

# Energy management in modern Russia: problems, development trends, prospects

**Victoria Lezier<sup>1</sup>, Miroslava Gusarova<sup>2,1</sup> and Anna Kopytova<sup>1</sup>**

<sup>1</sup>Tyumen Industrial University, Volodarskogo str., 38, Tyumen, 625000, Russia

<sup>2</sup>Tyumen State University, Volodarskogo str., 6, Tyumen, 625001, Russia

E-mail: a.copytowa@yandex.ru

**Abstract.** The article is dedicated to the relevant issue of implementing energy management in the practice of enterprise management. The status of material resources, which are carriers of energy, has recently changed, natural resources are disappearing from the face and bowels of the earth, so their optimal use is required. Recognition of importance of energy as a significant and exhaustible resource required all countries to look at their use in a new way. The article identifies the main directions for development of energy management in the world, and establishes the risks of its implementation in the Russian economy, both institutional and mental. The authors suggest implementing measures to introduce energy management to enterprises in accordance with the step-by-step implementation method, which assumes flexible, iterative promotion of energy management functions based on pilot models.

## 1. Introduction

The current socio-economic situation in Russia is conditioned by slowdown in the growth of the world economy. Russian companies are forced to reduce the costs of economic activity, improve the sphere of energy saving and improve energy efficiency, formulate principles for managing the energy efficiency of both the fuel and energy complex as a whole and a number of industrial companies.

In this regard, Russia follows the principles of international experience, the requirements that the governments of a number of countries propose to domestic policy of energy saving and increasing energy efficiency, the introduction of an energy management system.[1-4] For example, in the Netherlands, Denmark, the United States, and Ireland, many enterprises of the industrial sector practice the energy management system and show 2-3% growth versus 1% in doing business without introduction of an energy management system.

This experience actualizes the issue of increasing energy efficiency in production and consumption in the modern Russian economy, rationalizing the use of the fuel and energy complex, recognizing the importance of energy as a resource that requires the same management as any expensive product. Solving these problems is the main way to improve energy and environmental efficiency and reduce costs of the enterprise. [5-7]

The essence of Russia's energy strategy for the period until 2020 is the fact that increasing energy efficiency is a hidden reserve for dynamic economic growth due to the redistribution of released financial resources, as well as the creation of new high-tech industries.

It is not by chance that within the framework of the government's anti-crisis measures program for 2009, the policy of increasing energy efficiency of the economy was included in the list of seven main priorities of the federal executive power. Undoubtedly, the participation of Russian representatives in



the process of developing an international standard will give an additional impetus to the creation of energy management system at domestic enterprises. Russian companies no less than foreign companies are interested in implementing energy management and thereby increasing their energy efficiency. In this respect, the future ISO 50001 standard can provide them with real support and assistance. The energy management system is one of the components of management systems regulated by ISO (quality, ecology, social responsibility, risks, etc.) and it is designed to bring mankind out of the managerial impasse caused by the extreme complexity of the systems to be managed and the environment in which they work.

The process of creating an energy management system at Russian enterprises has not yet received proper development despite its relevance.

The purpose of this article is to highlight the objectives and principles of introducing the energy management system (EnMS) into the Russian economy in the context of the international standard ISO 50001: 2011, which is considered a prerequisite for a comprehensive solution to the problem of increasing energy efficiency.

Energy management can be defined as a system for managing fuel and energy resources. It ensures the efficient and rational use of these resources, leading to a reduction in energy costs.

Energy saving is the scientific, practical and organizational activity of energy management aimed at the rational use of energy. This is the achievement of a socially and economically justified reduction in expenditure of energy resources for the production of a unit of production with the current level of technology development, and maximum compliance with environmental safety requirements.

Such savings can be achieved by two methods - passive and active. Passive method of energy saving can include an arrangement of high-quality thermal insulation to reduce heat loss. To do this, use high-quality thermal insulation materials. The active method of energy saving is the regulation of heat consumption for air conditioning and heating, as well as regulation of the workload of consumer equipment. This also includes saving energy in the process of recycling secondary energy resources.

