Examining Factors that Influence the Commitment to Energy Master Planning in Industrial Organizations

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ABSTRACT

Economists and environmentalists have attempted to determine why a few proactive organizations embrace energy management master plans while most others fail to do so. Energy master planning signifies a commitment to conservation, efficiency and reduced environmental impacts. It institutes a top-down approach to planning, project implementation, results measurement, resource provision, and overall commitment to continual energy management improvement. While all organizations will benefit from energy management, the unanswered question is why so few organizations will commit to a structured master plan. If the factors influencing an organization's decision to implement an energy master plan could be determined, more locations might be persuaded to make the commitment.

The Energy and Environmental Management Center (EEMC) at Georgia Tech drafted the first energy master planning standard, MSE 2000. A national canvass group approved the standard, which the American National Standards Institute (ANSI) then adopted. Since its adoption in April, 2000, a number of commercial/industrial facilities have attempted to implement the standard. This paper analyzes the factors influencing the decision to embrace energy master planning in relation to characteristics of the organization. The objective is to identify possible strategies to accelerate the rate of adoption.

Introduction

When the Energy and Environmental Management Center (EEMC) at Georgia Tech drafted the first energy management standard, MSE 2000, the standards development team (almost all engineers) assumed that acceptance and implementation of the standard was simply a matter of making organizations aware of the standard, as its benefits were so "obvious." By the time the standard was declared an American National Standard, the authors were aware that the MSE 2000 standard faces the same barriers as other popular management systems such as ISO 9000 (quality management) and ISO 14000 (environmental management).

Our experience within industrial organizations agrees with research findings in a variety of areas requiring major organizational change. Without full upper management commitment, the implementation of any type of broad-based organizational system is doomed. In interviews with over 300 quality directors, researchers found that problems in obtaining management commitment, establishing an appropriate culture, and fully involving employees represented almost half the difficulties encountered (Lee, Faucett, and Briscoe 2000). Other researchers (Taylor and Wright 2003) concluded that senior management commitment and involvement are essential antecedents of TQM success. Management system performance is highly dependent on management attitudes toward understanding the standard being implemented (Young, Lee and Chun 2003). They also determined that only when senior management moves beyond a basic understanding of the standard to a commitment for adoption within operations does the organization reach its highest level of performance.

In examining the need for managing change during information technology projects, one researcher noted that changes in process, structure, and culture in the organizations tend to get little attention when implementation is heavily slanted toward technological aspects (McNish 2001). Implementation of Energy Master Planning requires awareness and consideration of organizational change achieved by revised management as well as technical practice. In a similar vein, f only when organizational priority is to continuing development and enhancement does top management support seem to be significant to end users (Marble 2003).An organization's ability to adopt energy management disciplines as a part of everyday activities depends on several organizational attributes required to achieve sustained energy management (Russell 2005). These attributes include fundamental business viability, energy champion leadership, pride intensity, fiscal protocol intensity, and engineering protocol. Thus, there are three types of attributes involved: one related to the "readiness" of the organization, one related to employee culture, and one related to technical documentation and control.

Factors Influencing Management Commitment to Energy Master Planning

With both research and experience as a guide, Georgia Tech EMC staff recognized that the best way to get upper management involvement, understanding, and support is to first develop an Energy Master Plan. Once upper management accepts the strategic importance of energy, the value of a management system such as ANSI/MSE 2000 becomes clear. Our analysis of the root causes of the major barriers to ANSI/MSE 2000 uncovered a common lack of organizational strategic energy planning appropriate to the organization.

Ultimately, upper management support (whether from the facility or at a corporate level) for master energy planning and implementation of a management system must be obtained first, followed quickly by early measurable successes designed to involve ever-widening circles of employees and permanently influencing the organization culture. For Energy Master Planning, this involves an organizational commitment to conservation of energy fuels and supplies, efficient use of fuels by equipment and systems, and reduced environmental impact. Upper management accomplishes this through a top-down approach to planning, embracing a process for energy management projects, providing adequate resources to support the management system for energy and committing to continual improvement in energy management.

