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OPTIMIZATION OF MODELING WHILE INCREASING ENERGY EFFICIENCY OF BUILDING STRUCTURES OF PUBLIC BUILDINGS

***Abstract**: The research paper deliberates improving the energy efficiency of building structures in public buildings while optimizing modeling. An analysis of the temperature of the premises was also carried out against the background of the individual impact of the considered factors having an influence.*

***Key words**: building structures, improving the energy efficiency, optimizing modeling, public buildings.*

***Language**: English*

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Introduction

The degree of energy efficiency of buildings depends on a number of factors, such as building envelopes, climatic conditions, etc.

When assessing and analyzing the energy efficiency of an object, it is necessary to take into account, in addition to energy indicators, a number of other parameters, for example, objects located in small cities or rural areas have their own specifics of functioning and are architecturally different from the typical projects of mass urban buildings.

Thermal modernization in the considered group of buildings of the social sphere, the average thermal resistance of external opaque fences was 0.8-1.5 m2K / W. The buildings used outdated boilers, some buildings are heated using stoves.

For example, the educational building of the housing college is considered as an example.

This is a 4-storey building with a technical floor, built 40 years ago. The total area of 8093m^2. The building has administrative premises - 10%, classrooms - 37%, computer classes - 4%, research laboratories - 18%, a buffet, utility rooms - 16% and training centers - 15%. The glazing area is 2031m^2 (about 45% of the external wall area). The building has the shape of an elongated rectangle oriented to the east by facades. Ventilation is natural.

Heat is supplied from district networks. The heating system is an independent one-pipe radiator with an upper wiring of 49 risers, connected to heating networks through a plate heat exchanger

Commercial metering of thermal energy is carried out through a meter installed at the entrance to the building. In most of the heating period, heating networks do not comply with the temperature schedule for supplying coolant, which leads to lower temperatures in the building's rooms with respect to comfortable conditions.

Materials And Methods

The aim of the study is to use modeling optimization to analyze changes in the energy efficiency of building envelopes. In conditions of exclusively central regulation and an insufficient level of heating in the building's premises, in addition to a decrease in the level, there is a noticeable uneven temperature distribution, different glazing coefficient and condition of the windows, the influence of radiation and infiltration, which makes it possible to consider the building as an object of the influence of a set of different operational factors on space-time changes in room temperature.

In detailed analysis of the dynamic energy characteristics of a building, one should not consider the building as a whole, but its separate zone, these rooms of which are of the same type and, if necessary, a similar calculation can be repeated. The allocation of representative premises will allow for analysis for individual zones and to obtain an overall picture of the energy characteristics for the facility as a whole.

Representative premises were selected taking into account the purpose, orientation and number of storeys of the building. Corner rooms were considered separately, taking into account the geometric features of the length of the building, these rooms are not characteristic of the building as a whole.

The definition and analysis of energy efficiency based on experimental data carries a number of approximations and inaccuracies, so it is advisable to obtain the establishment of annual energy consumption for heating buildings on the basis of calculation approaches. The solution to these problems requires the use of calculation methods.

