Overcoming Barriers to Effective Energy Management in Industrial Settings

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ABSTRACT

Energy management for industry is many times an unspoken objective in organizations because it is desirable to reduce operating costs but often not important enough to justify a financial investment in managing. Unfortunately without a comprehensively planned and adequately funded management program, energy management efforts degrade into unsustainable or ineffective programs that are discarded and forgotten shortly after initiation until the next energy crisis occurs. To overcome see-saw management efforts, implementation of systematic management like that described in the ANSI/MSE 2000 standard is recommended. The ANSI/MSE 2000 energy management standard contains the elements necessary to institute and sustain a system of continuous improvement in energy management.

While ANSI/MSE 2000 contains all the elements necessary to describe an effective management system, translating it from a standards document into a functioning real world management system can be complex. This paper details the implementation process at two industrial facilities. Activities involved in planning, instituting and maintaining an energy management system are presented. Additionally, barriers to successful implementation such as management commitment, funding support, project identification and prioritization, selection of energy team participants and tracking management system progress are described and resolutions discussed. The finished management system structure and system results are presented.

Introduction

Managing energy to reduce operating cost, minimize environmental impact and increase profitability has traditionally been a hard sell to executives and difficult task for those assigned. In most cases, since energy is not viewed as a "core" component of business activity a haphazard approach is followed. When energy is in short supply or energy prices rise, energy management becomes a major focus. After the "crisis" period passes, normal operations resume and energy is relegated to a secondary role.

Effective management of energy requires an organizational structure that elevates the importance of energy within the business and delineates the people, resources and planning to achieve the desired results. Achieving short-term results when energy is viewed as important to the organization is easy compared to achieving and maintaining long-term savings and efficiency objectives. One proven method to sustain and increase organizational efficiency in a given area is by instituting a management system consisting of elements formulated to improve management in a particular area.

While management systems to address quality and environmental issues have been heartily adopted by industries, energy management as yet remains a step-child with few organizations implementing a formal energy management system. ANSI/MSE 2000, the management system for energy national standard, employs the approach incorporated by these other management systems and adapts it directly to energy (American National Standards Institute. 2000). The elements of the standard are discussed in a feature article for Energy Manager magazine (Brown, Mike. 1999).

Although not yet widely adopted by industrial organizations, ANSI/MSE 2000 has been implemented with encouraging results. To date, two organizational factors have driven the implementation of ANSI/MSE 2000. These factors are high energy costs as a percentage of total production or a commitment by organizational management to reduce environmental impact and increase sustainability.

Barriers to Effective Energy Management

Before describing a system to improve energy management, the barriers to effective management must first be identified and understood. While most experts argue that energy management is a technical problem that must be addressed with technological solutions, the framers of the energy management standard, ANSI/MSE 2000, formulated a management solution that incorporates both management and technical solutions to the problem. Whatever the technology identified by an organization to address their energy needs, it still must be implemented by people, and to optimize the outcome people have to be managed.

The ANSI/MSE 2000 standard was formulated to address barriers that frequently inhibit organizational ability to manage energy. These issues are lack of organizational commitment, insufficient resources, lack of energy data, shifting priorities, results not sustained, correcting symptoms instead of problems, and narrow focus. These barriers are detailed below. (Brown, Ibid.).

Lack of Organizational Commitment

A fundamental aspect of an organization's energy management effectiveness is their commitment. While bottom-up support may influence executive management for a time as evidenced by demands for employee parking, break and office appointments, employee-driven calls for improved energy management are not effective. Managers approve employee perks often with an eye toward maintaining or increasing productivity. Energy management has no such recognized link.

To make executive management appreciate the importance of energy, its importance to the organization must be presented. In today's business world, no organization can function without adequate energy input. Improving energy management is crucial to increased profitability, decreased dependence on non-sustainable resources and reduced environmental impact. Too often energy is treated as a crisis problem that can be fixed and forgotten while core business issues require constant attention. Unfortunately energy management requires constant attention to be effective. Once energy is removed from a primary focus of attention, the organization will slip back into unsound management practices.

Insufficient Resources

Energy, as any other managed area, requires a commitment of resources to be effective. Resources are required to cover the cost of command and control (oversight) as well as the cost of energy management projects. In most organizations capital resources are reserved for core functions, and energy management is relegated to secondary status. This means that not only are there no funds for energy projects, but the resources to manage energy do not exist.

To effectively manage energy resources, its importance within the organization must be made visible and demonstrated by making energy a core value and delegating manpower, capital resources, and commitment.

Lack of Energy Data

Because the authority for energy is spread across an organization, no one is responsible for its management and no one has accurate data regarding the consumption, cost, and organizational energy efficiency. To achieve proper management, data on usage, demand, utility rates, average price, marginal price, and energy consumption per unit of output must be available and used to influence organizational decisions. Someone in the organization must be assigned responsibility to collect, analyze and report energy cost, consumption and efficiency information.