Once management confirms their commitment, implementation of an appropriate level of the ANSI/MSE 2000 energy management system provides a structured, flexible approach to ensure that development, management, and maintenance of the system retains alignment with strategic corporate direction. MSE team members must appreciate the fact that management commitment must be continually supported and strengthened to ensure continued resources and general support. The need for strategic energy planning has been recognized in the past, but usually consists of a stand-alone energy planning piece lacking the input (and thus the support) of other employees. Thus, there is little communication and conscious joint effort in the same direction.

Factors Influencing Management System Implementation

Four case studies of ANSI/MSE 2000 implementation illustrate the factors influencing commitment to energy management in different organizations.

The first site is a large sorting and distribution warehouse with strong initial interest in ANSI/MSE 2000 but with excessive management turnover. Turnover required frequent retraining of upper managers, energy coordinators, and energy team members regarding the management system and its benefits. This delayed the move by the energy team into energy management projects, which would have generated results from the system.

Based on initial assessments, even simple O&M projects would have resulted in significant energy savings. Alternately, the lack of results led to a belief by both upper management and by employees that training and team meetings and communication were a "waste of time." Severe problems or uncertainty within an organization, regardless of cause, can doom implementation attempts. In addition, early results are critical in developing employee support and in continuing upper management commitment.

In a second, a major manufacturing and repair facility, too much emphasis on the technical aspects of the management system for energy resulted in little attention left for other aspects of the management system. The early energy assessment revealed major opportunities for savings. Because upper management and the consulting implementation engineer shared the same technical leanings and enjoyed project implementation, other employees never became involved in the project or the management system. When the upper management champion left in a promotion to a different area, the entire implementation program disbanded. Clearly, both employee involvement and implementation of a sustainable system are crucial to development, implementation and maintenance of the management system.

Another large process manufacturer had demonstrated their concern with energy management by having a consulting firm develop a series of projects, data collection systems, and standard operating procedures. The result was a facility with some engineering protocols and empirical data, but little usable information or internal energy management expertise.

After upper management committed to ANSI/MSE 2000 implementation, they quickly selected an energy coordinator and energy team. The energy team installed data management software to gain an understanding of their energy situation, and began the MSE 2000 process of the alignment of upper management direction (energy policy, energy goals, management review) with energy-related activities within the entire organization. The MSE team adapted or incorporated existing programs and procedures or developed appropriate guidance (energy manual), programs (corrective and preventive action, internal MSE auditing) and procedures (document control, recordkeeping) to conform to the ANSI/MSE 2000 standard. Even with very tight resources and a change in plant managers in the midst of the implementation process, the facility was successful in completing implementation.

Last, a major carpet manufacturer, already known for their corporate energy and environmental responsibility, decided to implement ANSI/MSE 2000 as a way to improve both these areas. The company also appreciated that formal registration to a standard would allow wide recognition and add to their stature and recognition as a "green" company.

The energy coordinator (as "energy champion") handled all strategic planning and involvement in the implementation. Only gradually did he realize the need for continual upper management involvement and resource support.

Because the process was gradual, it took some time for employee training and system results to overcome resistance to change by line operators. The energy coordinator accomplished this by releasing the seemingly overwhelming task of developing operating procedures for numerous pieces of large equipment running over 400 different product variations to line operators. The coordinator determined that the energy team could gain most energy savings by concentrating on a small number of significant machines. (Pareto Rule: 20% of the actors cause 80% of the results) Once the first group of machines was in control and operating efficiently, the system members could move on to other "significant energy uses" and thereby increase the range of process and equipment control within the management system.

Line operators, once involved in the project, realized that they could summarize most of the differences between products in a graphical chart showing the required equipment settings, reducing the amount of documentation to an extremely small amount. This success energized the MSE team and operators, who went on to envision and implement creative approaches to long-standing problems, resulting in considerable savings. This result emphasizes the need for a multi-disciplinary team and wide employee involvement.

Because of limited resources, the energy coordinator insisted on handling internal auditing himself. After six months, he recognized the need for training and procedures (even if not formal) to ensure sustainability of the system. The management system for energy at this plant has been running smoothly for some time now. In fact, this organization will soon be the first formally registered to the ANSI/MSE 2000 standard.

