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Development of Energy Management Systems of Russian Companies in the Context of World Tendencies of Improving Energy Efficiency

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Abstract:

Developing world concept of sustainable development implies multi-aspect directions of its implementation one of which is sustainable energy. International practice accumulated successful experience in this area, and understanding of the world tendencies must be a foundation for improving energy efficiency of the Russian economy. Recently one of the most topical issues is development of energy management systems in companies and their ISO 50001 Certification. Comparative analysis of certification activity of companies in different countries showed a growing interest to establishing and certification of energy management systems. Some contradictions between the structure of gross domestic product, industry structure of energy management system certification and world tendencies in improving energy efficiency have been observed. The authors analysed the level of energy efficiency in certain countries and depicted a significant potential of development in this area in Russia. In this paper the authors also explored strategic and normative prerequisites for introducing energy management systems in Russian enterprises. Objective and subjective factors having an impact on decreasing energy efficiency in Russian economic were structured and their relations were shown. Evaluating maturity level of energy management systems in Russian companies, the authors proposed key areas for improvement and the ways to make them comply with ISO 50001. The authors depicted financial, organizational and image effects resulting from introduction of energy management systems in Russian companies and suggested specific ways to obtain these effects.

Key Words: *Energy efficiency, energy-saving, energy management, energy management system, sustainable energy*

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1. Introduction

1.1 Introduction to the Problem

Acknowledged by the world communion concept of sustainable development as a priority area for the next ten years, proved its relevance on the World Summit Rio+20. On that summit meeting for the first time the problems of sustainable energy were widely discussed. The problems of increasing energy efficiency in different economic sectors are becoming more acute for many countries, and the United Nations declared 2014-2024 years as the decade of sustainable economy for everyone. Current energy challenges are international and they require concentrated efforts of all countries.

Development of energy management systems meeting the requirements of international standards enables the companies to adopt and implement the principles of sustainable energy. There are many obstacles in this area which restrict and decrease activity of introduction of these systems in Russian enterprises. This requires special research identifying the ways of overcoming the obstacles during development of energy management systems and their further sustainable development.

1.2 Importance of the Problem

Studying current world tendencies in improving energy efficiency allows identify prior areas of development of the Russian economy in this sphere. Expansion of energy management systems in Russian companies is possible only on the basis of strong evidence of their feasibility and functioning. This requires comparative analysis of certified status of the company and energy efficiency using the example of the leading world countries. A separate study of the reasons of decreasing energy efficiency in the Russian economy is also needed as well as identification of Russian company's capacities to meet the requirements of international standards and ability to achieve effect from introducing energy management systems.

1.3 Relevant Scholarship

Research of international approaches to energy management, development of international and national standardization and increase of economic energy efficiency has a wide scientific reach. Researches in this area were conducted by Bashmakovi (2012), Buchin (2011), Dolmatov (2014), Zverev (2011), Lokteva (2010), Golovanova (2010), Ratner (2012), Dira (2012), and Sedash (2013).

Russian companies today face many organizational and technological problems when making a decision about introducing energy management systems. Available scientific publications presenting practical steps and accumulated experience in developing and implementing these systems in certain enterprises provide a solution to these problems. Among the authors publishing their works in this area are Aleksandrova (2014), Kondrasheva (2014), Stepochkin (2014), Gorokhova (2014),

Alutin (2011), Karavaikov (2011), Lakhov (2014), Lemesheva (2011), and Reishakhrit (2011).

The works of the authors Bobylev (2010), Averchenkov (2010), Solovieva (2010), Kirjushin (2010), Bragina (2011), Makhova (2011), Korobova (2011), Omeltchenko (2012), Savin (2014), Zanosienko (2014), and Tufetulov (2011) are devoted to the problem of development of specific instruments of implementation the concept of energy management on organizational and regional levels.

However, scientists have been emphasizing, primarily, experience of certain countries in increasing energy efficiency and systematizing obtained results. The issues of introducing energy management systems in particular Russian companies regarding their industry specifics are studied very well. With this being said, such important aspects as interdependence of energy management systems certification level and growth of economic energy efficiency of the country regarding its gross domestic product are not studied well enough. The same situation is with compliance of traditional systems of energy management systems in Russian companies to international demands. These aspects require a thorough research and further development in fundamental and applied researches.

1.4 Hypotheses and Their Correspondence to Research Design

Hypothesis of the study is assumption and evidence of the need and feasibility to activate work for developing and implementing energy management systems in Russian enterprises. It will offer new opportunities for increasing energy efficiency in Russian enterprises and enables to reach the goals of sustainable development and sustainable energy.

Research is aimed at addressing the following objectives:

- Synthesis of world experience and detecting key tendencies of energy efficiency increase taking into account standardization development in the area of energy management;

- Analysis of energy efficiency of the world economy and particular countries, evaluation of potential increase of Russian economy energy efficiency;

- Studying the condition and results of standardization in companies in different countries in terms of their compliance to ISO 50001; identifying interrelations between the level of certification of energy management systems and the level of energy efficiency of the country;

- Identifying prerequisites for introducing energy management systems in Russia;

• Explanation of the factors affecting decrease of energy efficiency of the Russian economy, conditions to make traditional energy management systems comply with ISO 50001 and effects resulting from energy management systems introduction.

