

Save Energy through the Superior Energy Performance Program

PAUL SCHEIHING
U.S. DEPT. OF ENERGY

Facilities have improved their energy efficiency by implementing the ISO 50001 energy-management standard and participating in the U.S. Dept. of Energy's SEP program. Here's how your facility can earn SEP certification while reducing its energy use and saving money.

Companies are seeing impressive returns and becoming more competitive after implementing the ISO 50001 energy-management system (EnMS) standard. As of April 2014, over 7,000 sites had earned ISO 50001 certification, an increase of nearly 200% from the previous year (1). Despite this success, many firms are unsure of the internal changes necessary to meet the energy-management standard and capture the value others have realized. The U.S. Dept. of Energy's (DOE) Superior Energy Performance (SEP) program was developed, in part, to help such companies.

SEP is an energy-management certification program administered by the DOE that helps facilities implement the ISO 50001 energy-management standard and verify energy savings. SEP helps individual manufacturing plants and processing facilities to master the use of ISO 50001 to drive deeper, more sustained energy savings and to capitalize on their achievements. Although certification to ISO 50001 is possible without SEP certification, achievement of ISO 50001 compliance is the foundation of SEP certification.

Designed and tested in partnership with U.S. industries, the SEP program provides a variety of resources, useful guidance, and tools to help manufacturers implement the program to start saving energy and money at their facilities. The DOE also worked with industry to create a workforce-development component of SEP that qualifies support personnel to assist in SEP implementation or serve as auditors to certify manufacturing plants.

SEP certification requires an audit of each candidate facility to ensure conformance to the ISO 50001 energy-management standard and verify energy performance

improvements of 5–15% or more over three years.

While large manufacturers with annual energy bills above \$1.5 million have derived the largest cost benefits from SEP certification, often with a payback in one year or less, plants of all sizes can benefit from the SEP program. As of June 2014, 17 industrial facilities had been SEP certified, including six in the chemical process industries (CPI) that improved their energy performance by 6–17% over a three-year period.

Managing energy with ISO 50001

U.S. manufacturers that have implemented an EnMS have found that it helps them make better use of their data to maintain and continuously improve their energy performance. Furthermore, they have realized benefits such as improved operational efficiencies, reduced energy intensity, and reduced environmental impact.

Experts from 44 countries contributed their knowledge and experience to define the requirements for the EnMS detailed in ISO 50001, which include: measuring, documenting, and reporting energy use and consumption; using best practices to design and procure equipment, systems, and processes that utilize energy; and developing an energy management plan.

Conformance with ISO 50001 means that an organization has put in place a sustainable EnMS, completed the energy planning process, and made a commitment to continually improve energy performance. Facilities establish an energy consumption baseline and introduce a measurement system to record, report, and demonstrate continual improvement in energy management and performance.

While ISO 50001 does not specify energy performance criteria or results, SEP requires facilities to define and meet energy performance targets and follow the SEP measurement and verification process.

Verifying energy savings with SEP

The SEP's transparent and credible certification process fosters a results-oriented approach to ISO 50001 conformance and emphasizes measurable energy savings. Manufacturers that pursue SEP certification have access to a cadre of qualified professionals, specialized software tools, and other resources aligned with SEP requirements and goals. The DOE also partners with state and regional entities to conduct SEP demonstrations at industrial facilities across the country.

To obtain SEP certification, a facility must undergo a third-party audit, which provides an independent verification that its EnMS conforms to ISO 50001 and that it has met SEP energy performance targets. (Requirements for SEP certification that go beyond those of ISO 50001 are detailed in Ref. 2.) Participating facilities can qualify for Silver, Gold, and Platinum designations by achieving increasing levels of energy performance improvement along the Energy Performance Pathway, or if a facility has a history of energy management performance achievement, along the Mature Energy Performance Pathway, which includes a combination of performance improvement and established best practices (3).

Plants that may not be ready to apply for SEP certification are encouraged to enroll in the program. Enrollment ensures access to guidance, tools, updates, and other

resources that can help the plant achieve significant and sustained energy savings and prepare for future certification.

