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STUDY AND ANALYSIS OF THE ENERGY SAVING POTENTIAL USING NEW EXTERIOR WALL PAINT COATINGS

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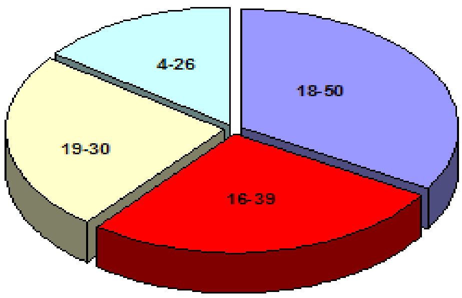
ANNOTATION

Energy saving and increasing the energy efficiency of buildings is also one of the main tasks of mankind and one of the ways to reduce the consumption of thermal energy is to reduce the heat loss of the building. The article considers options for insulating external walls using new paint and varnish coatings.

Keywords: energy efficiency, external walls, heat loss, wall insulation, thermal conductivity.

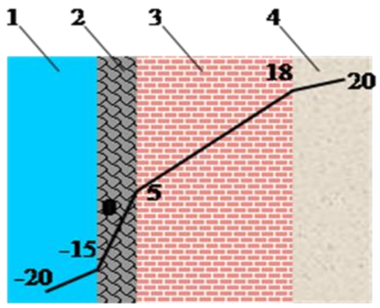
Recently, scientists in many countries have been focusing on energy saving issues. In the context of the predicted natural reduction of reserves of traditional hydrocarbon raw materials and the corresponding increase in prices for traditional energy resources, ensuring efficient energy consumption is an important task for increasing the competitiveness of the economy for all countries. Given that the volume of energy consumed in Uzbekistan by 2030, taking into account population growth, GDP, acceleration of urbanization processes, all other things being equal, may increase from 25 million toe. up to 86 Mtoe, comprehensive energy efficiency measures are required. Having a relatively high level of energy intensity of the economy compared to other countries, Uzbekistan also has large reserves for a radical reduction in energy consumption and saving energy resources, primarily in the housing sector and in the operation of buildings.
Improving the energy efficiency of buildings can also have significant social effects. The introduction of energy efficient buildings will help create productive employment in both the construction, thermal insulation and energy efficiency equipment sectors and related industries. Saving and reducing the population's costs for utility services for heating and providing electricity by 25-30% can contribute to the direction of the saved funds for further improving the energy efficiency of housing, meeting other needs of the population, and for the development of entrepreneurial activity.
One of the traditional ways to reduce the consumption of thermal energy is to reduce the heat loss of the building. It is necessary to know the structure of the energy balance of the object under consideration and the possibilities of energy saving associated with it for various components of the balance. On fig. 1 shows the average balance of heat losses by buildings in percent, compiled according to various expert estimates [1].



Rice. 1. Average balance of heat losses by buildings in percent: 1. infiltration; 2. walls; 3. windows and doors; 4. floor and attic

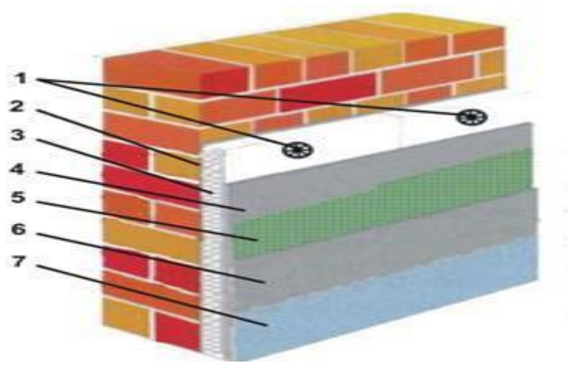
It should be said that the balance of heat losses depends on many factors, for example, the year the building was built and its purpose, number of storeys, type of building envelope, orientation to the cardinal points, region, etc. As can be seen from Figure 1, the greatest building losses are associated with infiltration and air exchange in the room. These losses can be reduced through modern window blocks, doorways and proper organization of air exchange in the room. A lot has already been done in this direction, and now there is a wide introduction of technologies in this area. In second place in the average balance of building losses are losses through the outer walls of buildings. Currently, many technologies have been developed to reduce heat loss through building envelopes associated with insulation [2].

Let's consider these technologies in more detail. Wall insulation can be done both from the outside of the building and from the inside. Insulation of internal walls has not received wide distribution despite the technical simplicity of the work. With such insulation, the area of \u200b\u200bthe room is reduced, the outer walls are subject to freezing and the effects of temperature changes, moisture can form between the insulation and the wall. With this approach, it is possible to achieve a reduction in heat loss, but the wall will not be protected from environmental influences. Currently, preference is given to external wall insulation, which has a number of advantages. The walls are reliably protected from seasonal and daily temperature fluctuations and the effects of precipitation, the dew point is moved beyond the wall structure, and sound insulation is increased. A variant of temperature distribution in a wall with external insulation is shown in fig. 2.



Rice. 2. Temperature distribution in the wall. 1. Outdoor air; 2. heat-insulating structure; 3. wall; 4. internal air

There are several technologies for external insulation. The most common technologies are "wet" and ventilated facades. "Wet type" is a complex facade finishing, in which the building is insulated from the outside with a continuous layer of heat-insulating boards, and then finished to give the building a finished look with a wide choice of various finishing materials, decorative plasters. An example of such a facade is shown in Fig. 3.



