SIE 2015
6th International Symposium on Industrial Engineering
24th-25th September 2015
FACULTY OF MECHANICAL ENGINEERING
STEINBEIS ADVANCED RISK TECHNOLOGIES
INNOVATION CENTER FME

ISO 50001 AS A TOOL TO ESTABLISH AN ADEQUATE ENERGY MANAGEMENT SYSTEM

Milovan Medojevic[1], Jovan Petrovic[1], Nenad Medic[1], Milana Medojevic[1]
[1]Faculty of Technical Sciences, University of Novi Sad, Serbia

Abstract. The aim of this paper is to point out the possibilities that ISO 50001, as a powerful tool, brings in order to define more closely the role and connections of the relevant government and state services, other international standards and regulations in the process of establishing and implementation of energy management systems. The concept of energy management is widely accepted in the progressive world and is the basis for rational energy management, continuous increase of energy efficiency, integration of renewable energy sources, environmental protection to reliably satisfy the energy needs and economically responsible behavior in part of any energy consuming sector.
Key words: Energy Efficiency, Energy Management System, ISO 50001.

1.INTRODUCTION

Energy Management Systems (EnMS) have emerged over the last two decades as a proven best practice methodology to ensure sustainable and progressing energy efficiency performance in industrial enterprises as well as in other organizations [1-5]. EnMS outlines a structured and systematic approach on how to integrate energy efficiency in an enterprise management culture and daily practices providing a framework for understanding energy use and consumption; Action plans to continually improve energy performance, including energy systems and production processes; Metrics to track and quantify energy performance against a baseline of energy consumption as well as Data and documentation to sustain and demonstrate energy performance improvements over time. In addition, EnMS seek to apply to energy use and consumption the same culture of continual improvement that has been successfully used by organizations to improve quality, environmental and safety practices. Since 2000 national EnMS standards and associated certification schemes were developed in a number of countries and proved to be an effective policy-driven, market-based mechanisms to promote dissemination of energy management best practices in variety of organizations and to support energy efficiency. Taking stock of the good results achieved through EnMS and standards at national level, in 2007 UNIDO launched a global initiative to advocate and promote the development of an international/ISO energy management system standard [3]. This initiative created the momentum for and catalyzed the ISO process that subsequently led to the release of ISO 50001 Energy management system – Requirements with guidance for use [6].

2. THE REASONS FOR INTRODUCING THE ENERGY MANAGEMENT SYSTEM

There are many reasons for establishment and implementation of EnMS while the most important ones are related to energy, economic and environmental issues.

2.1 Energy reasons for introducing the energy management

Only the introduction and regular, systematic and planned practice in implementation of activities of energy management systems guarantee a long-term, continuous and effective results in increasing energy efficiency and ongoing rationalization of energy resources utilization. This contributes to the conservation of existing energy resources, extended the service life of fossil fuels and reduction of the total required amount in energy balance at national, regional, local and micro level.

2.2 Economic reasons for introducing the energy management

Well-established and implemented energy management system represents the guarantee in the energy costs minimization process. This applies equally to individual, local to national, regional and

international levels. Reducing the required amount of useful energy simultaneously reduces costs of purchased energy or fuel. This, in the case of an industry, means less resource allocation for these purposes and the "liberation" of a part of energy expenses for other purposes.

2.3 Environmental reasons for introducing the energy management

Any reduction of energy losses and need for final useful energy, as well as by applying activities of the energy management, leads to a reduction in the amount of fuel to be combusted in the process of securing final energy. The direct result of this is reduction in emissions of combustion products that creates the greenhouse effect, reducing the energy share in the existing climate change, environmental and any other balance changing process on the Earth and in general reduction of environmental pollution. It is the most direct interest of each individual, stakeholder and community from the local to the broadest international community. As energy management practice entails the introduction of renewable energy sources, thus, their use, further contribution to environmental protection will be ensured.

