HIenergy
HIGHLANDS AND ISLANDS OF SCOTLAND
HARNESSING NATURE'S POWER

Factsheet

Solar Water Heating

Solar water heating systems use the heat from the sun to work alongside a building's conventional water heater.

The technology is the most established of all microgeneration technologies and installations involving their use are commonplace in many of the world's hotter climates.

Although not renowned for our abundant levels of sunshine such systems also have the potential to work well in Scotland. Over the course of a year 30-60% of a home's hot water can be heated by the sun.

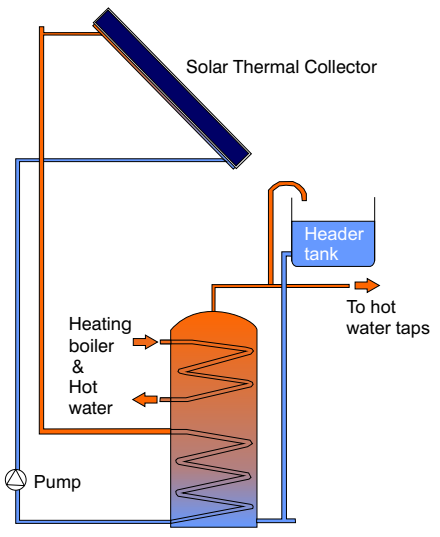
Optimally positioned panels on low occupancy homes will be at the higher end of this scale, while the same panels which are less well positioned, or on homes with 3 or more people may be at the lower end.

How the Technology Works

Solar Thermal Collectors (solar TC) use the energy in the sun's rays to heat a fluid that runs across it. There are two main types of solar TC available; flat plate and evacuated tube.

Both versions of solar TC do the same task of transferring heat to a fluid. In addition to the collector there are two other standard components to a solar water heating system; a hot water cylinder and a plumbing system (simple piping which circulates the fluid around the system).

Once heated by the solar collector the fluid then flows via a heat exchanger to the hot water cylinder. The cylinder stores this heated water and supplies it when required. On days when the sun's energy isn't sufficient to heat the water to the required temperature, the collector may still preheat the water so when it enters the cylinder less energy is required from other sources such as the boiler.



Typical Domestic Solar Thermal System

If you require further information, please contact the renewable energy team at Highlands and Islands Enterprise
Tel: **01463 244350** Email: **renewables@hient.co.uk**

Solar Water Heating
Technologies & Considerations

Collector Types
Flat plate is the most straightforward and conventional form of collector. Panels are made from a sheet of metal which is painted black to maximize absorption of the sun's energy. The sheet is situated inside an insulated box and covered with a transparent material, normally glass. A heat transfer fluid (water or glycol solution) is circulated through the panel via pipes attached to the metal sheet. Heat is then transferred from the panel to the fluid.


Flat Plate

Evacuated tube collectors are made up of a number of glass tubes arranged in parallel. Each tube houses an absorption material which is held inside a vacuum. The heat absorbed by this material is subsequently transferred to a fluid. The use of a vacuum (which prevents heat loss from the absorber surface) means that greater efficiencies are achieved when compared to flat plate collectors. The more complex manufacturing process, however, also means that they are more expensive to purchase.


Evacuated Tube

Costs
For the installation of a solar water heating system costs are likely to range from £2500 - £3500 for flat plate and £3500 - £4500 for the equivalent evacuated tube system.

Costs will vary due to a range of factors such as size of collector, type of roof and existing hot water system.

Space Requirements
The table below shows suggested collector area and cylinder capacity needed for the hot water provision of various sized households. This can only be a rough guide as the actual sizing of a system depends on whether residents are in or out most of the day, prefer a shower to a bath, use a washing machine regularly and so on.

Number of occupants	Collector Area (m2)	Cylinder Capacity (litres)
1 - 2	2.5	160
3 - 4	3.5	195
4 - 5	4.5	245
5 - 6	5.5	295

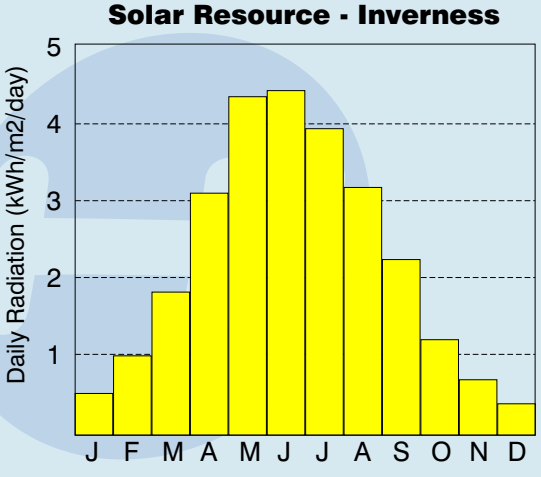
Insulation Levels
It is vital to ensure that the pipework and cylinder of your system are adequately insulated. Insufficient levels of insulation will mean that heat is needlessly lost and result in the reduced performance of your system.

A hot water cylinder jacket will cost around £20. Fitting one to a hot water cylinder is a straightforward DIY job. Fitting insulation to pipes is easy if the pipes are accessible and will cost around £10. Professional help may be required to fit insulation to harder to reach pipework.

Maintenance Requirements
The components of a solar water heating system will require a minimum of maintenance.

To ensure the ongoing satisfactory performance of the system, the collector surface should be kept clean and free from debris such as leaves. Any surrounding trees should also be checked to ensure that over time shading from them does not become a problem. The antifreeze in solar TCs may need replaced after five years and professional checks should be conducted approximately every 3-5 years.

