Formation of Conceptual Provisions for the Development of the Energy Efficient Housing Construction in Russia

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Abstract. Current problems and the prospects of energy saving in Russia as well as the importance of creation of complete legislative and legal base and the mechanisms of economic incentives of energy saving is are considered in article. The analysis of the existing criteria of the energy efficiency of buildings is carried out. The introduction of so-called "road map" of the development of energy saving in housing-and-communal services is expedient. According to the author, that will allow to provide owners of buildings and the servicing companies with the information for acceptance of organizational and technical project, construction and operational decisions, reasonable decisions on maintenance, reconstruction or dismantling of the buildings, directed to lowering of energetic expenses and also to the proper organization of life cycle of buildings in general.

1 Introduction

One of the current trends of housing construction is the development and designing of buildings in which the comfort of planning solutions would be combined with environmental friendliness and energy efficiency.

Works by Matrosov Yu.A., Butovo I.M., Shmarov I.A., Livchak V.I., Bashmakova I.A., etc. are devoted to the matters of rationing of energy efficiency of buildings, as well as to the development of normative-and-technical literature,. Scientific principles of the design of energy efficient buildings as energy systems are set in works by Tabunshchikov Yu.A., Brodach M.M., Shilkina N.V., V. Murgul, V. Pukhkal [1-8]

The performed analysis of the research works, devoted to energy efficiency of buildings proved, that all of them consider various aspects (first of all technical and organisation ones) of ensuring the energy energy efficiency of buildings.

However, according to the author, these are the matters of the development of energy efficient housing construction, which require special attention. Nearly a half of consumption of energy in the developed countries is the share of residential buildings (houses). Therefore, the improvement of energy efficiency of buildings becomes one of the main methods of resource-saving. Thus the innovative direction in construction, so far a little widespread in Russia, is the creation of energy efficient housing.

2 Methodology and Legal Regulation

The uniform methodological principles of ensuring energy efficiency of the building at all stages of his creation and operation with mutual coordination of all backbone elements of organizational processes are absent. It is obvious that the energy efficiency of the building is not only its static, final characteristic,
but also dynamic, formed throughout all the life cycle. Therefore along with the concentration on achievement of energy efficiency by the building of a certain indicator at a design stage it is necessary to pay attention to the effective and innovative implementation of construction and operational operations on his achievement.

Nowadays in the Russian science the methodology of processes of the organization of the life cycle of energy efficient buildings is developed insufficiently and has fragmentary character.

The simplest criterion for classification of buildings is energy consumption, as follows:
1. If costs of heating of rooms make up less than 90 KWh per sq.m per year, the building is considered energy efficient;
2. If costs of heating of rooms make up less than 45 KWh per sq.m per year, the building is considered power passive;
3. If costs of heating of rooms make up less than 15 kWh/sq.m per year, the building is considered to have zero energy consumption (nothing is spent for heating, but energy for the preparation of hot water is required).

In fact, there is the necessity of more detail classification of buildings according to their energy consumption, which might include up to 14 classes (A-N) [8] (Figure 1).

Figure 1. Classification of buildings according to the standardized expense of energy, kWh/m² per year

Detailed classification in Russian practice is carried out due to two documents: Construction Standards and Rules SNIP 23-02-2003 and SP 50.13330.2012.

As for the legal regulation, it is mainly presented by two key documents (Figure 2):
1) Federal low of the Russian Federation On Energy Saving and the Increase in Energy Efficiency and on the Introduction of Amendments to Separate Acts of the Russian Federation No 261 (23.11.2009);
2) State Programme of the Russian Federation Energy Saving and the Increase in Power Efficiency for the Period until 2020.
3 Results
The analysis of the available data proves, that the measures for the decrease in energy consumption during 1998-2005 were insufficient to stop dynamic increase in demand for energy and power. Increase in demand for gas and for the electric power was higher than the values provided by "The energy strategy of Russia". Total energy consumption of Russia in 2007 has made about 990 million t. at. t. When bringing introduction of the energy saving and energy efficient equipment to level in EU Member States, energy consumption would decrease to size of 650 million t. at. t. In other words, about 35% of energy at us are lost [9-11].

The author can recognize two solutions for the problems arisen:
- the first solution is extremely capital-intensive way of increasing oil and gas production and construction of new projects of energy generation;
- the second solution is significantly less expensive, connected with ensuring economic growth in the country due to increase in efficiency of use fuel-and-energy resources.

It should be also noted that in practice symbiosis of the first and second options with an undoubted priority of energy efficiency is necessary.

Some barriers constraining development of energy saving and energy efficiency were revealed during the study. These barriers are suggested to be divided into four groups:
- lack of motivation;
- lack of information;
- lack of experience of financing of projects;
- lack of the organization and coordination [12].

It is impossible to overcome such barriers without formation of proper legal and methodological provisions.