Responses to Lessons Learned

Due to the system implementation success in some organizations and failure in others, the standards team attempted to draw lessons from each site. The first lesson learned is that not all organizations are ready to undertake a management system for energy. Even when expressing interest in energy master planning and implementation, until an organization is fundamentally viable (including being without major turnover in upper management,) no implementation can be successful. We have incorporated some of the questions developed by Chris Russell in our initial marketing with organizations to determine if they truly are ready to undertake a project requiring so much communication and integration.

We also responded to the need for a more visible variety of approaches and implementations by developing an incremental approach. The organization's entry into an implementation now depends on where they start on the strategies/attributes scale.

Many smaller manufacturers will stop at a relatively low level. However, because of the fully functioning MSE 2000 management system, sustained savings and continual improvement will continue. Others will decide to improve their energy management system to gain further rewards by moving into the next level of sophistication. All implementations begin and periodically require further strategic planning. This brings even the small manufacturer into the company of larger industries using energy master planning. It also ensures strategic energy documents are continually updated and improved.

Table 1 summarizes the Georgia Tech EEMC response to barriers encountered in the implementation of an ANSI/MSE 2000 strategic energy management system.

Table 1: Georgia Tech MSE 2000 Developers' Responses to Implementation Barriers

Barrier	Impact	Response
• Excessive management turnover	Fatal	Organization must be fundamentally viable first.
• Delayed generation of projects results	Severe	Adapted the implementation guidance and assistance to ensure project results begin early in the implementation.
• Placing technical above management elements; lack of understanding of interactions between management and technical elements of the system	Fatal	Improved early contact with upper management to ensure understanding of the standard and support of the management system for energy; strengthened requirements for upper management involvement and responsibilities; strengthened content of management reviews; placed more emphasis on the process rather than content of energy management projects.
• Reliance on single person for implementation	Fatal, unless changed early	Increased requirements for upper management involvements, where they can identify resource needs more easily; more emphasis on the necessity of an interdisciplinary energy team
• Gathering of quantities of data rather than development of information	Moderate, as usually caught fairly early	Emphasize the use of energy information (after analysis) in energy planning; offer a GTEEMC-developed easy-to-use software tool for data management and analysis
• Developing duplicate or incompatible programs or procedures	Moderate, as can be rectified later	During the development of procedures and programs, caution team members to determine relevant existing documentation; incorporate if conforms to standard, adapt if missing some requirements, and communicate with owners of these documents. Develop new procedures or programs only if absolutely necessary!
• Single person unable to generate options for system elements or content	Serious, if not fatal	Avoid "burnout" or lack of knowledge/experience by requiring an interdisciplinary team, which includes a wide variety of viewpoints, insights, and ideas.
• Attempt to operate without a fully sustainable management system for energy	Minor to eventually fatal, depending on response	Development of an "incremental implementation" approach that allows full tailoring to size, scope, and resources with a variety of levels to meet requirements for a fully sustaining system.

Source: Georgia Tech EEMC ANSI/MSE 2000 Implementations and Responses Incorporated into Revised Standard or Program. 2005

Delayed generation of first results from the management system for energy was a problem at a number of sites. Management and employees both have a need to see an almost immediate return for their efforts. By encouraging early training in the *process* (identifying opportunities and potential energy management projects, evaluating value of each project to the company, prioritizing and selecting projects, evaluating results, reporting results, and updating documentation and behavior based on results), we tie all energy management projects to the system. Most early projects are simple no- or low-cost operations and maintenance changes that show an immediate payback.

This early success energizes the team and satisfies upper management that the system is working. It also provides an amazing stimulus to the creativity and willingness to share improvement ideas of operators, maintenance workers, and other often-neglected sources of information. The energy generated begins visibly to move the culture of the company to one of energy awareness and proactive action.

Upper management understanding of the standard elements, benefits, and costs of a management system is vital to implementation success. A simple overview of the standard is generally not sufficient to provide that level of understanding. The revised standard format is now an easy-to-understand process that follows the flow of the system.

