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Research Article

IMPROVING THE ENERGY EFFICIENCY OF LOW-RISE RESIDENTIAL BUILDINGS

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Khalimov Khabibullo Bakhtiyorjon Ugli
Fergana Polytechnic Institute, Fergana, Uzbekistan

ABSTRACT

The most promising direction of rational use and saving of fuel and energy resources is related to energy saving in various spheres of economic activity. More than a quarter of the energy saving potential is concentrated in the housing and utility industry, and more than a third in construction and industry. The main number of buildings in operation in our country are non-energy-efficient constructions made of prefabricated reinforced concrete and local materials, whose thermal performance deteriorates during operation due to poor quality or improper operation. In the article, the issues of improving the energy efficiency of low-rise residential buildings were studied in detail, suggestions and conclusions were given.

KEYWORDS

Power consumption, energy-efficient house, energy source, thermal insulation, power consumption, energy audit.

INTRODUCTION

A significant share of the operated housing stock is made up of low-rise buildings, and this share exceeds 30% of the total volume of housing built in a number of regions. Being environmentally

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attractive, low-rise buildings have a significantly higher specific characteristic of thermal energy consumption for heating and ventilation compared to high-rise buildings [1-3]. Many of the used space-planning solutions to improve the energy efficiency of multi-storey buildings are ineffective in the development of low-rise projects, especially one- and two-family houses with a small number of apartments, which, as a rule, are small in size due to functional considerations [4-7].

Materials and methods

The existing regulatory framework lacks methods that fully take into account the influence of interrelated processes of heat and mass transfer on heat losses through external fences, as well as the utilization of the heat of the outgoing air and the use of dissipated energy of the natural environment (the heat of solar radiation and the earth mass under the building) for additional space heating. This determines the relevance of the tasks set to improve the thermal efficiency of low-rise buildings. The degree of development of the research topic. A certain influence on the solution of the problem of increasing the thermal efficiency of buildings was exerted by numerous works of domestic and foreign scientists, the analysis of which made it possible to formulate tasks for further research [8-11].

Many aspects of issues related to the energy efficiency of buildings and their structures are covered in the works of domestic scientists Fokin K.F., Vasiliev B.R., Bogoslovsky V.N., Khlevchuk V.R., Samarin O.D., Livchak V.I. . [12-15].

The studies of these scientists indicate great opportunities for using two principles in the architectural design of low-rise buildings: increasing the thermal protection of external enclosing structures and constructive solutions adapted to use the scattered energy of the natural environment. However, due to insufficient knowledge of measures to improve the thermal protection of buildings and their feasibility study, further study of this problem is required, which makes the research topic relevant. The aim of the work is to increase the thermal efficiency of low-rise civil buildings and their enclosing structures through the use of energy-saving solutions.

One innovative direction in this area is the use of vacuum insulating glass units, in which convective heat transfer cannot occur [16-19]. The use of such a double-glazed window allows you to create lighter and heat-shielding window structures. In addition, in addition to a significant variety of architectural and compositional and space-planning configurations, the effect of energy saving can be achieved by adding and embedding additional volumes and blocking single-family houses, as well as creating an underground public space [20,21].

The use of energy-saving measures is of great importance not only in relation to buildings under construction, but also in relation to already existing old buildings. When carrying out work on the reconstruction of thermal protection in Tyumen, an entire energy-efficient quarter was created, where in houses built a relatively long time ago, work was carried out to repair and replace facades, roofs, utilities, modernization of

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in-house heating systems, window blocks. Subsequently, a complex of such works is planned to be carried out on the scale of the whole city [14-21].

Issues of control and accounting of consumed energy, according to Livchak V.I., have acquired particular relevance. In buildings, it is necessary to provide an automated control unit for the heating system, which allows optimizing the supply of heat for heating and avoiding unnecessary heat losses [23-25].

The world around us has various sources of inexhaustible energy. At present, some of them, solar energy, energy generated by the interaction of the earth and the moon, thermonuclear fusion energy, and geothermal energy are not fully exploited. Energy plays a decisive role in the development of human nature. There is an inextricable correlation between the volume of product production and energy consumption. Energy is of great importance in human life. Its level of development reflects the level of development of society's production forces, opportunities for scientific and technical development, and the standard of living of the population. Most of the energy consumed by humans is turned into useless heat due to the low efficiency of using the available energy resources. An approximate distribution of energy used in a year in the world is presented in Table 1. The energy value in this table is measured in megatons (Mt) of the amount of coal that provides the energy available when burned.

Table 1. Annual energy consumption in the world

Form of energy	*Amount, Mt*	*Source*
Feeding people and feed for working animals	650	sunlight (now)
Firewood	150	sunshine (past)
Hydroelectric plants	100	Water movement
Coal, oil. gas. peat	6600	sunlight (past)

At the same time, about 400 Mt of energy is consumed per village to feed people. of which about 40 Mt will be converted into useful mehnal. 800 Mt of energy is used for economic needs, and 1000 Mt for community production.

Thus, of the annual energy consumption of 7500 Mt, 2200 Mt is usefully consumed, and the rest is wasted in the form of heat. But even with 2200/7500 Mt of efficiency, humanity cannot boast, because the energy radiating to the earth from the sun, which is 10000000 Mt per year, is

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not taken into account here. Energy played a decisive role in the development of civilization. Energy consumption and information gathering. there is a strong relationship between the volume of product production and energy consumption, which have approximately the same change over time. The growth of energy consumption is surprisingly high. but as a result, a person has to rest a significant part of his life. to education. can devote to creative activities, and as a result, longevity is achieved.

