



SOLAR THERMAL

The Sun and Solar Energy

Annually the UK receives solar radiation equivalent to the typical output of 1,000 power stations. Apart from tidal power and geothermal energy (not to be confused with ground source heat pumps) all renewable energy is derived from solar energy; even the wind and biomass are created as a result of the Sun. Solar energy may be used more directly to provide domestic hot water.

Why Solar Thermal Hot Water System

The average annual domestic hot water demand requires around 3,000 - 4,000 KWh per household; annually over 1000KWh of energy is received for each square metre of the British Isles; that is 60% of the solar radiation found at the equator, and one third of the hot water energy demand of a household. The amount of solar energy reaching the roof of the average UK house would easily provide heating and hot water needs, though the energy available in summer is greater than in winter.

Types of Solar Thermal Hot Water Systems

The panels themselves are filled with an antifreeze mixture (heat transfer fluid) which is circulated around the system. This takes the heat absorbed by the collectors and offloads it into the hot water cylinder via a heat exchanger in the same way as a conventional boiler. No mixing between the water in the cylinder and the antifreeze mixture occurs. Usually a twin coil hot water cylinder (solar cylinder) is installed or possible a second coil in your existing cylinder sited below that of the conventional heating system in the hot water tank. This designates the solar thermal system as the primary water heating source, preventing the conventional boiler from firing unnecessarily.

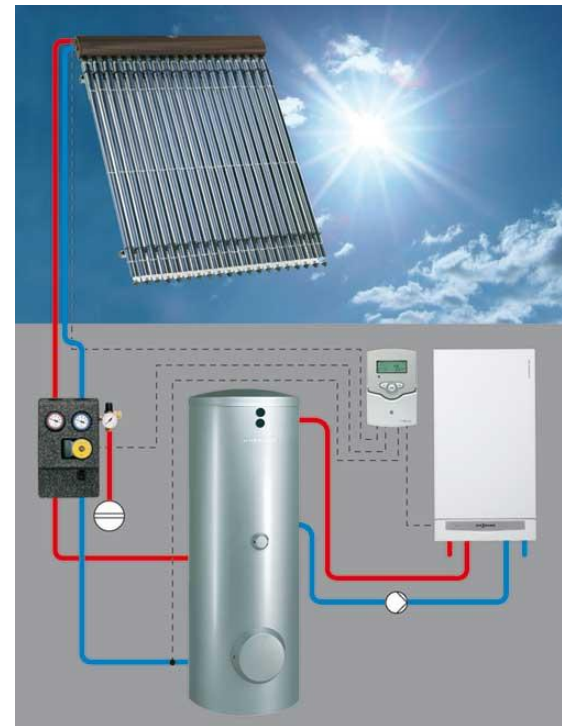
Flat panels are the simpler of the two collector technologies, and consequently are of lower cost and efficiency. Essentially they consist of a rectangular flat sheet of metal coated with a special absorbent paint. In contact with the back of the metal sheet are a series of pipes through which the antifreeze mixture flows, removing heat from the panel and transporting it to the hot water cylinder. This is encased in an insulated unit and glazed to the front. The flat panels look very similar to Velux windows when installed on the roof.

Evacuated tube collectors are more advanced, containing discreet, parallel rows of evacuated tubes containing a heat pipe, with either a 'dry' or 'wet' connection. Heat trapped within the tubes is prevented from escaping by a partial vacuum and so are more efficient, particularly in colder weather. The heat is transferred from the collector to a manifold, through which the heat transfer fluid flows; taking the heat energy generated to the hot water cylinder. Once the heat has been delivered to the hot water cylinder, the cooled heat transfer fluid then circulates back to the collector so that it can reheat and begin the process all over again.

What components comprise SHW Systems?

All solar thermal water heating systems contain some basic common components.

1. The solar collector (evacuated tubes or flat panels)
2. Heat transfer medium (antifreeze mixture or water), and circulatory system (pumps and pipes)
3. Hot water cylinder with or without secondary heat exchanger
4. Control units and safety features



How much energy can I expect a SHW system produce?

This depends mainly on the energy availability to the system (collector area, orientation and local conditions) and the amount of water needed to be heated (demand). If there is only a small hot water cylinder then the SHW system can only be sized to heat that quantity of water. If there is a large hot water cylinder then the SHW system has the potential to provide a lot of energy into the hot water cylinder, especially in summer. Shading of SHW systems is less critical than with PV. A properly designed and installed system should be capable of providing between 50% - 70% of the annual hot water demand of the household; up to 100% in the summer months, and down to 5% - 10% in the winter months.

What are the benefits of SHW?

Many tens of thousands of solar domestic water heating systems are estimated to be used currently in the UK. Typically 50-70% of annual household hot water needs can be produced by solar thermal, and provide at least 20 years' useful service. Other benefits include:

- Quick and easy installation, with little disruption to the household
- Free hot water generation
- Compact area requirement: 3-4 m² suitable for up to an average four-bedroom house (two flat plates or around 20 evacuated tubes)
- Long component lifetime
- Low maintenance
- Variety of installation methods including roof integrated



Ted's domestic evacuated tube installation

Suitability

Ideally, for best performance any SHW system should face between southeast and southwest, and have an angle of tilt of 30-45 degrees to the horizontal for the UK; arrays should not be angled towards the north. Shading should also be kept to a minimum.

Maintenance

Maintenance of SHW systems is low, consisting of an annual check by the householder and a more detailed inspection and replacement of anti freeze by an engineer every 3-5 years.

Costs

A significant proportion of the **installation cost** of a solar thermal hot water system is the collectors themselves, with the simpler flat plate design being less expensive. The price of a typical solar thermal system (2-3 panels) installed and commissioned therefore, should be approximately:

- Flat plate system: £3,000 - £5,000
- Evacuated tubes: £4,000 - £6,500

The **running cost** is limited only to any ongoing maintenance and the small electric pump circulating the solar transfer fluid.



The 15kW system at Ceridwen in Drefach Felindre



The System at Penybanc B&B Drefach Felindre heating 2 water tanks in adjoining houses - a total of 5 bathrooms

