

APPLICATION ENERGY MANAGEMENT IS AN EFFECTIVE ENERGY SAVING SYSTEM AND SOLVING PROBLEMS OF ITS IMPLEMENTATION

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Abstract. *The urgency of changing the attitude towards energy reserves is due to the ever-increasing price of fuel, the increase in the amount of consumed resources, resulting in high energy consumption and, accordingly, the cost of production. This problem, in turn, causes the competitiveness of products, their low sales in the world and domestic markets, the inefficiency of the economy in general, etc. The implementation of the energy management system allows analyzing and taking into account all processes related to energy consumption (energy aspects) of the company. Based on the analysis, it is possible to reduce energy loss and increase energy efficiency in all practices of production activities. The central place in the energy management system is aimed at the formation of an energy strategy that reflects the obligations of the company's management related to energy efficiency, aimed at ensuring the ability to consistently support and develop efforts to increase the energy efficiency of the enterprise and energy consumption. Increasing the energy efficiency of energy consumption and increasing the energy efficiency of energy consumption allows keeping the enterprise in accordance with its energy needs. Technically, the operation of the energy management system is based on the gross use of modern measuring equipment and software. The system of technical accounting of energy reserves provides objective information to the managers of the enterprise to make reasonable decisions from the functional and financial point of view. The benefits of conscious energy management are clear. The principle that leads to the transition to systematic energy management is the transition of the enterprise from one-time investment projects in the energy infrastructure to the construction of periodic processes for the development and implementation of organizational and technical measures. However, the low level of scientific and methodological support, insufficient training of personnel on energy saving and energy efficiency improvement, and other problems do not allow to create conditions for wide implementation of the considered energy cost management system in industrial enterprises.*

Keywords: *energy resources, energy management, energy saving, energy efficiency, energy policy of the enterprise.*

Introduction. The current state of Uzbekistan's economy is characterized by high energy intensity. The reasons for this situation, in addition to harsh climatic conditions and the territorial factor, are the structure of industrial production formed over a long period of time and the increasing technological backwardness of energy-intensive industries and housing and communal services, the peculiarities of the price and tariff policy of the state, the lack of incentives for energy saving, like in enterprises, and among the population.

It is assumed that the use of an energy management system, as a tool for managing the energy saving of organizations, and energy services - a set of services aimed at increasing energy efficiency, will allow organizations to contribute to the more efficient use of available energy resources, increasing competitiveness and reducing emissions of gases that cause the greenhouse effect, and others associated environmental impacts.

Today, in the context of the development of market relations, the intensification of competition in the market of goods and services predetermines the need to find ways to increase the efficiency of the functioning of enterprises and the competitiveness of their products. The formation of product costs is directly influenced by indicators related to the acquisition and use of energy resources [1]. The high level of energy intensity of production (especially metallurgical) is one of the most important inflationary factors that significantly limits the competitiveness of products, since a doubling of the cost of energy resources causes an increase in the prices of consumer and industrial goods by 15–20%. The overall level of energy consumption in industrial production in the world, according to various estimates, in the coming years (until 2050) will increase by 75% from the 2012 level. About 20% of the total consumption of energy resources by industrial enterprises in the world accounts for electrical energy, and in the projected In the future, by 2050, its share in the overall structure of energy consumption will increase to 25–27%, reducing the relative costs of oil and petroleum products, as well as fossil coals. The implementation of a global effective scenario for energy saving involves the use of alternative energy sources - biomass and various types of waste (from 9 to 15% of all energy by 2050). The implementation of a global effective scenario for energy saving involves the use of alternative energy sources - biomass and various types of waste (from 9 to 15% of all energy by 2050). Attracting investment in alternative energy sources is also stimulated by rising energy prices [2].

Issues of energy saving are associated with environmental problems not only in regions of the world where industrial production is concentrated. They are also relevant in connection with global climate change, which also occurred due to environmental pollution (for example, gases released into the atmosphere when burning fossil hydrocarbon fuels can cause a greenhouse effect).

