enviko
renewable energy solutions

Solar Thermal Information Booklet

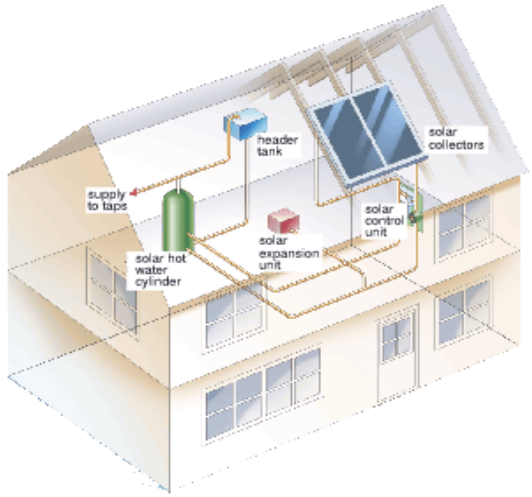
Zero Carbon Living

Introduction

Solar thermal heating systems use the energy from the Sun to raise the temperature of a body of water in your hot water cylinder or storage tank in order to offset the amount of work required from the existing AGA, gas fired or combi boiler.

Our systems use a heat collector, mounted on the roof in a southerly-direction in which a heat-transfer fluid is heated by the sun. This fluid is used to raise the temperature of the water that is stored in either a separate hot water cylinder or a twin coil hot water cylinder inside the building. During the summer our systems can raise the temperature of this water to boiling point and as such have temperature limiting features in place to ensure this does not occur.

During the winter the systems naturally perform to a lesser degree due to the decreased solar resource available. Nevertheless, the contribution for solar thermal can still be substantial, ensuring savings on your winter fuel-bills. Remember the energy required to raise a body of water from 1°C to 2 °C is the same as raising that body from 99 °C to 100 °C. Your fuel consumption neither notices nor cares to what purpose or effort that it is being used.

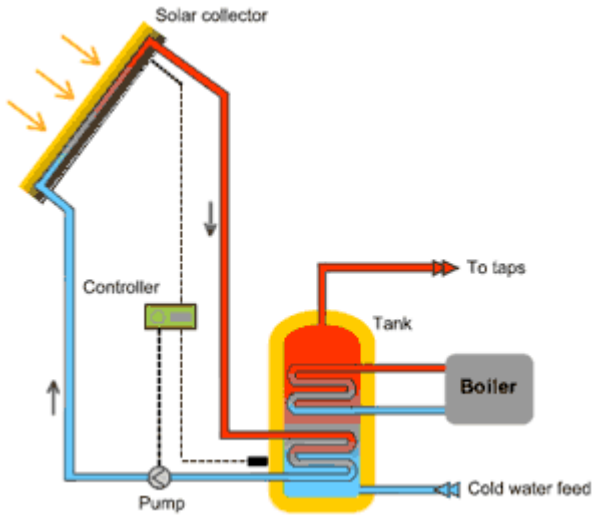


Solar System Design Layout

Our systems have been proven to work successfully in all parts of the UK, this is due to the nature of the resource. Our solar thermal systems require any sort of lighting conditions to function. They will perform better on bright sunny days without a cloud in the sky, but will also perform to near optimum standards in diffuse or overcast conditions. Our well designed systems will typically provide 90% of a family's hot water requirements during the months of April to September and make a very useful contribution during the rest of the year. In a typical year the system will provide up to 70% of a family's annual domestic water heating needs.

How does it Work?

There are two main parts to a solar water heating system: the collector and the thermal store (Fig 1).A solar collector uses the sun's radiant energy to heat water. The collector is normally fixed on the roof of a building, but can be located away from the building. Heated water is pumped via an insulated pipe to the thermal store (hot water tank).



Water from the cold supply provides water for the dedicated solar pre-heat storage, which is heated by the solar collectors. The pre-heated water is then heated to the required draw off temperature by a domestic hot water appliance, such as a boiler or electric immersion heater. A typical arrangement is to combine the solar pre-heat store and the store heated by the domestic hot water appliance in one twin coiled cylinder. Both the coils are arranged so that the water in the cylinder is firstly heated by the solar water heating and if not sufficiently hot enough the conventional boiler is used to heat the water.