2. Method

2.1 Method of Analysis and Measurement

We used a great amount of statistical information contained in annual ISO reviews to study experience of spreading energy management systems in different countries of the world. Data bases covering the information about the total number of issued ISO 50001 certificates, their sectoral structure and country-by-country structure have been used to conduct comparative analysis and build graphic charts. We applied the data form the official site World Bank for analyzing the level of energy efficiency in particular countries and to depict world tendency of changing energy efficient factors. Sectorial structure of gross domestic product indifferent countries is analyzed on the base of official statistical data of the Federal State Statistic Service.

2.2 Method of Observational Generalization and Logical Inference

Method of generalization is used for studying the world experience of energy efficiency increase in particular companies and in economy of a country, in general in order to determine world tendencies in this area. Logical inference concerning the factors that decrease energy efficiency are made due to generalizing special researches of some of the authors working in this field. We divided the factors on objective and subjective and gave them a detailed characteristic. With the help of the method of generalization, we identified the types and content of the effects from introduction of energy management system in companies complying with the international standard ISO 50001.

3. Results

World Tendencies for Increasing Energy Efficiency

For many developed countries the issues of increasing energy efficiency in organizations have been relevant for the last few decades. On International Summit in Rio-de-Janeiro in 1992 several important documents were adopted and the concept of sustainable development was justified for the first time. A special emphasis in this concept is placed on energy aspect of world economy functioning. The problems of energy efficiency receive a new dynamism when implementing provisions and guidelines of the last International Conference RIO+20. However, ahead of the Summit the United Nations General Assembly announced the year 2012 as the International Year of Sustainable Energy for All (United Nations, 2011). Follow-up to the World Summit in 2012 a new initiative by the United Nations was presented “Sustainable Energy for All” which is aimed at reaching three major goals by the year 2030 (International year of sustainable energy for all, 2012):

- Ensure universal access to modern energy services;
- Reduce global energy intensity by 40 per cent;
- Increase renewable energy use globally to 30 per cent.

Logic development of this initiative reflected in the decision that the United Nations General Assembly unanimously declared the decade 2014-2024 as the Decade of Sustainable Energy for All, underscoring the importance of energy issues for sustainable development and for the elaboration of the post-2015 development agenda (United Nations Decade of Sustainable Energy for All 2014-2024, 2013).

Sustainable energy is aimed at providing broader use of new and renewable energy resources and technologies for reducing carbon emissions including cleaner technologies of using fossil fuels. A special attention is paid on sustainable use of traditional energy sources and on expanding capacities to satisfy growing energy needs on national and organizational levels. Sustainable energy provides new opportunities for growth. It enables businesses to grow, generates jobs, and creates new markets.

Global business communities play an important role in achieving the goals of the United Nations initiative. A complete day-to-day use of modern approaches to increasing energy efficiency taking into account the principles of sustainability is demanded. Analysis of numerous publications (Bashmakov et al., 2012; Zverev, 2011; Ratner et al., 2012; Sedash, 2013; Buchin, 2011 etc.) and practical experience of international cooperation (International cooperation on Energy Efficiency, 2014) as well as the results of the study previously conducted by the author (Fedos'kina et al., 2013) showed that among the key modern world tendencies in the field of energy efficiency and energy efficiency awareness in the companies are:

- Use of alternative renewable energy resources among which the most widespread are such energy resources as the sun, wind and biomass. The sun energy is the most prospective;

- Production and implementation of energy efficient equipment, the priority of which is ensured by adoption of various state programs embodying economic benefits for its purchase and use in comparison with traditional equipment;

- Use of recoverable resources which implies not only building and development of special process industries and utilization production but also development of efficient system for collecting industrial and household wastes;

- Adoption and implementation of the incentives on the governmental level aimed at reducing tax and credit-insurance load of the organizations taking active part in implementing state and own initiatives concerning energy efficiency;

- Active exchange of experience in the field of energy efficiency and energy efficiency increase in organizations in the context of developing national, inter-state and international programs in this area.

- International experience shows that achievement of strategically important goals within each tendency may be ensured through introduction of modern management systems. Currently, the most efficient in this area are the companies which develop energy management systems corresponding to international and national standards. Setting up of such a system is a complex and multi-aspect process. For this reason, organization must have a well-defined methodological basis with a focus on requirements and guidelines of relevant international and national standards.

The first national standard in the world for energy management systems appeared in 2001 in Denmark, and within two years Sweden, Ireland and Spain also adopted their own standards. These four national standards became a foundation for a single European standard EN 16001:2009 which later obtained a national status in 30 European countries. The International Standards Organization (ISO) in 2011 presented its own approved version of the standard ISO 50001:2011 "Energy management systems – Requirements with guidance for use". Its content and requirements reflect consolidated American, European, Korean and other approaches to energy management.

The adoption of national standard on the basis of international ISO standards is a common practice abroad. Thus, after adopting ISO 50001:2011, the standard obtained a national status in 16 European countries (United Kingdom, Netherlands, Denmark, Spain, France etc.), in some Asian countries (Singapore, Japan, India, and South Korea) and in Republic of South Africa, Canada and Brasilia.

Russian Federation is also among the countries which adopted a similar national standard. GOST R ISO 50001-2012 was introduced by the Federal Agency On Technical regulation and Metrology of the Russian Federation and came into force on December 1st, 2012. However, we should notice that many countries adopted ISO 50001 instead of another national standard, and unlike Russia they already had experience in developing and introducing energy efficient system on the basis of the national standard and in certifying.

