

A Management System Standard for Energy

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ABSTRACT

Energy management, although a common aspiration among organizations, is seldom if ever achieved for the long term. The fluidity of individuals, management goals, and organizational objectives has made energy management all but unsustainable. One proven method to overcome volatile change within and without organizations is to adopt and implement a structured approach to management. Management systems defined by a documented standard present an ideal structure by which the management practices in every organization can be measured. The Management System for Energy, ANSI/MSE 2000, defines the elements necessary to create a stable, yet flexible, and sustainable structure for energy management.

INTRODUCTION

In most organizations, management of energy is relegated to a secondary function behind raw material and labor procurement, productivity, quality, safety, and environmental. The significance of energy is too often dismissed because it is viewed as a specialized field outside the core business of most organizations. Only when energy supply is constrained, energy price rapidly spikes, or deferred maintenance of energy systems results in production losses do energy managers receive significant attention. These short-term crisis conditions result in a realization of the importance of energy to the long-term viability of the organization and cause much effort directed to effective energy management in order to weather the crisis.

Unfortunately, past experience indicates that resorting to crisis management techniques with energy will generate only short-lived improvements. Long-term, lasting improvement in energy management can be achieved only when organizational management makes energy a priority. The nationally adopted management system

standard for energy, ANSI/MSE 2000, describes the elements required for a lasting program of continual improvement in organizational energy management. While implementation of the ANSI/MSE 2000 management system does not magically reduce energy expenditures by 40 percent, it does represent a reasonable and practical approach to improving energy management.

ENERGY MANAGEMENT-HISTORICAL PERSPECTIVE

Energy management in industrial, institutional and commercial facilities has evolved significantly since the days before the first Arab oil embargo. In the era prior to the embargo, energy was so inexpensive that little or no effort was wasted in managing it. After the rapid price escalations following the embargo, organizations enlisted outside specialists or consultants to develop conservation recommendations and an energy management plan. Energy consultants from universities, utilities or private firms brought the technical expertise necessary to solve complex energy problems into the organization.

Because it was cumbersome and often inconvenient to rely on external resources when managing energy and formulating management plans, the next step in the evolution of energy management was denoting an internal energy manager. To facilitate the training and standardize the knowledge base for energy managers, the Association of Energy Engineers (AEE) developed the Certified Energy Manager (CEM) program. To become certified, technical employees attend a one-week training course and pass the certification exam. CEMs have become a recognized and valued resource when dealing with energy management issues in many organizations across the globe.

While the Certified Energy Manager represents the culmination of years of development work in an energy

specialization, organizations with one person as the focal point of all energy efforts are at risk because employees are mobile and can retire, transfer, or change employers. If the designated energy manager leaves, the organization may be left with no one coordinating energy management activities and effectively no energy management program.

To share the responsibility of energy management, forward-thinking organizations recognized the need to create an energy management team. A team has the advantage of not limiting the effort to a single individual. By involving people from diverse functional areas, unique and creative management opportunities can often result. A few organizations have recognized the importance of sharing energy management responsibility and evolved to the sophistication of appointing and empowering an energy team.

IMPROVING ENERGY MANAGEMENT BY ADDING STRUCTURE

Appointing an energy team will improve organizational energy management; but the lack of formalized processes for managing energy inhibits the evolution of a stable, long-term program. A management system is a documented structure that defines an organization’s goals, policies, and procedures and the processes by which they are maintained and improved. A management system establishes clear-cut responsibilities, documented procedures, ongoing training, internal checks for conformance, corrective and preventive action, management reviews, and continual improvement.

Management systems to direct an organization’s quality and environmental programs are accepted and in wide use today. The management system for energy, MSE 2000, draws on these proven approaches to define all the necessary elements of an effective program which can assist an organization in achieving efficient energy use while meeting other management objectives (1).

The MSE 2000 management system for energy, like ISO 9000 for quality and ISO 14000 for environmental, is defined in a documented management standard. A management system establishes a stable structure because you must do the things included in the standard, but it is flexible because the standard does not tell you how to do them. The MSE 2000 standard was adopted as a national standard by ANSI (the American National Standards Institute) in April, 2000.

MANAGEMENT SYSTEM FOR ENERGY STRUCTURE

The Management System for Energy is defined in a standard that prescribes the required elements that must be implemented. Figure 1 (below) presents where each of the elements contained in the standard fit into the plan-do-

check-act cycle. The standard addresses both management and technical aspects of energy usage.

