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ENERGY EFFICIENCY DEVELOPMENT: THE THERMAL INERTIA OF BUILDINGS

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OVERVIEW

After the entrance in the European Union (EU) manifestations of architectural freedom are rapidly expanding in the Baltic States, as well as the other East European countries. There are also several ideas about energy-saving buildings, yet they are only on the level of ideas. The new normative acts on heat supply, too, allow rather free interpretation of the thermal endurance of the envelopes of buildings. The new building materials have high thermal resistance but low thermal capacity, which lowers thermal inertia of buildings. Thermal inertia has the decisive role in the choice of a heat supply capacity under extreme conditions (at low outdoor air temperatures). According to the norms existing in Latvia, it is sufficient to have 92-percent insurance for the buildings with a great thermal inertia in an average perennial year, but the buildings with a small inertia require, respectively, 98-percent insurance, which determines the choice of the heat supply capacity. However, in the buildings of modern architecture, particularly in the buildings the envelope of which is completely or partly made of glass, thermal inertia is much lower, and the heat supply capacity under the Latvian weather conditions must be increased from 10% up to 27%. Besides, a problematic comfort zone arises near such glazed surfaces of buildings where additional ventilation capacities are needed in order to ensure full comfort, which increases the ratio of the ventilation energy in the total consumption of thermal energy for heating. Therefore, in such situations innovative energy-saving ventilation systems are of great importance for the solution of energy efficiency problems.

METHODS

The main method of research of these problems can be regarded as “a general energy policy assessment methodology” with its vertical and horizontal dimensions. Besides, methods of the energy balance analysis of buildings, the analysis and processing of meteorological data for the weather conditions of Latvia (as a part of the Northern region of Europe) were used in the research.

The methodological studies of the development of architectural and building methods and materials allowed the formulation of such an indicator as the role of the thermal inertia of a building in the calculation methodology of the heat supply capacity. A scale has been developed for the determination of the heat supply capacity of buildings in order to achieve the necessary insurance for the comfort of the rooms under extreme conditions (at low outdoor temperatures).

A motivation is given for the methods of raising energy efficiency in buildings having envelopes with a low inertia, where the ratio of ventilation energy rises in the total consumption of energy.

RESULTS

The rated heating capacities of the heating systems, depending on the rated thermal inertia D of the buildings, will increase with the rated thermal inertia of the buildings reducing [1]. If the rated capacity of the heating system is assumed as 100% when the rated thermal inertia of the building D

> 7, then there will be an increase in the heating capacity at other numerical values of the thermal inertia (see Table 1).

Table 1. A thermal inertia scale of buildings for the capacity evaluation of the heating system

The thermal inertia indicator *D* of the building	The capacity of the heating system (%)
D > 7	100
4 < D ≤ 7	110
1.5 < D ≤ 4	119
D ≤ 1.5	127

This rise in the rated capacities and, hence, the installation costs of the heating systems continually operating in the buildings will increase their thermal comfort, which will promote the regeneration of the working capacity of the population when they are at home and their labour efficiency at work, and decrease their sickness rate during the cold winter months. According to the statistical data published in the technical literature, decrease in labour efficiency of the population is almost proportional to the fall of the outdoor air temperatures. The lower the outdoor air temperature is, the higher the thermal discomfort because of the insufficient heating and thermal inertia of the building. The thermal comfort can already be qualified as an economic factor which will compensate the rise in the installation costs of the heating systems during the operation of the buildings, increasing the set capacity of the heating systems [2].

Essential problems can be seen in the houses – both in the dwelling and public buildings – having low thermal inertia and increased glazing.

CONCLUSIONS

After joining the EU the new member states review their normative acts adjusting them to the EU regulations including the fields of heat supply and energy efficiency. A significant role in the improvement of the normative acts in these fields belongs to the development of the architectural and building methods and materials. The calculation methods of the heat supply capacities of buildings, using the thermal inertia scale, allow the insurance of the indoor comfort of buildings under particular weather conditions including extreme ones. Besides, a significant role in raising energy efficiency under such conditions will fall to the development of the ventilation system.

REFERENCES

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