Tovma N.A., Tleppaev A.M.

Increasing energy efficiency and reducing energy costs through the creation of national standards

In recent decades, the energy that began to make significant cost has become a key aspect. As before the energy has always been a resource for production, it has become recognized as one of the main sources of costs that deserves serious attention. Developing energy management concept involves energy management as any other productive resources to reduce enterprise costs by improving energy efficiency. There are a number of standards in the field of Energy Efficiency, but they do not take into account the specific characteristics of the country, it is proposed the use of National Energy Efficiency Standard. Industry is a major consumer of electricity (70%) and thermal energy (50%), the population consumes less than 25% of electricity and 30% heat.

Key words: energy efficiency, standards of energy efficiency and energy audit.

Товма Н.А., Тлеппаев А.М.

Ұлттық стандарттарды құру негізінде энерго тиімділікті жоғарылату мен энерго шығынды төмендету

Соңғы он жылдықта бизнестің маңызды құнын құраған энергия негізгі аспект болып келеді. Энергия өндіріске қажет ресурс болып келгендіктен, негізгі шығындардың бірі болып саналады және көңіл бөлуді талап етеді. Дамып жатқан энергия менеджментінің концепциясы кез-келген өндірістегі ресурс энергия менеджментінің энергия тиімділігінің жаңарлату негізінде кәсіпорын шығындарын төмендетуді меңзейді. Энерго тиімділік саласында бірнеше стандарттары бар, бірақ олар мемлекеттің спецефикалық ерекшеліктерінде есептелмейді, сондықтан энерго тиімділіктің Ұлттық стандарттарын пайдалану ұсынылады.

Түйін сөздер: энерго тиімділік, энерго тиімділік стандарттары, энергоаудит.

Товма Н.А., Тлеппаев А.М.

Повышение энергоэффективности и снижение энергозатрат путем создания национальных стандартов

В последние десятилетия энергия, которая стала составлять значительную стоимость в бизнесе, стала ключевым аспектом. Поскольку и ранее энергия всегда была ресурсом, необходимым для производства, она стала признаваться одним из главных источников затрат, который заслуживает серьезного внимания. Развивающаяся концепция энергетического менеджмента подразумевает менеджмент энергии как любого другого производственного ресурса с целью снижения затрат предприятия путем улучшения энергетической эффективности. Существует несколько стандартов в области энергоэффективности, однако они не учитывают специфические особенности страны, поэтому предлагается использование Национального стандарта энергоэффективности.

Ключевые слова: энергоэффективность, стандарты энергоэффективности, энергоаудит.

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INCREASING ENERGY EFFICIENCY AND REDUCING ENERGY COSTS THROUGH THE CREATION OF NATIONAL STANDARDS

The long-term priority for the Republic of Kazakhstan is a «welfare society based on a strong state, developed economy and universal labor opportunities» [1]. Energy is a major factor in the internal and external development strategy of each state, its economic security [2, p.101]. Recognition of the importance of energy as one of the types of resources that require the same management as any other valuable resource, and not as the overhead costs of the enterprise, is the essential first step to improve energy efficiency and reduce energy consumption.

Arrangements for expansion and modernization of existing power plants and construction of new needs to cover the electrical load growth. The following two images show the dynamics of production and consumption of electric and heat energy in Kazakhstan in the 21st century (fig. 1 and fig. 2).

The most effective solution to the reduction of natural resources is the practice of energy conservation and introduction of energy efficient technologies. Improving energy efficiency is a very important issue for the economy of Kazakhstan. Unit GDP energy intensity according to the IEA Kazakhstan remain very high (1,8 USD / kg.o.e) compared with developed countries (5,5 USD / kg.o.e). During the period of reforming the economy from 1991 to 2001 energy intensity of GDP has increased by 15 – 20%, which had a negative impact both on the economy as a whole, and on end users. During the period 2001-2012 the energy intensity of GDP fell slightly, but still higher than the average trend in the 5 times.