Steps to implement ISO 50001 with SEP

Implementing an EnMS that conforms to ISO 50001 and achieves the improvement targets set by SEP requires a planned approach, as well as a willingness to learn and adapt along the way. The DOE has worked with industry to develop a suite of tools and resources for chemical processing facilities of different sizes and levels of experience to manage energy. These resources reduce the time it takes to develop an EnMS that conforms to ISO 50001 and lower implementation costs.

A cornerstone resource for ISO 50001 is the *DOE eGuide for ISO 50001 (4)*. This comprehensive online reference provides free, step-by-step guidance for ISO 50001 implementation from start to finish. It is intended to serve as a companion to the ISO 50001 standard, not replace it. The user still needs to review the ISO 50001 requirements in the source document first, then consult the eGuide for step-by-step guidance on implementation strategies and resources.

The eGuide's structure is based on the plan-do-check-act management system, which is familiar to many manufacturing plants that have implemented other ISO standards (Figure 1). The following sections summarize the guide (which is currently under revision and will be re-released in 2015).

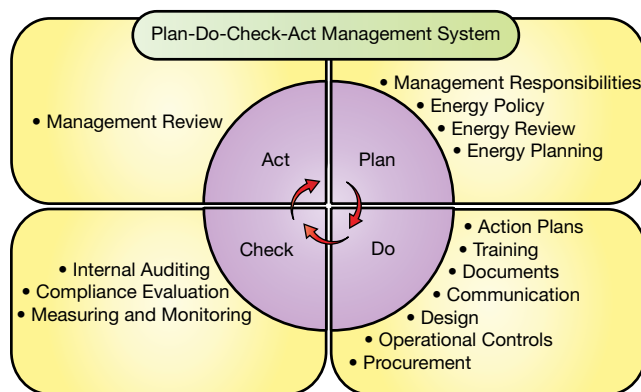
Plan

Outline management responsibilities. Top management commitment and involvement are critical to the success of an EnMS. Management engagement at the beginning of the

BENEFITS OF ISO 50001

The ISO 50001 energy-management system (EnMS) standard is an international framework that helps industrial plants, commercial facilities, and organizations to manage energy, reduce costs, and improve environmental performance. Some of the specific benefits include:

- assists organizations in optimizing their existing energy-consuming assets
- offers guidance on benchmarking, measuring, documenting, and reporting energy intensity improvements and their projected impact on greenhouse gas emissions
- creates transparency and facilitates communication of energy resource management techniques
- promotes energy-management best practices and reinforces good energy-management behaviors
- helps facilities evaluate and prioritize the implementation of new energy-efficient technologies
- provides a framework to promote energy efficiency throughout the supply chain
- facilitates energy-management improvements in the context of greenhouse gas emission reduction projects.



▲ **Figure 1.** The plan-do-check-act management system provides a methodical structure for solving problems and implementing solutions. During the *plan* stage, the problem is identified and analyzed, and a plan is developed. Then, during the *do* stage, steps are taken to implement the planned actions. To ensure that the best possible solution has been developed, a series of verifications and analyses are conducted during the *check* stage, and potential improvements are identified. In the final step, the *act* stage, necessary changes are applied.

Energy

process helps to encourage progress.

Define the scope. A defined EnMS scope and boundaries will help to focus efforts and resources. The scope may be a building, plant, facility, site, corporation, or a combination of these, but it should cover the activities, facilities, and decisions associated with the energy sources encompassed by the scope.

Establish a team. To obtain the needed skills, knowledge, and relevant expertise, an energy-management project relies on a team approach. A team provides diverse perspectives, distributes the workload, eases implementation, promotes wider acceptance, and improves the potential for sustaining the system. The team should include members from all areas of the facility concerned with the selection, procurement, consumption, reliability, disposal, or environmental impacts of fuels and energy systems.

Set the energy policy. An energy policy establishes top management commitment to energy performance improvement. The policy should state the company's energy priori-

ties. It may range from a few sentences to several paragraphs, and it must be documented and understood by all employees.

