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Using a Practical Approach to Energy Management to Get it Done

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ABSTRACT

The Wisconsin Focus on Energy program saw a need in 2002 to develop a template for energy management so that companies could easily implement a systematic and continual improvement approach to manage their energy. To meet this need the Focus program developed an approach called Practical Energy Management (PEM) that includes templates and tools for setting goals, establishing a long-term plan, uncovering project opportunities, and tracking progress toward projects and goals. Focus has trained over 900 companies in the PEM approach over the last six years. We have also used the approach to facilitate the energy teams for large industrial companies. This paper will discuss the PEM tool and the lessons learned on how to best use the tool.

BACKGROUND ON FOCUS ON ENERGY PROGRAM

The Focus on Energy Program is Wisconsin's statewide energy efficiency and renewable energy program overseen by the Wisconsin Public Service Commission. The Focus program started as a statewide program in 2001. It offers many of the standard demand-side management (DSM) program elements such as prescriptive and custom incentives to implement projects. The general intent of the program is to promote energy saving projects or actions for the short and long term.

The economic justification for the program touches three different economic realities:

- From the State economic perspective Wisconsin customers pay for $6 billion of coal and natural gas energy that is paid to out of state providers. Therefore, more money that can stay in the state can support Wisconsin's economy and employment.
- From the individual company's perspective the reduction in energy costs can provide stronger competitive advantages that may be critical for survival.
- From the energy rater payers perspective the fewer power plants that are needed to be built the less rates will need to go up to cover their cost. Power plants in the US are built at about $2,500 per kW. Focus on Energy has caused kW reductions with a cost less than $500 per kW. This is considerable savings to the rate payers and keeps rates lower for everyone in the future.

DEVELOPMENT OF THE PRACTICAL ENERGY MANAGEMENT APPROACH

The Practical Energy Management© (PEM) energy management tool that is described in this paper was developed as part of the Focus on Energy program. During the initial first two years the Focus program offered energy audits as one of its services. We learned that many audit recommendations provided were not actively pursued by the customers and the audits required significant amounts of program staff time to develop for each site.

Therefore, the program determined that a more cost effective method would be to develop a simple approach that a customer could follow on their own to continually uncover and implement energy efficiency opportunities. From this idea Practical Energy Management© (PEM) was born.

The following are the top barriers we have seen to implementing a strategic energy management plan.

- Lack of motivation of upper management
- Limited time available for staff
- Inability of staff to identifying all good opportunities
- Inability to impact process energy use

The Focus program developed the PEM approach to overcome many of these barriers. It uses a binder and CD to provide a systematic approach to energy management. PEM is not a "How-to" do energy management guide, it is the approach that can be used to DO energy management. It

contains a package of energy management tools that are designed to reduce the time and effort required for a company to implement an energy management program or enhance their existing program.

Elements of the PEM approach include samples for establishing energy goals, project prioritization, project tracking and Key Performance Indicator (KPI) tracking. The approach provides calculation tools for a facility to baseline their use of energy use per units of production and to estimate the energy use of equipment. A major tool is a section on best practices for typical end-use systems to provide a first-cut estimate of possible savings and practical tips for implementation. With these tools companies can quickly prioritize projects to develop a long-range plan for energy projects and develop a continuous improvement approach.

SUMMARY OF THE PRACTICAL ENERGY MANAGEMENT (PEM) TOOL

One of the key benefits of the PEM approach is to minimize the time required to implement an energy management plan. With PEM most of the elements needed are already developed. The company does not have to reinvent the wheel. The key sections and tools of PEM include:

- **Energy Management Plan**
- **Facility Profile**
- **Equipment and Process Profile**
- **Best Practices**
- **Project Prioritization**
- **Project Management**
- **Key Performance Indicators**
- **Continual Improvement**

The following summarizes each section of the PEM tool and how they are to be used to develop a comprehensive energy management program.

Energy Management Plan

This section contains a very straightforward energy management plan. The plan lists several goals with associated actions or tasks needed to achieve those goals and a suitable target against which to measure success. It also assigns responsibility and date of completion for each task. A plan such as this is typically the result of one or two facilitated meetings (each under two hours) with a cross-section of organizational members.

The concept of an energy management plan means different things to different people. At its core, an energy management plan lays out the specific actions or tasks needed to achieve a stated goal or goals. An energy management plan sets quantifiable targets against which progress toward achieving a particular goal can be measured. It also assigns responsibility to a particular individual for each required action.