According to expert data overrun fuel for electricity production is 10-15% on heating – 15-20%. The costs of implementing power saving is about 5 times lower than on a new energy production.

Currently, we developed a number of standards in different countries, each of which reflects national specificities, summarizes the experience and practice of the set of industrial and non-industrial organizations.

The very first was released in 1985, the British Standard BS 8207: 1985 «Code of Practice for Energy Efficiency of Buildings», is still in effect with minor changes introduced in 1994. American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE) developed by ANSI / MSE 2000: 2005 «Energy Management System» and ANSI / IEEE 739: 1995 «Recommended Practice for energy management in industrial and commercial enterprises».

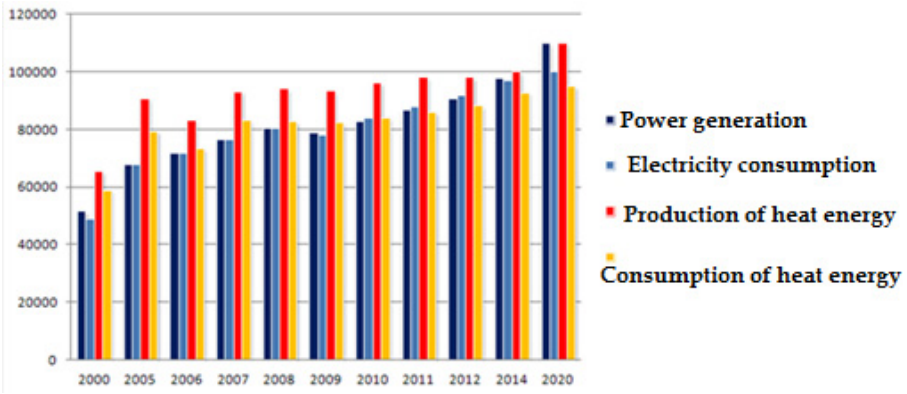

Figure 1 – Dynamics of production and consumption for 2000-2020 (Ministry of energy RK)

Industry is a major consumer of electricity (70%) and thermal energy (50%), the population consumes less than 25% of electricity and 30% heat. According to the forecast of the Energy Research Institute of the Russian Academy of Sciences (ERI RAS), consumption of electricity and heat in the world from 2010 to 2035 GG will increase due to the growth needs of the industry (industry) and the public (HCS) [3].

When you save the old industry base and low rates of its modernization without the introduction of energy-saving and energy-efficient technologies, further development of Kazakhstan's energy production capacity planned in the programs and plans of the government, will only be used to meet the needs of the industry without compromising the energy efficiency index. This will lead to reduced competitiveness, reduce product quality and preservation of the status of "raw" appendage of the developed countries of the world.

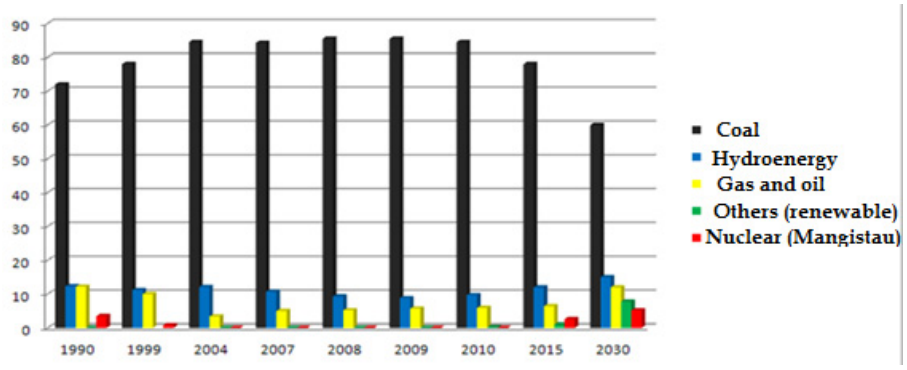

Figure 2 – Changes in the structure of fuel and energy resources in electricity production for 1990-2030 (Ministry of energy RK)

Danish DS 2403: 2001 standard was the first standard that provides organizations a complete guide to implementation of the energy management system. In 2009, the European standard EN 16001 was published in 2009, which has received national status to date in 17 European countries.