According to ISO (ISO standards tackle energy challenge, 2013), out of a total of over 19 500 published ISO standards, over 155 relate to energy efficiency and renewables, and many more are in development. They cover both generic subjects such as energy management and energy savings, as well as sector specific solutions for buildings, IT and household appliances, industrial processes and transport among others. ISO standards for renewables tackle subjects such as bioenergy, biofuels and solar power.

Development of ISO 50001:2011and due to the growing interest to energy management system in different companies in the world, it was agreed on the necessity of developing and adoption of the series of standards in this field. According to ISO (ISO's new additions to the energy management range, 2014) the standards in this series offer a more detailed guide and instruments for achieving the goals of energy management. Currently, the series include:

• ISO 50002:2014 "Energy audits -- Requirements with guidance for use";

• ISO 50003:2014 "Energy management systems -- Requirements for bodies providing audit and certification of energy management systems";

• ISO 50004:2014 "Energy management systems -- Guidance for the implementation, maintenance and improvement of an energy management system";

• ISO 50006:2014 "Energy management systems -- Measuring energy performance using energy baselines (EnB) and energy performance indicators (EnPI) -- General principles and guidance";

• ISO 50015:2014 "Energy management systems -- Measurement and verification of energy performance of organizations -- General principles and guidance".

The common goal of these international and national standards is to promote systems and processes needed for improving energy activity including energy efficiency and performance.

Energy Management System Expansion

Currently, the most progressive and actively developing companies in different countries and from different economic sectors acknowledge that efficient energy management system is the most important component of business. Consequently, its certification may be very beneficial.

Despite that the ISO 50001standard is relatively new, its popularity is rapidly growing (Figure 1). (The ISO Survey of Management System Standard Certifications, 2013).

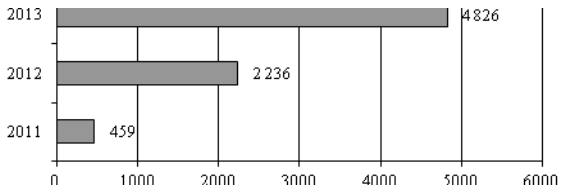


Figure 1. Total number of globally issued certificates ISO 50001, pcs.

Calculations based on the data on Figure 1 show that in 2013 the growth rate of the number of issues certificates was about 216%, growth rate for the same period was 116%; in 2012 the figures were even more impressive – 487% and 387%, respectively. In general, in three years since 2011 to 2013 the number of certified organizations in the world increased by over 10.5 times. Despite the fact that the time interval of energy management system expansion is limited, we still may see a steady tendency of significant increase of the number of certified organizations.

According to ISO, organization from 78 countries expressed the interest to implementing the standard ISO 50001 in 2013, while in 2011 only 32 countries participated in certification of energy management systems. The most active countries are Germany, United Kingdom and Italy (Figure 2) (ISO-survey. ISO 50001- Certificates worldwide, 2013).

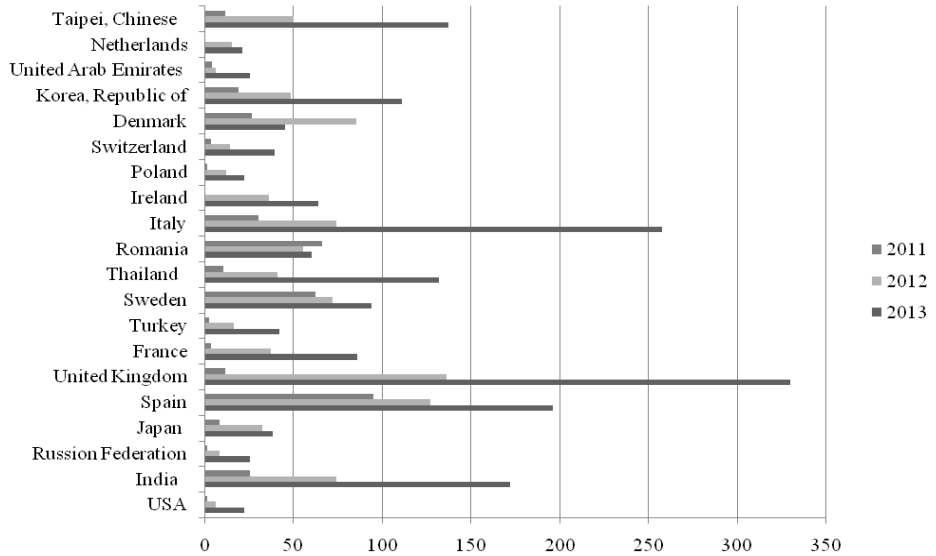


Figure 2. The number of issued ISO 50001 certificates worldwide in 2011–2013, pcs.

To build Figure 2 we took only those countries in which organizations from various sectors received 20 or more certificates in 2013. Russia is among them. However, such developed countries as Canada, Czech republic, Finland, Norway, Israel, Brasilia, China and many others were not included in this review. Germany is not presented on Figure 2 because its values are not comparable with the majority of countries and its situation will be analyzed separately.