As a source of reference, in Russian practice are used following standards of EnMS: GOST R 51387-99 "Energy saving. Normative and methodical support. Basic provisions" and GOST R 51541-99 "Energy saving. Energy efficiency. Composition of indicators. General provisions", as well as the group of standards of 2010, starting with GOST R 54195-2010 "Guidelines for the determination of indicators of energy efficiency", which provide a methodology for not only defining but also planning indicators, identifying comprehensive aspects of energy efficiency, applying the best available technologies.

The methodology "Energy analysis of economic activity" of Ural scientists V.G. Lisienko and Y.M. Shchelokova is also relevant. It was formed back in the 80s of the 20th century, It was ment to define a number of key energy-economic indicators in the whole for the enterprise; determine the largest energy consumers of energy resources by shops or technological processes; appropriate organization of technical accounting; calculate energy balances of the enterprise and some large divisions; prepare manuals on energy management for the personnel of the enterprise and so on. In the current situation, energy management is built according to the same methodology.

The "Methodology for carrying out energy surveys of enterprises and organizations" has not lost the most important logical justifications. it was approved by the Main state energy supervision of the Russian Federation in December 1998. It is proposed to determine the composition of energy use objects for which the analysis will be carried out, for each of them to determine the factors affecting energy consumption, calculate the specific consumption for individual types of resources as a ratio of energy consumption to an influencing factor, and compare with the base figures.

A number of Russian scientists are engaged in the formation of energy management: M.V. Stepanova, industry expert, assistant professor of the Power Engineering Department of UGMK Technical University, Ekaterinburg; L.S. Dvorkin, General Director of AFNOR Rus LLC, Moscow; Ibraeva RM, Candidate of Economic Sciences, specialist in the field of economics and management of the national economy; G.A. Romanov, art. Sci. Co-head of the Working Group under the RSPP Committee for the Development of an International Standard for Energy Management (ISO 50001), MEI-Intekhenergo Holding, Institute for Energy Efficiency Problems of MEI; A.E. Sikorsky, Ph.D.,

Associate Professor, Honorary Power Engineer of the Russian Federation, Chief Specialist of A1-Energo LLC, Project Manager for Energy Management System Implementation, St. Petersburg. In the world practice, many scientists dealt with this problem.

Energy saving and energy management are directly related to the saving of energy resources in industrial enterprises and in everyday life, in the transportation and transformation of energy. An example of such energy savings are electrochemical methods widely used to reduce or suppress the rate of destruction of metal structures due to corrosion. [8-12]

## 2. Methods

In order to choose the appropriate model of energy management, it is necessary to take into account conditions and difficulties of management, such as: limitations of methods of adequate modeling, contradiction between the detail of the model and the ability to process the information contained in it, loss of model adequacy with changes in external or internal conditions, principle impossibility of strict consideration of subjective (human) factor, and others. Consequently, any small observation errors included in calculations can eventually lead to gross blunders or the need to change the original model.

Given these objective factors, it is possible to define methodology for rational organization of technical appearance and life cycle processes of complex systems as a substantive basis for the EnMS.

The methodology should consider entire set of energy-supplying and energy-consuming systems in terms of priority of implementation of their functions. It must be guided by totality of life-cycle processes, from issuance of design assignment to utilization.

This methodology should contribute to the solution of problems:

- description of systems and formation of reliable, comparable models on this basis, basing of indicators and criteria for general and energy efficiency;
- analysis of systems and processes based on simulation results, obtaining energy efficiency estimates;
- synthesis of rational management decisions based on the received estimates and analysis results;
- Harmonization of systems and processes of energy supply and energy consumption at all levels of the hierarchy and stages of their life cycle, given the levels of overall performance and constraints.

Effective model of energy efficiency management should be considered as a dominant in the chosen methodology. It is ensured by its inclusion in overall management system, the use of all available elements and interrelations, spread to all levels of the hierarchy, and compliance with established management practices of overall effectiveness of this system.