Thus, problems of energy efficiency, along with increasing environmental safety of production and social responsibility, become the central object of research in modern theory and practice of managing industrial enterprises [3]. Energy management system Energy saving as a motivation for business. During the period of formation of a market economy in Russia in the early 1990s, characterized by the formation of private property in the industrial sector and the transition to decentralized planning, energy prices objectively increased while maintaining the general level of energy intensity of industrial products. The cost of doing business is still not getting any cheaper, especially for energy-intensive industrial enterprises. At the present stage of socio-economic development, resource conservation is a necessary condition for ensuring business survival. Doing more with less is the challenge for any company today [4]. But often the implementation of internal innovations turns out to be high-risk. Then, in order to maintain competitiveness, the management of the enterprise uses approaches that are promising in conditions of an unstable financial condition. This is the use of industrial waste and secondary energy resources of various kinds, which ultimately leads to waste-free or low-waste production. Indicators of the effectiveness of such processes are the degree of use of secondary thermal energy in the main and servicing production, increasing the heat of combustion of fuel, intensifying its

use, etc. Optimization reserves can also be found in the use of various energy carriers and/or changing the structure of their consumption, as well as in the introduction of renewable sources energy [5].

However, traditional approaches provide only the primary formulation of the problem of energy saving. To develop new approaches to managing energy costs, it is necessary to conduct a serious design and technological analysis of the resource intensity of manufactured products. As a result, there will certainly be opportunities to reduce resource intensity without deteriorating the consumer properties and quality of the product (service). With a competent approach, it is possible to reduce the share of energy costs in production costs without reducing the volume and quality of products, as well as without significant investments.

In most cases, to start the energy saving process, it is not cash injections that are required, but the will of management to carry out organizational measures. Putting things in order in energy use entails putting things in order in general management and vice versa, which increases business sustainability [6].

Activities to increase energy efficiency can become a starting point for modernization and renewal of the main production and provide the necessary money for subsequent work.

Energy efficiency is the same subject of business planning as any other investment project. The resulting savings can be considered as a source of domestic investment. Investing in energy saving is 3–4 times more profitable than investing in increasing energy consumption, that is, investing in efficiency is much more profitable than investing in simply increasing production. After a short period of time, energy efficiency measures become self-sustaining and profitable due to the resulting savings.

But savings need to be accumulated and used in new energy efficiency measures. To do this, the savings should be allocated to a separate account and used for subsequent activities that provide the greatest savings. characterizing the relationship between improving the quality of life and the level of energy consumption is that in the twentieth century, every year of increase in the average life expectancy of mankind was accompanied by an increase in per capita consumption of energy resources by 120 kg of standard fuel.

The above data eloquently confirms that historical experience determines the tendency of the relationship between the growth of the quality of life and the increasing consumption of electrical resources (Table 1).

Significant savings that make it possible to increase the competitiveness of products can be obtained by introducing systems for commercial and technological accounting of energy consumption along with energy saving activities.

Allocation of savings into a separate item and investment of saved funds in the implementation of new energy saving projects will make it possible in 2–3 years to use part of the saved funds for modernization of production and technological renewal of the enterprise [7–9].

From an economic point of view, there is no difference between investing in profit and investing in savings.

Simply, saving is a less expensive and more manageable process, which is based on a change in the manager's views on the sources of additional profit. By gaining experience in implementing energy efficiency measures, enterprises discover a promising market for energy-saving products and services.

Table 1.

Indicators of energy security and quality of life in countries with different levels of development

№	Index	Countries		
		underdeveloped	developing	highly developed
1	Energy supply, kWh/person.	300	1700	7700
2	Energy supply, rel. show	1,00	5,6	24,7
3	Life expectancy, years	53	67	74
4	Life expectancy, rel. show	1,00	1,26	1,4
5	GNP per capita, dollars/person.	270	2000	12000
6	GNP, rel. show	1,00	7,41	44,4
7	Energy efficiency, USD GNP/kWh	0,9	1,18	1,56
8	Energy efficiency, rel. show	1,00	1,31	1,73

Energy management. In modern economic realities, the price of energy resources is growing rapidly, tending to the world average level. Energy performance – measurable results related to the efficient use and consumption of energy. Energy performance and energy efficiency largely determine the competitiveness of an enterprise (organization) in both foreign and domestic markets. Therefore, newly developed products and technological processes should have less energy intensity and should be less resource intensive. The task of the enterprise management is to increase the level of use of all types of energy in economically feasible, progressive ways at the existing level of development of equipment and technology. It is obvious that energy saving issues in organizations should be approached comprehensively, with an emphasis on the application of the best global practices [10, 11].