3. THE ROLE OF THE STATE AND REGULATION, SERVICE ENTERPRISES AND ISO 50001 IN THE ESTABLISHMENT OF EnMS

The primary role of the state in the establishment of the energy management system is to create a proper environment for the introduction and effective functioning. What does that mean? In the first place is certainly a leadership role in establishing EnMS, which must be expressed to the moment when the process enters the regular routines of all energy users and relevant subjects for EnMS. To achieve this goal, countries should adopt adequate energy policy and establish the regulatory environment and framework that prescribes rules in terms of competences, rights and obligations, procedures, technical, logistic, personnel and other conditions for implementation and management of EnMS. For example, the Republic of Serbia has ensured adequate basis for the introduction of EnMS by improving the current Energy Law and introducing the Law on the efficient use of energy as well as by introducing secondary legislation through the 12 Rulebooks to further regulate this area. Formally and legally all conditions for the start of EnMS practice are fulfilled. Forthcoming practical step is setting of energy management services, training of personnel (Energy managers and authorized energy advisors), while within the secondary regulations additional regulations for this area were adopted [5]. In the case of companies, in establishing and maintaining practices of EnMS competent authorities and the responsible persons should fully cooperate with other services of the enterprise. Maintenance and quality services of an enterprise have a particularly important role in the establishment and proper functioning of EnMS. A good and continuous cooperation with the maintenance service, regardless of whether it is internal or external, is a guarantor of the preservation of the existing view of energy performance systems and subsystems in the company. Therefore, the energy manager must have a horizontal connection directly with the most competent entity responsible for maintenance service with defined responsibilities. On the lower hierarchical levels, persons responsible for maintaining and team members responsible for specific objects in EnMS should be in direct mutual contacts to exchange relevant information on changes in performance or any other changes in the building, which are in their jurisdiction while simultaneously informing the vertical structure on competence and responsibility. It is particularly important and can be very prolific the good collaboration with company's service for quality. This service has a number of tasks, which somehow overlap, while its jurisdiction is very similar and in touch with certain steps in the establishment and functioning EnMS. Therefore the support and good cooperation with this important service is prerequisite for efficient EnMS operation. This particularly applies to all activities during the establishment of the system and performance of control functions. For instance, quality service can have a decisive role in the introduction of standards in the implementation of the EnMS. In addition, one of the most important standards in the implementation of EnMS is the ISO standard 50001.

ISO 50001:2011 specifies requirements for establishing, implementing, maintaining and improving an EnMS, whose purpose is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy use and consumption. ISO 50001:2011 specifies requirements applicable to energy use and consumption, including measurement, documentation and reporting, design and procurement practices for equipment, systems, processes and personnel that contribute to energy performance. ISO 50001:2011 applies to all variables affecting energy performance that can be monitored and influenced by the organization. ISO 50001:2011 does not prescribe specific performance criteria with respect to energy. It is designed to be used independently, but it can be aligned or integrated with other management systems. ISO 50001:2011 is applicable to any organization wishing to ensure that it conforms to its stated energy policy and wishing to demonstrate this to others, such conformity being confirmed either by means of self-evaluation and self-declaration of

conformity, or by certification of the energy management system by an external organization.

4. THE BASICS OF EnMS PROCESS

Whether following a customized approach or the ISO 50001 standard, the basic EnMS process is based on the Plan-Do-Check-Act continual improvement framework (Figure 1.)

Figure 1 - Plan-Do-Check-Act continual improvement framework

Here Plan means to conduct energy review and establish the baseline, benchmark against similar sites, set objectives and targets, develop resources and action plans necessary to deliver results in accordance with the organization's energy policy. Do means to implement the action plans. Check means to monitor and measure processes, review the level of target achievement and the effectiveness of the EnMS against the objective of the energy policy. Finally, act means to recognize achievements, take action to continually improve energy performance and the EnMS, as well as to derive new objectives. This Plan-Do-Check-Act framework provides a procedure for companies to:

- Develop a policy for more efficient use of energy;
- Fix targets and objectives to meet the policy;
- Use data to better understand and make decisions concerning energy use and consumption;
- Measure the results;
- Review the effectiveness of the policy; and
- Continually improve energy management.

Within the Plan-Do-Check-Act framework the successful implementation of an EnMS depends on a sequence of steps to ensure the process of continuous improvement is achieved (Figure 2.).

The key steps of the process are senior management commitment (Step 1), and having an accurate baseline of energy use (Step 4). No EnMS will work effectively without the commitment of senior management and energy savings are very difficult to achieve and verify without having an in-depth understanding of the current energy usage on-site.

