Міністерство освіти і науки України
Міністерство освіти Азербайджанської Республіки

Національний університет «Полтавська політехніка
імені Юрія Кондратюка»
Азербайджанський архітектурно-будівельний університет

BUILDING INNOVATIONS – 2021

Збірник наукових праць
за матеріалами

IV Міжнародної
українсько-азербайджанської
науково-практичної конференції

20 – 21 травня 2021 року

Полтава – Баку 2021

UDK 620.91

Aghayeva Konul Asaf, PhD, associate professor,
ORCID: 0000-0002-7455-073X, e-mail: konul.aghayeva@gmail.com
Azerbaijan University of Architecture and Construction, Azerbaijan
Chichulina Kseniia, PhD, associate professor,
ORCID: 0000-0001-7448-0180, e-mail: chichulinak@ukr.net
National University «Yuri Kondratyuk Poltava Polytechnic», Ukraine

COMPARATIVE ANALYSIS OF WORLD ENERGY MANAGEMENT STANDARDS

Abstract. *The article presents a comparative analysis of world energy management standards. Particular attention is paid to EU National Standards. The main definitions of "energy management" and "energy control" are defined. The organizational and methodological bases of creating an energy monitoring system at the enterprise are determined.*

Keywords: *energy management, controlling, National standards, energy-saving.*

Агаєва Кьонуль Асаф, к.е.н., доцент,
ORCID: 0000-0002-7455-073X, e-mail: konul.aghayeva@gmail.com
Азербайджанський архітектурно-будівельний університет, Азербайджан
Чичуліна К.В., к.т.н., доцент,
ORCID: 0000-0001-7448-0180, e-mail: chichulinak@ukr.net
Національний університет «Полтавська політехніка імені Юрія Кондратюка», Україна

ПОРІВНЯЛЬНИЙ АНАЛІЗ СВІТОВИХ СТАНДАРТІВ ЕНЕРГОМЕНЕДЖМЕНТУ

Анотація*. У статті проведено порівняльний аналіз світових стандартів енергоменеджменту. Особливу увагу приділено Національним стандартам ЄС. Визначені основні дефініції "енргоменджменту" та "енергоконтролінгу". Визначено організаційно-методологічні основи створення системи енергетичного моніторингу на підприємстві.*

Ключові слова: *енергоменеджмент, контролінг, Національні стандарти, енергозбереження.*

To achieve the desired results in the field of energy saving, it is not enough just to implement the above measures, but also to systematically manage energy consumption, the main task of which is to reduce energy costs with the necessary quantity and quality. For this purpose, in European practice, an energy management system is created at any industrial or commercial facility, the main purpose of which is to systematically, purposefully increase the energy efficiency of management while simultaneously rational use of all other resources.

The development and formulation of Energy Management in Ukraine has been going on for more than a decade and a half. However, today there is still no definitive generally accepted understanding of energy management as a science, as a type of activity, as well as one of the specific functions of management.

Energy management is an activity aimed at ensuring the rational use of fuel and energy resources and is based on obtaining energy information through accounting,

conducting an energy audit, monitoring and analyzing the efficiency of energy use and implementing energy-saving measures.

Energy management is a methodological science with a practical tool for such needs:

1) implementation of the process of managing the use of energy, namely – the purpose, planning, organization of actions, coordination, accounting and control for the optimal (most rational) use of all types and forms of energy in the case of expedient meeting the needs of the organization and minimal negative impact on the environment, in the conditions of the best use of the resource potential of the energy use object;

2) management of personnel engaged in energy use management to achieve high energy efficiency, based on the material and financial resources of the organization. However, it should be noted that these definitions do not reflect the economic aspect of energy management. In a market economy, the main goal of energy management should be to make a profit through the rational and efficient use of fuel and energy resources for the production of a unit of production, the provision of services or the performance of works. Therefore, energy management is a type of activity, the content of which is to purposefully influence the employees of the organization in order to coordinate their actions to achieve one of the goals set for the organization – to increase profits by increasing the efficiency of using fuel and energy resources while reducing the cost of output. At the same time, the goal of energy management is to increase the efficiency of the organization's use of fuel and energy resources while increasing the organization's profit.

The term "energy management", depending on the scope of its application, can have a number of semantic loads. This concept generally includes an integral approach within the framework of a dedicated energy (production) system, which allows us to distinguish the following stages: planning, production (generation), transmission (transformation), accumulation, distribution and use of energy carriers. On the one hand, the development of intelligent energy systems according to the Smart Grid concept led to the development of the concept of energy management and the formation of energy management systems from the point of view of optimal management of energy processes in intelligent networks and systems.

