Solar Water Heating (SWH)



Evacuated Tubes Collectors



Flat Plate Collectors

Summary:

Solar Water Heating (SWH) arrays convert solar radiation into hot water which is then passed through a coil within the hot water tank, thus reducing demand from fossil fuelled hot water systems.

How it works:

There are two types of collector for heating although working on similar principles. An average family house would feature a SWH system made up of 2-3 individual collectors:

Evacuated Tube (ET) - consist of a copper pipe running down the centre of an evacuated glass tube along an absorber plate, the under side of the glass is painted black to increase temperature. The vacuum reduces the convective heat loss from the tube, increasing efficiency. It is also possible to turn the tubes the frame to reduce the effects of poor orientation.

Additionally, there are two derivatives of the ET system:

- Direct Flow (DF) - the glycol mix is pumped throughout the system, through each pipe in turn and through the manifold. This allows the system to be mounted at any inclination.
- Heat Pipe (HP) - each tube is a sealed, separate circuit which are connected 'dry' into the manifold. Allows for easier installation but relies on a minimum inclination level for the system to operate correctly.

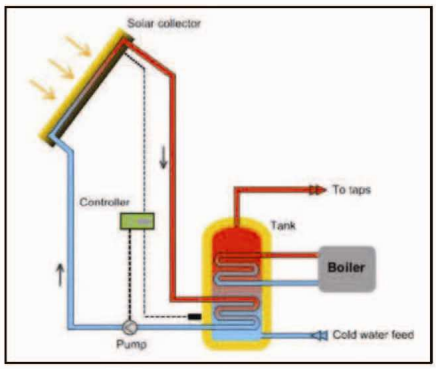
Flat Plate (FP) - have a layer of insulation covered by a black absorber plate with water/glycol pipes running through the collector. Heat is then absorbed by the fluid within the pipes, again, normally glycol. Protective glass covers the system although a vacuum is generally not created, therefore convective heat losses are greater than that from evacuated tubes.

There are also Integrated SWH systems available—these work on the same principle as a Flat Panel but are made up of separate 'Tiles', containing the required pipework, which are linked together to form a larger collector. These offer a much lower level of aesthetic intrusion but are more complex and as they are integrated into the roof, more difficult to maintain,

With either system type, the fluid heated by the collector is circulated through a dual coil hot water cylinder.

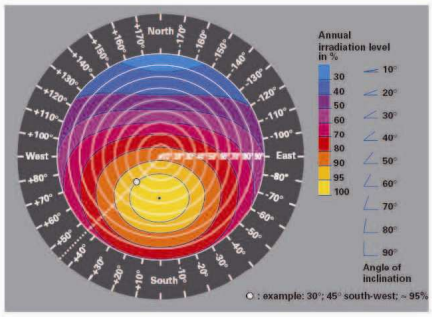
The systems are generally sized to meet a maximum of 60% of the unit's DHW load—this is to reduce the risk of the SWH collectors overheating the hot water system during periods of high solar insolation and/or low hot water demand. Heat dump radiators (such as a towel rail) are sometimes used to 'vent' excess hot water. The outstanding hot water load is provided by the larger heating system.

Example Schematic:



Ensuring Efficiency:

Three factors effecting the efficiency of a SWH installation are the orientation, inclination and potential shading of the system. Greatest efficiencies are achieved with an orientation of due south with an inclination of 30 degrees. Shading from vegetation and neighbouring buildings should be considered for all installations as it can reduce system efficiency significantly and should be avoided where practicable.



Relationship Between Efficiency and Orientation.

In order to ensure system efficiency the aim must be to minimise the use of additional immersion heater. Reducing domestic hot water use through water efficient fittings/appliances, and minimising heat loss through pipe lagging are two methods.

Evacuated tubes are more efficient although the initial cost of the system is higher and the visual impact is perceived as being greater than that of the flat panel collectors. These are additional considerations to be taken into account when deciding which installation is most appropriate.

Noise

Noise will not be an issue with SWH – the only moving part is the circulation pump, which is inside the property and should not be noticeable.

Technology Summary Table:

Evacuated Tube Collector	Flat Panel Collector
Typically 2.2m x 0.8m each	Typically 2.1m x 1.1m each
550 kWh/m^2/yr	450 kWh/m^2/yr
~£6,000/system	~£4,000/system