The analysis of the current performance of the problem proves the gaps in the legislation, namely:
- the lack of attention to the specifics of design, construction and operation of energy efficient residential buildings;
- the absence of any relevant Construction Standards and Regulations on the organization of construction production of energy efficient buildings.

The staticized editorial office Construction Standards and Regulations 12-01-2004 and 48.13330.2011 "The organization of construction", does not contain sections on energy saving and power efficiency. The main technical normative document, regulating requirements to energy efficiency of residential and public buildings is the Construction Standards and Regulations 23-02-2003 and 50.13330.2012. Comparing these two documents, it is possible to conclude, that the order of design of level of heat protection of buildings has not changed. Distinctions are traced in requirements to energy efficiency level: in Construction Standards and Regulations 23-02-2003 5 classes of power efficiency of buildings are specified, but Standard 50.13330.2012 includes 10 classes of energy saving for residential and public buildings are established.

According to the author, updating of the documents has proved the discrepancy in definitions and requirements: thus, classification of classes of buildings according to their energy efficiency is
transformed to classification of buildings according to their energy saving which is not specified in the Law No 261-FZ, and, therefore, is not the mandatory requirement. It is obvious that such approach to technical rationing in construction branch is inadmissible.

There is the necessity to improve the standard-and-methodical base of the housing construction production, according to the international standards of energy efficient construction (ISO 14001, ISO 50001, GOST R 51750-2001, etc.).

It is necessary to recognize that systematic work in the field of energy saving and increase in power efficiency in various sectors and spheres of economy of Russia has begun after the adoption of the federal law of the Russian Federation "About energy saving and about increase in power efficiency, and about introduction of amendments to separate acts of the Russian Federation". In 2010 the Ministry of Energy of the Russian Federation along with some large companies has developed the State programme of the Russian Federation "Energy saving and increase in power efficiency until 2020.", which has been approved at a meeting of the Government of the Russian Federation in 2010 and approved by the order of the Government of the Russian Federation the Programme is designed to become the tool of the solution of a major problem on decrease by 2020 to power consumption of GDP for 40%.

For the realization of the actions stated in the Program it is necessary to attract financing from various sources. Besides, the participants have to install programs without fail modern metering devices and conduct power examinations. As investment projects on energy saving and the feasibility study on actions are inconceivable without objective yielded account and results of inspection.

The solution of the tasks, set within the Programme demands high extent of coordination of actions not only federal executive authorities, but also authorities of territorial subjects of the Russian Federation, local government, the organizations and the population. It will be promoted by the Russian Energy Agency (REA) to which the order of the Ministry of Energy has assigned function of operational management of State Programme.

Potential of receiving profit on long-term investments into increase in energy efficiency of the Russian power is estimated by the western experts at 300 billion dollars. However still Russian and western investors reluctantly go to this sector. They are stopped by the underfulfilled standard and legal base of the industry and the lack of examples of the use of energy efficient technologies in practice. Therefore the Ministry of Energy has made the decision to develop practice of power service contracts. In particular, the Ministry of Energy plans to create federal power service company which for 100% will belong to the state, and will act as the initiator of new projects. It will assume all risk and will be able even to enter the share capital of regional power service companies which have to carry out power modernization of the Russian enterprises [13].

It is necessary to study the task, which the Ministry of Construction, Housing and Utilities of the Russian Federation faces/ That is the task of the increase in the share of buildings with the highest degree of energy efficiency: up to 10% in the total amount of commissioning of the objects in the 2018, 20% in the 2020 and 30% - in 2025. By 2025 every third new house will have to have the highest class of energy saving, and energy consumption in housing and public utilities in general will decrease on a quarter.

In this regard it is reasonable to suggest the assignment of the class of energy efficiency to the apartment residential building (blocks of flats). The proper principles were approved in December, 2016. Those are the regulations on the assignment of the class of energy efficiency on inhabited real estate projects. Buildings should be recognized to be not energy efficient at excess of the specific annual expense of energy resources over basic level for 25%. In this case the classes E, F, G (lowered, low, very low - respectively) are appropriated to such objects.

The definition of a class of energy efficiency is suggested to be obligatory in some cases, including:
- newly constructed real estate objects;
- buildings after reconstruction;
- objects in which capital repairs are completed;
- the objects put into operation;
the objects which are subject to the state construction supervision.

In the aforesaid cases, the class of energy efficiency is appropriated by the authority, exercising the state construction supervision in the respective region of the Russian Federation.

In case the house is in operation, then his class of energy efficiency is established and coordinated by the State housing inspectorate. Basing of the declaration on the actual annual specific sizes of an expense of energy resources the Inspectorate approves the inspection statement which contains the following information:

- compliance of a house (block of flats) to the standard requirements of energy efficiency;
- a class of energy efficiency of a house (block of flats) at the time of completion of check.