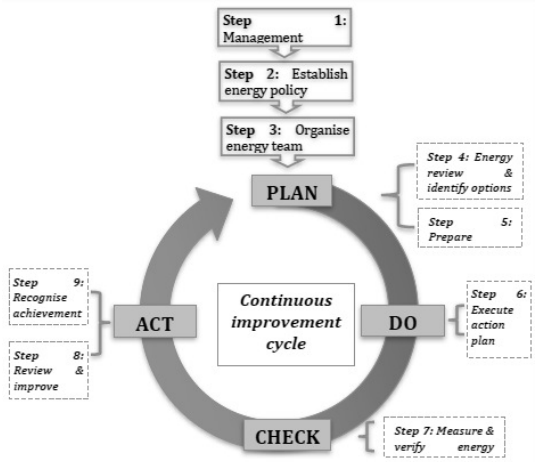

Figure 2 - Illustration of the EnMS Plan-Do-Check-Act framework

5. THE POSSIBILITY OF ISO 50001 INTEGRATION WITH OTHER MANAGEMENT SYSTEMS

ISO 50001 is based on common elements of ISO management system standards that ensure a high level of compatibility between ISO 9001 and ISO 14001. As a result, organizations that already have ISO 9001 or ISO 14001 can easily integrate the ISO 50001 system in its existing structure. ISO 9001 is a quality management system that provides organizations a systematic approach to meet the objectives of customers and quality assurance. On the other hand, ISO 14001 system for environmental management, provides a system for measuring, evaluating and improving influence of the organization on the environment. What should be bared in mind is a key difference between ISO 14001 and ISO 50001, which is that standard ISO 50001 yet detailed focuses on only one aspect of the environment - the energy use, oriented to the possibility of achieving financial savings, while standard ISO 14001 covers all aspects of the environment equally, oriented exclusively to environmental protection. Energy is by ISO 50001 recognized as very important and in this way separated from issues of environmental protection with the aim not only to reduce its consumption and environmental impact but also because of cost rationalization that leads to better competitiveness of products and services on the market. Having in mind that ISO 50001 is compatible and desirable for integration with ISO 14001, it can be also implemented and conducted with the EMAS (Eco Management and Audit Scheme) and LEED (Leadership in Energy and Environmental Design) certification programs. EMAS is a voluntary program for managing the environmental protection and control, which enables organizations to verify their system of environmental management in accordance with the relevant Regulation of the European Parliament and the Council. EMAS

includes all the requirements of ISO 14001 standard, as well as additional requirements (more "austere" then the ISO 14001). LEED is an internationally recognized mark of excellence that provides owners and operators of facilities framework for the identification, implementation, evaluation and design of "green buildings", including the construction, operation and maintenance. When an organization implements the EnMS, it needs to ensure that the key characteristics of its operations that determine energy performance are being monitored (Section 4.6.1 "Monitoring, Measurement and Analysis"). This section is a key component of the LEED program. Furthermore, it is also desirable to integrate and simultaneously implement other standards from ISO 50000 series [5,7].

6. CONCLUSIONS

The introduction and effective functioning of the energy management system is the basis for changes in energy-efficient, sustainable and environmentally friendly energy utilization. The detailed international regulatory environment for this already exists, while the Republic of Serbia is in the final stages of realization of conditions for its proper implementation. In addition to the regulatory environment, human resources are crucial for the complete success of this activity where it is needed to be very careful in setting the criteria for selection and development of all levels of staff, giving the authorization, control and verification of all activities, transitory and final results. If true significance hasn't been provided, all the effort and results could be challenged and ultimately depreciated. Without effective progress in the implementation of EnMS formal restrictions in the process of Serbia's EU accession could occur, while expensive energy and the high specific energy consumptions could become a serious threat to the development of our economy.

REFERENCES

[1] Global Superior Energy Performance Partnership, Models for Driving Energy Efficiency Nationally Using Energy Management, 2012.

[2] Global Superior Energy Performance Partnership, Knowledge and Skills Needed to Implement Energy Management System in Industry and Commercial Buildings – Multi-country Analysis and Recommendations, 2013.

[3] UNIDO, "Achieving impact and market credibility - Policy and conformity assessment frameworks for EnMS/ISO 50001" - Expert Group Meeting report, Vienna, 8-10 April 2014.

[4] Jelic, D.N., Gordic, D.R., Babic, M.J., Koncalovic, D.N., and V.M. Sustersi, Review of existing energy management standards and possibilities for its introduction in Serbia, Thermal Science no. 14 (3):613-623, 2010.

[5] Petrovic, J., Medojevic, M., Značaj i uloga države, standarda ISO 50001 i regulative u uvođenju sistema energetskog menadžmenta, IEEP'15, ISBN 978-86-7877-025-8, Zlatibor, 2015.

[6] SRPS EN ISO 50001:2011, Sistemi menadžmenta energijom – Zahtevi sa uputstvom za korišćenje, 2011.

[7] Roessler, R.; Schlieter, H.; Esswein, Werner: Towards Model-based Energy Management. Multikonferenz Wirtschaftsinformatik, pp. 1375-1389, 2014.