Data on Figure 2 show a significant growth of the number of certified organizations in many countries in 2013. The exceptions are Denmark and Romania. The number of issued certificates in 2013 in Denmark decreased by 47%, though in 2012 the

number of issued ISO 50001 certificates was 3.3 times more than in 2011. The similar situation is in Romani where in 2012 reduction of newly certified organizations was 20% in comparison with 2011 and by 2013 the level of 2011 was not reached, though there was an increase in the number of certificates by 10%. Thus, the general tendency shows a strong growth of the number of annually issued certificates almost in all countries with few exceptions.

Certification of energy management system under ISO 50001 requirements in Germany is beyond compare. 2.417 and 1.133 German companies obtained certificates In 2013 and 2012 respectively. While in 2011 German companies were only 10% of total number of certified companies in the world, in 2012 and 2013 the figure was already 51%. The German level of certification under ISO 50001 in 2013 is 7.5 times higher than the most country by activity – United Kingdom and 9.6 times outweighs the number of certificates issued to Italian companies. Figure 3 shows TOP-10 countries implementing energy management system in 2013.

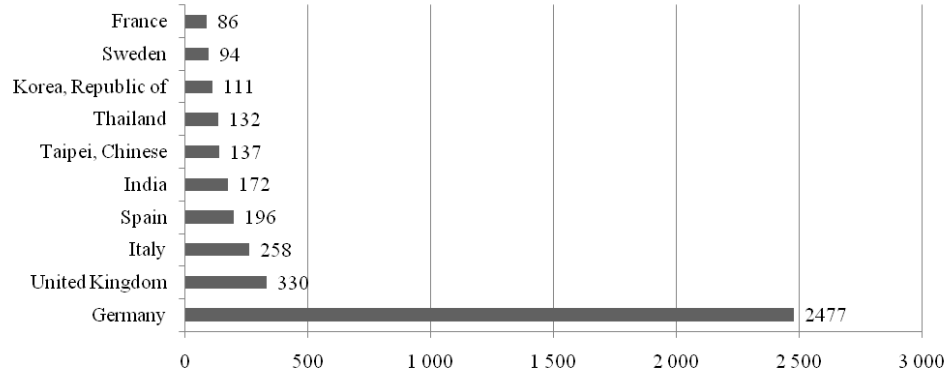


Figure 3. Top 10 countries for ISO 50001 growth – 2013

Figure 3 evidently shows that Germany is an undeniable leader in developing energy management systems. Germany is followed by the countries in which the growth rate was the highest during the last year of the analyzed period and that can be traced by comparing Figures 2 and 3. The exception here is Sweden; annual growth rates in the country were even and relatively small. However, during the year when ISO 50001 was firstly introduced, Sweden was holding one of the leading positions by the number of initial certificates giving way only to Spain and Romania. Germany in 2011 was just was just beginning to implement the systems and during this year 42 companies were certified, while in Sweden the figure was 62, in Romania 66 and in Spain 95. Later Romania receded from leading position, and the other leaders continued their stable development on the background of the rapid growth in Germany.

Russian Federation is not presented in this rating and this is logical as despite relatively high growth rates in the number of issued certificates, the total number of

certified companies and their in the total number of companies is small. However, Russian companies have a great potential in developing energy management systems. According to the World Bank (The World Bank, GDP per unit of energy use, 2012), the level of energy efficiency of Russian economy is one of the lowest in the world. In comparison with the leading countries, Russia has a weal position which is shown on Figure 4.

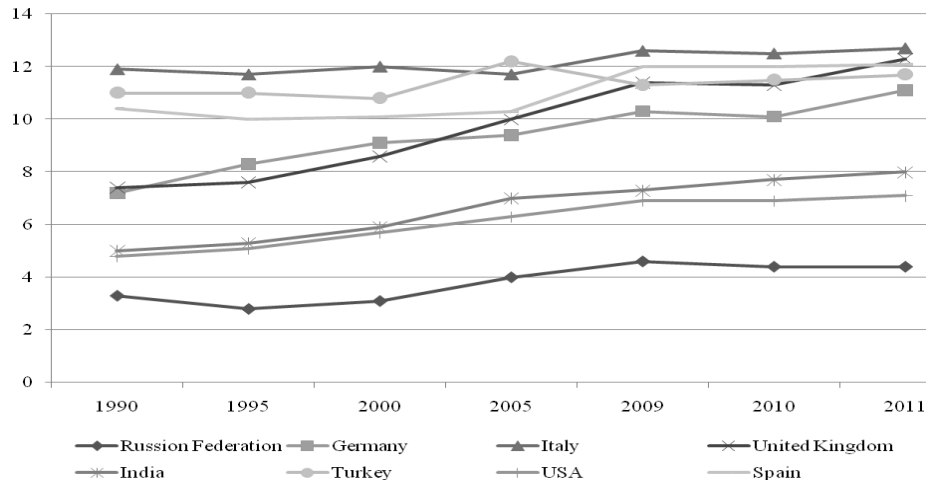


Figure 4. GDP per unit of energy use, constant 2011 PPP $ per kg of oil equivalent

Figure 4 shows data compared by the purchase power parity (PPP). In general, we can see that for the period of 1999-2011 there is a positive dynamics of changing the level of economy energy efficiency in all the countries. However, during the entire twenty year period energy efficiency of the Russian economy was still on the lowest level and did not exceed $4.6 per kg of oil equivalent, corresponding to the level of 2009. The lowest energy efficiency was observed in 1990 and since 2000 there is a tendency of a strong growth with insignificant slowdown in 2010-2011. However, during a crisis period for Russian performance in energy efficiency, the majority of economies had a stable growth. This is quite logical as in 1990s Russia saw dramatic political events, economic conditions were changing and weakening of country's economy in general took place. Many experts (Bobylev et al., 2010) share the opinion that enterprises during that period were applying the survival strategy which implied the secondary role of energy efficiency. Consequently, the major part of energy-intensive productions began to work with incomplete capacities. This approach seems to be reasonable as significant reduction of energy consumption was possible only due to interruption of the production activity and closing of the enterprise. It could lead to serious social and economic consequences.