Both upper management and plant engineers often feel most comfortable with the technical (energy management projects) side of the standard. However, the *interaction* between the management and technical sides is what provides a sustainable energy management system. Process rather than technical content receives more emphasis. Planned implementations now incorporate deeper discussion of the standard itself and the function of each requirement, as well as benefits and costs from management's standpoint.

Facilitation results in upper management's acknowledgement of the purpose and value of continued support and involvement in the system and is now required prior to the start of implementation. The revised standard further strengthens management responsibilities and expands content of the management review. The system builds in frequent interaction and communication with upper management from the beginning.

Reliance on a single person to perform all energy management tasks is common, especially in smaller facilities. Many large energy-intensive facilities have reduced staff to the point where resources are very limited. No matter how good that person is, unless the energy staff expands to an interdisciplinary team (including management) early in the implementation, the system will eventually fail. The ANSI/MSE 2000 standard is extremely flexible and, through smarter processes and procedures, a system can still avoid overloading those organizations with few resources. Undeniably, more efficient plant operation means personnel have more time, as constant "firefighting" ceases. This added time also permits further employee (and management) participation.

While most companies have little energy data, some recognize the importance of monitoring energy use parameters and proceed to sub-meter every piece of equipment. Frequently, the sheer amount of data makes analysis difficult or impossible. Data alone is NOT information, which suggests and supports decisions. The revised standard emphasizes the value of energy information in energy planning.

A software tool GTEEMC developed, *Energy Profiler*[11], provides an inexpensive and easy-to-use tool for data management and analysis. Many database packages, including the *Energy Profiler*, automatically produce a variety of graphical reports. By basing exchanges on the energy decision needs of each level of the organization, dissemination of information from these graphics makes value-added communication easier.

During the development of system documentation, many organizations fear leaving anything out and thus develop an extensive array of processes and procedures. This quickly becomes unwieldy and loses effectiveness. Emphasis now is on a measured approach, which

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[1] User and licensing information on the Energy Profiler software is listed on the Georgia Tech Energy and Environmental management Center website at www.edi.gatech.edu/energy.

identifies existing organizational documentation, determines whether it already conforms to the standard (and thus can be incorporated directly into the system) or needs tailoring to reach conformance. Analysis of the need for remaining documents will surprisingly lessen this most-dreaded task. Whenever possible, use of existing processes and procedures (or a relatively close cousin) increases employee acceptance of change.

Make sure at least one equipment operator is a member of the energy team. An operator frequently can determine quickly what level of documentation is required in various technical areas. It is crucial that the energy team communicate with the "owners" of current processes and procedures to discuss the appropriate use of their system. Operators and other technical personnel appreciate training (formal or informal) to introduce and explain new or changed requirements.

A single person controlling implementation and/or operation of a system with this range of coverage often depletes their ideas for continued improvement. Lack of extensive energy engineering knowledge and experience (especially with unintended consequences for other systems) or simple "burnout," are common problems. ANSI/MSE 2000 requirements for basic qualifications of an energy coordinator and an interdisciplinary team prevent this "block." The wide variety of viewpoints, insights, and ideas generated by this structure is invaluable. It also opens the team and eventually all employees to new ideas and improvements.

As experienced by at least one company, the exclusion of even one element of the management system for energy affects system performance. In most cases, organizations not expecting to register formally to the ANSI/MSE 2000 standard want to implement and maintain the system without internal MSE audits. While the system will implement successfully, within six months or a year, erosion of system performance is noticeable.

An "incremental implementation" approach allows full tailoring to size, scope, and resource availability by offering a variety of levels of programs, processes, and procedures. The full system required for energy management control and continual improvement requires degree of all of these elements. An incremental approach allows an organization to determine the "best fit" for their organization, while leaving open the option to expand the system later.

Conclusion

While organizations may face a variety of barriers to implementation of a strategic energy management system exemplified by ANSI/MSE 2000, success primarily depends on the "readiness" of the organization in terms of:

1. Fundamental business viability, including excessive turnover, the intensity of fiscal protocols, and strategic vision of upper management;
2. Employee culture and willingness to change, including the existence of energy leadership, the intensity of employee pride in their value to the organization, and a proactive training policy; and the
3. Level of technical documentation and control, including engineering and project management protocols, already existing within the organization,

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