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USE OF SOLAR HEATING SYSTEMS AS AN ELEMENT OF A PASSIVE HOUSE

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Annotation

This article analyzes the foreign experience of using energy efficient buildings in the construction. In particular, the prospects for the use of foreign experience in the conditions of Uzbekistan are sanctified, as well as the content and essence of the adopted normative legal acts for the development of this area, proposals and recommendations for improving this area are given.

Key words: passive system, sun rays, efficiency, building, energy, heating system, low-rise building, thermal protection, tightness, aerated concrete and expanded clay concrete blocks, expanded polystyrene, ventilation with a recuperation system, breathing walls, heat bell, wind power plant.

Introduction

Currently, one of the urgent problems in the design of energy-efficient buildings is the development of external enclosing structures with the required strength and heat-shielding properties, as well as the efficiency and simplicity of technology.

In Uzbekistan, large-scale measures are being taken to introduce energy-saving technologies in the construction industry, aimed at reducing the operational energy consumption of civil and industrial buildings.

The main directions of economic and social development of Uzbekistan for 2020-2025 and for the period up to 2030 outlined measures to reduce the material consumption of structures and increase

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the efficiency of capital construction. One of the ways to solve the set tasks is the development and implementation into practice of new light efficient building structures, including metal-wood structural structures, which allow saving materials, reducing the labor intensity of manufacturing and increasing the speed of installation.

In the construction of buildings, such energy-saving measures as the use of heat from solar radiation, strengthening of thermal protection and tightness of enclosing structures, installation of vacuum insulating glass units and more have recently begun to be actively used. Thermal insulation is a key aspect of energy conservation in construction. This is achieved through the use of modern high-quality thermal insulation materials (expanded polystyrene) and building materials with a lower heat transfer (aerated concrete, expanded clay concrete blocks, porous ceramics). Also, the thermal insulation system uses a complex protective thermal jacket around the building. The foundation structures in contact with the ground, pitched and flat roofs are insulated, ventilated facades are mounted, thanks to which positive temperatures are directed to the area of the supporting structures. It is known that significant heat losses occur due to the installation of leaky windows. Therefore, today high-quality glazing is used as the main energy-saving measure in construction (for example, triple glass units filled with inert gas).

Designing a compact configuration of buildings. The larger the outer surface of the building with the same volume of its premises, the higher the heat loss. Therefore, when building, reconstructing or expanding a house, you should, if possible, avoid all kinds of niches, ledges, ledges on the walls. It makes sense to build unheated outbuildings on the north side of the house. For example, rooms for storing garden tools and bicycles, technical rooms that protect the heated part of the house from wind and cold. A compact house not only consumes less energy, but also requires less construction costs.

Energy efficient passive houses are becoming more popular as construction companies begin to understand their environmental and economic benefits. Low- or zero-energy buildings play an important role in the fight against global warming.

Structurally, a passive house is an ordinary house. It has a traditional foundation, walls, floors and a roof. But, the fundamental difference lies in the approach, the removal of attention on each element and the use of innovative materials and engineering systems. The main attention in energy efficient houses is paid to the high level of tightness of the enclosing structures and their reinforced thermal insulation.

Let us consider these measures in more detail: In a passive house, the foundation is a "heat bell" around which a thermal field is created, and a special film embedded in the base protects against ground radon.

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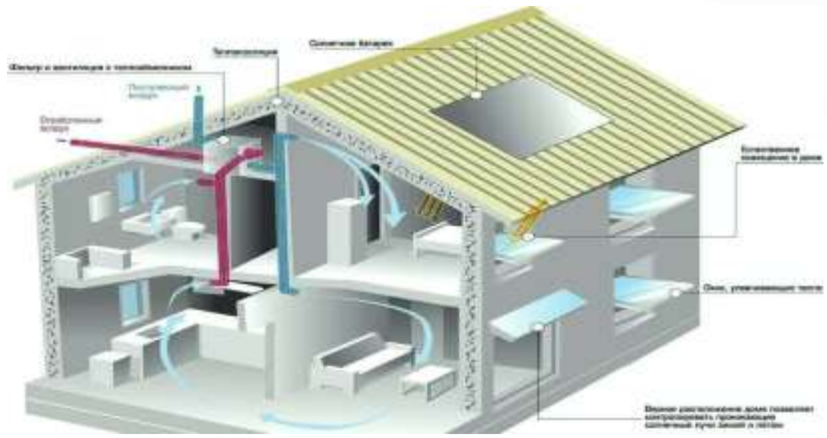

Picture 1. Passive house construction

Highlighting the design features of an energy-saving house, it can be noted that one of the foundations of the technology is maximum thermal insulation and tightness**.** The tightness prevents uncontrolled air exchange, which prevents waste of heat energy. This approach to structural elements can reduce heat loss by 20 times compared to a conventional house. This is confirmed by thermal imaging studies, which show a homogeneous distribution of thermal fields and ubiquitous heating of structural elements. Thermal liners are used to minimize the influence of cold bridges in the nodal joints. Their installation must be carried out with careful control of the tightness. Lack of tightness in cold areas with thermal liners can lead to heavy condensation and subsequent damage to building structures. To preserve heat inside the building by means of insulation, two layers of thermal insulation are designed - external and internal. This technique allows you to simultaneously not release heat from the house and not let the cold air flow into the room. Also, external thermal insulation qualitatively eliminates cold bridges in the building envelope. Windows in a passive house most often consist of double-glazed windows with two or three chambers, filled with gases with low thermal conductivity (argon, krypton). When talking about insolation, it is important to consider that the vast majority of windows must face south for a better flow of light and energy. This rule presupposes the use of an energy efficient architectural and planning solution, which includes: the correct orientation to the cardinal points and the wind rose; the choice of an energy-efficient form of the structure; energetically correct location of buffer zones. Roof insulation is made of effective insulation with a thickness of more 300 mm. Passive energy saving technology - we have already highlighted that a heat-insulated structure is one of the passive house technologies. To achieve the full effect, it must be supplemented with a number of engineering solutions for heat accumulation, the use of solar and heat energy, supply and exhaust ventilation with intake air purification and heat recovery.