In modern Russia, the process of organizing an energy management system at an enterprise includes methodology, analysis and taking measures in following main areas:

- current state of energy management in the enterprise.
- formation and approval of energy policy of the enterprise;
- organization of the energy management structure and information system of its operation;
- development and implementation of a comprehensive program for energy saving and rational use of FER;
- organization of financing of energy-saving projects;
- Implementation of continuous monitoring of the energy consumption and efficient use of energy resources. Energy monitoring;
- creation of a system for stimulating energy saving and rational use of fuel and energy resources.

The most important stage in organization of energy management system is formation of energy policy of the enterprise. Energy policy is not a one-time directive document, but a system for monitoring the energy situation, forecasting possible economic, resource and demand trends, and most importantly, formation and continuous improvement of organizational, economic and legal mechanisms that ensure reliable energy supply and rational use of FER.

The next important aspect in creating an energy management system is the creation of perfect regulatory and legal framework for energy saving. It should remove such barriers as lack of information, limited access to long-term financial resources, and regulation of the level of tariffs for energy resources.

Improvement of management system plays important role in the methodology of building a new model of energy savings, as well as achieving real improvement in energy and environmental efficiency of enterprises. For example, at Russian enterprises management of operation, maintenance and repair of power equipment is carried out either by the main power engineer or by the energy service by department of the Chief Power Engineer (ChPE). Regardless of the form of ownership and subordination of the enterprise, the ChPE provides and is responsible, first of all, for uninterrupted power supply of all divisions of the enterprise and for compliance with specified parameters of all types of energy and energy carriers at the consumers' inputs. Energy enterprises have their own peculiarities in management structure: energy management here should be led not just by a representative of the top management, but directly by the top manager of the enterprise, which ensures achievement of the main goals.

As an effective methodology for creating an energy management system, there can be offered step-by-step implementation model.

#### Planning. Step 1. Identification of needs and objectives

At this step, you need to set the goals that you want to achieve. The rationale and objectives of the program must correlate with other business objectives, and other related tasks may be included in the process.

Data collection involves the search for relevant information from a wide range of sources and is an iterative process: possible gaps can be replenished later during implementation of the program.

At the stage of determining the objectives of the program you need to get answers to the questions:

- What problems can be overcome with the energy-saving program;
- what benefits can be obtained with successful program implementation.

The range of problems identified during the development of programs is quite broad and can include:

- rising prices for energy carriers, which affect the competitiveness of the enterprise;
- the presence of power supply disruptions due to infrastructure constraints, which is a significant operational risk for small and medium-sized businesses and affects product quality and overall productivity;
- presence of local air pollution caused by the enterprise;
- lack of skills and knowledge;
- Legislative regulation of energy efficiency and reduction of greenhouse gas emissions;
- The pressure of corporations seeking to use energy efficiently, maintaining supply chains to reduce costs, reducing greenhouse gas emissions and meeting sustainable development commitments.

Identifying the problems that need to be overcome and the expected benefits determines the content of the objectives in relation to the existing conditions.

#### Planning. Step 2. Consultations with stakeholders

Stakeholders are all individuals, groups and organizations with an interest in program development. It can be enterprises, suppliers of energy services and equipment, as well as those who are ready to provide support and provide useful information: industry associations, financial institutions, civil servants, politicians and heads of relevant programs, and educational institutions.

#### Planning. Step 3. Identification of target groups and tools

The choice of a target group of small or medium-sized enterprises may require more detailed research than at the stage of defining policies and objectives. Considerations for choosing a group of enterprises may include government priorities and policies, importance of a particular sector of small and medium-sized businesses in the economy, limiting the supply of electricity in a particular region, proximity of similar enterprises in the region, intensity of energy use, energy efficiency potential, level of support already received, possibility of continuing the previous or terminated program, relative size of the enterprise.

#### Planning. Step 4: Determination of framework program and funding sources

A clear framework is especially important for planning, as the stakeholder group plays an important role in the program activities.