An effective energy management plan integrates consideration of energy efficiency into all aspects of an organization's operation. An effective energy management plan utilizes existing organizational practices and resources to achieve its goals rather than inventing new methods or acquiring new resources. An effective energy management plan also sets a realistic target for its energy efficiency goal based, not on an arbitrary percent of savings, but on the potential energy savings from identified energy efficiency projects and a prioritized schedule of these projects.

This requires some up front gathering of information and analysis of facility energy use and opportunities. The following sections of the PEM tool provide a method to gather and analyze information for establishing and updating the energy management plan.

Facility Profile

Understanding how a facility uses energy is fundamental to developing an energy management system. The facility energy profile helps to organize and quantify overall facility energy use by each energy source. It also allows a view of energy in the broader context of the organizations operation by comparing energy use to other important factors such as annual profits, sales figures, facility square footage or employee salaries. Figure 1 is a partial summary of a facility profile for plastic injection molding company.

Equipment and Process Profile

Developing a realistic set of energy efficiency goals and targets, and identifying energy efficiency projects requires you to know how much energy each major system, piece of equipment, or production process uses. Some of the more common energy uses within most organizations are lighting, space heating and space cooling. Other facilities may have systems that use compressed air, refrigeration, process heating or process cooling. This section provides spreadsheets for estimating the energy use of these primary systems.

Figure 1 – Summary of Facility Energy Profile – Plastic Company Example

Electricity	2005	2004	2003	% Change 2004 to 2005
Consumption (kWh)	24,860,390	26,274,784	23,647,305	-6.6%
Electrical cost ($)	$1,130,698	$1,156,090	$1,040,481	-2.2%
$ per kWh	$0.046	$0.044	$0.044	4.5%
Key Performance Indicators				
Lb of resin	10,000,000	10,028,500	8,957,500	-0.3%
KWh per lLb of resin	2.49	2.62	2.64	-5.0%
Electric $ per lb of resin	$0.1145	$0.1153	$0.1162	0.7%
Business Indicators				
Operating Costs	$15,000,000	$13,850,000	$12,900,000	8.3%
Electricity as % of operating costs	7.54%	8.35%	8.07%	-9.7%
Annual profits	$3,450,000	$3,750,000	$3,200,000	-8.0%
Electricity as % of profits	32.8%	30.7%	32.5%	6.8%

These spreadsheets use basic engineering equations and operating assumptions to help provide an approximation of the energy use of the systems. They are not intended to give a precise estimate or measure of energy use. If an overall energy use warrants the added time and effort, a sub-metering system can be installed or a detailed engineering study can be conducted to get more precise estimates. Ideally, the estimated combined energy use of the major systems should be within 10 percent of the overall energy use identified in the facility profile.

Best Practices

Energy efficiency improvements whose technical validity and economic benefits have been verified through multiple field applications are called “best practices”. Of all of the sections, the one that is usually of most interest to plant engineers is the Best Practices section. This section provides calculations sheets for best practices associated with the common energy using systems. The common systems covered are:

- Compressed Air
- Lighting
- Motors
- Pumps
- Refrigeration
- Steam
- Ventilation
- Wastewater
- Comfort cooling
- Comfort heating
- Dehumidification
- Fans
- Hydraulic systems
- Process cooling
- Process heating
- Vacuum systems

Each system has five to a dozen best practices listed. Many of the best practices have a one page spreadsheet that describes the practice and provides a "first-cut savings estimate". These first-cut estimates can help them begin to prioritize the projects, establish goals/targets and develop a long-term energy management plan.

The idea is to give the energy manager a quick understanding of the magnitude of any opportunities that they may have in their facility. Practical notes, rules of thumb and payback estimates for each of the improvements are also listed.

Project Prioritization

Once projects are identified the next step is to select which potential projects to undertake within the limits of time and budget. When considering how to prioritize among potential projects, the following prioritization criteria may be important:

- Required projects for operation
- Simple return on investment
- Impact on production / productivity
- Maintenance costs
- Age of existing equipment

- Size of capital needed
- Employee safety
- Scheduling or timing (e.g. seasonal activity)
- Environmental improvement
- Confidence in project estimations

This section contains the Project Prioritization Worksheet. It enables users to quantify and rank projects based on selected criteria while maintaining a running list of conceptual, identified, quantified and completed projects. Typically only three to four of the above criteria are used to prioritize the projects.