Identify significant energy uses. To achieve the greatest performance improvement with the fewest resources, facilities must identify all of their significant energy uses (SEUs). SEUs should receive special attention when establishing energy objectives, targets, and action plans, during training and competency evaluations, when planning for effective operation and maintenance, and when analyzing performance.

Determine energy performance indicators. Energy performance indicators (EnPIs) are measured parameters, ratios, or models that help to quantify energy use and efficiency improvements at the organization, facility, system, process, or equipment level. When compared to baseline values, they help to gauge performance and improvements.

Set energy objectives and targets. Once opportunities for energy improvement are identified and organized, energy objectives and targets for meeting the energy policy or performance commitment need to be set. Energy objectives should be high-level goals or specified outcomes that guide development of strategies and activities. For each objective, specific, quantifiable achievement targets should be outlined to help reach the overall goal.

Prepare an action plan. An energy-management action plan is a comprehensive project guide that needs to be communicated to all responsible parties. It should define the activities to be completed, resources needed, personnel responsibilities, and methods for verifying results.

Do

Manage and control documentation. An EnMS requires two types of information to be controlled: documents, which lay out expectations for energy-management actions and behaviors; and records, which provide evidence of the results of those efforts. Document control ensures that the correct information is available and helps to manage external and obsolete information. Accurate, accessible records are essential to corrective and preventive efforts and for confirming system processes and results.

Communicate. Internal communication is essential to managing change. It keeps personnel abreast of energy-management activities, incentives, and successes, which strengthens commitment and participation. The communication plan should include multiple pathways for disseminating information.

Confirm competency, training, and awareness. ISO 50001 requires positions associated with significant energy uses to have defined competencies, as well as evidence that the person responsible for the SEU has those competencies. Thus, the team must define the needed competencies, assess the personnel, and develop a plan to address any training needs.

SEP RESULTS

SEP implementation has produced impressive results and enabled CPI facilities of many sizes to realize sustained energy savings and higher returns on energy efficiency investments. Nine SEP-certified facilities saved between \$87,000 and \$984,000 annually after implementing no-cost or low-cost operational measures. On average, these facilities achieved a 10% improvement in energy performance within 18 months of SEP certification (5).

In 2010, a relatively small-scale plant that manufactures synthetic resins near Houston, TX, became one of the first facilities to achieve SEP certification. The facility easily integrated a new EnMS into its existing integrated environmental, health, safety, and quality management system, which already used the plan-do-check-act structure of ISO standards. With the SEP-compliant EnMS in place, the plant realized a \$250,000/yr energy savings, which gave it a competitive edge in its low-margin industry.

The system was put to the test shortly after implementation when the energy-management team underwent a reorganization. This could have been a major disruption, but because the EnMS had merged energy reporting into normal business systems and the facility had established a supportive culture, the plant was positioned to maintain and continue with the EnMS.

As of 2013, the facility had achieved SEP recertification and saved an additional \$87,000/yr in annual energy costs, with no capital investment. Energy management has been integrated into the company's corporate culture.

The Results and Testimonials page on the SEP website (6) includes more energy improvement results from other facilities that have achieved certification.

Define energy procurement specifications. To comply with ISO 50001, an organization must define specifications for purchasing energy. The specifications may include quality and quantity requirements, characteristics (e.g., fuel composition, moisture, and energy content), approximate cost, delivery schedule, resource reliability, and voltage, current, and/or electricity peaking times. To ensure that the procurement plan and the EnMS are cohesive, the staff involved with energy procurement should understand SEUs and related controls; energy objectives, targets, and action plans; EnPIs; operational controls critical to sustain improvements made by previous energy projects; and key maintenance items related to energy systems (e.g., compressed air, steam, etc.).

Check

Verify legal and other requirements. A profile of the organization's energy obligations needs to be gathered, and should include any legal or voluntary commitments. Processes should be put in place to identify, assess, and evaluate those requirements.