#### Implementation. Step 5. Involvement of stakeholders and initiation of implementation

The experience gained can be applied first for a small number of pilot projects with separate aspects of program. The method of pilot project in general program allows you to try out ideas, get first results and feedback for further development, research and expansion of programs.

Implementation. Step 6. Raising awareness of the program

It is necessary to provide access of interested parties to information on energy efficiency programs. Creating a site as a channel for obtaining information is an important element of the program, as well as other communication opportunities: seminars and webinars, promotion through industry associations and various organizations with their own information distribution channels.

Implementation. Step 7. Management of the implementation process

The most important condition for the implementation process is the fulfillment of obligations under the program by all responsible parties, which may include:

- providing support and services to small and medium-sized enterprises;
- regular reporting to program partners;
- Solution of issues arising from any interested party.

Enterprises participating in the program assume obligations that must be clearly indicated when signing the program and may include providing access to energy audit results and other activities, to information related to energy consumption and economic activities.

Monitoring. Step 8: Monitoring, analysis and dissemination of data

Regular monitoring of the implementation of program objectives includes a report to partners and other stakeholders, identification of potential problems and identification of corrective measures, etc.

Evaluation. Step 9. Evaluation of program performance

Program managers regularly assess the effectiveness in accordance with the methods developed at the planning stage.

Different methods of performance assessing have shown different advantages and disadvantages. Examining the documentation (for example, energy audit reports) is a low-cost method, but its contribution depends on quality and content of the reports. Polls are considered an effective method when involving a large number of respondents, but require high level of response. Interview allows you to delve into the program more deeply, but requires availability of resources and reducing the risk of bias. Analysis of concrete examples as a result gives an understanding of problems and prospects, but the result of the enterprise with the most significant results influences the overall result.

Evaluation. Step 10. Adaptation of programs and planning the next steps

The results of evaluation determine opportunities for improving the program, while enterprises may require additional funds and further support for the subsequent implementation of energy-efficient projects. The International Energy Agency IEA notes that improving the energy efficiency of small and medium-sized enterprises in all countries of the world can produce significant results while increasing productivity and competitiveness.

It can be said with certainty that Russian small and medium-sized enterprises have a large under-utilized energy-saving potential, which can be effectively implemented taking into account already accumulated international experience.

### 3. Discussion

Introduction of energy management system is a largely controversial issue. It should be remembered that the goal of energy management is formation of energy efficiency criteria and their introduction into decision-making system in the operating company. [13-15]

Russian specificity lies in the fact that EnMS is not an independent subsystem of energy efficiency management, but is "attached" as an addition to already established general management system. This system is based on traditional principles and decades-old norms and often contradicts the ISO standard. For example, leading oil and gas industry is represented in Russian economy by well-known large companies that unite extractive and processing enterprises.

The problem of efficiency improvement sources is still worth discussion, namely, ways to improve technological processes and organizational management processes. As a rule, following experts are



involved in it: technologists, economists working with production indicators, specialists in planning and development, capital construction, operation and repair (not only energy, but all technical systems), metrologists, personnel officers, personnel managers (In terms of motivation), specialists in public relations (in terms of informing), etc.

Implementation of EnMS in oil and gas industry enterprises can be difficult in the presence of already implemented management systems. It is quite logical, therefore, to "integrate" EnMS into existing ISMs and to organize them in such a way that further development of the IMS will be ensured with the introduction in the future of other ISO management systems. This approach is verbally approved by the management of enterprises, but in fact integration into a single management system is declarative and faces difficulties in departmental disunity and reluctance to remodel existing local regulatory documents.

Formation of normative documents in the field of energy management is also a debatable problem. [16-18] Despite such an abundance of existing and developed regulatory documents, they are usually not implemented. This is due, on the one hand, to the lack of real organizational structures that coordinate the work of objects and subjects of legal regulation in the field of energy saving and carry out direct state supervision (control) over implementation of adopted standards and rules. On the other hand, there is a number of objective reasons.

