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Analysis of Standards in Energy Management

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Abstract: Over the past few years a number of countries have developed national standards for energy management. Their structure is very similar and is based on the Deming cycle. The main objective of the standards is to encourage companies to form the systems and processes for energy management in order to reduce energy costs and greenhouse gas emissions. The challenges in achieving the objectives of the various national standards are somewhat different. Analysis of standards for energy management revealed that only two of them: the American standard ANSI / MSE 2000:2008 and the European standard EN 16001:2009 include the tasks of strategic management (and, in the American standard, they are reflected in more detail.) The greater part of the standards, including the International Standard for Energy Management ISO 50001, is aimed at solving problems only in operational management. The analysis of these standards has shown that they do not account for the possibility of strategic management of energy resources of the enterprise. In our view, to enhance the operation of the energy management and the possibility of long-term and strategic business objectives, it must necessarily be integrated into the strategic management of the company.

Key words: Energy management · National standards · Strategic business

INTRODUCTION

The energy crisis of the late 70's of the XX century in Europe and the United States and growing competition from Asian producers predetermined the need to urgently address the problems accumulated for years in the field of energy efficiency and the rational use of energy resources. The industrialized countries of the West, which have traditionally been the world leaders in the manufacture of various types of products, including, above all, high-tech goods, began to experience strong competition from producers in Asia. Chinese, Indian and Taiwanese companies, having, on the one hand a powerful high-tech industrial base and on the other hand, cheap labor, began to actively position themselves in foreign markets. However, access to world markets for European and American companies was conjugated with difficulties. To a great extent, this was due also to the high labor costs in Europe and the U.S. This situation initially put producers under a disadvantage relative to their competitors from the developing countries. In these circumstances, the emphasis on saving energy, consumed in the production process, became very logical for Western companies and as it turned out, a very effective way of development [1].

Most countries that experienced serious consequences of the energy crisis were to realize a large-scale policy of rational use of primary energy resources, including, primarily, oil and natural gas and efficient consumption of electrical and thermal energy obtained on their basis. The significant contribution to such policy was due to the implementation of an integrated approach to energy efficiency that became a national doctrine in many countries around the world, because of the urgency in addressing this important issue for the economic development of Western countries.

Despite the differences in the implementation of programs aimed at solving the problems in Europe and the U.S., they suggested a radical transformation at different levels of economic management, including serious adjustments to the solution of the considered problem at the federal level, at the level of the energy sector functioning as the energy supplier and the level of enterprises, which are the major consumers of energy carriers.

At the level of federal government in a fairly short time, almost all countries of the world have developed legal and regulatory framework in the field of energy saving.

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At the level of energy management, a wide range of measures was undertaken to create a competitive environment in the industry, first of all, in order to control the rates for energy products for the public, industry and other customers.

At the level of industrial enterprise management, strategic solving of the problems is now focused on the application of innovative approaches for improvement of the energy use efficiency, where the special place is given to energy management [2].

Key Part: At the level of federal government the adoption of a legislative framework for the rational use of energy resources aimed at the development of programs and legislation on energy efficiency, standards for efficient use of energy resources and a number of regulations, guidelines and technical recommendations. Special attention was paid to toughening the regulations on the consumption of fuel and energy resources in various industries and fields, including industry, construction, housing and communal services, etc.

At the level of energy management, the mainstream in increasing the efficient use of energy resources has been associated with the development of competition in the industry. Introduction of market-based competition has dramatically expanded the consumer choice of optimal conditions of power consumption. Currently, the energy companies in most developed countries offer consumers a wide range of power supply options and payment services. In the EU Member States, the foundations for a free choice of suppliers of energy resources were laid already in the late XX century. At that time, the first electric (1996) and the first gas (1998) directives were adopted to create a single liberalized market of electricity and gas. It should be noted that the market will have been completely formed by 2014. It is expected that the emergence of a single market will lead to alignment and an overall reduction in energy tariffs in the various EU member states. Thus, the industrial companies have the additional options for selection of the most preferred selling rates for the purchased energy resources and for reduction of the energy costs in the prime cost of their products.

Application of energy management at the industrial enterprises determined the need in the development of appropriate standards.

Among the standards for energy management it is possible to distinguish the ones adopted in Australia, AS 3595:1990 and AS 3596:1992 Energy Management Programs, in Sweden SS 627750:2003 Energy Management Systems, SenterNovem in the Netherlands in 2004, in Germany VDI 4602-1 Energiemanagement, in Denmark DS 2403:2001, Ireland IS 393:2005, American Standard ANSI / MSE 2000:2008, UK PAS 99:2006, Korean standard KSA 400:2007, standards for South Africa SANS 879:2009, China GB / T xxx-2000x ICS 03.120.10, Belarus STB 1777-2009 and the European standard EN 16001:2009, which was supported by the document BIP 2187:2009 Energy Management Principles and Practice: A Companion to BS EN 16001:2009, issued by the British Standards Institution (BSI) [3].

The comparative analysis of the structure and functions of national standards for energy management are described in a large number of special studies [4-7].

It should be noted that until recently, the operation of a large number of national standards for energy management was primarily due to the absence of a common international standard in this area and the concomitant increase in the importance of addressing energy conservation and energy efficiency [8]. Despite the variety of standards for energy management, yet they are characterized by common elements and structural identity. Thus, the basis of all standards' structure is the Deming cycle, assuming the implementation sequences Plan, Do, Check, Act in the formation of an energy management system. The considered sequence in system formation is also reflected in the standards for environmental management system ISO 14001:2004, ISO 9001:2008 quality management system and food safety management ISO 22000:2005, which implies a high level of performance compatibility during standard operations.