The international standard STB ISO 50001, which offers a systematic approach to management, is designed to ensure targeted improvement in the energy performance of organizations¹. Thus, STB ISO 50001-2013 establishes requirements applicable to the use and consumption of energy, including energy planning, monitoring and measurement, documentation and reporting, design approaches, practices for purchasing energy services, products, equipment and energy, as well as to personnel responsible for energy performance.

The energy management system includes the following points: energy supply; measuring, documenting and maintaining required records of energy use; selection and procurement of energy production equipment, processes and systems.

When developing an energy management system, you need to go through four stages:

1. Performing a preliminary audit in the management system.
2. Development of an energy management system and its implementation in accordance with the ISO 50001 standard.
3. Carrying out internal audits of the company. Analysis of the effectiveness of the energy management system. Pre-certification audit.
4. Certification audit. (Produced under a contract with a certification body).

The implementation of an energy management system at an enterprise provides the following advantages:

- expands and structures the understanding of the significance of energy use processes;
- provides a systematic, structured approach to the process of integrating efficient energy consumption into corporate culture, as well as into the practice of everyday management in industry;
- forms plans for continuous improvement of energy performance;
- is the organizational basis and structure for continuous work to improve energy performance, regardless of personnel changes.

The management solutions proposed in it will help organizations:

- use energy-intensive assets most efficiently;
- identify objects and set priorities for the introduction of new energy-saving technologies and equipment;
- create conditions for increasing energy efficiency in the supply chain, involving its suppliers and partners in this process;
- achieve maximum efficiency in the use of resources at the existing technical level of development of the organization;
- reduce energy costs.

The energy management system allows you to track energy consumption and thereby makes it possible to compare the energy intensity of the educational process with other educational institutions and more accurately assess the benefits of possible energy saving projects. It should be emphasized that the successful application of an energy management system largely depends on the position of management. With a positive attitude from management, significant results can be achieved.

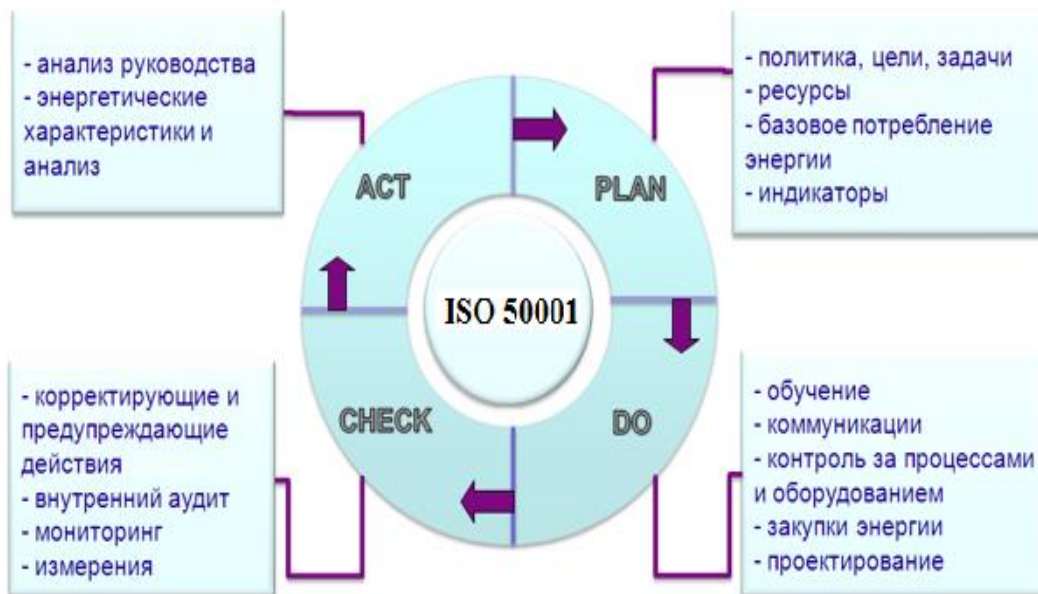
The standard is based on a methodology known as the Continuous Improvement Cycle (PDCA) (Figure 1):