Mandatory elements of the technological support of a passive house are:

- Supply and exhaust mechanical ventilation with heat recovery and underground duct system.
- House heating system.

Recuperation ventilation is ventilation that uses a heat exchanger to heat the incoming air using the thermal energy of the outgoing air or soil. Compared to convection heating, an integrated heating,

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ventilation and air conditioning system is resource-saving. However, this system is not always applicable. In regions with very high or very low temperatures, or where temperature fluctuations often occur, traditional heating and cooling remains relevant.

Picture 2. Passive house technology

It is possible to increase the energy security of a passive house by supplementing engineering equipment with traditional stoves, a heat pump, a solar collector for heating water, solar panels, and a wind farm.

The uniqueness of such a passive system lies in the fact that when designing and building, there is no need to focus on the availability of gas networks and heating plants. A passive house only needs water (centralized or a well) and electricity. Moreover, a line with a capacity of 10 kW will be enough for cooking, heating, air conditioning, ventilation, hot and cold water supply. It is important to note that in emergency situations (power outages), the passive house cools down by 1 ° C per day at an outside air temperature of -15 ° C. This is achieved by accumulating heat by means of reinforced insulation of walls and ceilings.

Thermal insulation of a house - the technology of passive housing construction with thermal insulation makes it possible to combine various materials in combination with a ventilation system and architectural techniques (calculation of roof slopes, positioning on the site).

Given the multiplicity of implementation due to a wide selection of modern materials, it is still worthwhile to clearly understand that there are differences between passive technology and traditional buildings. And they are expressed, as noted earlier, by a higher tightness and powerful thermal insulation of the passive house.

The walls of energy efficient buildings, as an example, can be made of cellular blocks, 400 mm thick, insulated from the outside with mineral wool or expanded polystyrene plates with a thickness of more than 200 mm. It should be noted that the controversial issue of "breathing walls" for the technology under consideration can be safely omitted. Any excess moisture must be removed by means of a balanced ventilation system.

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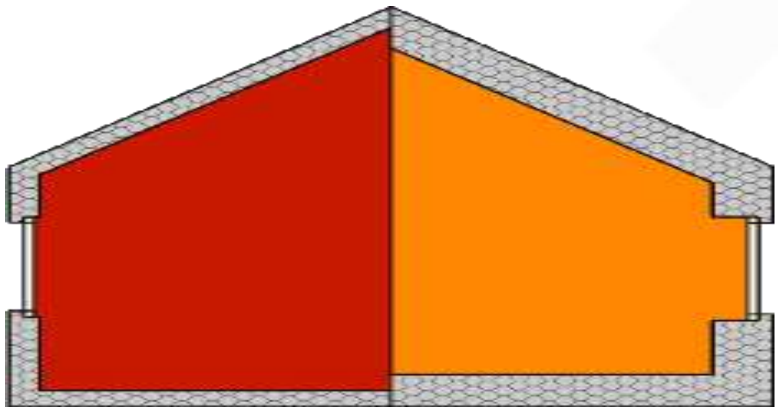
For clarity, let's compare the heat transfer coefficients of an ordinary and a passive house:



Picture 3. Comparison of the heat transfer coefficients of a conventional and a passive house.

Ordinary house	**Passive house**
Roof: U = 0.15 - 0.25; R = 3.8 - 4.2	Roof: U ≤ 0.15; R ≥ 6.7
Windows: U = 1.6; R = 0.63	Windows: U ≤ 0.8; R ≥ 1.25
Walls: U = 0.2 - 0.3; R = 3.5 - 5.0	Walls: U ≤ 0.15; R ≥ 6.67
Foundation: U = 0.3 - 0.35; R = 2.86 - 3.3	Foundation: U ≤ 0.15; R ≥ 6.67

The heat transfer coefficient U (W / (m × K)) shows how much heat energy (Wc) passes through one square meter of the surface of a homogeneous enclosing structure in 1 second at a given difference of external and internal temperatures of 1 K. The heat transfer coefficient indicates how well structural element (roof, wall, floor) conducts heat. The lower this indicator, the worse the heat is transmitted and the better the thermal insulation. Heat transfer resistance R ((m^2 × K) / W) is the inverse of the heat transfer coefficient U and describes how well a particular material resists heat transfer. The higher the resistance to heat transfer, the better the thermal insulation.

The high level of thermal insulation not only reduces the energy requirements of the passive house, but also helps to maintain an increased temperature of the interior surfaces in the room in winter, and a lower temperature in summer. In a passive house, thermal comfort is increased and a pleasant, uniform indoor climate is established.

The right architecture is considered to be the basis for the construction of energy efficient buildings. Therefore, the designs of passive houses are compact and rational space planning. After all, heat is used to heat the premises, which is generated by people and household appliances, as well as the energy of the sun.

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