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Solar thermal heating systems

Solar heating systems are generally composed of solar thermal collectors and a fluid system to move the heat from the collector to a heat store for subsequent use. The systems are most commonly used to heat domestic hot water or a swimming pool, but larger systems can also provide heat for a space heating circuit, for industrial applications or as an energy input for other uses such as cooling equipment. In many climates, including northern Europe, a solar thermal system can provide a very high percentage (~70%) of domestic hot water energy. There are a number of different system layouts for residential solar thermal installations and each system layout can use a variety of different types of solar collector to gather the solar energy.

System Layouts

There are two main types of domestic solar thermal systems:

Passive (thermosyphon) systems

The hot water storage vessel is positioned above the solar collector. As the collector absorbs radiation and increases in temperature a convection current transfers heat from the collector to the store. Thermosyphon systems are generally not suitable for roof mounted solar collectors in Northern climates due to the risk of freezing.

Pumped/active systems

Systems using a circulation pump are used whenever the hot water tank is positioned below the solar panels. Most systems in northern Europe are of this type. The storage tank is placed inside the building, and thus requires a controller that measures when the water is hotter in the panels than in the tank. The system also requires a pump for transferring the fluid between the collector and the tank. There are two main types of pumped systems: 'drainback' and 'fully-filled'. In a drainback system the heat transfer medium that flows through the solar collector is drained back into a reservoir to prevent freezing when the pump is switched off. In contrast, in a fully-filled system, the heat transfer medium remains under pressure in the collector at all times and contains anti-freeze to prevent freezing.

Solar Thermal Collectors

There are three main kinds of solar thermal collectors in common use:

Formed plastic collectors (such as polypropelene, EPDM or PET plastics)

These consist of tubes or formed panels through which water is circulated and heated by the sun's radiation. This type of panel is not suitable for year round uses like providing hot water for home use, due to its low efficiency and lack of insulation. It is mainly used to heat swimming pools.

Flat plate collectors

The most popular form of solar collector, these consists of a thin absorber sheet (usually copper, to which a selective coating is applied) backed by a fluid tubing system and placed in an insulated casing with a glass cover. Fluid is circulated through the tubing which absorbs the heat from the collector and transports it to an insulated water tank, a heat exchanger, or other device which uses the heated fluid.

Evacuated tube collectors

The absorber in an evacuated tube system is similar to a flat plate collector but is enclosed in an evacuated glass tube. Conduction and convection heat losses from the absorber surface are significantly reduced by the vacuum. The heat is normally transferred to a manifold by direct flow or heat pipe technology.

Read on for further information or download our Solar Energy Fact Sheet

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- Solar thermal heating systems
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- Types of PV system
- A bright future for PV
- Less common types of solar technology