We advise that an area of 2-4m2 of south-east- to south-west-facing roof, receiving direct sunlight during the main part of the day, would generate a significant annual yield of energy. Collectors can still be effective on the east and west faces but the annual yield would be lower.

It is important that no trees or other structures – or parts of the same building such as chimneys or dormer windows – would cast shadows on a collector, as this would reduce its energy output.

Collector Types

We offer two types of collectors used for solar water heating applications. Flat plate collectors and evacuated tube collectors:

- Flat plate collectors are cheaper, more rigid and are the predominant type used in domestic systems worldwide. Their efficiency in converting energy in the sun to useful heat in the water is less than that of evacuated tube however. Flat plate collectors are made of a metal collector plate, usually copper, coated in special materials and fitted into an insulated box. Tubes running along the collector carry water, and heat is conducted from the surface of the collector into the water.

- Evacuated-tube collectors are slightly more expensive due to the superior quality in manufacturing (a vacuum must be achieved within the solid glass tubing). This manufacturing process ensures that greater efficiencies than flat-plate panels can be achieved on an annual basis.

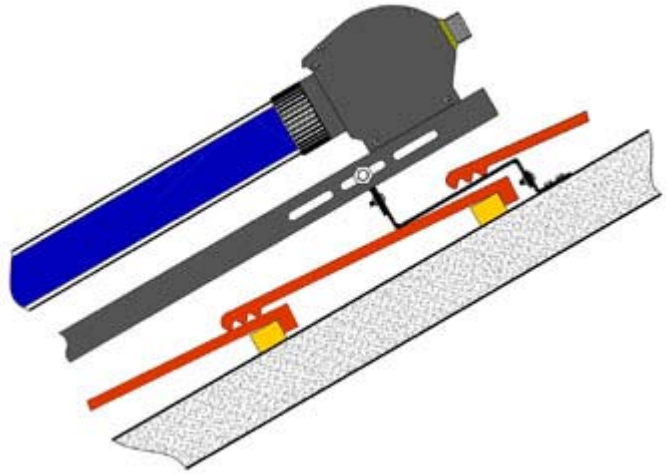
During the summer months both types will contribute similar savings, however the difference in cost will be noticed during the winter period when the superior performance and heat gains from evacuated tubes will be found over that of the flat plate collector.

Flat Plate Collectors

Evacuated Tube Collectors

Collector Mounting

A solar collector may be installed on a building's roof or in a separate location. A collector on a roof may be fixed on top of the roof covering, for example tiles or slates, or replace the roof covering so that it sits flush.



As noted earlier, the optimum angle for mounting a collector is 30° off the horizontal. The closer the mounting angle is to this optimal value, the more efficient the collector will be but slight variations do not have a very significant effect.

Most pitched roofs have angles of 30-50°, the actual angle (pitch) generally determined by site exposure and local climate.

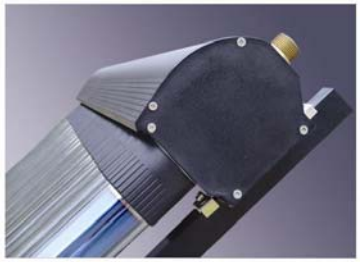
Our evacuate tube collectors are generally mounted on top of the roof as can be seen in the diagram above and as illustrated in the photo opposite.

The other system components are then simply linked from the collectors to the hot water cylinder via the pump station and a control unit via the pipework.

The technology

Our ‘evacuated tube’ solar collectors are highly efficient due to the fact that they work on diffused light. Their shape and selective surface harness indirect solar radiation as well as direct sunlight, maximizing efficiency even on cloudy days.

Each evacuated tube is made up of two strong glass tubes, similar to large test tubes; one tube within the other. The tops of the tubes are fused together and the gap between them ‘evacuated’ creating a vacuum, just like a thermos flask. The outer tube is made of clear glass that allows the sun’s rays to pass through it with minimal reflection. The inner glass tube is coated with a special selective coating that absorbs the sun’s rays whilst preventing any heat losses from radiating. Once the heat has been captured it cannot escape because the vacuum is an excellent insulator. Temperatures inside the tube can reach over 180 degrees Celsius, while the outer tube remains cool to the touch. This is the reason why evacuated tubes work well in all climates and can easily out perform flat plate collectors in cold weather.