On December 27, 2002 the Federal Law No. 184-FZ "On Technical Regulation" was adopted. it was put into effect in 2003. The law has a number of significant shortcomings, even taking into account the Federal Law No. 65-FZ "On Amendments to the Federal Law "On Technical Regulation"" adopted in 2007. The law, in spite of its importance and relevance, still does not actually work. First, there are no developed technical regulations, so confirmation of compliance and accreditation of certification bodies and testing laboratories can not function, and secondly, the law is essentially referential. It contains more than two dozen instructions to the Government of the Russian Federation on the approval, establishment of various procedures, rules, methods, development and harmonization of which will require considerable effort and time. Moreover, in order to successfully implement this law, it is necessary to correct at least more than a hundred current federal laws and about six hundred decrees of the Government of the Russian Federation.

For the time remaining until the end of 2017, it is necessary to revise the regulatory framework, which is mainly represented by documents (including standards) of the executive bodies created for decades by efforts of specialists from a wide variety of research and design institutes.

#### **4. Results**

Analysis of the data of Russian researchers showed that at the beginning of 2017, about 20% of Russian enterprises practice systematic energy management. Energy management claims to be at the top of the management thought pyramid in terms of managing energy flows just due to the system and suitability for any organization.

What are the results of the implementation of this system and what are the characteristics of Russian enterprises implementing the energy management system?

First, EnMS is understood at Russian enterprises as a combination of actions: document management, internal audit system, corrective actions, training, provisions providing feedback and the possibility of submitting proposals required for energy management. However, in most cases, the EnMS starts to be introduced in service of the main power engineer separately, and engineers of quality departments treat it remotely.

Secondly, everywhere companies implementing EnMS face a contradiction, when producers, technologists and economists are not ready to mentally acknowledge the responsibility of power engineers for reducing fuel costs and perceive attempts to find new opportunities for this as an infringement on their own borders. Unavailability of other departments to assume this new responsibility is probably the very first and main barrier on the way of introduction (or development) of energy management system at the enterprise.

Third, elements of energy analysis at enterprises are calculated and controlled, but this is done in isolation from the energy economy, not for the purposes of power engineers, but for the budget. There are contradictions in use of terminology. Experts do not use the concept of "energy productivity" and do not distinguish it from "energy efficiency". By measuring specific indicators, they leave factors outside the analysis that affect the level of energy consumption, and can not distinguish degree of their influence, measure contribution of organizational measures, operational control in improving the result.

Objective differences in the culture and organization of production and a number of contradictions make it difficult to implement the EnMS standard for Russian enterprises, but this only indicates that we need to be more careful in adapting it. And here there are not only the peculiarities of each particular enterprise, but also a certain common national specificity.

At present, a number of large fuel and energy and industrial companies of Russia are implementing projects to introduce an energy management system based on the requirements of the international standard ISO 50001: 2011 (GOST R ISO 50001-2012), including Transneft OJSC, Rosneft OJSC, Sibur Holding PJSC, Surgutneftegas OJSC, LUKOIL PJSC, Russian Grids PJSC, INTER RAO PJSC, Rosatom State Corporation, Russian Railways OJSC, Gazprom Neft and others.

The Ministry of Energy of Russia carried out in 2015 monitoring of energy efficiency management and introduction of energy management systems in Russian companies (hereinafter - the study) in order to study the best practices and effectiveness of implementation of the energy management system of the Ministry of Energy of Russia with the participation of the Russian Energy Agency.

This study involved more than 80 large energy and industrial companies in Russia from various industries, including energy, oil and gas, coal, metallurgy and mining, chemical and petrochemical industry, transport and communications.

During the research, forms of information collection were developed, approaches to energy efficiency management in companies were analyzed, and the efficiency of their activities in the field of energy saving and energy efficiency was assessed.

