

Challenges and prospects for energy efficiency development in residential buildings

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Abstract. The multifamily housing stock in Russia has a high degree of wear and tear, low energy efficiency, and inadequate maintenance, which leads to over-consumption of energy resources. High energy intensity is related to the fact that energy equipment is obsolete, high heat and energy losses during transportation occur, energy is spent by enterprises and population unreasonably, buildings and constructions have high heat losses. The main reasons for the efficient use of energy in the building sector is to reduce the heating and hot water costs of building owners, improve the indoor climate of buildings, save taxpayers' money in order to use the saved funds in other areas, introduce energy efficient and renewable energy technologies, improve the air quality, reduce the negative impact on the environment and climate change. Based on the above mentioned, the article examines the aspects of energy efficiency of residential buildings, namely identifying the problems of energy efficiency, the main parameters of the state programme of energy efficiency of residential and public buildings. An example of potential incentives, comprehensive and reasonable use of incentives, which can change the current situation in the shortest possible time, is presented.

1 Introduction

The development of industry and transport, and the accompanying increase in energy consumption, has led to an acute dependence of mankind on energy resources. The increase in energy demand with the simultaneous complication and increase in the cost of energy resource extraction, as well as the aggravation of global environmental problems, have made energy saving and energy efficiency improvement an important area of development in many countries of the world [1].

The existing limitation of research in the field of energy savings in residential construction is not only due to the restrictions imposed by legal requirements. This is mainly due to the peculiarities of market relations. The high cost of living space and the still low level of awareness on energy savings do not encourage future flat owners to overpay for the energy efficiency class of the building or for the energy saving measures carried out.

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2 Methods and materials

The potential in this area is enormous, both in terms of investment attractiveness and innovative development [2, 3]. The methods of energy saving in residential construction are currently underdeveloped and limited [4, 5]. Most of them are connected with accounting and regulation of energy consumption and with increase of heat transfer resistance of building envelopes (Fig. 1).

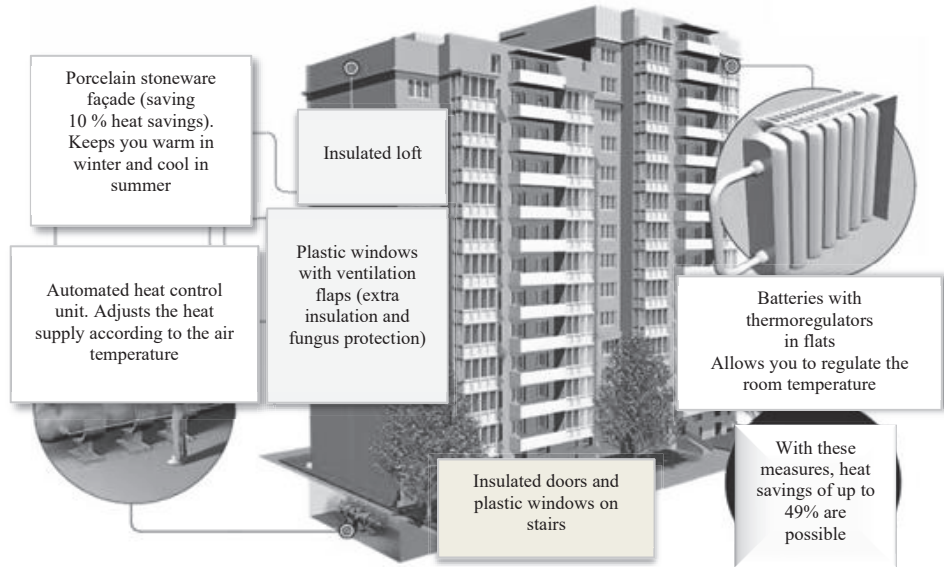


Fig. 1. Fragment of an energy saving project.

Energy consumes enormous amounts of oxygen, water and fossil resources from the environment, producing, in addition to useful energy, waste and pollutants, thereby having a significant impact on all envelopes of the earth: atmosphere, hydrosphere, lithosphere and biosphere [6].

The issue of the need to save energy resources in Russia is quite acute. Russia ranks third in the world by the absolute indicator of total energy consumption, and at the same time among the ten largest energy consuming countries it has the highest level of energy intensity: it spends more energy per unit of gross domestic product (GDP).

3 Results

According to the Ministry of Energy report, the residential sector also accounts for a large share of the maximum end-use energy saving potential. One of the main reasons for the low energy efficiency of the Russian housing stock is that apartment buildings built before 1995 (which constitute the majority of multi-family housing) were designed according to old building standards, so they do not meet modern requirements for thermal protection of buildings (heat loss through the envelope is up to 40%) (Fig. 2.) [7].

