The energy from the sun

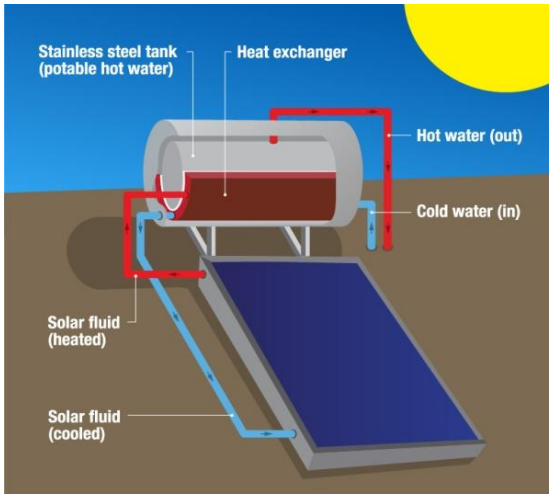
Solar thermal can be used in a wide variety of applications, including domestic water heating, space heating, swimming pool heating, district heating, process heat generation for industry, etc.

In the domestic sector, water heating is the main application for this technology, but it can be used also as a support for space heating. Also developments are being made to use solar energy for space cooling.

INTRODUCTION

Solar systems all have the same components: solar panel and a hot water storage. The circulation of the fluid between the water store and the panel can be made in two ways:

Thermosiphon (or natural flow) systems: these systems use gravity to circulate the heat transfer fluid (usually water treated with glycol, an anti-freezing fluid) between the collector and the water tank. The fluid is heated in the collector, rises to the top of the hot water tank and cools down, then flows back to the bottom of the collector. The domestic hot water in the hot water store can be heated directly by the hot water from the collector or then heated by means of a heat exchanger. From the hot water store it is then available for domestic use.



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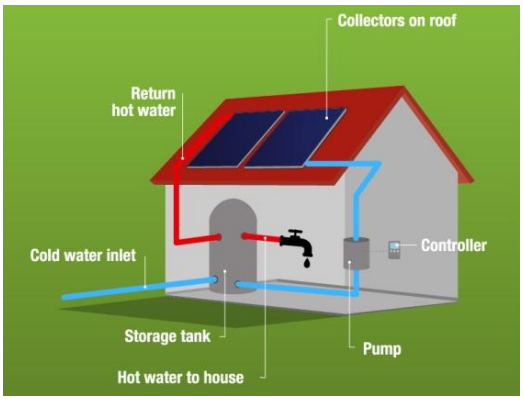
The main benefit of this system is that it works without a pump and controller, making it simple, robust and very cost effective. In most thermosiphon systems, the hot water store is attached to the collector and both are situated on the roof, so no space is needed inside the house. This system is most common in the frost-free climates of Southern Europe.

Forced circulation systems: In this case the tank can be installed anywhere as the heat transfer fluid is circulated by a pump. Therefore, integration with other heating systems is easier. The aesthetic benefit of these systems is that only the solar thermal collectors are placed on the roof, as the hot water store is located inside the house, with benefits also in terms of heat losses avoidance. A forced circulation system will need sensors, a controller and a pump.



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Three types of solar collectors are used for residential applications:

- **Flat-plate collector**: these are the more commonly used, mainly for water heating at temperatures below 60ºC.
- **Evacuated-tube solar collectors**: these round shaped glass tubes, using vacuum as an insulator, are used for situations which need temperatures above 60ºC.

- **Compound Parabolic Concentrator (CPC) solar collector**: these panels combine the characteristics of the flat-plate collectors with the ability to produce water at 70ºC or more.

CONSIDERATIONS IN INSTALLING A SOLAR THERMAL SYSTEM

When the house is already built, there is some work required to install the solar system, since it is needed to have cold and hot water pipes from the roof into the house, in order to connect to the domestic hot water installation or to the hot water store. The size of these systems depends also on the hot water demand of the house, though it is common to have a collector area between 2 and 4 m^2 and a hot water store between 150 and 300 liters.

Solar thermal systems works at a very high performance when used for swimming pool heating because this application demands energy at a very low range of temperatures. They are extensively used in Mediterranean climate. Solar thermal systems are also used for space heating. As the demand for space heating is much higher, these installations are bigger, in general 3-5 times larger. Also, while solar hot water systems can cover around 80% of the hot water demand, in the case of systems used both for hot water and space heating this value is only around 40%.

BENEFITS AND CONSIDERATIONS

Domestic hot water is one of the main consumption of energy at home. Using a technology that doesn't need fuel for at least half of the year (and commonly even during nine months), is a way to reduce buildings energy dependence on fuel, reducing CO_2 emissions and providing economic savings.

Still, it needs to be taken into account that a backup system is always required. This technology can't produce hot water 100% of the time, namely when consecutive cloudy days occur. The back-up system can vary. For thermosiphon systems it can be an electrical heating element in the tank, but it is not allowed in some European countries. This is a simple, common and cheap solution, provided there is an adequate control to prevent consumption of electricity when not needed. The solar thermal systems can also complement the already existing system (e.g. hot water gas heater).

COSTS USING THE TECHNOLOGY

The costs in the installation of an equipment depends a lot on the characteristics of the house where the installation will be made. Therefore, this cost is not addressed here. Considering the use, a solar thermal installation will need a small amount of a complementary source of energy, only when there are several days without sun, so the costs related to energy consumption are very low. The operational costs are also stable and low, meaning that the initial cost is paid back relatively quickly.

ENERGY LABELS

Since 26 September 2015, all new heat pumps with a thermal capacity of less than 400kW must comply with European 'Ecodesign' regulations, which establish minimum requirements for the efficiency of various commonly used products. All units with a capacity of less than 70kW must carry an energy label. The label provides information on the efficiency of the product, noise emissions, and its capacity in different climate zones. Installers that combine different products in one installation must provide a 'package label'.

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