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USE OF SOLAR ENERGY IN HEATING AND HOT WATER SUPPLY SYSTEMS

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Annotation:
This article discusses the possibilities of using solar energy in heating systems. The advantages and disadvantages of solar heating systems are outlined. The types of solar collectors are analyzed and recommendations for their use are presented.

Key words: solar energy, flat solar collector, vacuum solar collectors, solar radiation, bak-akkumulyator, heating boiler.

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ИСПОЛЬЗОВАНИЕ СОЛНЕЧНОЙ ЭНЕРГИИ В СИСТЕМАХ ОТОПЛЕНИЯ И ГОРЯЧЕГО ВОДОСНАБЖЕНИЯ

Аннотация:
В данной статье рассматриваются возможности использования солнечной энергии в системах отопления. Изложены преимущества и недостатки солнечных систем отопления. Анализируются типы солнечных коллекторов и изложены рекомендации по их использованию.

Ключевые слова: солнечная энергия, плоский солнечный коллектор, вакуумные солнечные коллекторы, солнечный излучения, отопительный котел.

Uzbekistan has an average of 300 sunny days a year, so the use of solar thermal energy has a great future. In some regions of our country, there are interruptions in the supply of gas and electricity, which makes it difficult to use them as a heat source.

The sun rises every day, so the "use" of solar energy today is a very promising direction. Of course, the cost of such heating is several times higher than the cost of gas or electric boilers, but it will pay off in a few years.

Solar energy can be used in two ways:

• convert solar energy into electricity and then use it to power a boiler or heater.
• use solar heat to heat water, and then use it to operate a water heater.

In the first case, more than 70% of solar energy is lost during the conversion process. In the second case, the losses are less than 30%, so this method is often used for heating and hot water supply.

What is a collector?

A solar collector is a component that heats a heat carrier due to a sunbeam. Collectors can be flat or tubular. The flat collector is capable of absorbing 80 percent of solar energy. The upper layer of the collector is made of glass. Tubular manifolds are efficient and multifunctional, but also requires more attention when using.

Advantages of solar heating systems

Every day the growing popularity of solar heating systems is explained by the following cases

• Low heating costs;
• Separation from urban communications;
• Does not depend on the increase in gas and electricity tariffs;
• Environmentally friendly for the environment and absolute safety for humans;
• Possibility of using collectors for heating and hot water supply;
• Plenty of sunny days in Uzbekistan.

Disadvantages of the system:

However, this heating system is not without drawbacks. The main ones are the following:

• The need to use an auxiliary water heater (electric, gas or diesel) to heat water on cloudy days.

• It requires a lot of money to install equipment and systems (however, it pays off in 1-3 years due to fuel economy).

As you can see, there are more pluses than minuses, which means that innovative batteries deserve attention.

Subtleties of installation and operation

If you decide to install such a system, consider the following:

• the flat surface of the collector should be oriented to the south (may have a slight slope to the southeast or southwest);

• do not leave batteries in the shade of buildings or trees;

• it is possible to increase the efficiency of solar energy absorption in winter by increasing the bending angle of the collector;

Before installing batteries, it is necessary to pay special attention to the overall thermal insulation of the house.

Depending on the average climatic conditions and the width of the terrain throughout the year, the drop of solar radiation on the earth's surface ranges from 100 to 250 W / м², and the maximum on cloudless days is almost anywhere (regardless of latitude). Approximately 1000 W/ м².

Various indicators are used to estimate the amount of solar energy entering the unit's surface units. The value of the average annual, average monthly and daily amount of energy, measured in kWh / м², is usually used. In addition, the "number of peak hours" of falling solar energy is often used - this is a reduced value, usually obtained by dividing the energy consumption over a period by 1000 W/ м². This parameter is convenient to use, since usually all parameters of solar panels and solar collectors are illuminated based on the values of peak hours of solar energy drop.

