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# Energy efficiency of civil buildings

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***Abstract:*** *The problem under consideration is multifactorial and includes several methods for reducing the cost of resources in heating, ventilation and air conditioning systems: architectural and construction solutions, an equally unfavorable picture has developed, in particular, in heat supply.*

**Keywords:** construction, energy efficiency, energy saving, properties, fencing, construction, microclimate, energy, optimization, system.

**Introduction.**

The situation of the economy of Uzbekistan, in which the domestic energy industry has found itself, in the near future may lead to an energy crisis, which will nullify all efforts to reform the economy and stop the emerging trends in the revival of industry. According to experts, in order to maintain the energy potential at least at the level of the mid-90s, it is necessary to commission 2 million kW of electrical capacities per year, which will require more than 10 billion dollars of investment by 2012.

An equally unfavorable picture has developed, in particular, in heat supply. The buildings constructed by us have high rates of heat consumption during the heating period: multi-apartment buildings - 350...600 kWh/($m^2$xyear), single-apartment buildings - 600...800 kWh/($m^2$xyear), while in countries with a similar climate, for example, Sweden and Finland - 135 kWh/($m^2$x year). The specific consumption of water from the city water supply is 250 liters or more per person per day, and taking into account the needs of the economy and industry - 500 liters, including the consumption of hot water by the population with centralized hot water supply - 150.200 liters per day per person, while as in the countries of Western Europe - 3 times.

The available energy saving potential is largely due to standard technical solutions used in the design of energy consumption and energy supply systems in the 50-70s of the XX century. The current practice of irrational spending of fuel and energy resources is largely determined by the previously established system of priorities, in which the rational use of energy resources did not have a significant impact on economic performance.

**Research.**

In connection with the foregoing, work aimed at reducing the energy consumption of existing buildings and structures and the use of non-traditional energy sources seems to be relevant and of great scientific, technical and practical significance.

The purpose of this work is to substantiate and select, on the basis of comprehensive studies, optimal space-planning and design solutions, as well as engineering systems and equipment for energy-efficient residential buildings.

• to substantiate the choice of the type of mass construction building in Moscow as a basis for creating an energy-efficient residential building;

to substantiate, in relation to the chosen type of building, space-planning and design solutions that improve energy efficiency, quality of operation and economy;

• to conduct substantiations and studies of a complex of technical systems that contribute to the implementation of energy-saving technologies in the experimental house;

• conduct experimental studies of the effectiveness of the decisions taken in the design and technical and economic evaluation of the results obtained;

• to systematize the optimal energy-saving measures for the technical and economic evaluation of the results obtained.

• systematized optimal energy-saving measures for their implementation in the practice of mass construction.

The subject of the study is space-planning and design solutions for buildings, as well as technical solutions for engineering systems and equipment used for their construction, which contribute to reducing energy consumption during their operation [1].

Theoretical and methodological foundations of research. Theoretical and methodological foundations of research are the achievements of domestic and foreign science in the field of energy saving.

The scientific, technical and practical value of the work lies in the substantiation and selection of optimal energy-saving measures and technical solutions for residential buildings recommended for mass development.

World experience has shown that advanced countries that have made significant progress in the field of resource conservation had legislative, legal, financial support from parliaments, congresses and other legislative and government bodies. They adopted special laws on energy conservation and funded state programs for energy conservation.

One of the most important in the field of rational use of energy resources is the Law "On Energy Saving", adopted in 2002. The law, as well as the Government's resolution on this issue, determined the long-term energy-saving policy of the state in various sectors of the national economy, including the construction sector. The law contains a provision on the implementation of state supervision over the efficient use of energy resources in the extraction, production, processing, transportation, storage and consumption.

The role of the state is to create conditions of interest in improving the efficiency of energy-consuming facilities of all subjects of the state. The growth of energy efficiency will save the state from excessive subsidizing of energy costs, in particular through low prices for heat and gas, improve the energy security of the state and the competitiveness of domestic products, and reduce the environmental burden on the environment.