We should also note that even one of the best indicators of Russian economy energy efficiency during the analyzed period do not reach the average global value.

Dynamics of changes in world economy energy efficiency (The World Bank, GDP per unit of energy use, 2012) is shown on Figure 5.

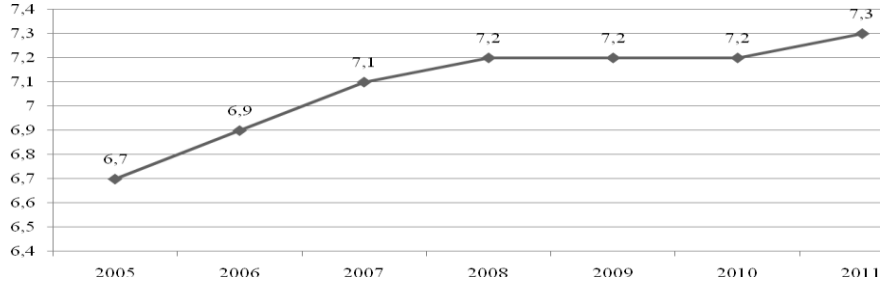


Figure 5. Changes in world economy energy efficiency during 2005-2011, constant 2011 PPP $ per kg of oil equivalent

In the world economy stable positive dynamic of energy efficiency values changes can be traced. In 6 years values have grown by 0,6 $ per kg of oil equivalent. In the leading countries the growth during the same period is 1–2 $ per kg of oil equivalent, in Russia – 0.4 $ per kg of oil equivalent. We should note that during the most successful 2009 year in Russia this value differed from the global values by 2.6 $ per kg of oil equivalent and in 2011 by 2.9 $ per kg of oil equivalent.

Figure 4 also demonstrates that the overall gap between the best global values and Russian values remains. It varies between 8 and 9 $ per kg of oil equivalent indicating that the efforts made by the Russian companies in the field of improving energy sufficiency is not enough. In opinion of some of the authors (Bragina et al., 2011) the issues of energy efficiency are traditionally regarded as technical upgrades, consequently the companies pay attention to the technical aspects of energy efficiency but not to energy efficiency management. Only understanding that energy as one of the resources is extremely important and requires management as any other expensive resource is the first step to energy efficiency and reduction of energy consumption.

Analyzing data on Figure 4, we may come to conclusion that by 2011 the world community fully realized the objective necessity of constant improvement of activity in the field of production and consumption of energy resources. Energy efficiency increase has become a strong tendency of the world economy development and especially economies of developed countries. Technical and technological methods of energy saving are considered by the companies today as obligatory; however, it turned out that the efforts are not enough for further improvements in this area. Due to this, adoption of the international standard containing requirements to establishing efficient energy management systems in companies was timely, logical, expected and corresponding to the concept of sustainable development. For this reason companies from various economic sectors

in many countries in 2011 began actively introduce energy efficient systems under the standard ISO 50001.

Despite the fact that introduction of the requirements of ISO 50001 is available for all organizations regardless their size and type of activity, it would be logical to suppose that establishment of energy efficient systems is a priority for companies working in energy-intensive sectors. Studies (Dolmatov et al., 2014; Lokteva et al., 2010) show that among these sectors are metallurgical and oil industry, production and generation of electric energy and housing and public utilities. If to analyze the sectors globally, then we will see that the greatest development of energy efficient systems is in agricultural sector (47% of the total number of issued certificates) and pulp and paper industry (34%) (Figure 6) (The ISO Survey of Management System Standard Certifications, 2013).

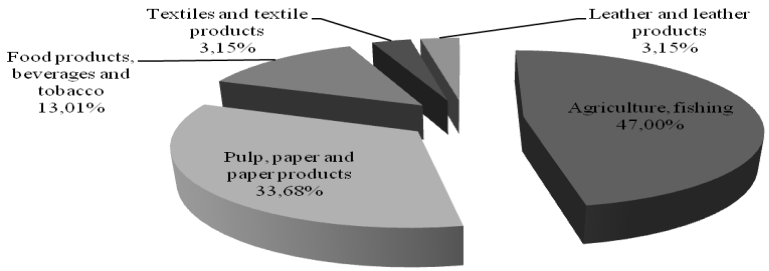
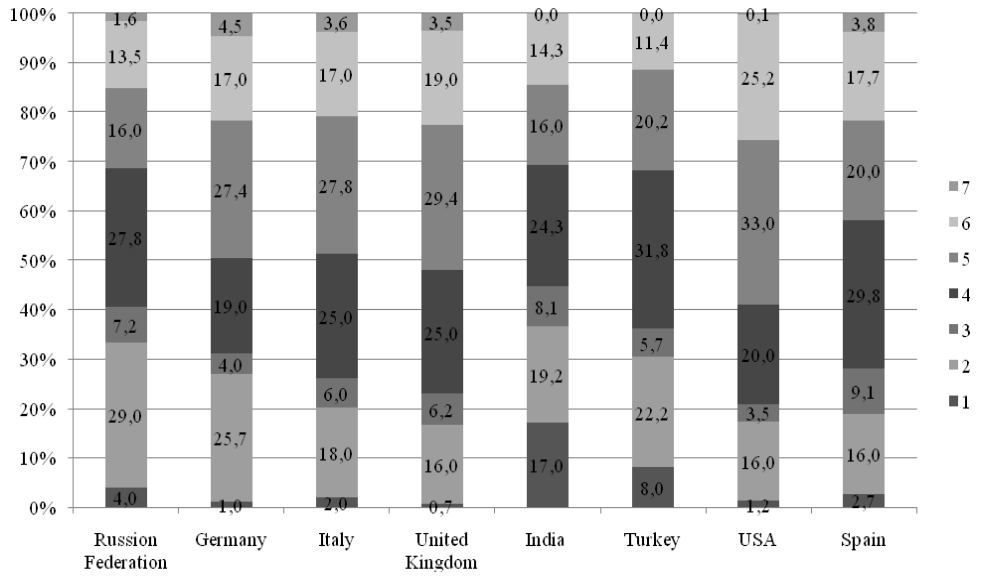