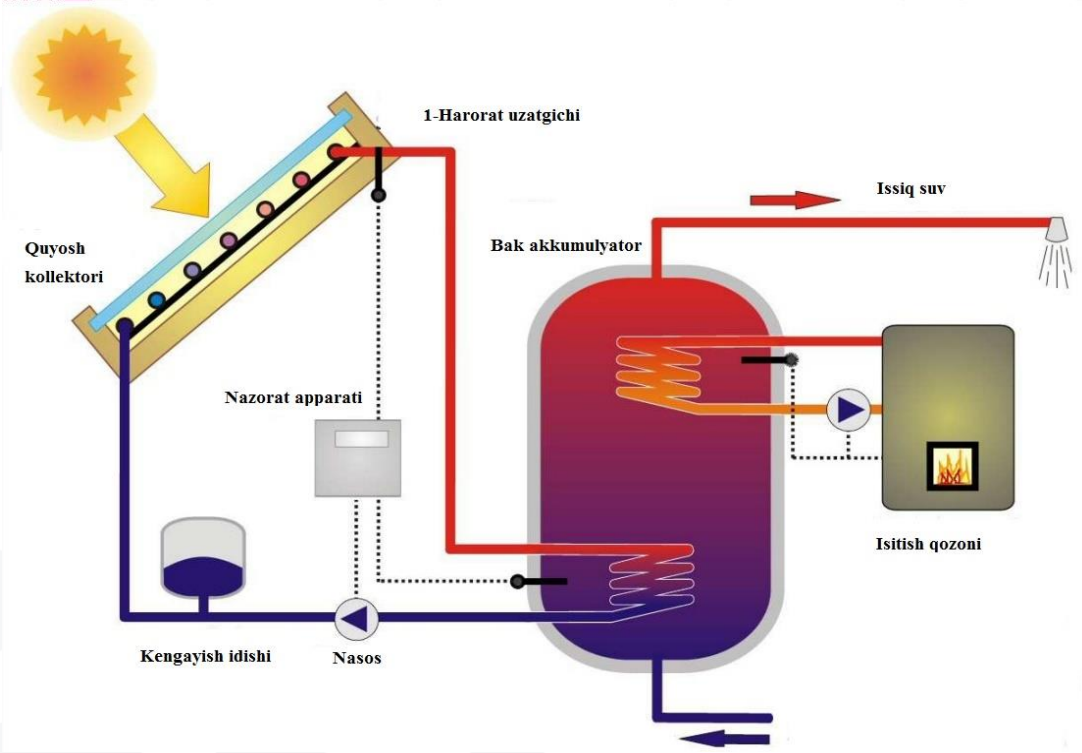
The practical task facing manufacturers and creators of various types of solar devices is to "collect" the energy flow in the most efficient way and convert it into the desired type of energy (heat, electricity) at the lowest cost. The simplest and cheapest way to use solar energy is to heat water for household needs in flat solar collectors.

Using solar energy, it is possible to save conventional fuel annually by using solar systems:

- in year-round hot water supply systems - up to 75%;
- in seasonal hot water systems - up to 95%;
- in heating systems - up to 50%;
- in heating systems operating in standby mode - up to 80 %.

Each system is unique, therefore, when using the solar system, it is necessary to calculate the percentage of energy savings for each system. Sophisticated software products are used to accurately calculate solar systems.

Various types of solar collectors are important for obtaining thermal energy, which is mainly used for the production of hot water in the summer, when there is solar activity and maximum consumption of hot water. It is also possible to use boilers combined with solar collectors, in some cases in different heating systems. For example, when the boiler is running during the transition period of the year. This approach allows you to significantly increase the overall boiler.



Recently, systems with vacuum solar collectors have been increasingly used. On sunny summer days, the difference in the operation of flat and vacuum solar collectors is almost imperceptible. However, the advantages of vacuum collectors are obvious at low ambient temperatures. In addition, even in summer, there is a temperature difference between the collectors for maximum water heating.

If the maximum temperature for flat collectors does not exceed 80-90 degrees, then the temperature of the coolant in vacuum collectors may exceed 100 ° C. On the one hand, this requires constant heat removal from vacuum collectors. It also requires the

use of other technical solutions to prevent overheating of the water in the tank as well as to ensure that the water in the tank does not boil.

On the other hand, in systems with a flat collector there is a problem of reproduction of bacteria and other microorganisms (where it is hot and humid), in systems with vacuum collectors there is no such problem (they periodically have "pasteurization and sterilization" due to high temperature). The average temperature in a system with a flat collector is usually 40-50 degrees, and in a system with a vacuum collector 60-80 degrees (the values are given for the summer season with normal water flow).

We offer flat and vacuum solar collectors and systems based on them. As a rule, flat collector systems are used seasonally from spring to autumn. In winter, the performance of systems with flat solar collectors is reduced due to heat loss to the environment. Vacuum solar collectors are commonly used in solar water heaters that are used continuously throughout the year. In the southern regions, insulated flat collectors can be used. Flat solar collectors can operate with 90% efficiency.

Flat solar collectors are more efficient when used to heat a large amount of water at a lower temperature than to heat a small amount of water to a high temperature and then mix it with cold water [2].

In any case, great attention should be paid to the thermal insulation of the collector and the pipes coming out of it.

The solar water heating plant consists of a solar collector and a heat exchanger-accumulator. The circulation of the coolant (special antifreeze) occurs through the solar collector. In a solar collector, the heat carrier is heated by solar thermal energy and then transfers thermal energy to water through a heat exchanger.

Hot water is stored in a storage tank before use, so it must have good thermal insulation.

Natural or forced circulation of the coolant can be used in the primary circuit where the solar collector is located. The battery tank can be equipped with a backup electric heater. If the temperature in the battery tank falls below the set level (prolonged cloudy weather or a decrease in the number of sunny days in winter), the backup electric heater will automatically turn on and heat the water to the set temperature.

Most often solar heaters are used in combination with other heat sources – gas, liquid fuel and other types of heat sources.

In seasonal solar collectors, water can be heated directly in the battery tank.

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