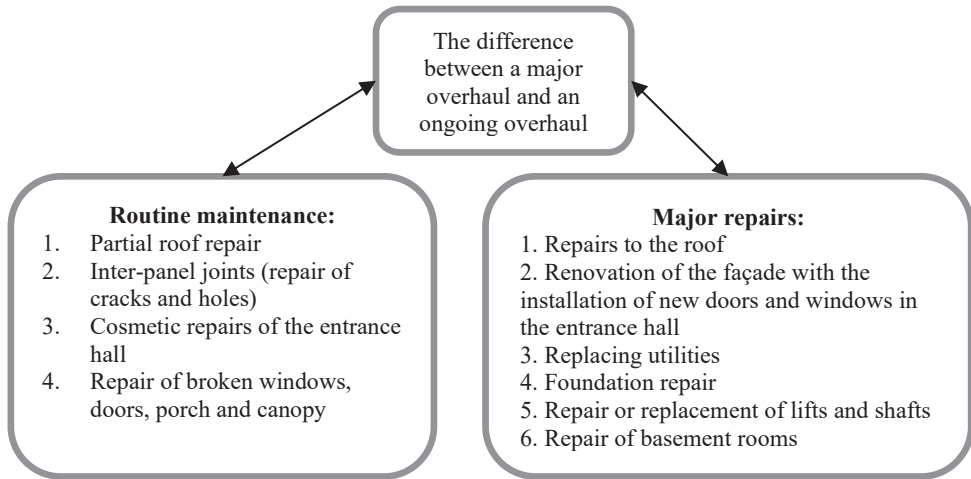


Fig. 2. The difference between a major overhaul and an ongoing overhaul.

Increasing the heat transfer resistance beyond the requirements of the regulations is ineffective, and metering and consumption control yield significant results only in the case of a renovation project [8, 9].

The limitation of research in the field of energy saving in residential construction is not only due to the restrictions imposed by the requirements of regulatory documents [10]. One of the underlying reasons is the lack of attractiveness of this area of research.

This is primarily due to the peculiarities of market relations, where the direct benefit from the operation of an energy efficient apartment building is usually received by the flat owners rather than the design and construction company or the customer.

Incentives for energy savings at the national level are becoming an important and effective tool. An example of a potential incentive is presented in Fig. 3.

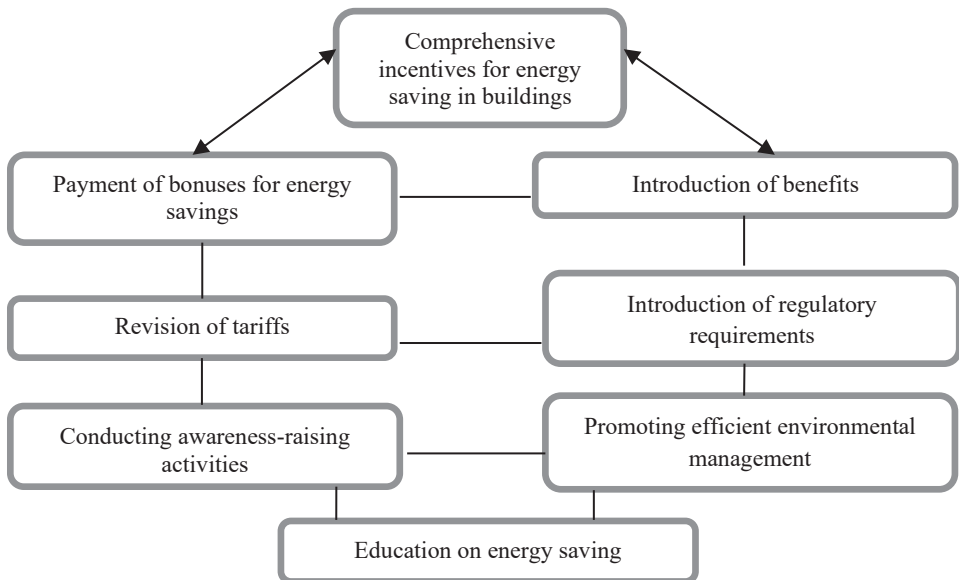


Fig. 3. Comprehensive incentives for energy saving in buildings.

A comprehensive and prudent use of incentives can change the current situation in the shortest possible time.

At present, state regulation in the field of energy saving in Russia is carried out by a whole range of documents, represented by Federal Laws, decrees of the President of Russia, as well as decrees and other documents of the Government.

4 Discussion

An important role directly in the construction industry is played by the regulatory document on thermal protection of buildings, which establishes requirements for the energy consumption level of buildings, presents rules for assigning an energy efficiency class, and provides recommendations for economic incentives for buildings with a high energy efficiency class. Also in 2016, new rules for determining the energy efficiency class of apartment buildings were approved by Order No. 399/pr of the Ministry of Construction of Russia. The new rules allow taking into account climatic conditions and bring the domestic classification closer to similar European standards.

5 Conclusions

Thus, improving the energy efficiency of residential buildings is an important factor in reducing the energy intensity of the Russian economy, as well as a necessary condition for reducing the anthropogenic impact on the environment. Important problems in this area are insufficient scientific research and low attractiveness of the direction due to the peculiarities of market relations.

An effective tool for overcoming the above-mentioned problems is state incentives, which have developed considerably in recent years. However, at present, state incentives are not yet sufficiently effective. Further development of the legal and regulatory framework, as well as a system of incentives and benefits for legal entities and individuals using energy resources efficiently, is required.

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