In total, 23% of respondents and companies that submitted information implemented the energy management system. The largest number and percentage of implemented and implementing the energy management system are companies from the energy, oil, gas and coal industries of the fuel and energy complex of the Russian Federation, which may partly be due to the high attention to this problem of the Ministry of Energy of Russia as a supervisory federal executive body.

100% of companies that have implemented energy management system have developed energy policy, energy saving program and energy efficiency standards. 70% of companies have developed methods to assess the effectiveness of measures to improve energy efficiency.

In companies that fulfill only legislative requirements, energy policy is developed only in 7%, and methods for assessing the effectiveness of measures to improve energy efficiency are developed in 10% of companies. The company's energy saving standards are developed only in 1/3 of companies, and in every fifth organization there is no energy saving program. This statistics allows us to conclude that results of mandatory energy survey are applied to a greater extent in companies that have implemented energy management system, as evidenced by availability in 100% of their energy conservation programs. The requirement of mandatory implementation of energy management system is not a widespread measure of public policy. At this time, there are no methods for assessing the effectiveness of energy management system implementation, which results could serve as evidence and condition for clarifying the state policy in field of energy saving and energy efficiency improving.

In the course of the study, an assessment of the energy management system effectiveness was carried out using comprehensive analysis of information on selected energy management criteria, including saving fuel and energy resources in total (%), the share of costs for energy saving measures from total costs for fuel and energy Resources (%), the share of costs for fuel and energy resources in cost of production compared to the base year.

The high results of the consolidated assessment of efficient companies in terms of energy efficiency were shown by "Transneft" JSC, "SIBUR Holding" PJSC and "Russian networks" PJSC, which implemented the energy management system in accordance with ISO 50001: 2011.

The analysis of changes caused by the implementation of energy management system in the organization allows us to speak about many qualitative effects that were achieved when implementing the system / elements of the energy management system. There are currently best practices for managing the energy efficiency of the organization, for example, in Transneft OJSC, there have been improvements in discipline of workers in energy saving, both in domestic and industrial conditions, and planning procedures were improved.

"Sibur Holding" PJSC notes the growth of generation of energy-saving ideas, as well as reduction in timing of project implementation. The introduction of new energy-efficient equipment has made it possible to increase safety, reliability of NPP systems, as well as convenience of their maintenance and repair, at Rosenergoatom OJSC. TVEL JSC managed to reduce fuel and energy resources expenses by using more energy-efficient materials and equipment with improved energy characteristics.

Lukoil PJSC notes objective assessment of expenditure of fuel and energy resources by technological personnel in real time with help of the implemented program in the system of Real Time Database and immediate measures to reduce the consumption of fuel and energy resources. The qualitative result of the energy management system implementation in "Surgutneftegas" OJSC is increasing efficiency of making managerial decisions, streamline management procedures in field of energy saving and increasing of their transparency, establishing a system of continuous automated energy audit for main technological processes of oil production, covering more than 70% of the company's energy costs. As a result, plants and units working with an overestimated power consumption are monitored and promptly identified, and necessary optimization measures are continuously carried out. Despite fairly high level of popularity of the energy management system in Russian companies (especially in fuel and energy sector), a number of companies are faced with factors that impede implementation of measures to develop and implement the energy management system, or do not plan to implement the system for the reasons given below.

The main factors impeding implementation of the energy management system in Russia on basis of the international standard ISO 50001: 2011 are:

- imperfection of the methodological basis for justifying economic efficiency of energy saving measures and improving energy efficiency, including effectiveness of the energy management system implementation and other organizational arrangements; The consequence is a lack of financing for energy saving measures and improving energy efficiency;
- insufficiently high level of awareness of the effectiveness and efficiency of the energy management system among management and personnel of companies;
- Lack of information on best practices and methodology for developing and implementing an energy management system;
- lack of motivation of management and personnel of companies in development and implementation of the energy management system;
- lack of information about companies providing high-quality integrated services (energy analysis, recommendations for energy efficiency measures, accounting and automation) for development and implementation of energy management system.