Figure 6. Sectoral structure of companies certified under ISO 50001 during 2013, %

Data on Figure 6 is quite unexpected. First, no one of these sectors is regarded by the experts as energy-intensive. Second, this structure of sectoral certification does not accurately reflect the structure of gross domestic product of the countries developing certification of energy management system under ISO 50001. To maintain our statement, Figure 7 shows the structure of gross domestic product of the countries by economy sectors (Russia and countries worldwide, 2014).



1 Agriculture and forestry, fishery and hunting
2 Manufacturing
3 Construction
4 Trade, hotels and restaurants, transport and communication
5 Financial activity, real estate operations, rent and service delivery
6 Public management, defense, education, health care, social services
7 Other services

Figure 7. Sectoral structure of gross domestic product in the countries worldwide, %

For instance, agriculture collectively with forestry fishing and hunting as a rule occupies a small share (in the United Kingdom 0.7% GDP, in Germany and the USA is about 1%), while the number of certified companies in this sector has the highest value. We may assume that such growth of certification is due to the demands on the concerned part regarding certified energy management system. However, we think that the most potential has manufacturing sector and housing and public utilities (Figure 7 shows the structure of financial activity, real estate operations, rent and service delivery). Taking into account that housing and public utilities have a significant share in any economy and if we include its share into entire group on the level 50% of total volume of services provided, then according to our calculations energy-intensive sectors in different countries may have the following structure: in Russia their share will be around 35%, in Germany – 40%, in Italy and the United Kingdom – 30% etc.

Summarizing numerous studies some authors (Bragyna et al., 2011) think that Russia has one of the largest technical potentials in the world in terms of increasing energy efficiency. It makes over 40% of energy consumption level in the country and this statement is supported by the afore-mentioned calculations of the share of energy-intensive sectors in the structure of gross domestic product in Russia and other countries. Some estimates (Korobova, 2011) based on the data of the Russian Federation Ministry of Energy suggest that the largest potential of improving energy efficiency have fuel and energy complex (50.7% of total potential), population (18.3%) and manufacturing (15.4%).

In Russia as in many other countries worldly, interest to certifying energy management systems corresponding to ISO 50001, arose almost immediately when the standard was adopted. However, the interest was developing slower than, for instance, in Germany, though during the three years of standard existence (since 2011 to 2013) the number of Russian companies which obtained certificates has evidenced significant growth (Figure 8) (World distribution of ISO 50001 certificates, 2013).

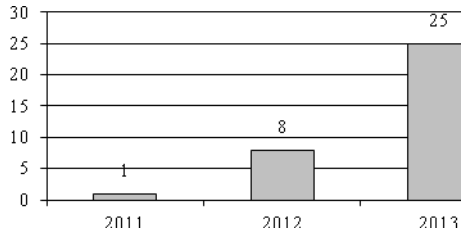


Figure 8. The number of issued ISO 50001 certificates in Russia, pcs.

Total growth of the number of issued certificates during 2013 was 312% in comparison with 2012. While the global growth two times behind, we cannot say that energy management system expansion in Russian companies is high. Absolute number of certified companies is miniscule compared to the total number of energy-intensive companies with a large potential for improving energy efficiency in compliance with ISO 50001. We should also notice that according to ISO (ISO-survey, 2013) the number of web sites offering certification services for energy management systems in compliance with ISO 50001 is annually growing. Thus, 3 471 web site was registered in 2013 in the world. Based on the number of issued certificates for the same year, each certification site issues 1.3 certificates, in Germany 1.7 and in Russia 4.2 certificates. It should be noted that in Russia the number of certifying companies in 2012 and 2013 was the same. According to ISO in Russia only 6 official web sites posted information about system certification under ISO 5000. In the world the number of sites increased by 1.6 times and in Germany by 1.5 times. Consequently, one site issued 1.1 certificates in 2012, in Germany 1.2 and in Russia 1.3 certificates.

Consequently, we can make a two-fold conclusion. In the one hand, interest of organizations in confirmation of compliance and in certification under ISO 50001 is growing in the whole world and especially, in Russia. On the other hand, a small quantity of official web sites offering certification of energy management systems under ISO 50001 demonstrates the absence of demand for this type of services on the part of Russian companies.

