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Research Article

ANALYSIS OF THE PROSPECTS FOR THE USE OF ENERGY-EFFICIENT ACTIVE SOLAR DEVICES IN UZBEKISTAN

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ABSTRACT

Industrial and agricultural technological processes, heating and hot water supply, as well as the production of low and medium temperature heat for air conditioning, are one of the main areas of use of solar energy. 25% of the energy in the fuel and energy balance of the republic is consumed in heating and hot water supply. Also, in the radiation-climatic conditions of the republic, the use of solar energy for heating and hot water supply is the most technically and economically efficient. In the southern regions with the most favourable climatic conditions, 50 ... 70% of the total amount of heat consumed in the field of housing and communal services is used for hot water supply. But the requirements for hot water supply are much lower than for heating supply. As such factors show,

KEYWORDS

Radiation climate, solar energy, favourable climatic conditions.

INTRODUCTION

Science, technology and social development are accompanied by an increase in energy consumption and the use of its efficient forms. Currently, as a result of energy development and increasing consumption of

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natural energy resources, the reduction and use of fossil fuels process a problem of negative impact on the environment. The burning of large amounts of fossil fuels is polluting the world's oceans, deforestation, the harmful effects of hydroelectric power stations, the impact of thermal power plants on water and air basins, and changes in the planet's heat balance [1-4].

One of the most pressing issues today is to strengthen the modernization of the energy system, implement measures to reduce energy consumption and introduce an efficient energy-saving system and reduce the number of fuel resources in the production of thermal energy to world standards.

So, saving, rational and efficient use of energy resources is a requirement of the time. Therefore, it is necessary to develop thermal energy, to use alternative energy sources that are cheap, environmentally friendly and highly efficient in energy supply. In particular, it is advisable to regulate the use of non-traditional and renewable energy sources in this area [5-9].

MATERIALS AND METHODS

Solar collectors (air - or water heaters), heat carrier circulation elements (air ducts, fans, pipelines, pumps, heat exchangers) and heat accumulators are the main components of active solar heating systems.

Active systems can be classified according to the following characteristics:

- On the function of hot water supply, heating and combined systems;
- On a seasonal, annual basis;
- For individual, group, and centralized consumers;
- 1, 2 and multi-contour, by number of contours;
- Depending on the availability and type of heat source that can be substituted.

50 ... 70% of the total amount of heat required in the heat supply is spent on hot water supply. There are no stricter requirements for hot water supply than for heating supply. Therefore, it is preferable to use a hot water supply for solar heating.

Solar hot water supply systems can be natural (thermosyphon) or forced circulation 1, 2 and multi-contour. The main elements of such systems are solar collector-water heater and tank-accumulator.

The tank-accumulator is installed higher than the solar collector, and due to the density gradient, water circulates under the influence of natural convection. The disadvantage of two-contour natural-convection systems is that their efficiency is low due to the small water circulation rate. Forced circulation is used to increase efficiency.

In active solar heating systems, the heat in the solar collector is first transferred to the heat accumulator and then to the room, during which time it is required to adjust the absorption, accumulation and distribution of solar heat.

Two-circuit systems with a tank-accumulator of water heating systems are the most common. In such systems, independent adjustment of some parts of the system is ensured and the accumulator is not allowed to overheat due to the additional heat source using the bypass line.

Coordinated active systems provide both heating and hot water supply. Additional heat exchangers are used to heating the consumed water [8-11].

It is necessary to provide the operating mode of the device of active solar heat supply systems with automatic control systems. When water is used as a heat carrier, it has specific disadvantages such as the possibility of freezing the water in the solar collector when the outside air temperature is negative and corrosion of the system elements. Therefore, antifreeze solutions are used as the primary heat carrier [10-12]. The heat load for the heat supply is determined by the following sum

$$Q_{hl} = Q_h + Q_{hg} \quad (1)$$

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Heat load for heating

$$Q_{u} = K_{б} V_{б} \left(t_{u} - t_{x}\right) n \qquad (2)$$

Heat load for hot water supply

$$Q_{uc} = G\, mC_{p} \left(t_{uc} - t_{cc}\right) N_{n} \qquad (3)$$

The amount of heat produced from the solar collector in period n

$$Q_{ku} = \eta_{t} F_{k} [q_{ю} - K_{K} (t_{cc} - t_{x})] n \qquad (4)$$

The efficiency of a solar collector is determined by the following relationship

$$\eta = Q_{ku} / Q_{k}; \qquad (5)$$

Heat load $Q_{uю}$ solar energy Q_{ku} *and* additional energy source Q_{m} are covered by

$$Q_{uю} = Q_{ku} + Q_{m} \qquad (6)$$

The share of solar energy or the coverage coefficient to cover the heat load is determined by the following expression

$$f = Q_{ku} / Q_{uю} \qquad (7)$$

If the incident $q_{ю}$ solar radiation [q] exceeds the limit amount, in such conditions the solar collector provides useful energy, ie:

$$q_{ю} \geq [q] = \frac{K_{K}}{K_{k\eta_{0}}} (t_{cc} - t_{x}) \qquad (8)$$

(8) shows that the heat transfer coefficient K_{K} the smaller the light absorption capacity k and the optical f.i.k. η_{0} so large and the amount of the limit $[q]$ will also be so small. This is done by thermal insulation, darkening the surface of the heat sink, corrugation, corrugation, double glazing, selective coating and the use of vacuum collectors.

CONCLUSION

As a result of studying and analyzing the literature on radiation and temperature regimes, as well as solar collectors, the following conclusions were drawn:

1. In areas where solar radiation and temperature regimes are favourable, the use of solar energy has the most effective opportunities for heating and hot water supply of housing and communal services, individual and autonomous houses.
2. In Uzbekistan, 30 ... 60% of the heat load required for heating with passive solar systems can be provided by solar energy.
3. With the help of active solar systems it is possible to save 35 ... 55% of the fuel used for heating and 45 ... 70% of the fuel used for hot water supply.

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