We consider energy as necessary and capable of working for us. Providing energy to the society is divided into the following, i.e., heating of buildings, providing movement, production of products we need, various machines, inechanism. ensuring the equipment's ability to work. it is necessary for food preparation, lighting, life support and others.

One of the modern trends in housing construction is to carry out design and construction works taking into account the convenience, environmental and energy efficiency of the houses that are planned to be built. As we know, reserves (oil, gas and coal) are the main sources of energy in the world. According to experts' calculations, energy sources can last up to 100 years. In many developed countries, almost half of the energy consumption falls on houses. Therefore, one of the main ways to save resources is to improve the energy efficiency of buildings. The main principle of designing an energy-efficient house is to maintain a comfortable internal temperature without the use of ventilation and heating systems by using alternative energy sources.

The criteria for classifying such houses is energy consumption: if annual heating costs are less than 90 kWh/m2, the house is energy efficient; Less than 45 kWh/m2 is less energy efficient; Less than 15 kVh/m2 energy consumption is considered zero (nothing is spent on heating, but energy is required to prepare hot water).

The first experimental energy-efficient building appeared in Manchester (USA) in 1974 after the global energy crisis. This was an office building requested by the Office of General Services to test and identify the best energy saving technical solutions. The building's energy consumption has been reduced due to efficient use of solar radiation, double-layer closed structures and computer control of the building's engineering equipment. The implementation of this project laid the foundation for the construction of energy-efficient buildings around the world. Efforts to improve energy efficiency are being successfully implemented in Europe. According to various sources, from 2,000 to 10,000 such houses were built in Western European countries [24-27].

Targeted state programs have been developed in Denmark, Germany and Finland for such energy saving and construction of energy-efficient buildings. 10 kilometers outside Helsinki, the capital of Finland, is Vikki, a neighborhood of energy-efficient buildings (5,500 local residents and 1,132 hectares of land). It accounts for 50 percent of the neighborhood's solar energy use and hot water needs. The total area of solar

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collectors is 1248 m2. Energy-saving technology and alternative energy consumption can reduce energy consumption by 40% compared to conventional houses.

Denmark is currently the city of Egedal. In accordance with the state program, the construction of all energy-efficient residential buildings was carried out in South Stenlos. These local citizens do not limit their buildings to ecology and energy saving, but also provide ready-made houses equipped with all energy-saving innovations.

The following constructive and engineering planning solutions are used to minimize energy consumption. From the point of view of planning, to reduce the area of the walls of 1-3-story houses and their facades (glazing) and thereby prevent heat loss. Therefore, the main thing is to design a drum at the entrance and build the house facing south, because the main source of heat for heating the house is solar energy. The houses are prevented from being shaded by other buildings and trees. The heat transfer resistance of the walls should not exceed 0.15 kW/m2, for this, internal or double (internal and external) thermal insulation is used.

Today, in our Republic, the development of the way of living of the population in rural areas, the construction of houses on the basis of model projects is inextricably linked with the development of rural infrastructures and the construction of infrastructure facilities. Many houses and apartments based on model projects in accordance with the "Program for the construction of affordable housing on updated model projects in rural areas in 2017-2021" approved by the decision of the President of the Republic of Uzbekistan PQ-2639 of October 21, 2016 was built and a family in need of improvement of living conditions was provided with housing [1-3].

Also, in our country, today attention is paid to the issue of building energy-efficient, economical houses as one of the most important factors in the development of the construction industry, in particular, residential buildings and social sector buildings, which are built on the basis of model projects in rural and urban areas within the framework of state programs. Enrichment with these features is defined as the main task. Decree No. PF-5577 of the President of the Republic of Uzbekistan, adopted on November 14, 2018, "On additional measures to improve the state regulation of the construction industry", from January 1, 2020, housing construction It is strictly determined that facilities must be equipped with energy-efficient and energy-saving equipment at the stage of design-research and construction-assembly work [1-3].

In this regard, our project "Supporting the development of energy-efficient rural housing construction in Uzbekistan", which has been implemented since 2017 in cooperation with the Global Ecology Fund and the Ministry of Construction of the Republic of Uzbekistan, deserves attention. As a result of the implementation of the project, it is expected that energy consumption and greenhouse gas emissions will decrease in households.

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As part of the project "Supporting the development of energy-efficient rural housing construction in Uzbekistan", 800 low-carbon three-room energy-efficient houses were built in Samarkand, Surkhandarya, Fergana, Khorezm and Bukhara regions. Photoelectric plants (FES) with a power of 300 Watts are installed and working in each of these houses for lighting needs.

Ten such houses are equipped with solar water heaters capable of heating 200 liters of water. However, this level of energy consumption in the building remains for 3 to 5 years, and then it starts to increase again. It is necessary to carry out an energy audit to determine the reasons for this decrease in energy efficiency. Therefore, it is recommended to conduct an energy audit once every four years.

It is worth mentioning that within the framework of our project "Supporting the development of energy-efficient rural housing construction in Uzbekistan" in cooperation with the Global Ecology Fund and the Ministry of Construction of the Republic of Uzbekistan, 800 energy-efficient houses built in 2019 with a power of 300 watts power plants (FES) are installed.

Conclusion

An energy audit will be conducted in 60 houses selected from among these constructed buildings and ordinary model houses built in 2018 within the framework of the State program. This approach makes it possible to compare energy-efficient houses with ordinary houses and to analyze the effectiveness of using energy-efficient and low-carbon technologies in reducing heat and electricity consumption in rural houses. The widespread introduction of energy audit, the use of renewable energy sources is one of the important and not yet fully exploited reserves. It will help solve the problem of natural gas and oil shortages in the future and, according to experts, it can double the energy costs of consumers.

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