Prerequisites and Conditions for Implementing Energy Management System on Russian Companies

Improvement of energy efficiency of Russian economy by rationalizing energy consumption, application of energy-saving technologies and equipment is one of the major provisions of the "Energy Strategy of Russia through 2020" approved in 2003. Also in 2009 by the Decree of the government of the Russian Federation "Energy Strategy of Russia through 2030" was adopted. Among primary strategic directions of long-term state energy policy is energy efficiency of economy and major mechanisms of implementing state energy policy include:

• Introduction of the system of potential technical regulations, national standards and norms improving controllability and stimulating implementation of the most important priorities and guidelines of energy development including increase of energy efficiency of economy;

• Stimulation and support of strategic initiative of business entities in investment, innovative, energy-saving, ecological and other priority spheres (Energy Strategy of Russia through 2030, 2009)

For the time being, the provisions of the project "Energy Strategy of Russia through 2035", which is planned to be adopted in the first half of 2015, is widely discussed. It preserves continuity of the previous strategy but undergone relevant updating in line with changing circumstances and worsening of crisis in the world economy and national fuel and energy complex. Pursuant to the project, the main strategic guidelines of the "Energy Strategy of Russia through 2035" must be energy security, energy efficiency, economic efficiency and sustainable energy development. In the context of the strategy it is expected to decrease the level of GDP electricity intensity by 40% and energy consumption by 50% until 2035. Among the measures of state policy is the need to improve and update regulations, methods and standards in the sphere of energy management (Energy Strategy of Russia through 2035, 2014).

Besides, recently in Russia in order to reduce costs of energy an active state initiative is conducted as well as support of energy-saving programs and programs for increasing energy efficiency. Thus, pursuant to Federal Act No. 261-FZ "On Energy Saving and Energy Efficiency Increase and Amending Certain Legislative Acts of the Russian Federation" each enterprise which fells under it, is obliged to develop, adopt and implement energy-saving program and program for increasing

energy efficiency (Federal Act No. 261-FZ, 2009). In this regard, energy management systems become the instrument which ensures significant cost savings due to adequate policy of purchase and use of natural resources as well as proper waste utilization.

In addition to these quite influential documents regulating activity of organizations in the area of improving energy efficiency, the national standard GOST R ISO 50001-2012 has been put into place.

4. Discussion

Thus, our analysis showed that energy efficiency of Russian economy is still insufficient but Russia has a great potential of reducing energy consumption of gross domestic product, in general and production of certain sectors, in particular.

Regarding this, it seems necessary to determine the reasons of contradiction between growing requirements of the government to companies in terms of improving energy efficiency and a stable low level of energy efficiency of Russian economy compared to the rest of the world. Analysis of the results of researches conducted by Lokteva et al. (2010), Bobylev et al. (2010), Savin et al. (2014) and Bragina et al. (2011) allows us make generalization of the factors affecting energy efficiency of the Russian economy (Figure 9).

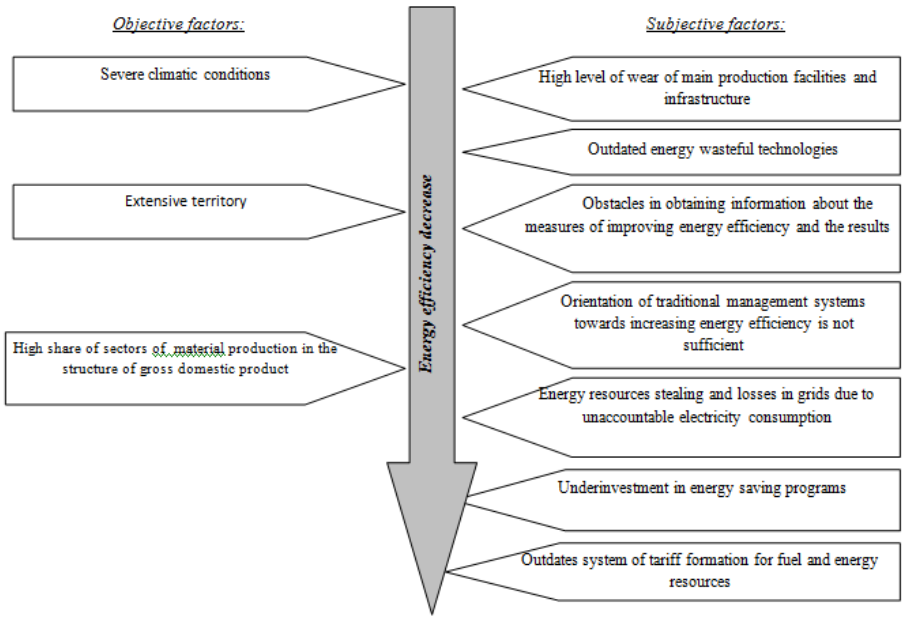


Figure 9. Factors decreasing energy efficiency of the Russian economy

Many authors divide all the factors into two groups: objective and subjective factors.

Objective factors are determined by geographic characteristics of the country and historical tendencies in its economy. The group of subjective factors is larger and it reflects key reasons of occurrence and development of the energy management problems on the national and organizational levels. Well-performing energy management systems are oriented towards elimination of negative influence of subjective factors and towards solution of problems caused by subjective factors. It will help to use potential capacities to improve energy efficiency of the Russian enterprises and economy of the country, in general.