- planning (plan) – conducting an energy analysis and determining basic criteria, energy performance indicators, setting goals, objectives and developing action plans necessary to achieve results that will improve energy performance in accordance with the organization's energy policy;
- implementation (do) – implementation of action plans in the field of energy management;
- check – monitoring and measuring the processes and key characteristics of operations that determine energy performance in relation to the implementation of energy policy and achievement of energy goals, and reporting the results;
- action (act) – taking action to continuously improve the performance of activities in the field of energy and the energy management system. The application of the standard can be adapted to the characteristics of the organization, taking into account the amount of resources, document flow, and personnel competence.

As a result of the implementation of the energy management system according to the ISO 50001 standard, the following is ensured:

- increasing the investment attractiveness of the enterprise;
- reduction of costs up to 15% on fuel and energy resources;
- operational management of energy consumption and costs.

Energy management is an advanced direction in organizing and running a business in a highly competitive environment. The main goal of enterprise energy management is the efficient use of energy resources and reliable operation of the organization's energy system.



1.-drawing. Energy management principle Plan Do Check Act

The International Organization for Standardization - ISO in 2008 developed a new international standard, which became the most innovative standard in the field of energy management after approval on June 15, 2011. It received the name “Energy Management Systems – Requirements” and the international designation ISO 50001.

The international standard ISO 50001 is being implemented throughout the world. Companies are eager to announce that they are the first in the country or industry to implement a new international standard for systemic energy management, thereby demonstrating their social responsibility. And the leaders in this are economically developed countries that want to put energy consumption under constant control, following the idea of “non-destructive development.” In addition, certification in accordance with the ISO 50001 standard helps to acquire a marketing tool to attract more consumers and partners, as well as strengthen the image and reputation of the organization.

Energy policy. The limitation of non-renewable energy resources and the steady increase in tariffs for energy resources in one way or another affect all states and are becoming a problem on a global scale. The change in attitude towards energy resources is associated with the high energy intensity of a number of industries. The cost of energy today has become one of the main components of production costs. And this problem, in turn, entails such consequences as economic inefficiency, uncompetitiveness of products, low sales on world and domestic markets, export costs, closure of ineffective enterprises, etc. Obviously, reducing costs per unit of production increases economic sustainability and competitiveness enterprises.

On a state scale, the task of stimulating enterprises to increase the efficiency of using energy resources is due to the fact that reducing the cost of producing a unit of product leads to an increase in the competitiveness of these products on the market (including on the world market, if the product is exported), which can contribute to the growth of the national economy economy.

Energy saving is the main goal of the governments of many countries around the world (for example, the USA, Canada, Japan, Belarus, Kazakhstan) [10, 12–14]. Uzbekistan has also put energy saving and increasing energy efficiency on its basis among the main priorities of the state energy policy, despite the sufficiency of its own natural energy resources and the presence of a powerful energy infrastructure.

Encouraging the state to implement programs to improve the efficiency of using energy resources is not so much an “act of goodwill” as it is the requirements of modern economic realities.

The policy reflects senior management's commitment to energy efficiency to ensure the enterprise's ability to consistently support and develop efforts to improve energy efficiency and align energy consumption with the enterprise's energy needs.

The development of energy policy involves studying the relationship between the formation of costs and energy saving reserves, between the distribution of energy resources and the provision of consumption sources with them.

As defined in the STB ISO 50001-2013 standard, energy policy is an official statement by senior management about the main intentions and directions of activity in relation to energy performance. Energy policy, in turn, determines the relevance of solving a number of theoretical and methodological problems related to the formation of an energy strategy for an industrial enterprise.

Energy policy is the driving force behind the process of introducing and improving the energy management system. And mutually, the implementation of state policy in the field of energy saving and increasing energy efficiency can be facilitated by the widespread introduction of an energy management system.