Safety
In all solar water heating installations it is advisable to regularly heat the water stored in your cylinder to 60°C. The thermostat temperature on your conventional water heater should be set to this temperature in order to prevent the build up of harmful bacteria.



Solar Resource in the Highlands and Islands
The power density of solar energy is made up of two components, the radiation in the direct beam from the sun, and diffuse radiation from the sky. Solar collectors are able to harness both components. On a clear day diffuse energy may amount to 15-20% of the global irradiance whereas on a cloudy day it will be 100%. Global irradiance varies throughout the course of the day because the path length of the solar radiation through the atmosphere changes. For the same reason, there are variations with season and latitude. The total solar energy received in a day (known as the insolation or solar irradiation) can vary in the UK from around 0.5kWh/m^2 in the winter to 5kWh/m^2 in the summer. The graph opposite shows the typical solar resource available to Inverness throughout a year. This variability is an important aspect of any solar energy project as it will influence system design and economics.

If you know the Latitude and Longitude of your property you can calculate the solar resource available to it by following the link at the end of the factsheet.

Solar Water Heating
Is My Property Suitable?

Not all properties will be suitable for the installation of a solar water heating system.

As virtually all domestic schemes will have the panels mounted on the roof, the setting and orientation of the dwelling will have an effect on the performance of any installation.

Orientation & Tilt
Panels should be oriented to maximize the level of daily and seasonal solar energy that they receive. The optimum orientation for a solar panel in Scotland is due south.

Where this is not possible your panel should at least face within 45 degrees (east or west) of due south as per Figure 1.

As most solar panels will be mounted on the roof of a property they will share the same tilt as that of the roof.

Should your roof have a tilt that is between 30 and 60 degrees any panel mounted on it will be able to capture the vast majority of the available solar resource.

Overshading
If the surface of the solar panel is in shadow for parts of the day, the output of the whole system will decrease. Shadows from buildings, trees or other structures can significantly reduce performance. Bearing in mind that the sun moves throughout the day the panel should be positioned carefully so as to avoid all potential obstructions.

Planning Permission
Solar collectors are generally integrated into the slope of a property's roof. This method of installation gives the collector the appearance of a rectangular glass skylight. In Scotland, such installations are generally regarded as permitted development and will not require planning permission.

There may be circumstances where permitted development status does not apply (installing upon a listed building or in a conservation area) therefore it may be prudent to first check with your local planning department.

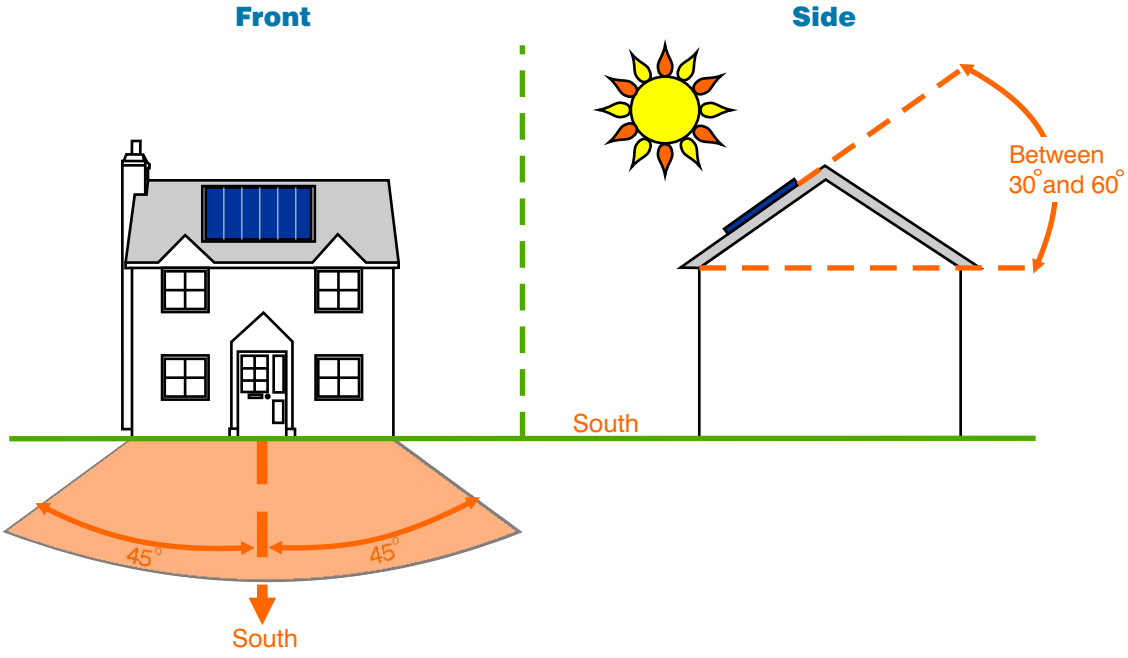


Figure 1: Optimum Orientation and Tilt of a Solar Panel

Useful **Links**

The Energy Saving Trust - Solar
www.est.org.uk/myhome/generating/types/solarwater

Solar Trade Association
www.greenenergy.org.uk/sta

Scottish Solar Energy Group
www.sseg.org.uk

NASA Surface Meteorology and Solar Energy Data - Calculate the solar resource at your property
http://eosweb.larc.nasa.gov/sse/RETScreen

A comprehensive list of accredited manufacturers and installers of solar equipment can be found here
www.lowcarbonbuildings.org.uk/info/installers