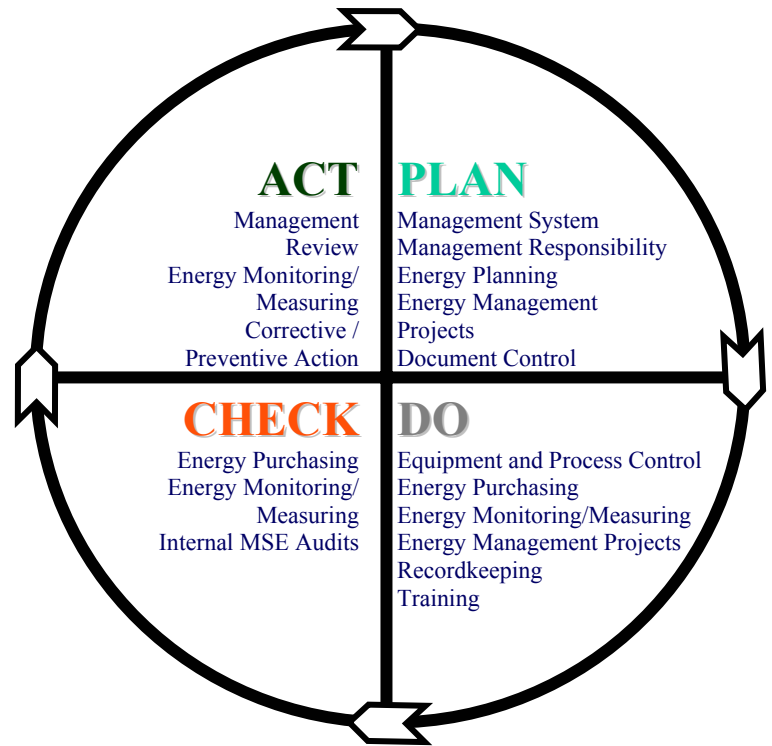


Figure 1. The Plan-Do-Check-Act Cycle showing elements of the Management System for Energy (MSE) in each quadrant.

The primary objective of the MSE 2000 system is to control energy usage and cost at a facility. An estimated energy savings of 10% to 20% can be achieved through efficient operation and proper maintenance of a building's existing systems. Eliminating the unnecessary energy use and implementing other simple no or low cost improvements can produce measurable energy and cost savings (2). Improving energy purchasing practice and implementing efficient capital projects will yield even greater savings.

Close control of energy expenses and optimization of energy efficiency at a facility can also improve the public

perception and acceptance of a company. For many organizations, their commitment to energy efficiency translates into higher sales, greater profits and general improvement in financial indicators. In addition, the energy management system is structured to continually review progress toward established energy goals. This review promotes continual improvement of both the management and technical system. The steps involved in implementing the ANSI/MSE 2000 management system are described below (3).

Step 1. Initiate the System

The first step in the implementation of any management system is establishing the underlying principles that will guide the program and selection of appropriate personnel to put it into practice. Support of top management must be secured before any action is taken. Although executive management is not normally involved in the day-to-day operation of the system, their endorsement establishes energy management as an organizational priority and legitimizes the energy management system.

After deciding to implement ANSI/MSE 2000 in a facility or organization, management can then appoint an energy management team coordinator. The energy coordinator serves as the focal point for all subsequent management system efforts. Next, members of the energy management team should be selected. When deciding on team members, representatives from all the major functional areas within the operation having contact, dependence or responsibility for energy resources must be included. After the team is complete, a meeting with executive management should be convened to develop the energy policy. The energy policy should describe the overall direction and commitment to energy management by the organization and focus management efforts. In formulating a policy, management must state their commitment to continual improvement.

Step 2. Plan

Set Goals

Once the structure of the management system is in place, the planning aspect of the system begins. After the policy is defined, energy management goals are set to align with energy policy. The goals should be specific and cover a defined time interval. This permits monitoring of system performance.

Acceptable goals can be general or specific so long as they are compatible with the defined energy policy. Whether specific or general, system goals must be readily measurable.