Energy management. Energy management is a set of administrative actions aimed at ensuring rational consumption of energy resources and increasing the energy efficiency of a management facility, including the development and implementation of energy saving and energy efficiency policies, action plans, monitoring procedures and techniques, energy consumption assessment and other actions aimed at increasing energy efficiency [15–17].

Energy management is closely related to other types of management: production process management, production logistics, environmental management and human resource management, etc.

An energy management system (EMS) enables an organization to take a systematic approach to ensure continuous improvement of energy performance, including energy efficiency, energy use and consumption.

For the successful implementation of an EMS at an enterprise, a policy for more efficient use of energy must be developed, in accordance with which the goals and objectives of energy management must be adjusted. To better understand how best to use energy and make decisions accordingly, it is necessary to collect data and measure results so that analysis can be carried out to determine how well policies are working.

The relevance of the implementation of this system is increasing year by year, since transparency and objectivity in assessing the efficiency of energy consumption makes it possible to identify not only significant energy aspects, but also weak points of energy consumption and optimize them in the first place. The main functions of energy management are:

- interaction with energy consumers of the enterprise and energy supply organizations;

- processing and provision of information on energy consumption for individual structural divisions (productions, workshops, sections);
- preparation of proposals for energy saving;
- launching and managing energy saving projects;
- conducting explanatory and educational work with all employees about the importance and necessity of energy saving.

The work of the SEM occurs in several stages.

1. There is a system of “technical accounting” of energy resources, when meters are installed on the main groups of consumers, and a system of constant collection and archiving of readings is created, i.e. resource consumption is monitored.
2. Visualization and quick analysis of the collected information occurs.
3. The results are compared, the worst ones are identified, i.e. the most energy-consuming consumers and processes.
4. A corrective action plan is developed and then implemented.

At the final stage, the effectiveness of the actions taken is confirmed (verified) and replicated to other objects.

The main tool of energy management is an energy audit, which is a survey of an enterprise in order to collect information about energy sources and its specific consumption per unit of output. Based on the results of the energy audit, recommendations and technical solutions are developed to reduce energy costs. An energy audit is carried out to determine ways to quickly and effectively reduce energy costs and avoid unjustified costs for energy saving measures. It can become a solid basis, a springboard for a qualitative breakthrough in the competition in the market of goods and services. However, this is only true if the energy audit is properly organized. The role of the management and specialists of the enterprise is important in this.

Based on the results of the energy audit, the management of the enterprise should receive:

1. An assessment of current energy consumption with reliable data on the volume of consumption of all resources and the amount of money spent on them, for the enterprise as a whole, for individual areas, and their specific values for each type of product.
2. A program of energy saving measures, containing a system of organizational, legal and technical measures aimed at constant and systematic reduction of costs, while improving the production, economic and environmental performance of the enterprise and the working conditions of its personnel. Thus, the correct setting of goals and objectives for conducting an energy audit determines whether the course for reforms will be taken in the future, or whether everything will end with the issuance of an energy passport. An energy survey, competently carried out by specialists, will indicate the right directions for activity, and organizing and carrying out practical work to improve the energy efficiency of an enterprise is the task of its management. Energy management implementation can start with existing capabilities and then be adjusted to meet new resources and requirements.

The implementation of an EMS gives the following positive results:

- reduction of energy intensity and costs;
- increasing energy efficiency;
- resource and energy saving;
- reducing dependence on rising energy prices;
- reducing the impact on the environment;

- increasing competitiveness;
- guarantees of stability;
- increasing the level of trust of stakeholders;
- attractiveness for investment;
- an incentive for innovation.