The following areas of development of energy management systems are used here: HEMS – energy management systems in buildings, IPMS – energy management systems for industry, PMS – energy management systems in the electric power industry, EMCS – management systems for energy management systems, EMPS – software tools for energy management systems, etc. Organizational and methodological foundations for creating an energy monitoring system at an enterprise, as a rule, include the organization of a controlling Service, determining its place in the organizational structure of the enterprise, analyzing information flows and possible options for implementing controlling at the enterprise. For effective operation and a clear definition of the responsibility of the energy monitoring system at the enterprise, it is necessary to create a special structural division – the controlling service.

The energy audit and energy control service summarizes the work of the accounting department, Finance Department, planning and economic department, departments of the chief engineer, and chief Power engineer. Since the main function of energy monitoring at the enterprise is to analyze and manage costs and profits, form and use energy reserves, the controlling service should be able to receive all the necessary information and turn it into recommendations for making managerial decisions by senior managers of the enterprise.

When organizing an energy monitoring service at an enterprise in order to improve its energy efficiency, the following prerequisites must be taken into account: - it is necessary to strive for visually simple structures (use a linear, linear-functional, but not a matrix structure); - goal alignment, goal management, and goal achievement are coordinated only at the first level of management; - methods of managing the energy efficiency of the enterprise's

activities within the framework of the overall, main strategy, become effective only when the controller manages to coordinate them between the responsibility centers; - the controller needs to obtain information about economic relationships and reserves, their use and savings; - the controlling service is independent, independent and neutral in relation to management levels.

The implementation of the controlling and energy audit system at the enterprise should take place in three directions: the preparatory stage; the stage of implementing controlling; and the stage of automation. In turn, the second stage consists of the following four stages: changes in the management system; changes in the organizational structure; information flows in the enterprise system; changes in the enterprise culture. Changes in the process of energy saving management of the enterprise during the implementation of the controlling system are carried out in the following areas:

- introduction of responsibility centers based on the principles of functionality, territoriality, compliance with the organizational structure and cost structure;
- distribution of financial responsibility centers to optimize planning (budgeting), accounting and control of the company's activities. Management of the implementation of energy-efficient technologies in the controlling system at the enterprise should be an independent subsystem containing a set of specific tools, rules, structural bodies, information and processes aimed at preparing and ensuring the implementation of plans for the implementation of energy-efficient measures. When managing the implementation of energy-efficient technologies at the enterprise, it is necessary to make a reasonable choice of the main directions of energy saving at the enterprise as a whole and for each structural unit in particular.

The functioning of the controlling system will ensure the implementation of the following areas in the field of energy saving:

- the controlling department develops the main directions of energy saving at the enterprise and brings them to structural divisions (heads of workshops, departments, services);
- subjects of energy saving at the places of occurrence of costs carry out planning of production processes with coordination of the main directions of implementation of energy-saving technologies defined by the company's management;
- motivational measures are being developed for the company's personnel;
- at certain facilities that are sources of energy saving, the enterprise organizes and manages energy saving processes;
- the existing strategy of the enterprise's activities is being adjusted for the results obtained from the measures taken to reduce the energy intensity of products, and so on;
- adjustment of economic processes for enterprises, relative to the available reserves for reducing the energy intensity of products.

Thus, the formation of an effective energy saving management system at the enterprise is a set of measures implemented through the mechanisms of functioning of the controlling system, and ensure a balance between the final results of Labor, characterize the growth of its productivity, rational use of resources and their savings. Energy security and energy efficiency issues have become a new challenge for all countries of the world. Requirements aimed at improving energy efficiency and preserving all types of energy resources are now becoming the basis of national policies and legislation in most countries. Energy saving and energy efficiency policies require the development and implementation of a set of mechanisms, criteria and methods for assessing the level of energy efficiency in various sectors of economic activity based on appropriate energy audit systems.

Of particular importance is the problem of rational use of energy resources among consumers, the largest of which is industry. Along with the need to contribute to improving

energy efficiency indicators at enterprises of all industries, it is necessary to actively develop industrial production focused on the supply of energy-efficient equipment and technologies in order to improve energy efficiency in all sectors of the economy and social sphere. To achieve this goal, National Industrial and energy strategies must be synchronized, interlinked with principles, priorities and pace, reflecting deep internal links in the economy of the energy and industrial sectors.