Project Management

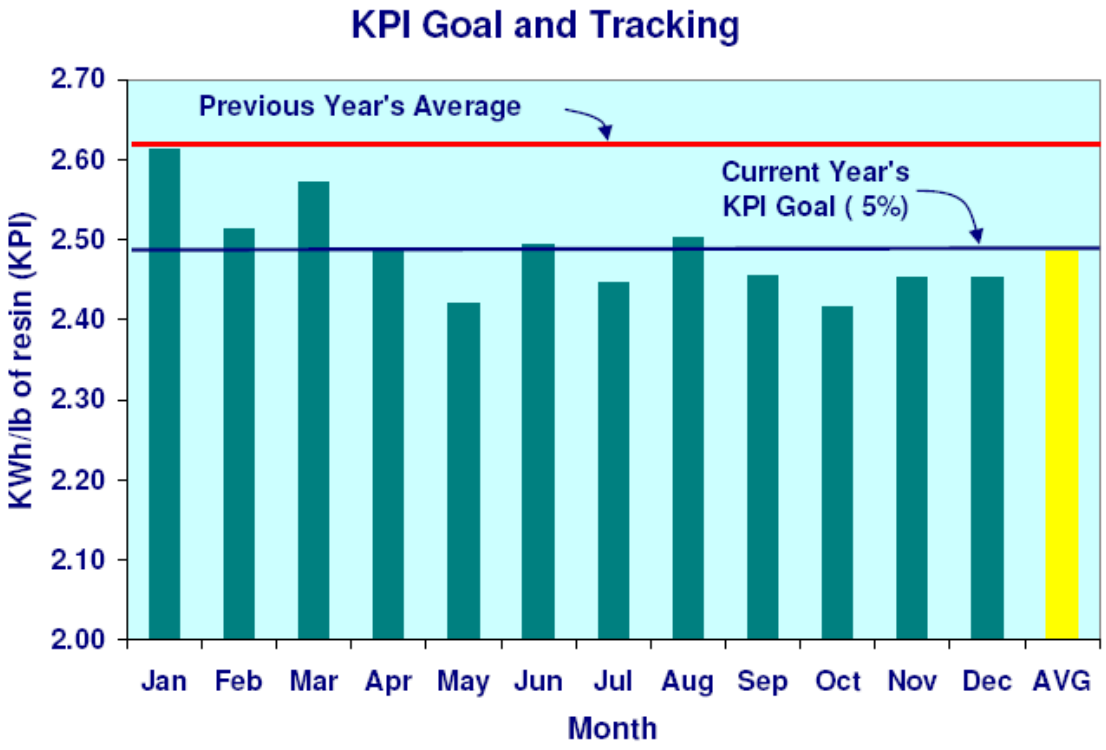
All projects require some formal management process to ensure effective planning, implementation and achievement of the desired outcome. This section of the PEM binder includes a sample Project Management Template. This section also contains the Project Task List for tracking the various project-related tasks identified and discussed within the context of an energy management team.

Also included in this section is a copy of). By electronically linking the Project Management and a Project Calculation Sheet (from the section on Best Practices) to the task list and the prioritization worksheet, PEM minimizes the amount of data entry and document updating required in maintaining an effective inventory of projects.

Key Performance Indicators

Key performance indicators (KPI) define and measure progress toward organizational goals. To be useful, KPI's must be well-defined, related to key operational factors, quantifiable, easily measured, and easily explained. A high-level energy-related KPI might be gas consumption per product produced or electricity used per ton of finished output. These high-level KPI's can be broken down by department or by time interval. In doing so, KPI's are helpful in identifying sources of waste and potential energy saving opportunities. This section provides a sample KPI. Because KPI analysis relies on energy use data as well as organizational specific data (such as production data), the electronic versions of the KPI material contained in this section are part of the electronic file for the Facility Profile. Figure 2 shows the tracking of the KPI for a plastic injection molding company.

Figure 2 – Key Performance Indicator Tracking



Continual Improvement

An effective energy management program goes beyond simply identifying and implementing energy efficiency projects. To maintain long-term stability while challenging participants to improve their energy management efforts, an energy management program must foster an iterative relationship among the primary program elements. These elements include:

- Management Commitment in the form of an energy management team, an energy policy statement, capital and human resource allocation, and periodic management reviews of facility energy performance and the energy management program itself.