Shifting Priorities

Effective management requires a sustained commitment to achieve measurable results. Too often, energy management is a passing fancy. When shortages occur or prices spike unexpectedly, energy becomes the crisis de jour and receives the full attention of the organization. Then when market conditions change, energy management is once again relegated to a minor concern. Because energy is used every day, it must be managed every day.

Employing a crisis approach to energy, or any other organizational concern, produces no sustained improvement and often results in resentment as organizational priorities are constantly changed. Effective management of energy requires a stable, committed staff to provide command and control, collect and analyze energy data, and implement energy management projects. A firm commitment to energy management must be demonstrated by providing adequate resources, and following a carefully planned strategy.

Results Not Sustained

Sustaining the effort in energy management faces the same concerns as shifting priorities described above. Too often, energy problems are handled with a crisis approach. After the perceived crisis passes or is superceded by other concerns, the effort devoted to managing energy is removed and placed elsewhere. Sustaining energy management efforts and results can only be achieved by instituting a recognized, stable management that defines a structure for managing energy within the organization.

Correcting Symptoms instead of Problems

Many times, a crisis approach to manage resources results in a focus on easy solutions and quick results. This can often cause a reliance on correcting symptom instead of identifying and solving the actual problem. Instead of focusing on completing projects divorced from results, the emphasis should be on results that address root cause problems. Concentrating on problems instead of symptoms can be achieved by tracking the results of energy management efforts and using measurement to determine if the correction employed yielded sustained improvement.

Narrow Focus

In most cases, the responsibility for energy management is centralized in a single functional area, such as engineering or maintenance. Employing a narrow focus limits the range of opportunities identified and fails to consider how an opportunity identified in one functional area may impact a different department. While the organization's technical expertise may exist primarily in one departmental area, energy opportunities are not limited to technological improvements and can include improved purchasing, operating practices and maintenance. Widening the focus and participation in energy management will yield measurable improvement in the results.

Addressing Energy Management Barriers

The barriers described above present a serious impediment to effective energy management. However, instituting a structured, stable management system like that described by ANSI/MSE 2000 can address and overcome these barriers. ANSI/MSE 2000 implementation at two contrasting industrial sites will be considered. The first site is a recycled paper mill. ANSI/MSE 2000 was instituted because energy represents over 25 percent of the cost of manufacturing and tight control must be maintained if any profit is returned. The second plant manufactures carpet and floor covering. Although energy does not constitute as large a percentage of manufacturing cost as recycled paper, the parent corporation has made a commitment to sustainability in managing wastewater, solid waste and energy. ANSI/MSE 2000 was implemented as a tool to reduce energy losses and improve plant efficiency. How ANSI/MSE 2000 helped both these facilities address the common barriers to effective energy management is presented below.

Organizational Commitment

Implementation of MSE 2000 by definition begins at the top. Executive management must formulate, communicate and embrace the organization's energy management policy. The policy sets the tone for the entire organization and establishes a firm commitment to sustained energy management. With the policy, goals, targets and projects aligned with executive management's priorities, the energy management system ensures that management objectives are fulfilled. System internal consistency promotes this alignment.

In addition, the MSE standard requires that executive management maintain their commitment to energy management by conducting regular management reviews. The

management review schedule and agenda is determined by the individual organization but should include management system performance, energy indicators, projects completed and planned, resource needs, and future directions.

In both organizations, executive management made the commitment to proceed with implementation. In both plants, management teams participated in the development of the energy policy, guided the selection of the energy team and continue to closely monitor management system function (Brown, Michael and Adams, John. 2000). The paper mill energy team consists of eight people including representatives from engineering, maintenance, production, purchasing and operations. The carpet mill's energy team includes representatives from engineering, production, maintenance, environmental and purchasing. The environmental manager was appointed to the energy team because the organization's primary focus was environmental stewardship.

Resource Allocation

Due to the high energy cost involved with paper manufacturing, the paper mill funded a custom implementation of MSE 2000. Management provides support for the energy team to attend training events and planning meetings. After an energy assessment identified viable projects, funds to cover low investment projects were allocated. At this facility, the MSE 2000 institutionalized energy management and elevated it to a standing function of the same level as safety and environmental management.

The carpet plant had an active environmental management team, so the cost to cover energy team labor was drawn from the same fund. Because energy costs are lower for carpet manufacturing than paper, the energy management projects in this facility concentrated on creating operating and maintenance procedures for energy intensive equipment.

Because the carpet plant had no other management system in place, one need was to complete operating procedures for all the significant energy users in the facility. The large number of significant energy users forced a change in the organization's perception regarding operating procedures. Instead of detailed text describing the correct operating settings for each type of carpet run on each machine, the team found that settings for different carpet types on a given machine could most easily be displayed in a table. Use of tables of settings reduced the number of required procedures from 400 to only 40. This reduced the time necessary to complete documentation.

