# STUDY OF USE OF AUTONOMOUS ENERGY SUPPLY SYSTEM IN A MOBILE HOME

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***Abstract:*** *In this article, the effectiveness of integrated solar and biogas energy devices with an autonomous energy supply system for a mobile home is studied. In addition, calculations were made on the storage and use of heat in a mobile home. For the thermal regime of this mobile home, the formula for calculating infiltration, that is, heat loss from the building walls and its cracks, is also presented.*

***Key words:*** *mobile home, heat, heat loss, infiltration, solar energy, heating system, biogas energy.*

**Introduction.** One of the areas considered technologically ready for the practical use of solar energy in countries around the world is the conversion of solar energy into heat and electricity and its use to partially cover the energy needs of the population.

In the conditions of Uzbekistan, it is especially appropriate to use solar energy for heating, because our republic is very rich in solar resources. In particular, Kashkadarya region, which is located in the southern part of the Republic of Uzbekistan, has solar energy resources with a very large capacity in the climatic conditions. Because in the southern regions, the duration of sunny days during the year is 300-3200 hours, and in July, up to 1 kW of solar energy falls on 1 $m^2$ of the earth's surface. Observations show that on average there are 3-5 hours of sunshine in winter days, and 13 hours a day in summer. -14 hours corresponds to sunny time. In the Kashkadarya region, the total average solar radiation is 0.5...0.96 kW/$m^2$, and 6...10 kW$^x$ hour/$m^2$ of energy falls on the earth's surface in a day. This heat is equivalent to 21,600 kJ...36,080 kJ, which makes it possible to save up to 1.26 kg of conventional fuel from each $m^2$ of land area, which is effectively used from this heat. The purpose of heating buildings is to maintain the temperature of the air inside at a given level. For this, it is necessary to maintain a balance between the heat lost by the building and the heat supplied to it. The heat balance of the building can be expressed by the following equation:

$$Q = Q_{I.U} + Q_{IN} = Q_{IS} + Q_{IM} \, ; \qquad (1)$$

where: $Q_{i.u.}$-heat lost as a result of heat transfer through the external walls of the building; J

$Q_{IN.}$– heat lost as a result of cold air entering through cracks in external walls; *J*

$Q_{IS}$ – heat supplied to the building through the heating system; *J*

$Q_{I.M}$– heat released from internal sources of the building. *J*

Heat loss of buildings occurs in two ways: *J*

a) with heat transfer through the outer walls – $Q_{I.U}$; *J*

b) by infiltration – $Q_{IN}$. *J*

$$Q = Q_{IU} + Q_{IN} \qquad (2)$$

$$Q = Q_{IU} + (1 + \mu) \qquad (3)$$

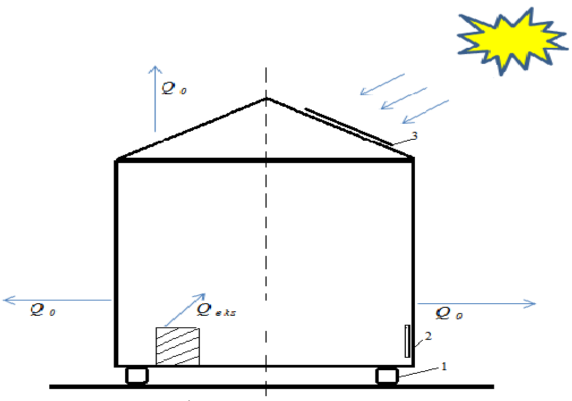


**Figure 2. Physical model of a mobile home based on completely alternative energy sources.**

*1-mobile home wheels; 2-heating batteries; 3-solar collectors.*

where $Q_0$ is the heat lost through the walls of the house, kW;

this heat consists of the sum of the heat lost from the walls, floor, windows, and ceiling of the house.

$Q_r$ – heat entering the house due to solar radiation, *kVt*;

$Q_{eks}$ – operational heat, for example, heat emitted from people living in the house and equipment and devices, *kVt*.

in which: $\mu=Q_{IN}/Q_{IU}$– the infiltration coefficient expresses the ratio of heat lost by infiltration to heat lost as a result of heat transfer through external walls.

Heat lost due to heat transfer can be calculated based on the following equation: $Q_{IU} = \sum FK \cdot \Delta t, kJoul / hour;$ (4)

where: F is the surface of the outer walls of the building, $m^2$;

K- heat transfer coefficient of external walls,

[kJoul / $m^{2\cdot}$ hour·grad. *or* Wt / $m^2$ · grad];

Δt - internal and external temperature difference, [grad].

$K_d$, $K_{der}$, $K_{ship}$, $K_{pol}$ - heat transfer coefficients of building walls, windows, upper floor ceiling and lower floor floor, [(kJoul / $m^{2\cdot}$ hour · grad.) or (Vt / $m^{2\cdot}$ grad)];

φ - the percentage of the surface of all windows taken in relation to the total surface of the external walls of the building.

$\varphi_1$ and $\varphi_2$ – correction coefficients for the temperature difference on the upper and lower horizontal surfaces of the building.

Always $\varphi_1$<1 and $\varphi_2$, because the temperature of the air under the floor of the building and above its ceiling is higher than the calculated temperature of the outside air. In many cases $\varphi_1$=0,75-0,9; $\varphi_2$=0,5-0,7.

**Conclusions.** According to the results of the research, the following conclusions were reached: based on the existing resources of renewable energy sources (solar and biomass energy) in southern climatic conditions, schemes of the combined energy (heat and electricity) supply system of rural houses working on the basis of renewable energy sources were developed and recommended. This energy-saving system works on 100% solar energy throughout the year in the hot water supply of houses located far from the central energy supply and provides 400 liters of hot water with a temperature of not less than 50 $^0$C per day. Also, in centralized energy supply districts, the use of local autonomous energy sources allows to create a competitive environment of the energy market.

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