Monitor Energy

Once the goals are established and agreed on, the next phase in the planning process is

monitoring of energy resource consumption and cost. Accurate tracking of plant energy usage is the only way that performance can be measured, and feedback incorporated into new and revised goals. An old adage states, "If you can't measure it, you can't manage it." This certainly applies to energy resources. Energy suppliers provide consumption and cost data to customers for custody transfer and billing. One objective of the energy management team is to match the energy measurement period with that of the production period so that a baseline performance measure can be calculated. Tracking energy consumption and production in the future will permit energy efficiency comparisons to be made, and management system technical performance to be determined.

In order to compare energy efficiencies from different time periods, an index must be calculated. Indexes are defined as cost or consumption per unit of production, output or amount of value added during processing. A simple index that provides sound insight into process efficiency is the efficiency index (energy consumption divided by the amount produced or Btu/unit). When Btu/unit produced is used as an index, the cost index (utility cost/unit) should also be determined because the efficiency index provides no insight into cost. Other indexes can be developed so long as they effectively communicate process and cost efficiencies.

Step 3. Do

Identify and Assess Opportunities

After the management system is initiated, goals are set, and energy resource tracking begun, the next step in the process is developing means to achieve the goals. Energy management goals are met by identifying savings measures and assessing (analyzing) the measures so they can be prioritized. The prioritized list then becomes an action plan for achieving the management system for energy goals.

Four types of energy cost saving opportunities exist: purchasing, operation, maintenance, and capital improvements. To afford the most cost-effective plan of investment, measures should be implemented in the order presented above. Purchasing, operation, and maintenance are considered first because usually little or no capital investment is involved. Although the savings generated with these types of measures is commonly less than that from capital improvements, the potential returns and inherent risks are better understood. Starting with simple measures will help insure successful implementation.

1. Energy Purchasing

When a list of potential measures has been compiled, those dealing with cost savings from improved purchasing practices should have first

priority. Purchasing improvements often involve little or no capital-expense, yet can offer substantial cost savings.

2. Equipment and Process Control

The way energy and process systems are operated constitutes a second category of savings opportunities that should be considered. Equipment and process control involves the temperature, pressure, operating hours, load point or other relevant operating variable for a system. Too often, energy or process systems are operated uneconomically because no one has verified what the required conditions actually are. Control losses occur when energy systems are operated out of the intended range. Restoring a system to the proper condition can generally eliminate this loss. Often the only cost involved is a small amount for labor.

Not only must energy systems be operated correctly to optimize energy consumption, they must be maintained as well. Improper maintenance causes unintentional losses due to improperly adjusted or misadjusted equipment settings. Maintenance is another low cost opportunity usually involving a small amount of labor and replacement or repair of non-functioning parts.

3. Energy Management Projects

After the no-cost and low-cost type measures described above have been exhausted, investments to upgrade and improve the facility's capital equipment should be considered. Capital projects may also involve a plant expansion or process addition.

Potential saving measures can be identified in energy management team brainstorming sessions by energy management team members familiar with individual energy systems, by suggestions from maintenance and equipment operating personnel, or by consultants hired from outside the firm. Both required investment and financial risk increase as you move from simple operation and maintenance measures to capital measures. ANSI/MSE 2000 encourages the consideration of purchasing opportunities first, followed by maintenance and operation. Capital measures, because they have the greatest investment and highest risk, should be considered last.

After a representative list of opportunities is formulated, each one must be assessed to determine its saving potential. Assessment involves collecting detailed operating conditions and performing calculations that

quantify the measure's savings. Depending on the type of measure being considered, information such as temperature, flow, pressure, power input, efficiency, load factor, and energy consumption may be required. To determine annual energy and cost savings, the actual operating hours and incremental energy cost are needed. Using the determined operating conditions and incremental utility cost, energy and cost savings for a given opportunity can be found. In addition, non-energy benefits and costs are incorporated into the analysis.

Implement Opportunities

Perhaps the most important aspect of the "do" phase is implementation. Here the opportunities identified earlier are put into practice based on planned priorities. Because time and capital resources are always limited, prioritization of opportunities is essential. Opportunities are prioritized based on management goals as well as factors in related areas, such as environmental impact, waste reduction, process safety, productivity, and production.

Step 4. Check

The fourth step in the cycle is checking. Two areas are of concern: 1) technology implementation effectiveness and 2) management system effectiveness. This step includes methods to evaluate both areas.

