



Department for
Business, Energy
& Industrial Strategy



Energy Technology List

Solar Thermal Systems and Collectors

A guide to energy efficient equipment listed on
the Energy Technology List (ETL)



Contents



- 1. Introduction**
- 2. Setting the scene**
- 3. Glazed flat plate solar collectors**
- 4. Evacuated tube solar collectors**
- 5. Renewable heat incentive**
- 6. Further information**



Introduction



The ETL is a government register of energy saving products. When you select products from the list you are choosing from amongst the most energy efficient products in the marketplace.

When replacing equipment, businesses are often tempted to opt for equipment with the lowest capital cost. However, such immediate cost savings may prove to be a false economy. Considering higher energy efficient products, means that life cycle costs are reduced, improving cash flow in the longer term.

Businesses can also claim accelerated tax relief through the Annual Investment Allowance (AIA) for investments in plant and machinery equipment. The AIA has been temporarily increased to £1 million from January 2019.

This leaflet illustrates the benefits of investing in solar thermal systems and collectors equipment which qualifies for the ETL.

The ETL comprises two lists:

- **Energy Technology Criteria List:** defines the performance criteria that equipment must meet to qualify for the ETL;
- **Energy Technology Product List:** is the list of products that have been assessed as being compliant with ETL criteria.

Eligible Solar Thermal Systems and Collectors products on the ETL can be searched at:
https://etl.beis.gov.uk/engetl/fox/live/ETL_PUBLIC_PRODUCT_SEARCH



Setting the scene

Definition

Solar water heating systems, or 'solar thermal' systems, use free heat from the sun to warm hot water. This replaces other energy sources such as natural gas and electricity as a means of providing hot water to buildings. A conventional boiler or immersion heater can be used to make the water hotter, or to provide hot water when solar energy is unavailable.

The most important part of a solar thermal system is the 'collector'. The collector's role is to absorb the sun's energy and efficiently convert it to heat for transfer to the hot water system. The collector is normally mounted on the roof of a building. There are a number of different types of solar thermal system; a typical system is shown in Figure 1.

Hot water is supplied to the building by transferring the heat (energy) absorbed by the collector and pumping it down to the cylinder tank. The solar energy reduces the heat demand on the boiler, and therefore energy consumption and cost.

Did you know?

A well designed solar thermal system can provide 40% of domestic hot water

Solar Thermal systems can be hugely beneficial in residential buildings where the hot water demand is high and in non residential buildings such as leisure centres and swimming pools.

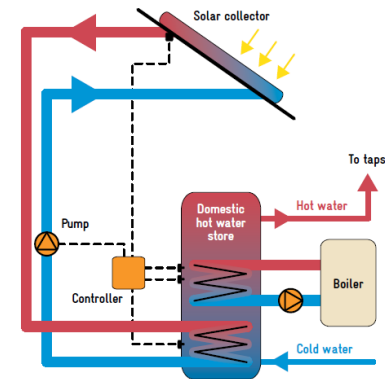


Figure 1 Typical twin coil solar thermal system



Setting the scene

Definition

A well designed system, incorporating a collector from the ETL, can be expected to collect useful energy greater than 450 kilowatt hours per year per square metre ($\text{kWh}/\text{y}/\text{m}^2$). However, performance is dependent on the location and orientation of the collector.

The available solar energy across the UK is shown in the adjacent solar irradiation chart. This shows that the South West receives the highest level of solar radiation falling on the horizontal plan per square metre, making it an ideal location for the use of a solar thermal system. However, a wide range of other locations in the UK will also be suitable.

There is a common misconception that solar thermal systems do not operate when it is cloudy. In the UK there is a relatively high percentage of cloudy days compared to clear days. When the sun's radiation passes through clouds, it is dispersed and is known as diffused radiation. On clear days, with no dispersion effect, it is known as direct radiation. Solar thermal systems are able to operate in both conditions.