The energy management system is one of the subsystems of the overall enterprise management system, connecting the strategic goals of the company, energy audit, personnel training on energy saving and energy efficiency, as well as automation of energy saving activities. The EMS is presented as a set of elements that form the basis of regular business processes involving a developed system of motivation and training. Since the requirements for the development, implementation, maintenance and improvement of an EMS are established by the STB ISO 50001-2013 standard, the operating principles of the system are also based on the concept of E. Deming - the concept of continuous improvement cycle - PDCA (“plan - do - check - improve”)³, which allows us to speak about a high level of compatibility of STB ISO 50001-2013 with other management system standards (ISO 9001, ISO 14001, etc.). This allows you to integrate the EMS into a unified management system of the organization, aimed at balanced satisfaction of the needs of all stakeholders. Note that management and staff develop and implement EMS to improve the performance and competitiveness of their enterprise in the domestic and international markets, and not for inspection organizations and government agencies. The most important thing is that the system allows you to constantly improve and implement best practices.

Problems of developing energy management at Russian enterprises We see that in the conditions of a dynamically developing economy and technology, a significant contribution to the energy efficiency of an organization is no longer made by energy-saving equipment and technologies, but by perfect management approaches. Despite the advantages that the implementation of an EMS provides, today its presence in Russian enterprises is not widespread enough. This is due to a lack of understanding of why it is needed, how it works, how difficult and time consuming it is to implement. Sometimes business managers intuitively fear the significant costs of completely or partially replacing previously installed energy meters. At the same time, there are already successful examples of the use of such a system in Russian companies, which prove that these fears are in vain.

Barriers to the implementation of EMS are entirely related to the specifics of energy cost management.

Management is focused on production rather than energy efficiency. Enterprise managers do not pay attention to the possibility of energy saving and try to solve emerging problems in other ways, including cutting staff and wages.

The management of enterprises does not show the will to comprehensively carry out work to improve energy efficiency. The reasons for this are the lack of information among enterprise managers about the forms and possibilities of energy saving and a lack of understanding of the real prospects of the enterprise under the existing energy management, or rather, in its absence.

The lack of scientific and methodological support also affects this. Insufficient level of technical knowledge and qualifications to identify, develop and implement energy efficiency measures and projects. Weak level of monitoring and data collection.

The area of energy management remains poorly studied, since most issues are resolved within the framework of the international standard, which only regulates the basic principles of

organizing business processes of energy consumption and energy saving. Developing an energy management system based on a standard, taking into account the specifics of a particular company, is often not difficult. Meanwhile, the potential of energy management can be revealed through the sphere of enterprise human capital management by attracting the intellectual and creative potential of employees in solving energy saving problems.

To achieve the goals of energy management, which must be achievable, realistic and consistent with the conditions of environmental and economic security, a comprehensive government policy is needed aimed at increasing the energy efficiency of production. The main measures include:

- the need for widespread implementation of energy management and lean production standards;
- introduction of criteria for comparing the energy efficiency of standard processes of different enterprises and the requirements for its annual increase for enterprises with significant backlogs;
- publication of energy efficiency indicators of each company;
- formation of economic incentives (tax incentives, co-financing) for the introduction of energy-saving technologies.

We especially note that motivating personnel for energy saving purposes is an additional reserve in increasing energy efficiency, related to the technologies of social and labor management and the accumulation of positive human capital [18].

CONCLUSION

Due to the relative availability of electricity, heat, and hot water, many people have the idea that these benefits appear on their own and will never run out (although it has long been common knowledge that reserves of traditional energy resources are steadily depleting). Why save them if everyone is provided with them in sufficient quantities at an affordable price (how much I spend, I'll pay for as much, I'll spend more, so what, I'll pay more). But here's some comparison: one kW of electricity is enough to bake 38 kg of bread or sew 2 pairs of shoes, or produce 14 kg of cheese. The same amount of energy is consumed during 10 hours of pointless burning of a 100 W light bulb [19]. We believe that these figures are impressive. It is very difficult to limit the growth of energy consumption, because the health and well-being of each person directly depends on it. How to rationally use energy, save it, without worsening the level of comfort, without changing your lifestyle? Modern man needs to learn to optimize his energy consumption, while saving minerals and natural resources. By consuming energy efficiently, we can not only significantly save money on bills, but also contribute to solving global environmental problems. At the same time, if energy saving measures are comprehensive and carried out systematically, then, acting systematically, step by step, it is possible to achieve a significant reduction in energy costs both for each individual enterprise and throughout the economy, and should take part in these processes every.

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