1. Energy Monitoring and Measuring

Energy monitoring and measuring at the startup of the management system provide baseline data on which to compare performance. Energy monitoring refers to the tracking and analysis of data provided by the utility or energy supplier. It provides a global view of energy management performance. Energy measuring refers to usage at a finer level than the main utility meter. Measuring is often called sub-metering. Energy measuring is appropriate to quantify the effect of improvements at the system or process level. Detailed descriptions of measuring techniques are outlined in the International Performance Measurement and Verification Protocol (4). Both monitoring and measuring are useful in checking management system performance and success of technical improvements.

2. Internal Audits

Failures of the management system can be resolved by conducting an internal audit. Internal audits are planned surveys of the management system conducted by trained auditors from within the company. The purpose of internal audits is to document conformance with system requirements, to determine management system effectiveness, and to fully implement the standard (since internal audits are

a standard requirement). Audits ensure conformance with the standard and improve management system effectiveness. Audit results are a listing of nonconformities to the requirements.

Step 5. Act

The final step in the management cycle is act. Action refers to executing recommendations developed during system checks, the previous step. Action items include activities to improve energy efficiency and/or management system effectiveness.

1. Management Review- Management review is concerned with both management system and technology implementation effectiveness. During the review meeting, the energy savings from technical measures are reported and compared with goals to determine if planned objectives were realized. If project goals are met, the management and technical aspects of the system are functioning adequately and new goals should be established for the next cycle. Failure to meet goals should be analyzed to determine whether breakdowns in the management system or technology implementation have occurred. Once the problem is identified, plans for correction should be formulated.

At the management review, current goals may be revised based on measured results or new goals created based on system priorities. The review assesses how well the system performed with respect to the goals. Using data from internal audits, missed goals and opportunities identified but not implemented, the energy management team can develop new goals for the management system.

2. Corrective/Preventive Action- This refers to management system changes required to remove nonconformities. Nonconformities are identified during internal audits of the management system. Implementation of corrective/preventive action items improves system performance, with necessary changes and improvements assured through documentation and training.

OVERCOMING RESISTANCE TO CHANGE

Although a management system for energy defined by a documented standard has been adopted by national standards body, implementation and adherence to the standard has been limited. Slow growth in acceptance begs the question of why is there wide adoption of the ISO standards for quality and environmental management

(9000 and 14000), but general disinterest in a similarly framed energy standard?

Reasons for the slow adoption of ANSI/MSE 2000 were the topic of discussion at a recent Georgia Tech Industrial Advisory Board meeting (5). Four barriers were identified by the group: 1) Lack of awareness, 2) Policy issues, 3) Internal constraints and 4) Application barriers. Details are presented below.

The greatest barrier to implementation of ANSI/MSE 2000 is a general lack of public awareness. While some organizations have recognized the importance of having a structured energy management system, they have attempted to define and establish their own internal management system. While a self-described energy management system may be an improvement, there is no assurance that all the elements necessary for an effective plan-do-check-act system are defined. Further promotion by relevant energy, environmental and technical organizations will be necessary to overcome this barrier.

Policy issues were the next greatest barrier identified. Policy issues refer to the lack of external drivers such as the supply chain mandate that forced adoption of ISO 9000 by many manufacturers. An additional policy issue that would favorably impact MSE 2000 is federal or state mandated efficiency commitments. Changes in governmental energy policy to make it more favorable to MSE 2000 are possible but require a long time to achieve.

Internal constraints within the organization also limit many sites from implementing MSE 2000. Identified internal constraints include budgetary limits on proposed new spending, a lack of human resources to implement and maintain the management system or a weak commitment to energy management in the organization. Internal constraints to MSE 2000 may be addressed by adapting new implementation strategies that permit piecemeal adoption of the standard. Emphasizing the bigger payback offered by improved energy management may adequately address the budgetary concerns.

Barriers to the effective implementation of MSE 2000 further limit its application. Application barriers include a project rather than a management system focus, a perception that the management system is too complex, and the belief that MSE 2000 can not be easily integrated with existing management systems. These concerns are best addressed through education of the marketplace.

CONCLUSION

The ANSI/MSE 2000 standard contains the elements required to implement a comprehensive management system for energy. The standard document presents a management system based on the plan-do-check-act cycle

for continual improvement. Wider implementation of the standard can be expected as the barriers to implementation are addressed.

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