Solar air collector

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A solar thermal collector collects heat by absorbing sunlight. The term "solar collector" commonly refers to a device for solar hot water heating, but may refer to large power generating installations such as solar parabolic troughs and solar towers or non-water heating devices such as solar cookers or solar air heaters.[1]

Solar thermal collectors are either non-concentrating or concentrating. In non-concentrating collectors, the aperture area (i.e., the area that receives the solar radiation) is roughly the same as the absorber area (i.e., the area absorbing the radiation). A common example of such a system is a metal plate that is painted a dark color to maximize the absorption of sunlight. The energy is then collected by cooling the plate with a working fluid, often water or glycol running in pipes attached to the plate.

Concentrating collectors have a much larger aperture than the absorber area. The aperture is typically in the form of a mirror that is focussed on the absorber, which in most cases are the pipes carrying the working fluid.[2] Due to the movement of the sun during the day, concentrating collectors often require some form of solar tracking system, and are sometimes referred to "active" collectors for this reason.

Flat-plate and evacuated-tube solar collectors are mainly used to collect heat for space heating, domestic hot water, or cooling with an absorption chiller. In contrast to solar hot water panels, they use a circulating fluid to displace heat to a separated reservoir. The first solar thermal collector designed for building roofs was patented by William H. Goettl and called the "Solar heat collector and radiator for building roof".[4]

Evacuated flat-plate solar collectors are a more recent innovation and can be used for Solar Heat for Industrial Cooling (SHIC) and Solar Air Conditioning (SAC), where temperature in excess of 100 ?C (212 ?F) are required.[5][6] These non-concentrating collectors harvest both diffuse and direct light and can make use of steam instead of water as fluid.

A flat plate collector making use of a honeycomb structure to reduce heat loss also at the glass side too has also been made available commercially. Most flat plate collectors have a life expectancy of over 25 years.[citation needed].

The high temperatures that can occur inside evacuated tubes may require special design to prevent thermal shock and overheating. Some evacuated tube collectors work as a thermal one-way valve due to their heat pipes. This gives them an inherent maximum operating temperature that acts as a safety feature.[9] Evacuated tubes collectors can also be provided with low concentrating reflectors at the back of the tubes realising a CPC collector.[10]

A pool or unglazed collector is a simple form of flat-plate collector without a transparent cover. Typically,

polypropylene or EPDM rubber or silicone rubber is used as an absorber. Used for pool heating, it can work quite well when the desired output temperature is near the ambient temperature (that is, when it is warm outside). As the ambient temperature gets cooler, these collectors become less effective.[citation needed]

A solar bowl is a type of solar thermal collector that operates similarly to a parabolic dish, but instead of using a tracking parabolic mirror with a fixed receiver, it has a fixed spherical mirror with a tracking receiver. This reduces efficiency but makes it cheaper to build and operate. Designers call it a fixed mirror distributed focus solar power system. The main reason for its development was to eliminate the cost of moving a large mirror to track the sun as with parabolic dish systems.[23]

As the sun moves across the sky, the aperture of any fixed collector changes. This causes changes in the amount of captured sunlight, producing what is called the sinus effect of power output. Proponents of the solar bowl design claim the reduction in overall power output compared with tracking parabolic mirrors is offset by lower system costs.[23]

The sunlight concentrated at the focal line of a spherical reflector is collected using a tracking receiver. This receiver is pivoted around the focal line and is usually counterbalanced. The receiver may consist of pipes carrying fluid for thermal transfer or photovoltaic cells for direct conversion of light to electricity.