Down the centre of the inner evacuated tube a heat pipe is threaded. This narrow copper pipe is partially filled with a fluid that boils at approximately 30 degrees Celsius. As the fluid boils it turns to steam and rises to the bulbous tip of the heat pipe where it dissipates its heat via the manifold. After dissipating its heat the fluid condenses and returns to the bottom of the heat pipe ready to start the process again. The manifold is the rectangular box visible at the top of the collector, which links all the tubes together. Inside the stainless steel casing of the manifold is a copper tube with a series of ports that accept the heat pipes.

These ports use dry joints, with the heat pipe tips requiring no more than a gentle push to locate them. This system means the water in the manifold never mixes with the fluid in the heat pipe and because the water in the manifold never enters the evacuated tube, the whole system can work even when a tube is broken. Broken tubes are easily replaced without the need to drain down any part of the system***.***

All our approved equipment has the industry recognized Solar keymark.

How much does it cost?

Complete System Prices

The typical installation cost for a domestic system is £3,200 - £4,500 however costs are site-specific. All systems come with a 5-10 year warranty and require little maintenance. A yearly check by the householder and a more detailed check by a professional installer every 3-5 years should be sufficient. A 4m2 collection area will provide between 50% and 70% of a typical home's hot water requirements depending on the quantity of hot water required and the timing of that requirement. The percentage can be increased if:

- Hot water is drawn off during the day, allowing more water to be heated up in the afternoon
- Low flow showers and spray taps are fitted so that less hot water is required
- Showers are taken instead of baths. The system is particularly beneficial for dwellings where residents are at home using hot water during the day, for example, young families or the elderly. Savings from solar water heating are difficult to predict and will in practice depend on how much water the occupants use and at what times they use it.

The Energy Efficiency Commitment Scheme bases savings from solar water heating on an average figure of 454kWh/year saving per m2 of flat plate collector or 582kWh/yr per m2 for an evacuated tube system. Assuming a 4m2 system this would provide a saving in energy use of 1,816kWh/year and 2,328kWh/year respectively for the two systems, 34 to 44% of an average modern house's space and water heating demand.

Grants available

The Government is supporting the introduction of Solar Thermal technology into the UK through grants under its Low Carbon Buildings Programme, which has replaced the former Clear Skies grant scheme. In England and Wales an overall maximum of £400 **or** 30% of the relevant eligible costs, whichever is the lower. Funding for householders in Scotland is set at 30% of the eligible costs of each technology up to a maximum of £4,000 per technology.

What happens now?

Survey

A survey for solar thermal takes about an hour and a half. Local mains water pressure as close to the inlet point as possible is measured and flow rates at the different outlet points are checked. The client is then interviewed about their current water consumption patterns, number of people inhabiting the property, their age and gender. The orientation and pitch of the roof are noted as is the access to the roof, and possible routing of pipes and the positioning of cylinders, pumps and controllers.

At this stage a risk assessment is prepared to ensure that it is safe to work on the roof, in the attic and any other part of the building which may be the requirement of the installation.

From this information a system design, components list, scaffolding tower design and any other details can be drawn up for preparing the quotation.

Estimate

In some circumstances an estimate of costs may be submitted prior to a quotation, work rarely proceeds based on an estimate, however aspects of a quote may contain estimates due to a particular aspect of an installation being of an uncertain cost.

Quotation

A quotation accompanied by a copy of the Standard Terms and Conditions of Sale, Trade and Supply of Services will be submitted to the client. Acceptance of the quotation may be in writing by email or letter and confirmed (and a start date agreed) accompanied by the appropriate deposits.

Installation

Once the acceptance of the quotation has been received we then arrange a suitable time with you to install the equipment usually within 3 weeks or less. The equipment should take no longer than 3 days to install and comes with full warranties.

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