It should be noted that many subjective factors are interrelated and have a reciprocal influence. For example, Bobylev et al. (2010) notes that currently in Russia a paradoxical situation has emerged when key indicators of social and economic development associated with energy efficiency are included into the most important documents of the country's development but they are not taken into account and not officially published. It makes it difficult to use them for making decisions on all the levels and for informing civil society.

For example, indicators of energy efficiency and energy consumption are contained in all afore-mentioned strategic documents and regulations. However their retrospective dynamics remains unclear because these indicators are not included into the publications of the Federal State Statistics Service. Even for the purposes of this study we used the data of the World Bank but not the Russian state statistics. As a result we may face a direct relationship between the information lack factor and such factors as "Orientation of traditional management systems towards increasing energy efficiency is not sufficient" and "underinvestment in energy saving programs". It may cause synergetic effect of negative impact of several factors simultaneously. The same relations may be observed with the other factors as well.

It will be reasonable to support the opinion by Bragina et al. (2011) who state that the notion of energy management in Russia is still at the stage of realization and primary understanding. Russian experts in the industry used to assessing efficiency of separate systems and machines, but energy management is a complex approach of solving common energy problems both in enterprises and large industrial structures such as holdings, concerns, state corporations and economy sectors. In addition to it, the author Tufetulov (2011) suggests including instruments that are contained in ISO 50001 into regional policy concerning energy saving with their duplicates in all regional and municipal programs of energy efficiency and energy saving (energy policy of a region, energy review of a region, goals and objectives of regional policy of energy saving etc.).

Bragina et al. (2011) also note that it is not correct to attribute to energy management purely utilitarian function of an applied instrument for boosting profits, regarding the practice which restricts energy management by the limits of an enterprise. A developing concept of energy management implies management of energy consumption with the aim of reducing costs by increasing energy efficiency

and it is not restricted only by the manufacturing process of a certain enterprise. Requirements of energy efficiency imply developing of a system of managing production and distribution and consumption of energy resources including development of strategic energy plans, replacement of energy consumption norms by instrument metering, energy consumption monitoring, optimized use of the funds, information management, and improvement of incentive energy saving programs.

The companies which made a decision to establish energy management systems corresponding to current international requirements should assess current energy management system and energy efficiency in the company. Using the results of the studies covering mature level of management systems in particular Russian companies for compatibility with initial requirements (Lemesheva et al., 2011; Alutin et al., 2011; Lakhov, 2014; Omeltchenko, 2012; Aleksandrova et al., 2014), we may come to conclusion that the companies already have basic conditions for introducing the systems, but the experts evaluate maturity level as not high enough. The authors suggest paying attention to the following important aspects:

- Organizational support of the system ensured by the team of professional and competent specialists;

- Properly built system of incentives and motivation of the staff and divisions concerning energy saving;

- Better informational support through improvement of energy consumption accounting and monitoring systems which ensure detection of the periods when equipment is used the most and periods of inactivity and to apply internal and external benchmarking in the area of energy efficiency;

- Rationalization and optimization of financing energy efficiency programs.

Study of practical experience of Russian companies (Lemesheva et al., 2011) shows that under conditions of constant growth of tariffs and prices for energy resources, one of the competitive advantages is a properly designed energy management system. According to predictive estimates (Omeltchenko, 2012; Tufetulov, 2011) energy management system introduced in the company ensures financial, organizational and image benefits (Table 1).

Table 1. Types of effects due to introduction of energy management system

Effect	The way of achieving the effect
Financial	• Direct cost savings of all types of energy resources • Cost reduction, detection and elimination of unproductive expenditure • Better financial transparency

	• Reduction of tax allocation and sanctions due to less CO emissions • Guaranteed investments into energy saving projects (investment attractiveness) • Higher market value of the company • Competitive positions when participating in tenders
Organizational	• Development of the series of corporate documents regulating energy management • Balance in functions allocation by divisions • Engagement of the staff of all levels and categories due to better corporate culture and motivation • Improved control and optimization of business-processes • Integration with current management systems for better economic effect • Accelerated process of introducing innovations and modernization of technologies in the company
Image	• Image attractiveness for business partners, population and authorities • Better loyalty of direct consumers and general public • Advantages regarding insurance and obtaining credits • Reputation of a successful company in energy efficiency

As a result of introduction of energy management principles, the company ensures management transparency, increases its manageability, investment and image attractiveness.

5. Conclusion

Under current conditions energy efficiency in a manufacturing sphere in developed countries is achieved not by implementing new expensive energy efficient technologies, but due to changes in the methods and approaches to management.

Energy management system is an approach that enables to make adequate decisions in the sphere of improving efficiency and performance of energy activity. For this reason energy management may be regarded by Russian companies as a priority line of its improvement in the sphere of energy efficiency.

We assume that the results of this study ensure new theoretical understanding of the place and the role of energy management systems in the processes of increasing energy efficiency in Russian companies and economy of the country, in general. It will ensure a foundation for further studies covering practical application of international experience in achieving high results in energy efficiency by implementing energy management systems in full compliance with ISO 50001.

Expansion of energy management systems in Russian companies enables to use world tendencies in the sphere of energy efficiency and supports Russian efforts to join the initiative of the United Nations “Sustainable Energy for All”.

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