The criteria of the assignment of the class of energy efficiency to the residential building is presented in Table 1.

According to the class of the energy efficiency, assigned, that is possible to recommend certain measures for the building. So, for the buildings of D class the reconstruction until 2020 is recommended. For the buildings of E class warming or demolition is recommended.

**Table 1. Classes of the energy efficiency of the residential building**

| Class | Energy efficiency level | Deviation of the actual expense of energy on heating and ventilation of the building the from normalized expense, % | Recommendations |
|-------|-------------------------|-----------------------------------------------------------------------------------------------------------------|----------------|
| A++   | Very high               | Less than -60                                                                                                      | Privilege on the property tax for 3 years |
| A+    | from -50 to -60 (inclusive) |                                                                                                                 |                |
| A     | from -40 to -50          |                                                                                                                 |                |
| B+    | High                    | from -30 to -40                                                                                                    |                |
| B     | from -15 to -30          |                                                                                                                 |                |
| C+    | Normal                  | from -5 to -15                                                                                                     |                |
| C     | from +5 to -5            |                                                                                                                 |                |
| C-    | from +15 to +5           |                                                                                                                 |                |
| D     | Lowered                 | from +15.1 to +50                                                                                                   | Reconstruction in case of proper economic justification |
| E     | Low                     | more than +50                                                                                                      | Reconstruction in case of proper economic justification or Demolition |

During the reconstruction of housing stock some technologies of priority actions for the increase in energy efficiency of buildings are expedient, including:

- warming of facades with the use of modern heat-insulating materials;
- installation of modern highly effective window systems with application of schemes of compulsory ventilation.

Meanwhile it is necessary to understand that the initial investment in practical introduction of energy saving technologies costs much, but great capital expenditure can be considered long-term and very reliable investment since they pay off at the expense of further low operational costs. Expenses on the maintenance, after introduction of energy saving technologies, decrease by 25-30%. Unfortunately, this low difference serves as the argument for those, who unreasonably underestimate the sum of initial
investments in a building energy efficiency in construction and reconstruction. On the other hand, too much initial investments will not be able to pay off for all the time of maintenance of the building.

For the purpose of the implementation of the energy saving strategy the introduction of so-called "road map" of the development of energy saving in housing-and-communal services is expedient. "Road map" represents the plan of measures on increase in power efficiency of buildings thanks to which, as expected, it will be possible to overcome technical and information obstacles of increase in energy efficiency of buildings.

According to its main provisions, the decrease in expenses of heat and electric power in housing and public utilities in ten years is planned for 25% in comparison with basic 2015. The control points will become decrease in average consumption by 5% in the 2018th and for 15% — in 2020.

Besides, the purposes of implementation of "road map" include:
- ensuring rational use of energy resources at operation of capital construction projects due to establishment of requirements of power efficiency of buildings, structures and constructions;
- ensuring power efficiency when purchasing services in construction, reconstruction, capital repairs of buildings, structures and constructions.

4 Discussion

Nevertheless, concerning expediency and practical benefits of "road map" still there is no consensus. By results of survey conducted among specialists of power industry, most of respondents (37%) considers the "road map" of development of energy saving approved by the Government of the Russian Federation in housing and communal services a necessary measure for economy of resources and to improvement of living conditions of citizens, at the same time more than 27% of respondents are afraid that the programme will not be executed, is similar, the program of an energy audit, etc., and more than 18% consider that this "road map" is not necessary. 9% of respondents consider that the programme will allow to save energy, but it will make the housing more expensive. 9% of respondents consider that energy saving is not possible in Russia at all (Figure 3).

![Figure 3. Opinion of experts on the role of "road map" for the development of energy saving and the increase in energy efficiency](image)

The author believes, that for the increase in practical benefits of the specified "road map" it is necessary to include in its provisions the aspects concerning ecological standardization ("green" construction) in a type of conditionality of process of management of energy consumption of questions of power management.

5 Conclusions

The Russian fuel-and-energy complex has one of the most high potentials in the field of energy efficiency, but this potential needs to be developed. Thus there is the necessity of modernization of the distributive-and-network complex where considerable losses are still observed. But in case of the corresponding modernization they can be reduced twice.

Analyzing the problems and the prospects of energy saving in Russia, we should note the importance of creation of complete legal base and mechanisms of economic incentives of energy saving. In many developed countries of the world there are already rather effective mechanisms. During the research the necessity of the development of standard documents, which would be the instrument of achievement of
energy efficiency at all stages of life cycle, was revealed. The author considers the “road map” to be useful in the modern conditions. It might help to overcome such obstacles in the way of the increase in energy efficiency of residential buildings as: the lack of motivation, information, financial resources, the organization and coordination, skills of design, quality control and respect for technology of construction or reconstruction, operating experience of energy efficient buildings

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