Today, energy efficiency in all sectors of the country (the company, the transport sector, housing, and agriculture) is a priority issue in the development of Kazakhstan.

Currently, the existing national standards in the field of energy management systems are available in almost all the developed and rapidly developing countries:

– USA (ANSI / MSE 2000: 2008)
– United Europe (EN 16001: 2009)
– United Kingdom (BS EN 16001: 2009)
– China (GB / T 23331: 2009)
– South Korea (KS A 4000: 2007).

Some of the above-mentioned standards came out in the second and even a third version, which

once again demonstrates their relevance and development. International experience has shown that the energy standards in the field of energy management systems are a viable instrument of policy and market mechanism, which allows achieving a sustainable energy industry. As a result of the implementation of programs in the US, UK and China can unequivocally say that the potential for optimization of industrial systems and energy efficiency is not less than 20%. As an example, the experience of two companies in one of them – the plant, owned by a large company, Dow Chemicals. One of the basic principles of economics steadily developing country is the reduction of energy intensity by increasing or stabilizing energy consumption.

Also, there are the following standards:

– European Standard EN 16001: 2009 Energy Management Systems, Requirements with guidance for use. This document has been prepared by CEN / CLC BT / TF 189 "Energy management and related services – general requirements and qualification procedures". Adopted by the CEN (European Committee for Standardization) June 6, 2009 At the heart of EN 16001 are well-proven national standards: Denmark (DS 2403: 2001), Sweden (SS 627750: 2003), Ireland (IS393: 2005) and Spain (UNE 216 301: 2007).

– The international standard ISO 50001: 2011 Energy Management Systems – Requirements with guidance for use. This document has been prepared by Technical Committee ISO / TC 242 «Energy Management» which adopted by ISO (International Organization for Standardization) June 9, 2011. ISO 50001: 2011 is based on the European Standard EN 16001: 2009, the American ANSI / MSE 2000: 2008 and Korean KS A 4000: 2007.

The increase is caused by waste and emissions caused the need to reduce environmental pollution. In 2008, the International Organization for Standardization (ISO) began developing a new international standard ISO 50001 (energy management systems – Requirements with guidance for use). To this end, it established a new technical committee ISO / TC 242 «Energy Management». Implementation of ISO 50001 is possible for all organizations, regardless of their size and type of business; it can be implemented in organizations both individually and with other management systems such as ISO 9001, ISO 14001, OHSAS 18001 and others.

In Kazakhstan, the energy saving and energy efficiency of all sectors of the economy are now a priority, with the decision which will be solved complex problems – energy, environmental, economic and social.

January 13, 2012 № 541-IV LRK adopted a new Law «On energy saving and energy efficiency». The law was adopted to replace the pre-existing Law «On energy saving». [4] The new law defines the concept State Energy Registry – a systematic set of information about business entities, consuming more than 1,500 tons of fuel per year, or 2 MW of installed capacity.

So, following the global socio-economic trends, Kazakhstan, as well as many countries of the West and the East, he joined the international environmental movement and is now taking its first steps along the road of sustainable development. This is confirmed by the Strategic Development Plan of the Republic of Kazakhstan till 2020. According to this document, which generally does not change the general trend, Kazakhstan aims to reduce the energy intensity of the economy (by Strategic plan on 25%) and carbon emissions (in accordance with the obligations under the Kyoto Protocol – by 15% by 2025 and by 25% by 2050).