For each stage of the Deming Cycle the standards identify specific tasks. The work [9] provides a comparison of existing national standards for energy management in order to identify common problems and the existing differences. Table 1 shows the stages of forming the energy management system and their relevant tasks, selected from the entire set of analyzed documents. For each of the tasks listed in the table the level of matching (cross-correlation) is set. If the problem is found in most standards, then it has high cross-correlation. The low cross-correlation resides in the task, if it is met in one or maximum two standards [9].

Analyzing the table one can conclude that the majority of matches in the list of tasks of national standards for energy management is specific for the last two stages. The first two stages are characterized by a

Table 1: Assessment of the matching level of national standards for energy management [9]

Categories	Elements	Level of Matching (Agreement)
PLAN	- Records	High
	- Management commitment	*Low*
	- Energy policy	High
	- Responsibility and authority	Medium
	- Strategic planning	*Low*
	-Energy data management, energy profile	*Low*, Medium
	- Legal and other	High
	- Goals, targets and projects	High
DO	- Purchasing	*Low*
	- Design	*Low*
	- Communication	High
	-Competency, training and awareness	High
	- Equipment, systems and process control	Medium
	- Energy project implementation	*Low*
	- Calibration	Medium
	- Contingency planning	*Low*
CHECK	- Monitoring and measuring	Medium
	- Evaluation of legal and other requirements	High
	- Internal audit	Medium
	-Non-conforming, corrective actions, preventive action	High
ACT	- Management review	High

Table 2: The list of tasks for the stages of the energy management system.

The stages provided in the standard for energy management	Tasks
Energy planning	1. Identification and implementation of legislative and other requirements related to the nature of the use, the amount of energy consumption and energy efficiency.
	2. Development of the method and an order of the energy analysis.
	3. Determination of the energy baseline.
	4. Establishing a list of energy efficiency indicators to monitor and measure energy efficiency.
	5. Identifying the goals, objectives and action plan for energy management.
Introduction and operation	1. Determining the need for personnel, requirements for their competence.
	2. Development of documentation for energy management and provision of their safety.
	3. Operational control in accordance with the objectives and tasks.
	4. The exchange of information between the enterprise subdivisions.
	5. Development of projects aimed at improving energy efficiency.
	6. Setting rules for working with energy suppliers.
Control over energy efficiency	1. Measurements. Monitoring energy efficiency.
	2. Assessment of the energy management system conformity with legal and other requirements.
	3. An internal audit.
	4. Identifying discrepancies for corrective measures.
	5. Documenting the ongoing changes and generating reports.
Analysis of energy management system by top-management	1. Analysis of accounting information on the energy management system.
	2. The adoption of measures designed to correct the energy management system.

number of problems with low match. In our opinion, this can be explained by the fact that the stages of planning and implementation are more creative and can be interpreted in different ways depending on the goals and objectives. Stages of testing and analysis are more standard and a list of tasks realized at these stages, even in the event of their selection for the other comparable standard, such as the environmental management system, quality management system and food safety management will differ only slightly. Especially, it is necessary to note that the majority among the problems with low match is the tasks of strategic management. Indeed, the analysis of the national standards for energy management revealed that only the American standard ANSI / MSE 2000:2008 and the European standard EN 16001:2009, the list of tasks included the tasks of strategic management, including strategic planning at enterprises and planning under uncertainty. All other tasks, listed in Table 1, may be classified as operational management tasks.

In 2011, the international standard ISO 50001 Energy Management System-Requirements, with user manual was adopted [10]. The international standard ISO 50001 includes the appropriate task for each stage of the cycle (Table 2).

Analyzing the objectives established in the ISO standard, we may note that during its development the nuances of different national standards for energy management were taken into account, as the standard list of tasks included the tasks with different levels of match, including the low one. However, among the considered problems of the international standard there are only problems of operative management, whereas the Table 1 presented the tasks of strategic management. In our view, the inclusion of a set of strategic objectives in the formation of an energy management system allows organizing the work on strategic management of energy resources, which provides a long-term viability of the organization in a changing environment. For this purpose, the energy management system has to be incorporated in the strategic management of the company and not be limited to the performance of work related to the current activity.

CONCLUSION

The orientation of the ISO standard along with the majority of national standards in this area to solving the operational problems is determined, to a large extent, by the local character of EM work; at that, only the current problems of energy cost management are solved. In our view, the energy management system should be integrated into the overall development strategy of the company development. This will solve the problems of strategic management, including strengthening the company's market position and engaging in new strategic economic areas, growth of the enterprises competitiveness, the use of new energy sources, including the alternative sources of energy, the organization of new business processes, as well as the restructuring of the company in the light of the energy management system.

RESULTS

We carried out a detailed analysis of national standards for energy management and the ISO 50001 standard, revealing that these documents provide a general idea of the system formation and a certain sequence of actions for its implementation. At the same time, the standards have not solved the fundamental problems of forming an energy management system, which directly affect the company intending to implement this system. Among them, there is the lack of methodologies for surveying companies, for forming the energy baseline, follow-up monitoring and energy analysis, principles of institutional mechanism, the mechanism of interaction with stakeholders and company subdivisions, requirements for documentation and its volume, etc. Thus, further works will be associated with the development of guidance, which allows adapting the energy management systems, proposed in the standards, for industrial activities.

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