Energy Audit of Buildings Commissioned Upon Completion of Industrial Facility Conversion Projects

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Abstract. This article deals with the problems of an integrated energy assessment of industrial and civil facilities commissioned upon completion of conversion projects for capital construction facilities located on former industrial sites. It describes the need for updating the regulatory framework that determines the general methodology of this type of works and specifies energy research methods and instruments. In addition, it formulates requirements to the professional skills of experts involved in this research. The article reviews the European experience of energy saving and enhancing the energy efficiency of this type of buildings. It should be noted that only every fourth subject of the Russian Federation, the largest energy producing country, has an approved energy saving and energy efficiency improvement governmental program for newly commissioned buildings and structures. The article also offers an organizational and methodological structure for raising the energy efficiency level of buildings being commissioned after conversion of industrial facilities.

1. Introduction
Newly constructed industrial and civil facilities and reconstructed buildings must necessarily be examined in terms of energy efficiency. They must be verified for conformity to all design requirements. Absence of regulatory and engineering documentation on appropriate energy consumption assessment and energy audit is among the key problems in this industry. Properly developed measurement methods clearly specifying assessment instruments and controlled parameters are also lacking [1, 2]. There is an acute shortage of highly skilled personnel.

2. Materials and methods
In 2008, Russia set a national objective of reducing energy intensity of the gross domestic product by 40% by 2020 as compared with 2007. Decree of the President of the Russian Federation No.889 on Some Measures of Improving Energy and Environmental Efficiency of Russia’s Economy dated June 4, 2008, identified some specific tasks:

- Organization of technical regulation processes for economic sectors to improve energy and environmental efficiency;
- Preparation of a number of federal laws that would provide for financial and incentive mechanisms and liability for incompliance with established standards;
- Provision for budget support to energy conservation projects and innovation-related energy efficiency and saving projects.

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In pursuance to this Presidential Decree, Federal Law No.261-FZ on Energy Saving and Improving Energy Efficiency and Amendment of Some Legal Acts of the Russian Federation was adopted on November 23, 2009. This law aims at establishing an economic, legal, and organizational framework in this area. Attainment of the objectives set forth by the program is subject to an integrated approach that would include the development of efficient methods to be applied at various seasons of the year, elaboration of requirements to equipment and laboratories, and, most importantly, organization of high-quality staff training and skill development for auditors. What is also required is the introduction of advanced energy-efficient construction technologies and standards [3, 4].

European countries have been making energy saving and energy efficiency improvement efforts for half a century [5, 6]. Their extensive experience and steps in the right direction have led to the development of a comprehensive strategy of reducing dependence on available energy resources. Measures taken by many countries in the field of low-carbon energy sources have proved to be successful. Research on innovative energy-efficient technologies is financially supported at the state level. European standards are reviewed on an ongoing basis to make them more stringent and foster new technology development. Western countries have considerably decreased energy intensity of their economy, but continue to aim at its further reduction.

3. Results and discussions
Russia is among the world’s leaders in terms of energy resources and the largest crude oil and gas producer [7, 8]. This country has abundant coal, iron ore, gold, diamond, platinum, nickel, and zinc reserves, but lacks a developed infra-structure of their cost-efficient production and faces problems of mining, transportation to processing facilities and consumption. Russia has a great potential to save energy that can be used as an essential factor of economic recovery. But heat energy producers are not interested in energy saving by consumers. In 2007, energy consumption was 990 million tons of fuel oil equivalent. Energy-saving equipment could have reduced it by 30% to 35%. Unfortunately, energy consumption was not reduced.

According to a report on the energy-saving situation and improvement of energy efficiency in the Russian Federation in 2015 issued by Russia’s Energy Ministry, only some 25% of all subjects of the Russian Federation had an approved governmental energy-saving and energy-efficiency improvement program. The same situation in the energy saving area prevails at the municipal level. Regional actions taken for the implementation of the state policy have been analysed on the basis of a unified assessment algorithm for general indicators of improving energy efficiency.

4. Conclusions
Summing it up, let us review a list of basic actions required to be taken consciously and responsibly both by the state and each individual with a view of raising energy efficiency:

1. Development of incentive mechanisms to encourage businesses towards introduction of energy-saving procedures and technologies.
2. Stage-by-stage withdrawal from operation of energy-inefficient equipment in favour of innovative energy-efficient technologies.
3. Attracting investment in energy-efficient and energy-saving projects in energy industries.
4. Application of tax incentive measures to encourage fixed assets renewal and introduction of innovative equipment and energy-saving technologies.
5. Creation of mechanisms for development and implementation of information activities in energy saving [9].
6. Governmental support in the form of partial reimbursement of interest expenses of credits and loans for energy efficiency and energy-saving innovations.
7. Reduced requirements to and simplified procedures of state guarantees for projects associated with energy-saving and improved energy efficiency at production facilities.
8. Research and development, introduction, and commercial use of research findings, active use of energy-efficient technologies.
9. Compulsory energy efficiency inspections of facilities.
10. Introduction of metering devices and other equipment instrumental in reducing fuel and energy consumption.
11. Working out clear requirements for basic innovative energy-efficient equipment and products acquired for corporate needs.
12. Use of energy-efficient light sources, the introduction of alternative energy sources for internal needs.
13. Amendment of the tariff policy.
14. Staff training and professional development in the introduction of energy efficiency innovations on an ongoing basis.
15. Elaboration of systems of mutual regulation among higher education establishments, companies engaged in scientific research, and development institutes.
16. Use of advanced ball cleaning technologies and heat exchange equipment.
17. Increasing the effective fuel utilization factor.
18. Integrated energy audits of industrial facilities.

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