5% or Less	50
10% or Less	25
more than 10%	1
no data	-10

Criteria: % Energy Goal
Value: $250,000
Weight: 15%

% of Goal	Score
10% or more	100
5% or more	75
2% or more	50
1% or more	25
less than 1%	1
no data	-10

Prioritization criteria considered by participants included simple return on investment, project capital cost in relation to overall capital budget, estimated project energy savings in relation to overall energy savings goal, confidence and reliability of project estimates, a project's impact on production, and non-energy benefits such as safety. A weighting mechanism enables users to assign greater importance to a particular criterion, such a return on investment.

The PEM Implementation Series is, in essence, a dynamic gap analysis in which participants fill in the holes in their energy management program as they are identified through session discussions and homework assignments. Obviously, not all gaps can be identified or effectively filled during nine week program. Participants are advised that it can take 12 to 18 months to fully implement a comprehensive energy management program. They are given a formatted Energy Management Task List to help them record and track progress on specific actions that they determine are necessary to improve their energy management program.

An optional sixth session was offered to each participating organization. This session, conducted at their facility, is intended as a briefing for senior decision-makers on the status of the organization's energy management program. The PEM material includes a PowerPoint-style management presentation template that participants can modify and populate with information specific to their company's energy program. The 90-minute management session is includes a summary of critical energy use and cost data, a look at the potential impact of greater energy efficiency on bottom-line business factors, a list of completed and potential energy efficiency projects, and a discussion of some of the tasks that lie ahead in building a more effective energy management program. It is hoped that participants in the on-site sessions will come away with a better sense of their overall energy picture, a willingness to look more closely at energy efficiency opportunities, and a stronger commitment from senior decision-makers for improving the effectiveness of energy management within their organizations.

While it is too recent since the end of the pilot program to talk definitively about the ultimate impact of the PEM Implementation Series, we can safely say that participants found the sessions useful and were pleased with the progress they made in developing their respective energy management programs. The PEM facilitator has worked outside of the training sessions with 5 of the 6 participating organizations' to help either with a specific homework assignment, assess a particular aspect of their existing energy management effort, participate in regular energy team meetings or quantify the costs and savings a particular energy efficiency project. This suggests that participants were engaged in the process, found the PEM material useful and wanted to succeed in applying it to their programs. Furthermore, 4 of the 6 participating organization opted for the 6th session at their facility. The other two participants stated that the 6th session was not necessary because they already meet regularly with their senior most decision-makers about energy. Based on results of the 3 on-site sessions that have taken place thus far, it is apparent that the meetings had the intended consequence of raising the profile of energy management within the organization and generating willingness among senior management to support additional program improvement efforts.

The primary challenge associated with the Implementation Series format was presenting the PEM material in a way that recognized the diversity in energy program development among participating organizations and the background (e.g. financial or technical) of individual participants. For instance, one participating organization was ISO 9000 and 14000 certified and its representative was well-versed in continual improvement concepts. A different company's representative had never heard of those international standards. Similarly, two organizations

were represented by financial or accounting personnel while another was represented by its boiler room supervisor.

A condition of enrollment in future offerings of the PEM Implementation Series may be that participating organization be represented by one technical and one non-technical staff member. We believe the Implementation Series format will work well with up to 15 participants and that participants need not be from the same or similar industries.

Intensive Assistance

Many companies have taken some steps to control their energy use and costs, such as negotiating utility rates and undertaking studies to identify energy-saving opportunities. Very often, however, companies do so only as a reactionary counter measure to sharp rises in energy prices or a corporate-wide mandate to slash costs, not at as a matter of routine business practice. When energy prices stabilize or the business climate improves, energy management once again becomes an afterthought in day-to-day operations and long-term strategic planning.

In the fall of 2004, PEM implementation assistance was provided to one such company, a specialty metals manufacturer outside the Focus on Energy territory. The first step in applying the PEM approach to this company's energy management efforts was to conduct a gap analysis. Whereas the PEM Implementation Series incorporates a "fill as you go" gap analysis the intensive on-site assistance for PEM implementation for this company followed a more traditional gap analysis process.

We began working with the energy manager for this company via telephone and e-mail 2 months prior to our October 2004 site visit. During that time we identified several existing company practices and documents that could be used either in conjunction with or instead of corresponding PEM material. For instance, several recently completed technical studies on the energy use of major production processes at the facility were useful in compiling a Facility Energy Profile. These studies identified potential projects totaling approximately $3.3 million in energy savings with a collective 10 month simple payback. Because of the valuable project-specific information in the studies, there was no need to apply PEM's Equipment & Process Profile or the Best Practices applications to identify energy savings opportunities. The gap analysis provided us with good understanding of the technical aspects of the company's energy program, namely their historical energy use and cost, energy as a percent of broader production and other business indicators such as operating costs, and information on recently completed and potential energy projects.

The next step of the project involved addressing the management, or non-technical, side of the company's energy program. This was done largely during six hours of meetings over two days with 15 participants representing Operations, Maintenance, Safety, Environment, Finance and Administration along with the company's President and Chief Financial Officer. Participants were first briefed on the company's energy use and costs as well as recently completed and proposed energy efficiency projects. After a brief presentation on the PEM approach, participants were asked to discuss the company's current approach to energy management in the context of PEM's continual improvement framework.

The discussions yielded several insights about the shortcomings of the company's approach to energy management. For example, despite the existence of a comprehensive cost control system there apparently was no thought given to establishing specific energy efficiency or energy cost reduction targets for individual departments. Similarly, many department heads were either not aware that the Finance Department allocated energy costs to end-users or were unfamiliar with the methodology used for allocation those costs.

The various deficiencies identified on the first day were revisited on the second day when participants identified some sixteen tasks intended to improve the current approach. Among the identified tasks were:

- Setting an annual energy savings target based on the potential energy savings from a prioritized list of technical projects.
- Determining appropriate energy indicators and including them in the monthly information statements provided to department heads.
- Determining appropriate communication methods for promoting general staff awareness of energy efficiency; and
- Building energy considerations into the company's business plan.

All sixteen tasks identified on the second day where immediately assigned to a responsible party and given a completion date. In fact, the company President himself took on the tasks of identifying appropriate communication vehicles to promote general energy awareness and for including energy into the company's strategic plan. The strong attendance by senior managers on both days and the willingness to take on specific tasks clearly indicates a strong commitment for a more rigorous energy management program based on the PEM approach.

Conclusion

Most organizations have traditionally addressed energy issues separately from day-to-day operations and long-term planning. As a consequence, energy decisions have been made on a case-by-case basis and outside of established management programs and operational considerations. While energy professionals are generally aware of the value of greater energy efficiency and more effective energy management, they have collectively achieved only limited success in integrating energy matters into their organization's broader decision-making and operational activities.

The goal of the PEM approach is to help organizations improve the effectiveness of their energy management effort be integrating it into existing business practices. PEM offers users a menu of sample documents, calculation tools and strategies they can use to fill in the gaps in their existing energy management program in the context of a continual improvement process.

The PEM Overview Session enables participants to identify specific energy projects both as a means to immediate energy savings and as a first step in generating additional support for a more assertive energy management effort. Furthermore, it appears the PEM Implementation Series is effective in focusing the attention of participants on the task of assessing and improving the effectiveness of existing energy management efforts. Finally, providing PEM

implementation assistance to a single company is an effective way to create awareness among company decision-makers about the need for better energy management and to generate support for making the necessary changes.

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