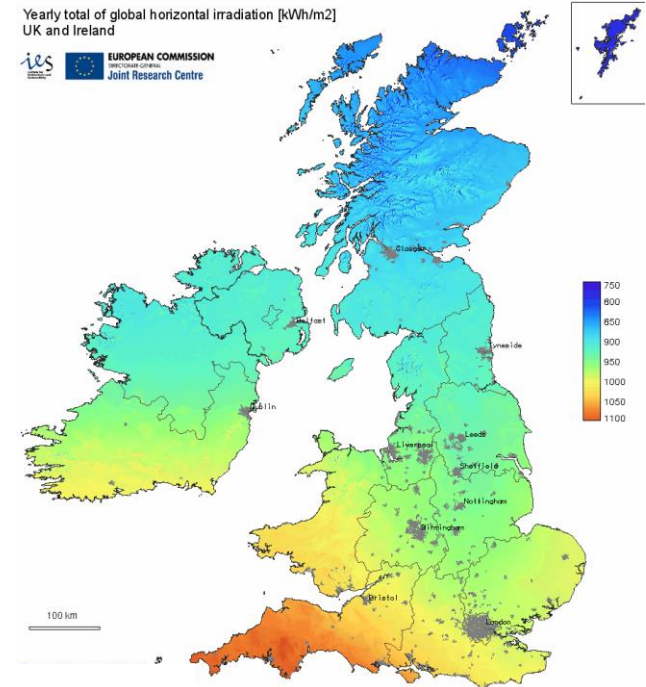


Figure 2 Solar irradiation chart (PVGIS European Communities 2001-07)

Setting the scene

Definition

Figures 3 and 4 show that solar thermal systems will provide more hot water during the summer than during the winter. This means that an auxiliary heat source will still be required to heat the water during the winter months. However, solar thermal systems are still able to save between 40% and 60% of the energy that would have been required annually to heat up the hot water using conventional energy sources, such as gas.

Figure 3 shows the average daily values for both diffused and direct irradiation for the London area. Figure 4 shows the monthly contribution of domestic hot water provided by a solar collector.

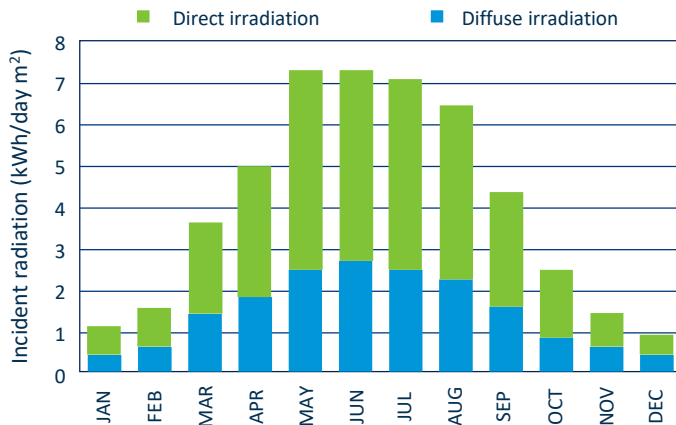


Figure 3 Average daily light values

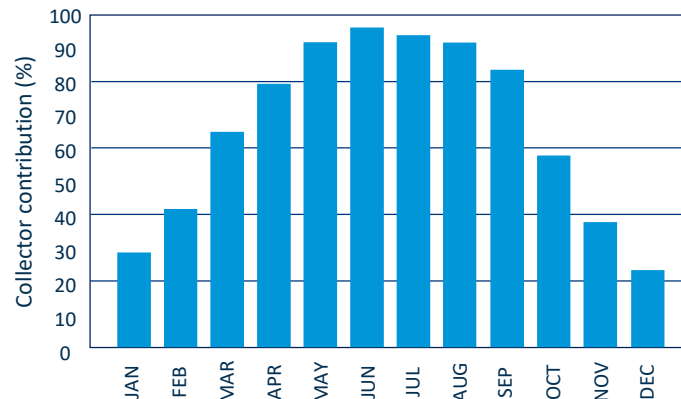


Figure 4 Solar collector contribution



Types of solar thermal collector eligible for the ETL



The ETL covers solar thermal systems incorporating two main types of solar collector:

- Glazed flat plate collectors.
- Evacuated tube collectors:
 - Direct flow collectors.
 - Heat pipe collectors.

Using the baseline scenario below, the potential financial (£), energy (kWh) and carbon savings (kg CO₂) have been calculated for comparison unless otherwise indicated:

- Gas cost 2.59/kWh, oil cost of 4.82p/kWh and electricity cost 11.14p/kWh.
- Gas/oil boiler efficiency of 80%. Electric heating efficiency of 100%.
- An ETL compliant product could save 350kWh/m²/year.
- Carbon dioxide emissions factors of 0.18416kgCO₂e/kWh (gas) and 0.35156kgCO₂e/kWh (electricity).



© Vaillant – Glazed flat plate collector



Solar thermal systems eligible for the ETL:

Glazed Flat Plate Collectors



Glazed flat plate collectors

Glazed flat plates are constructed with insulation on their back and sides and are covered by a transparent cover. This reduces the heat loss to the surrounding area and therefore improves the performance of the collector compared to an unglazed version. These collectors can be integrated with the roof, mounted on the roof or façade mounted.

Flat plate collectors are generally cheaper than evacuated tube collectors with a good cost-to-performance ratio.