Speaking about the potential of energy saving in the CIS countries, it is worth noting that today, in a number of companies are already elements of the energy used, for example, developed and implemented programs, plans and energy saving projects carried out purchase more energy-efficient equipment, analyzes the opportunities for improving the energy efficiency of certain production facilities and / or processes. The introduction of the international standard ISO 50001 energy management is defined as state regulatory purposes.

The standard is based on the common elements used in all of ISO management system that provides a high level of compatibility with other management systems. The purpose of the standard is to provide companies a structured and comprehensive management to optimize the process of consumption of energy resources and systems management data process. The purpose of the introduction of ISO 50001: 2011 is to provide companies with a structured and comprehensive guide to the process optimization of consumption of energy resources and the system managing the process.

ISO 50001: 2011 – Energy Management System is a fundamental basis for the creation of an efficient and modern energy management in the industrial, commercial and other enterprises and organizations.

Companies that have implemented ISO 50001 standard for energy management system, the ability to get an objective to reduce the

costs of energy consumption and reduce carbon dioxide emissions into the environment, as well as give a great number of benefits to users. With regard to the specifics of the enterprise energy management, basic steps that should be provided for the effective management of energy use in the enterprise:

– The adoption of the energy policy of the company;

– Planning of energy production and consumption;

– The introduction and operation of power plants;

– Monitoring and measuring energy use, including the result of the activities of the staff;

– Corrective and preventive actions to identify and predictable inconsistencies;

– internal audit;

– Management Analysis in energy use;

– Improving management.

The standard is intended for independent use, and for its use as a part of other quality management systems, environmental impact, safe working conditions and social responsibility. ISO 50001 standards includes requirements for the development and implementation of energy policy, objectives, targets and energy management action plans, taking into account the legislative regulatory legal acts. The standard will be to organize any type of base, along with the standards for ISO 9001 quality management system and ISO 14001 environmental system management.

The main standard in this series is ISO 50001: 2011 "Energy Management Systems. Requirements with guidance for use". ISO 50001: 2011 is a new voluntary international standard that is applicable to all organizations, including large and small industrial enterprises, commercial organizations, institutions and government agencies wishing to demonstrate their compliance with the declared energy policy by self-assessment and self-declaration of conformity or by passing the system of certification procedures Energy.

ISO 50001: 2011 specifies requirements for designing, implementing, maintaining and improving an energy management system in order to achieve continuous improvement in the field of energy management, including energy efficiency, energy use and consumption in the framework of a systematic approach based on the PDCA cycle.

In addition, as described in the standard requirements apply to measurement, documentation and reporting, design and practice of procurement of equipment, systems, processes, selection and training, which contribute to improving the energy efficiency of the organization.

On stage there are several projects related series of standards ISO 50000. These include:

1) ISO / CD 50002 Energy audit;

2) ISO / CD 50003 energy management system audits and competence of the auditors;

3) ISO / CD 50004 Guidelines for the implementation, maintenance and improvement of the energy management system;

4) ISO / CD 50006 Basic use of energy and energy efficiency (EnPIs) – General Principles and Guidelines;

5) ISO / CD 50015 Monitoring, measurement, analysis and verification of the organizational level of energy efficiency.

Standard ISO 50001:2011 is based on a model of continuous improvement management system, so it can be used either alone or in conjunction with other well-known standards such as ISO 9001, ISO 14001, ISO 22000 and OHSAS 18001 standards. This enables organizations to integrate energy management into their overall efforts to improve product quality and safety as well as environmental management and the management of occupational safety and health personnel.

The European Union developed and adopted to the new standard IEC 60034-30, according to which three energy efficiency class set (IE – International energy efficiency) of single-speed three-phase asynchronous motors with squirrel-cage rotor:

The IE1 – Standard energy efficiency class – roughly equivalent to the energy efficiency class EFF2, used now in Europe;

The IE2 – High energy efficiency class – roughly equivalent to the energy efficiency class EFF1,

IE3 – the highest energy efficiency class – the new class of energy for Europe.