Rice. 3. Option for insulation of the outer wall
1. dish-shaped dowels; 2. adhesive layer; 3. insulation; 4. protective layer; 5. reinforcing glass mesh; 6. protective layer; 7. decorative plaster

The installation of "wet facades" is associated with some difficulties and limitations. Installation work must be carried out at a temperature not lower than 5°C. The device of a wet facade is also possible in the winter, for which the scaffolding is protected with a special film, and the space under it is heated around the clock with heat guns until the applied solutions are completely dry. But the implementation of such a process will lead to additional costs, and the air temperature should not be lower than -15 ° C, since at sub-zero temperatures the sudden disappearance of electricity threatens to redo all the work performed. The last plaster layer is still recommended to be applied at positive temperatures. Ventilated facades have been used for more than 15 years in the reconstruction of buildings for various purposes. Such a system consists of cladding materials (panels, slabs or sheet materials), insulation and a supporting structure, which, in turn, is attached to the wall in such a way that an air gap remains between the protective and decorative coating and the wall. In some cases, for additional insulation of external structures between the wall and the cladding of the facade system, it is necessary to install a heat-insulating layer - in this case, a gap is left between the cladding and thermal insulation.

Ventilated facades, having a number of advantages compared to other types of insulation, are not without drawbacks. The façade panels together with the substructure can be of considerable weight and an examination of the supporting structure of the building is required. The problem is "cold bridges", which create a free flow of heat from the building wall through the metal elements of the sub-facing structure. This problem is solved by laying (between the brackets and the wall) paronite or plastic, which interrupts the heat flow. Elements of the substructure and facade panels are characterized by various thermal expansions. This disadvantage is eliminated due to the use of special damping sealing tapes placed between the cladding and profiles, which is guaranteed to exclude the possibility of deformations and cracks when changing the temperature regime, but increases the cost of the structure. Reliable operation of the ventilation facade is guaranteed only if it is installed by highly professional builders and installers. One of the main problems is the high cost and, according to some sources, depending on the type of materials, together with insulation, installation and design work, it can reach 5 thousand rubles per square meter. The above-described shortcomings of existing insulation methods force us to look for new cheaper technologies to reduce heat loss by the outer walls of buildings [3].

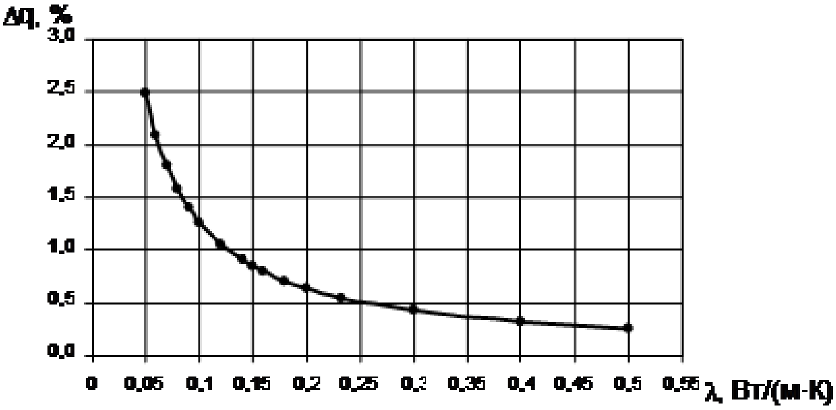
Recently, there have been reports in the media about the creation of new heat-insulating coatings based on paints and varnishes of special compositions, which make it possible to reduce heat losses through external enclosing structures. Manufacturers of heat-insulating paints and coatings claim very low thermal conductivity coefficients of their products, which reach 0.001 W/m°C. It is very difficult to believe in such parameters and it is necessary to conduct full-scale tests in laboratory conditions. Of interest is the question of the effect on heat loss through walls of ordinary facade paint, traditionally used for facades and pursuing architectural goals. You can evaluate the possibilities of energy saving when using ordinary facade paints by calculating the specific heat loss through the wall.

For this purpose, the specific heat flux q, W/m2, was calculated for a steady state through a multilayer wall using the formula

$$q = \frac{t_{\text{н}} - t_{\text{вн}}}{\sum_{i-1}^{n} \frac{\delta_1}{\lambda_1}}$$

where: $t_{\text{н}}$, $t_{\text{вн}}$ - temperatures of the outer and inner surfaces, respectively, °C; δ - layer thickness, m; λ - coefficient of thermal conductivity, W/(m·K).

The calculation was carried out for a brick wall without painting and the percentage change in the heat flux was determined, taking into account the paint layer at various values of λ. Due to the lack of data on the thermal conductivity of various types of facade paints, the value of the thermal conductivity coefficient for the paint was taken in the range from 0.5 to 0.05 W/(m·K). The initial data are as follows: = t_n - 26 ° C; t_{in} = 20 °C; $\delta 1$ = 0.5 m; $\delta 2$ = 0.001 m; λ=0.64 W/(m K). Based on the results of calculations, a graph was constructed, shown in Fig. 4, showing the percentage change in heat flux when the wall is painted.



Rice. 4. Effect of wall painting on heat flow

From fig. 4 shows that by painting the walls, you can get a reduction in heat loss. The lower the thermal conductivity of the paint, the lower the loss. Painting can be carried out both from the outside and from the inside, then the effect will double. In the presented calculation, only the heat-conducting component is taken into account. The average annual wind speed, for example for Tashkent, is 4.2 m/s. It is not possible to take into account the convective component in the absence of data on the heat transfer coefficient of paints. Approximate calculations by different methods give strongly divergent results. To fully assess the energy saving potential of the proposed measure, data on the coefficients of thermal conductivity, heat transfer and emissivity of the paints used are required, which are not available in modern literature. Painting facades with special or conventional paints can help reduce heat loss through the walls. To analyze the energy saving potential using this measure, as well as calculations of building structures, taking into account paint and varnish coatings, it is necessary to obtain experimental data on some of the physical properties of these substances.

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