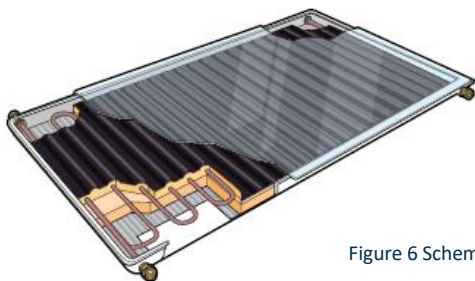


Figure 6 Schematic of a glazed flat plate collector

A commercial installation of 43m² ETL listed glazed flat plate collector with an annual yield of 350kWh/m² could result in the following annual savings when compared to conventional water heating using a gas, oil or electrically heated boiler.

	Solar thermal replacing gas boiler	Solar thermal replacing oil boiler	Solar thermal replacing electric water heating
Fuel Savings (£/yr)	390	720	1,340
Energy Saving (kWh/yr)	15,000	15,000	12,000
Carbon Dioxide Savings (kgCO ₂ e/yr)	2,760	4,140	4,220
Payback period	20 years	11 years	6 years



Solar thermal systems eligible for the ETL:

Evacuated tube solar collectors



Evacuated tube solar collectors

Evacuated tubes are highly efficient even with low solar radiation, as well as in circumstances where there is a large temperature difference between the absorber and ambient temperatures.

In general, evacuated tubes are more expensive than glazed flat plate collectors and cannot be installed integral to the roof. Evacuated tube collectors use glass tubes in which a vacuum is created. This acts as a source of insulation, reducing heat losses from the collector and making the product very efficient. There are two types of evacuated tube collectors: direct flow and heat pipe collectors.





Solar thermal systems eligible for the ETL:

Evacuated tube solar collectors



Direct flow collectors

Direct flow evacuated tube collectors use an evacuated tube inside a U-shaped tube.

There are three different designs of direct flow evacuated tubes for the U-shaped tube. These are:

- Concentric fluid inlet and outlet
- Two separate tubes for inlet and outlet
- The Sydney tube

The fluid in the solar system is used as the heat transfer medium and the fluid runs through a concentric tube-in-tube or a U-shaped tube to the base of the glass bulb and then returns to the header.

The Sydney tube is an example that incorporates a vacuum double glass tube sealed together at one end.

Did you know?

An evacuated tube collector will collect approximately 450-550kWh/m² per year. Therefore, a typical 4m² system could provide an annual solar yield of 2,200kWh.



Solar thermal systems eligible for the ETL:

Evacuated tube solar collectors



Heat pipe collectors

A heat pipe evacuated tube collector uses alcohol or water in a vacuum which is used to absorb the sun's energy.

Due to the vacuum, the alcohol or water will evaporate at a low temperature of 25°C to form a vapour. This vapour then rises up the collector tube to the heat exchanger where heat transfer to the solar fluid takes place. Following heat transfer, the vapour condenses back to a liquid and flows back down the collector tube. Heat pipe evacuated tubes must be installed with a tilt of at least 25°C degrees. There are two types of heat pipe evacuated tube collectors: a dry connection collector; a wet connection collector.

In a dry connection collector, the condenser completely surrounds the collector tube. This provides good heat transfer between the tube and the heat exchanger and allows for tubes to be replaced without the need to drain the solar fluid. In a wet connection collector, the tube is submersed in the heat transfer fluid. Therefore, if a tube needs to be replaced then the system must be drained.

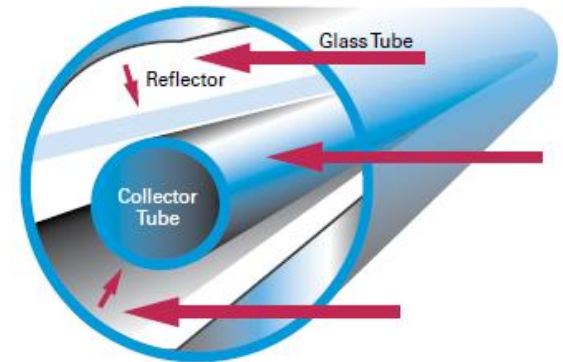


Figure 8 Schematic of heat pipe evacuated tube collector



Non-domestic Renewable Heat Incentive (RHI)



- Non-domestic solar thermal installations can qualify for the Renewable Heat Incentive (RHI).
- This is a financial incentive, which was set up by the UK government to encourage communities and businesses to install renewable heating technologies. This is administered through quarterly cash payments over a twenty year period.



Where can I find more information?



For information about the ETL please visit: <https://www.gov.uk/guidance/energy-technology-list> and see our [Information for Purchasers](#) factsheet. Or contact the ETL Help Line on 0300 330 0657; email ETLQuestions@carbontrust.com



For more information on the ETL:

To search for a product on the ETL please visit:
https://etl.beis.gov.uk/engetl/fox/live/ETL_PUBLIC_PRODUCT_SEARCH



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