Thus, from October 1, 2002, it is prohibited to accept objects for operation without installation of metering devices, control and regulation of heat, hot and cold water, gas in accordance with the requirements of current regulatory documents, and from January 1, 2005 - without full implementation regulatory requirements for resistance to heat transfer of enclosing structures.

Regional and sectoral building codes for thermal protection and energy efficiency of buildings have been developed and put into effect in more than 50 constituent entities of the Russian Federation, and during their development and implementation, the task of stimulating the design of buildings with less energy consumption was solved.

As the main consumer requirement, it is proposed to establish standards for the specific energy consumption for heating buildings during the heating period, while the building should provide comfortable conditions for people to stay in it.

The indicator of specific energy consumption is determined taking into account the efficiency of the heating system as a whole. The design specific consumption of thermal energy by the building's heating system during the heating period should be less than or equal to the required value and is determined by choosing space-planning solutions, heat-shielding properties of the building envelope, type, efficiency and control method of the heating system used.

When designing residential buildings of mass construction, in addition to economic restrictions, the requirements for manufacturability of construction and ease of maintenance are usually imposed. At the same time, in order to identify the most effective energy-saving measures, the model of the thermal regime of the building as a single heat and power system is presented in the form of separate interconnected models.

For unrelated technical building systems (hot water supply, heating system, electricity supply) is not acceptable, and the overall energy saving effect of all systems is determined by summation.

The implementation of energy-saving measures can be fully implemented with an integrated approach to the problem of saving fuel and energy resources. The main measures and engineering solutions that provide the specified conditions in the premises of the building include architectural and planning solutions for the building (urban planning, space-planning, enclosing structures, translucent fences) and engineering systems (heating, ventilation, air conditioning, recycling, regulation, automation and control). Therefore, the approach to the study of the energy performance of buildings and the search for the right solutions to optimize their energy efficiency determines the solution of complex interrelated problems that make up three main areas:

• organization of indoor microclimate;
• minimization of energy costs;
• efficiency of the building, rational use of material resources.

Achieving optimal results in these areas is possible if the following conditions are met:

1. Assignment of design internal conditions, including air quality in the premises of the building. Optimal and permissible conditions, lower and upper limits of the ranges of changes, availability of calculated parameters in the warm and cold periods of the year.

2. Choice of design parameters of outdoor air with different probabilities of meteorological elements.

3. The choice of options for architectural and planning solutions.

4. Temperature-humidity regime and air exchange regime in the building. Accepted heat, air, moisture protective characteristics of the elements of the building envelope. Specific characteristics of enclosing structures and energy indicators of building engineering systems. Methods for calculating the thermal and air conditions of the premises of the building.

5. Engineering systems for ensuring the temperature and humidity conditions of the building. Traditional and alternative energy sources. Collaboration of the building envelope and engineering systems

6. Efficiency and optimization of solutions that ensure the microclimate of buildings. Indicators of efficiency, security, reliability, controllability of the microclimate of buildings. Technical and economic optimization of options and the feasibility of solutions [2].

It is known that the specific heat losses of buildings depend on the ratio of the area of external fences to the volume or area of heated premises.

The second most important set of energy-saving measures is the transition during the construction of new and reconstruction of existing buildings to new types of multilayer external enclosing structures, the reduced resistance to heat transfer of which meets the requirements and current standards.

The third set of energy-saving measures is associated with the use of improved engineering systems: heating, ventilation, hot water supply, energy supply, automation, and the use of non-traditional heat sources.

**Conclusions.**

Thus, a comprehensive analysis provides:

1. Representation of the microclimate system of the building in the form of interconnected parts (subsystems) and their technological connections with external systems of heat, cold, water, electricity.

2. Availability of information about the functioning of the system and its subsystems for the annual cycle of operation in the form of technological parameters: the consumption of heat, cold, air, electricity and water in their totality.

3. A strictly defined structure of technical and economic indicators for assessing the quality of decisions made on the building microclimate system:

• functional and technological;

• structural and layout (occupied space, consumption of metal, valuable materials, etc.);

• operational and energy (fuel consumption, electricity, ease of use, reliability, etc.);

• economic (monetary value of previous in-situ indicators); well-known names can be used economic costs: capital, operating, reduced, but with their tracing in relation to market conditions.

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