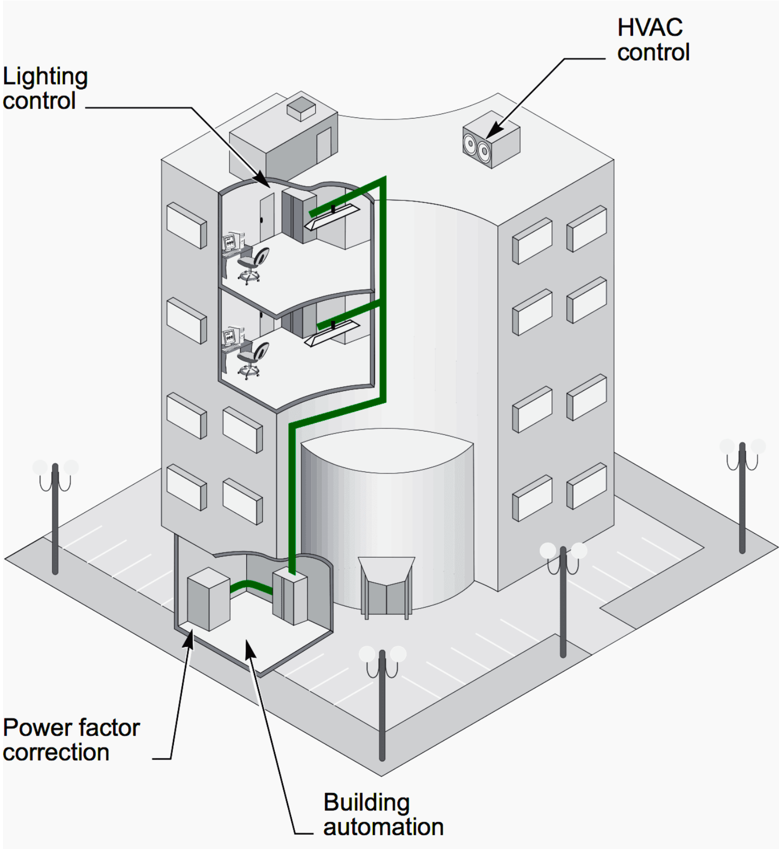

Figure 1. Optimization modeling while improving the energy efficiency of public buildings

In most buildings, specific characteristics are set for the value of heating and ventilation, depending on the purpose, year of construction and volume of the building. According to integrated heating characteristics of building standards. There are also international standards for public buildings on the need for heating, allowing you to set energy requirements depending on the purpose and location of the facility.

In the calculations, it is accepted that only scattered solar radiation falls on the northern surface. In this calculation method, cloud cover is taken into account by decreasing direct solar radiation.

The heat flux entering the area of the room is determined by:

$Qsol= qi\ F_{trsl}k_{tra}k_{pre}$,

where, $\mathbf{Q_{sol}}$ is the heat flux from the sun to the room zone, W;

qi is the specific heat flux entering the vertical surface of the corresponding orientation, W / m2;

$\mathbf{F_{trsl}}$ - the area of translucent structural elements, m2;

$\mathbf{k_{tra}}$ - transmittance of solar radiation;

$\mathbf{k_{pre}}$ - coefficient taking into account the presence of shading elements.

Typically, in calculations to determine the energy requirements of buildings, the ventilation component (air exchange) is specified through the value of the air exchange ratio. Air exchange is difficult to determine experimentally. Even with the same window designs, in terms of breathability, a different amount of air naturally enters the room. Indoor air exchange depends on a number of factors, both external and internal.

There was a temperature peak on the south side of the premises on a clear day. It should also be noted that during working hours this peak is longer in comparison with weekends. This is because on weekdays, in addition to solar heat, there are additional heats.

To assess the energy efficiency of buildings, calculation models and methods for their use for determining energy efficiency indicators have been developed by clarifying the separation of the thermal inertia characteristics of the building fencing, changing weather conditions, and reducing the differences in determining energy consumption.

On a cloudy day, the nature of the temperature change turned out to be approximately the same, if we did not take into account the effects of different levels of heat input during working hours.

In classrooms, as well as in administrative buildings, hours of solar activity have a similar peak length during working hours; at weekends, peak temperatures last only a few hours. At night, the classrooms located on the south side of the building also cool more significantly.

Metering of thermal energy in the building of the educational building was carried out at the entrance, the connection diagram is independent through a plate heat exchanger.

The heating system is single-pipe with a vertical top wiring. To analyze the experimentally obtained local characteristics of indoor air temperatures, there were local characteristics of the distribution of heat from the heating system.

The basis of an in-depth analysis of the thermal state and non-stationary energy balances of buildings is optimization modeling. One approach is to use models based on the thermophysical and geometric characteristics of the building. The main attention is paid to building models of energy consumption of buildings; the influence of various factors on the change and characteristics of the distribution of internal temperature in the premises is studied little. The second is to use the measured values of the thermal parameters of the building.

Results And Discussion

They allow you to analyze and predict various aspects of the behavior of the building as an energy system. The first approach requires the construction of a model for calculations (simulation, white models). The second large number of accumulated experimental data. Experimentally obtained data may contain a complex effect, which complicates their analysis and reduces the accuracy of the results. The combination of the two above approaches was developed in the use of gray models.

The combination of these approaches to determine the energy characteristics of the building will allow you to combine their advantages and predict the temperature conditions of the premises as closely as possible in real conditions. Gray models allow you to refine the characteristics of the calculation model based on actual data, to highlight the actual impact of individual source data using the calculation models.

Conclusion

Consequently, analysis of the temperature of premises against the background of the combined action of considered influential important factors. More accurate selection of their influence is provided by optimization in determining the energy characteristics of buildings for various calculation time intervals.

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