## 5. Conclusions

The main first step to improving energy and environmental efficiency and reducing costs of the enterprise is recognizing the importance of energy as a type of resource that requires the same management as any other expensive resource, and not as an overhead expense of the enterprise.

Energy and environmental management are financial instruments that can provide enterprises with economies by implementation of sound policy for purchase and use of natural resources and utilization of industrial waste. A prerequisite for successful implementation of energy policy at the enterprise level is the appropriation of projects to improve energy efficiency of equal status with projects for modernization of production technology.

The implementation of energy management system based on ISO 50001: 2011 as an organizational tool for improving energy efficiency is actively used by companies in the fuel and energy complex, and



is planned to be implemented in the industrial sector. For a more qualitative approach to the implementation of energy management system in Russia, it is necessary to implement following activities:

- monitoring (including changes in the forms of state statistical observation), analysis, popularization and replication of best practices in implementation of the energy management system based on ISO 50001: 2011;
- improvement of methodological base of energy management, as well as regulatory and technical base (including translation and localization of international standards of the ISO 50000 series);
- training and advanced training of specialists both in energy companies and organizations providing services in field of energy management;
- development of voluntary certification system in field of energy management, including issues of certification of qualifications, certification of individuals and legal entities providing services in field of energy management;
- formation and maintenance of single register of authorized individuals and legal entities that provide services in field of energy management;
- formation and maintenance of single register of companies that confirmed implementation of the energy management system.

Thus, with implementation of the above measures, conditions will be created for transition from the pilot implementation phase to the wide implementation of the energy management system, an effective instrument for implementing state policy in field of energy conservation and improving energy efficiency.

## References

- [1] Edwards R A, Kirwin J, Gonyeau M, Matthews S J, Lancaster J and DiVall M 2014 *American Journal of Pharmaceutical Education* **78** pp 103
- [2] Bartle E and Thistlethwaite J 2014 *BMC Medical Education* **14** pp 110
- [3] Bonenberger M, Aikins M, Akweongo P and Wyss K 2014 *Human Resources for Health* **12** pp 43
- [4] Urheim R, Rypdal K, Melkevik O, Hoff H A, Mykletun A and Palmstierna T 2014 *Criminal Behaviour and Mental Health* **24** pp 141
- [5] Jakubowska A, Woolga M J, Haselton P A and Jones A 2013 *Eating Disorders* **21** pp 16
- [6] Kopytova A 2016 *Procedia Engineering* **165** pp 1132
- [7] Nemirovskiy V G and Polovinko V S 2015 *Sotsiologicheskie Issledovaniya* **1** pp 27
- [8] Kopytova A 2015 *Modern problems of science and education* **1-1** DOI:10.17513/spno.18700
- [9] Simonova M V, Sankova L V, Mirzabalaeva F I, Shchipanova D Y, Dorozhkin V E 2016 *International Journal of Environmental and Science Education* **11** pp 7608
- [10] Sturikova M V, Albrekht N V, Kondyurina I M, Rozhneva S S, Sankova L V, Morozova E S 2016 *International Journal of Environmental and Science Education* **11** pp 7826
- [11] Saver C 2016 *OR manager* **32** pp 18
- [12] Bansal R N, Malhotra M 2016 *Biomedical and Pharmacology Journal* **9** pp 585
- [13] Kukla M, McGuire A B and Salyers M P 2016 *Psychiatric Services* **67** pp 412
- [14] Nilsen E R, Olafsen A H, Steinsvåg A G, Halvari H and Grov E K 2016 *Journal of Multidisciplinary Healthcare* **9** pp 153
- [15] Westcott 2016 *Journal of Clinical Nursing* **25** pp 2669
- [16] Kreye M E 2016 *Production Planning and Control* **27** pp 1249
- [17] Engbers R, Fluit C R M G, Bolhuis S, Sluiter R, Stuyt P M J and Laan R F J M 2014 *Advances in Health Sciences Education* **20** pp 969
- [18] Yuan Z, Li Y and Tetrack L E 2015 *Applied Ergonomics* **51** pp 163