The introduction of the new standard in Europe will take place in three stages: Since January 2011, all engines must conform to class IE2.

From January 2015 all engines from 7.5 to 375 kW must be no lower than class IE3; at the same time allowed the class IE2 motor, but only when working with variable frequency drive. From January 2017 all motors with power from 0.75 to 375 kW must be no lower than class IE3; at the same time it allowed the class IE2 motor and when working with variable frequency drive. In order to increase energy and reduce inventories of CO2 emissions, the European Union (EU) has focused attention on the achievement of energy efficiency. In particular, the energy efficiency of the

housing funds of the EU's largest energy consumers in more than 40%. Directive on energy performance of buildings (DEEZ) and its updated revision (recast), adopted in 2002 and 2010 respectively, the EU contributes to achieve its ambitious goals in energy use and energy saving. Although some EU Member States (such as Belgium, the Netherlands and Germany) have already made considerable progress towards the achievement of high energy efficiency standards, other countries (such as Poland, Spain, and Czech Republic) have faced great challenges in achieving these figures.

Germany has long been a world leader in the development of energy efficiency standards and regulations at the national level ("Progress with Implementing Energy Efficiency Policies," OECD / IEA, 2009). To date, Germany has a number of laws that support the construction of energy-efficient buildings and houses, as well as contribute to the modernization of existing buildings in order to increase their effectiveness. Germany has also developed and is implementing an innovative energy efficiency financing system that has been successful not only in Germany but also in other EU Member States [5].

Directive on energy performance of buildings (ECD) is the main legislative instrument which affects the energy consumption and energy efficiency in the EU. This document regulates the construction of buildings erected and controls existing buildings. The original directive was adopted in 2002 (Directive 2002/91 / EC); its updated edition (2010/31 / EU) and published in 2010, which were proposed significant changes to the standards and energy efficiency standards ("Energy Efficiency of Buildings Directive," ECEEE, 2010).

On the basis of the federal German law on energy saving (Energieeinsparung Gesetz) in 2002, the government has been developed Regulation on Energy Conservation (Energieeinsparverordnung), where the detailed requirements with respect to indicators of energy consumed were presented in new and existing buildings (Regulation on Energy Conservation was modified in 2004, 2007 and 2009) (Schettler-Köhler, 2008; Schettler-Köhler & Kunkel, 2010). Through Decree on energy saving and other activities aimed at the development of energy efficiency in the country, in Germany managed to implement many aspects of ECD even before the Directive was formally presented to the EU in 2002. For example, in Germany the method of calculating the energy efficiency of buildings has been developed and involved long before the ECD, energy certificates (as passport) was required for the construction of buildings, and in some cases even for modern buildings, as well as the requirements for almost all kinds of upgrades of factory products have existed since 1984 years without any restriction on the size of buildings [6].

As previously mentioned, the Decree on the Energy Conservation plays an important role in energy conservation and efficiency, as this regulation defines standards and energy efficiency requirements and implements control over their observance. In Germany, the energy certificate (also energy performance certificate) is a binding instrument since 2002 for new or substantially modernized buildings. Requirements to energy certificates for existing buildings for sale or rent, as well as the public, were introduced in July 2008. German energy certificates can be grouped into two main categories:

1) certificates on the basis of pre-calculated to be the energy needs of the building,

2) certificates based on the actual energy consumed the building. Certificates based on the calculated energy requirements previously, are usually quite expensive, because such certificates often require a visit to the building energy expert who could provide detailed information about the building and its energy needs. Certificates based on actually expended energy, usually do not require visiting the building expert and therefore are considered as relatively cheap.

There are standard forms that are required for energy certificates. Today in Germany a holistic method of calculation of the energy, which is painted in detail in the standard DIN V 18599. Standard DIN V 18599 is a single method of calculation of the energy required for heating and cooling buildings, as well as its normal functioning. This standard assesses the energy efficiency of lighting and heating, ventilation, cooling and hot water supply [7].