Energy Data

Capturing and analyzing energy data is an essential element of energy management. Georgia Tech EEMC provided both plants with a spreadsheet package to monitor energy performance. The software stores data on energy usage, energy cost and production output. It calculates average and marginal energy costs, converts all energy units to Btu, and presents the average cost per Btu of each energy resource. Tracking energy data on a monthly basis facilitates comparisons between different months, seasons and years. Changing trends quickly become apparent so root causes can be investigated.

Both facilities identified energy indicators (unit energy factors) that are industry specific. Gross energy data for the paper mill is calculated per ton of paper produced. For the carpet plant, the energy indicator used is dollars and Btu per square yard. As part of their

measurement system, the carpet plant installed sub-meters for several significant users (drying ovens, coating ovens, and dye machines).

Shifting Priorities

One hallmark of an effective management system is structured planning, and MSE 2000 is no different. This system employs a team approach and uses energy and production data to identify baseline operating conditions and potential improvement opportunities. Following the establishment of an energy management team at both facilities, each organization cooperated with Georgia Tech to complete a detailed energy assessment (Brown, Michael and Long, Joshua. 2002., Adams, John and Hitch, Robert. 2000., Meffert, Bill and Adams, John. 2000).

The plant energy assessment provided a list of energy saving opportunities complete with projected energy and cost savings, estimated investment and simple payback. The energy team used the assessment report as a planning document to complete a feasibility study and prioritize the projects for implementation order. Management review was used to oversee the planning process, project implementation, and to track project savings. The impact of good planning cannot be overemphasized. The projects identified and implemented during the initial year of MSE 2000 are shown in Table 1 for both facilities.

Table 1. MSE 2000 Projects

Paper Mill	Carpet Mill
Reduce deaerator pressure	Report and repair steam and air leaks
Install ASD exhaust fans on paper machine	Install energy-efficient space dye machine

Sustaining Effort

Many facilities embark on an energy management program that is successful at the beginning yet dies due to lack of interest after the easy improvements have been exhausted. The trick is to sustain a program over the long term. The management structure, central to MSE 2000, is critical to this achieving this objective. Organizing a program that has the full support of executive management, is carefully planned and executed, quantifies results and tracks progress and has a team to provide momentum will ensure success. Organizations follow the will of their leaders, and when the responsible executives embrace MSE 2000 it conveys the importance of energy to everyone.

The energy policy is a statement approved by management that expresses the organizations commitment to managing energy. Furthermore, the MSE 2000 standard document requires that the policy statement express commitment to continual improvement. Continual improvement was included as a requirement to encourage sustaining the energy management program.

Regular management reviews function to sustain the management system. Management review serves as a feedback mechanism evaluate the results of the system and move the program forward based on the results discovered. When problem areas are

identified, corrections are implemented by revising system procedures. Permanent improvement is sustained by incorporating revised procedures into training.

Correcting Problems: Corrective/Preventive Action

Instead of repeatedly correcting symptoms, a properly administered management system identifies and corrects problems. The avenue through which problems can be identified and corrected is the corrective/preventive action (C/PA) mechanism. When management system or technical problems are identified, C/PA is the process by which a fix can be developed and incorporated into the organization's procedures. Corrective/ preventive action processes increase the robustness of the management system by adding an element of flexibility.

The paper mill plant had an existing work order system to rectify problem issues. The problems were sorted according to a quick assessment (i.e. instantaneous solution identified and implemented or capital solution ordered or additional problem study needed). The work order system was revised and used to correct energy management system problems. The work order system now includes a problem solving focus to identify problem root cause before a solution is selected. Additionally, a verification step was included to assure that the solution identified is correct.

The carpet mill used example forms and procedures to develop their corrective/preventive action system. Example documents and forms for MSE 2000 are provided in supporting guidance documents (Georgia Tech Research Corp. 2002).

Narrow Focus

Broadening the focus of energy management efforts is accomplished through the selection of the energy management team and through writing formal communication procedures. By requiring that the energy team have members from each functional area concerned with energy, the focus of energy management is widened. Effective communication requires the energy team to share information on the impact of energy within the facility and the results of energy management efforts. Sharing the results of the energy management program improves the perception of energy in the organization.

The facilities examined in this study used energy reports to communicate program results to team members and executive management and charts and graphs to communicate results to the general work staff. In both organizations, the MSE 2000 system has increased the awareness and importance of energy management to everyone in the facility.

Conclusion

Instituting a formal energy management system like ANSI/MSE 2000 at an industrial or commercial facility can yield huge improvements in organizational efficiency and sustain improvements for the long term. Implementation of the ANSI/MSE 2000 management system at two representative manufacturing plants has demonstrated the advantages of adopting such a plan. The completed implementations demonstrate that the most feasible candidates for an energy management system are those with high total energy costs, with

energy cost greater than 20% of the manufacturing cost, or those with an organizational commitment of improved environmental stewardship.

When an organization has the characteristics that make a firm commitment to energy management practical, institution of a formal energy management system should be considered. The ANSI/MSE 2000 standard will yield improved efficiency, increased cost savings, continual improvement and sustainable energy management in implementing organizations.

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