One of the main reasons for the need to improve energy efficiency and energy saving in EU member states is the depletion of Natural Resources. The relevance of changing attitudes to energy resources is associated with the high energy intensity of products. This problem leads to such consequences as economic inefficiency, low product competitiveness, export costs, closure of inefficient enterprises, and so on. Another important reason for improving energy efficiency and energy saving is environmental pollution, primarily from power plants running on fossil hydrocarbon fuels.

The introduction of an energy management system helps to solve these problems. Energy efficiency standards and labeling programs are a set of procedures and regulations that prescribe minimum requirements for the energy characteristics of industrial goods and supplies, with their energy characteristics marked. Rationing the minimum requirements for energy characteristics contributes to the adoption of informed decisions by market participants on the purchase of more efficient goods and the gradual displacement of inefficient technologies from the market. It should be noted that standards and labeling are most effective if they are part of comprehensive strategies and programs for market transformation.

In 2008, the International Organization for Standardization (ISO) established the technical committee ISO/TC 242 "Energy Management", whose secretariat was headed by representatives of the United States and Brazil (they were the initiators in this matter). Specialists from 40 countries of the world were involved in the work of ISO/TC 242 on an ongoing basis. Of the total number of more than 19,500 international ISO standards introduced, more than 155 relate to the regulation of energy efficiency and renewable energy sources. They cover areas such as energy management and energy conservation, as well as industry-specific solutions for buildings, it and home appliances, industrial processes, and transportation.

In July 2011, the final version of the international standard ISO 50001:2011 "Energy management systems - Requirements with guidance for use" was adopted. According to the head of the ISO/TC 242 technical committee, the new standard will cover up to 60% of global energy consumption, and "it is hoped that the application of the ISO 50001 standard will lead to a broad understanding between all types of energy suppliers and consumers."

The ISO 50001 standard combines the requirements for the energy management system at the international level, which were previously formed by the National standards of a number of countries, in particular:

- **USA: ANSI/MSE 2000:2008** A Management System for Energy;

- **USA: ANSI/IEEE 739:1995** Recommended practice for energy management in industrial and commercial facilities;

- **South Korea: KS A 4000:2007** Energy Management System

- **China: GB/T 23331:2009** Management System for Energy – Requirements;

- **South Africa: SANS 879:2009** Energy Management – Specifications.

European standard: EN 16001:2009 Energy management systems. Requirements with guidance for use:

- Denmark: DS 2403:2001 Energy Management – Specifications; **DS/INF 136:2001** Energy Management – Guidance on Energy Management;

- Sweden: SS 627750:2003 Energy Management Systems – Specification;

- Ireland: I.S. 393:2005 Energy Management Systems – Specification with Guidance for Use.

The international standard ISO 50001: 2011 creates the basis for integrating energy efficiency into the management practice of an enterprise (organization, institution). The implementation of the requirements of the standard is aimed at ensuring the rational use of fuel and energy resources at enterprises and municipalities, which makes it possible to significantly optimize the volume of energy consumption, determine the priority of introducing new energy-saving technologies, and so on.

The energy management system includes:

- monitoring of energy consumption;
- analysis of existing indicators as a basis for drawing up new budgets;
- development of new low-waste and waste-free technologies;
- development of energy budgets;
- development of energy policy;
- planning of new energy-saving measures;
- development of effective systems and tools for controlling energy consumption and protecting the environment from pollution.

In the practice of economically developed countries, the functioning of energy management systems is based on the application, in particular, of such well-known management concepts as:

- Integrated Resource Planning, IRP;
- Demand Side Management, DSM;
- Supply Side Management, SSM;
- Load Management, DSM;
- End User Consumption Management, DSM.

References

1. *Чичуліна К.В., Биба В.В., Міняйленко І.В., Скриль В.В. Навчальний посібник до вивчення курсу «Виклики енергоефективності: співпраця України з ЄС» для студентів спеціальності 076 «Підприємництво, торгівля та біржова діяльність», 101 «Екологія», 192 «Будівництво та цивільна інженерія» другого рівня вищої освіти. – Полтава: НУ «Полтавська політехніка ім. Ю. Кондратюка», 2020. – 257 с.*
2. *A study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems, European Commission, 2016.*
3. *Within the framework of a project EU Erasmus +: "The challenges of energy efficiency: cooperation of Ukraine with the EU", № 599740-EPP-1-2018-1-UA-EPPJMO-MODULE*