German experience in the implementation of high standards of energy efficiency has been very successful and has even become a model to be followed for the EU member states.

Currently, in Kazakhstan implemented a variety of government programs to improve the country's energy saving and energy efficiency. These programs are aimed at accelerating the development of energy saving and energy efficiency in different sectors of the economy in nine areas:
– industrial energy efficiency;
– innovative energy;
– energy-efficient housing and communal services;
– energy-efficient construction;

– energy-efficient vehicles;
– energy efficient the public sector;
– energy-efficient lighting;
– energy-efficient society; and
– economical cost.

The main objective of the program is to optimize the energy losses in the existing heating systems and hot water supply, as well as reduce energy consumption and reduce the inefficient use of energy resources. The introduction of energy management systems in accordance with the international standard, is one of the most effective measures for the implementation of energy saving and energy efficiency in the Republic of Kazakhstan.

We believe that for the Republic of Kazakhstan it is necessary to adopt national standards for energy efficiency.

National energy efficiency standard needs to be set for energy-saving integration of the recognized organizations scheme in their management practices. In organizations around the world had access to a single harmonized standard for implementing it in all areas of the building on a logical and robust method for determining and implementing improvements. It is intended to achieve the following objectives:

– Help organizations use them more energy efficiency assets;

– To create transparency and facilitate communication on the management of energy resources

– Promote best practice energy management and strengthen the good practices of energy management;

– Support capacity to assess and prioritize the implementation of new energy-saving technologies;

– Ensure scheme promoting the rational use of the entire energy supply chain;

– improve energy management for the implementation of GHG emission reduction projects;

– allow the implementation of integration with other organizational management systems such as environmental management, occupational health and safety.

We consider it necessary to establish a national energy efficiency standard for the Republic of Kazakhstan which confirms the fact that the requirements of the Regulation on energy conservation and have been performed in full, and produces standards (standards) energy efficiency for energy certificates based on pre-calculated to be the energy needs. National energy efficiency standard should include the following ten sections:

1) general information,

2) The amount of energy required for heating and cooling,

3) energy required for air conditioning,

4) the general (total) amount of energy required for lighting,

5) the general (total) amount of energy required for heating,

6) the general (total) amount of energy required for ventilation systems of dwelling houses,

7) the total (final) energy required for air conditioning and refrigeration

8) the general (total) amount of energy required for hot water supply,

9) the general (total) amount of energy required for the multi-function generators,

10) mandatory conditions

This national standard should include the following aspects:

1) The minimum energy requirements for new buildings and modernizing existing buildings (provision applies to residential and commercial buildings);

2) The minimum energy requirements for heating and air conditioning systems. Also encourage that the use of energy derived from renewable sources (for example, electricity from renewable energy sources);

3) periodic inspection / inspection of boilers and heating and air conditioning systems;

4) The energy certificate / passport for new and modernized buildings;

Sanctions and penalties in case of non-energy efficiency standards properly.

The company, which built and organizes the work quality of the energy management system, is able to:

– Improve the production cycle;

– Promptly implement effective energy conservation measures;

– To benefit from these activities in the form of financial gain;

– Increase their efficiency;

– Implement the plans to improve the energy-saving performance by analyzing the current energy consumption with respect to the expected;

– Introduce and apply in daily activities of the organizations various legislative, regulatory, contractual and other requirements and obligations.

– To perform an important function in regulating climate change.

Thus, the National Energy Efficiency Standard for the Republic of Kazakhstan to assist organizations to develop a strategy to improve energy efficiency, reduce costs, and improve the environmental aspect of operations. One of the significant advantages of the introduction of the

energy management system will also increase the investment attractiveness of the company. Implementation of the standard should lead to a reduction in financial costs, greenhouse gases and other environmental impacts of emissions through systematic management of energy (energy). Successful implementation depends on commitment from all levels and functions of the organization, and especially from top management.

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