- Planning involves gathering historical energy use data, determining where that energy is used within your organization, identifying energy opportunities, and prioritizing among those opportunities. It also involves setting energy savings goals and targets based on the potential opportunities.

- Implementation of actual energy savings projects is the goal of any energy management effort. It involves quantifying energy savings, generating realistic project costs, identifying other potential benefits, providing a well-reasoned justification, seeking management approval, and finally, undertaking and completing the project.

- Assessment involves measuring and verifying implemented energy efficiency projects to ensure savings are real and to instill confidence in the value of your energy management efforts.

- Communication of energy performance, energy projects, and program management with company senior management, department staffs, hourly employees and other appropriate parties such as customers and contractors.

Along with describing the process of continual improvement and the steps needed. This section includes many sample documents that can be used to facilitate the continual improvement process. These are:

- Energy Management Responsibility Matrix
- Energy Management Team Meeting Agenda
- Energy Management Team Meeting Minutes
- Energy Management Review Agenda
- Energy Management Review Meeting Minutes
- Energy Management Program Audits
- Sample Audit Plan
- Sample Audit Record
- Corrective & Preventive Action Inventory
- Corrective & Preventive Action Notice
- Communication & Involvement
- Measurement & Verification

The idea in this section, as with others, is for the user to use the materials that will be helpful and to modify them with their own information. This section is also meant to be used to keep track of other project materials like supplier quotes and measurements for various projects.

RESULTS OF PEM IMPLEMENTATION

During the four years of using PEM to help industrial companies, the Focus program has tried a number of different ways to use the PEM approach to bolster the energy management efforts of these companies. We have provided half-day PEM overview trainings to over 900 companies with more than 30 training sessions. Some of these trainings were with individual large companies at their sites.

We surveyed 65 participants of the first overview trainings 6 to 12 months after they took the training. We found that about 60% of them had incorporated some of the PEM tools into their energy management approach and that about 30% of them had implemented some type of energy management project because of the training. Even with this success the participants rated themselves a “2” out of “5” when asked how well they felt they had implemented the PEM approach. The most frequent reason they gave for not doing a better job was the limit on their time.

Recently we have provided on-site individual energy team facilitation using the PEM tools at more than a dozen large industrial companies. Typically we facilitate the energy teams keeping them on track and moving forward on projects. We have found that the energy team meetings need to be no more than two weeks apart on a scheduled two week rotation. This keeps the meetings on everyone’s calendar and provides the appropriate level of focus on tasks to keep projects moving forward.

One specific example of the use of the PEM approach was at a large meat processing facility in Wisconsin. The company staff originally attended the PEM overview training in the spring of 2005. The team then met every two weeks with the support of their electric utility (Wisconsin Public Service) and Focus on Energy representatives. They use the PEM tracking spreadsheets to manage their efforts and schedule tasks to make projects move forward. Tasks may include estimating potential energy savings or getting bids from contractors.

The tracking spreadsheet can also be used to estimate energy savings and keep track of savings that occur for implemented projects. This is used to show projections and results to upper management and provides the capital improvement team with projects for their consideration. The company has already made improvements with annual savings of $143,000 and planned projects with over $800,000 in annual savings. Together the implemented and planned projects have a simple payback of below 0.6 years.

CONCLUSIONS

Part of the intent of PEM is to overcome basic barriers that the Focus program has observed within industrial companies. In summary, these barriers are addressed using PEM as follows:

- **Lack of motivation from upper management** - PEM can be used to benchmark a company to provide motivation and show significant opportunity.
- **Limited time available from staff** - PEM provides an approach that is easy to implement
- **Inability to identifying all good opportunities** - With the PEM facility profiles, equipment profiles and best practices an energy manager can systematically identify opportunities.
- **Inability to impact process energy use** - Using the PEM approach requires developing a cross functional team that ties in those people responsible for process optimization. For most facilities the process is the largest energy user, but is usually too complex to impact if a team approach is not used.

In addition to helping to overcome these barriers, the PEM process has uncovered many project leads for the program and supported the Focus on Energy industrial program's impact on annual energy savings in FY2007 of 35,500 MWH, 5.6 MW and 4.9 million therms. The PEM tool and on-site facilitation has provided Focus on Energy and its customers a very valuable tool to systematically and comprehensively reduce energy use and costs.