Implement a monitoring, measurement, and analysis plan. A primary requirement of ISO 50001 is that the organization establish an energy monitoring, measurement, and analysis plan. The components of the plan depend on the size and complexity of the organization and the monitoring equipment available. Typically, the plan includes system specifications, processes or equipment to be monitored, methods and frequency of data collection, processes for data analysis, and calibration requirements.

Conduct internal audits. An audit is a systematic, documented process that verifies that the EnMS meets the organization's criteria, is effectively implemented and maintained, supports the energy objectives and targets, and improves energy performance. During an audit, the auditors interview personnel, observe activities, review documents, and examine records and data. Many facilities conduct audits annually.

PAUL SCHEIHING is a technology manager (Email: paul.scheihing@ee.doe.gov) with the U.S. Dept. of Energy's (DOE) Advanced Manufacturing Office (AMO), where he leads the Superior Energy Performance (SEP) certification program. He was a member of the U.S. Technical Advisory Group that developed the ISO 50001 energy management standard. In partnership with U.S. industry, he has developed a variety of research, development, and technology deployment partnerships and initiatives to encourage more rapid adoption of energy-efficient industrial technologies. He was responsible for the management of some of the DOE's voluntary industry partnerships, including the Motor Challenge, Steam Challenge, and Compressed Air Challenge. He also led the Save Energy Now program, which provided over 1,000 energy assessments to manufacturing plants from 2006 to 2011. Scheihing earned his BS and MS in mechanical engineering from the Univ. of Connecticut (Storrs) and Drexel Univ., respectively. In July 2013, he was honored by the American Council for Energy-Efficient Economy as Champion in Energy Efficiency in Industry.

Act

Perform a management review. The organization must periodically review and evaluate its activities and energy performance to identify opportunities for improvement. Typically, a management representative ensures that the appropriate information is collected, organized, and presented to enable management to carry out evaluations and make informed decisions.

How to participate

If your facility is considering implementing ISO 50001, consider also the additional benefits associated with setting performance targets and verifying energy performance improvements. SEP provides the framework, rigor, and tools to continuously improve energy performance and report accurate progress. DOE resources are available on the SEP website (6), which describes how to enroll and apply for the program.

CEP

LITERATURE CITED

1. **Peglau, R.**, "ISO 50001 Certifications Update," German Federal Environment Agency (Apr. 2014).
2. **American National Standards Institute**, "Superior Energy Performance — Additional Requirements for Energy Management Systems," ANSI Standard ANSI/MSE 50021, New York, NY (2013).
3. **Georgia Tech Research Corp.**, "SEP Industrial Facility Best Practice Scorecard," http://superiorenergyperformance.energy.gov/pdfs/sep_industrial_bp_scorecard.pdf, Georgia Tech Research Corp., Atlanta, GA (2012).
4. **U.S. Dept. of Energy**, "DOE eGuide for ISO 50001," <https://ecenter.ee.doe.gov/EM/SPM/Pages/home.aspx>, DOE, Washington, DC (2011).
5. **Therkelsen, P., et al.**, "Assessing the Costs and Benefits of the Superior Energy Performance Program," www.superiorenergyperformance.energy.gov/pdfs/sep_costbenefits_paper13.pdf, American Council for an Energy-Efficient Economy (ACEEE), Niagara Falls, NY (July 2013).
6. **U.S. Dept. of Energy**, "Superior Energy Performance," <http://superiorenergyperformance.energy.gov>, DOE, Washington, DC (2014).

ADDITIONAL RESOURCES

Institute for Energy Management Professionals, IEMP, Atlanta, GA, <http://ienmp.com>.

U.S. Dept. of Energy

"DOE Better Plants Program," <http://energy.gov/eere/amo/better-plants>.

"Strategic Energy Management Checklist," https://ecenter.ee.doe.gov/EM/SPM/Pages/SEM_checklist.aspx.

"DOE Energy Performance Indicator (EnPI) Tool," <http://ecenter.ee.doe.gov/EM/tools/Pages/EnPI.aspx>.

"DOE Energy Resources Center," http://www1.eere.energy.gov/manufacturing/tech_assistance/ecenter.html.