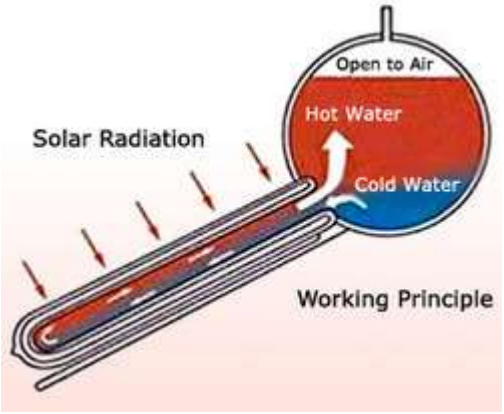
The vacuum tube solar collector consists of a set of cylindrical tubes. The tubes are made up of a selective absorber, located on a reflective seat and surrounded by a transparent glass cylinder.

A vacuum has been created between the transparent outer tube and the inner absorber. Thus, thermodynamic losses by conduction and convection from the absorbent surface are avoided. This characteristic makes it possible to reach temperatures of more than 100ºC and to take much more advantage of solar radiation.

This type of solar panel has a higher performance than flat collectors.

Solar vacuum tubes can be used to obtain sanitary hot water, heating systems, swimming pool heating, etc.

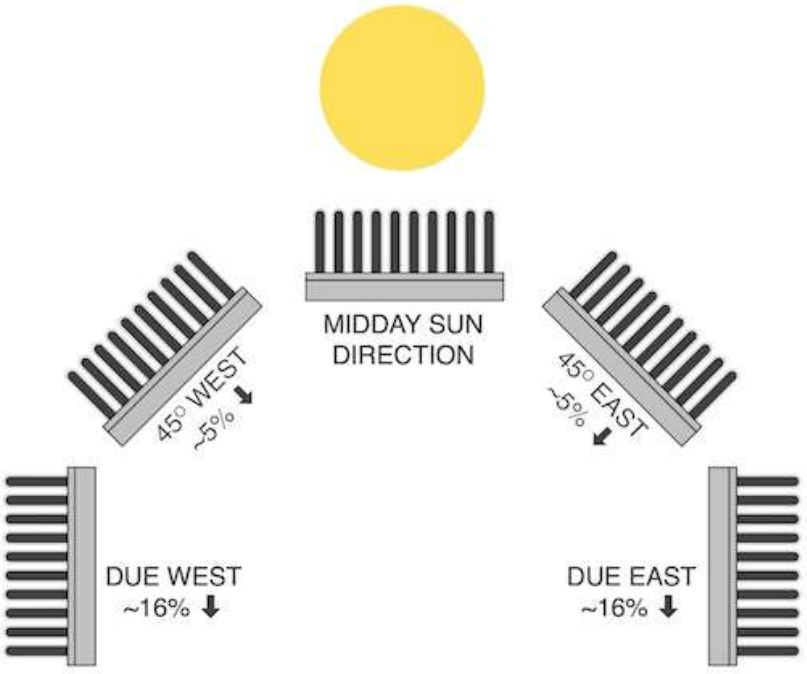
In solar vacuum tube collectors the insulating effect is achieved by a vacuum in a glass tube or in the space of two concentrically arranged glass tubes. This technique greatly reduces the thermodynamic transfer of heat to ambient air through reduced convective losses.




Especially in winter, vacuum collectors, due to their good insulation, obtain a significantly higher thermal performance than flat-plate solar collectors. Very low temperature resistance is given as an average of -30 degrees Celsius.

Flat Plate vs Evacuated Tubes

How to choose between a Flat Plate or Evacuate Tube collector? Below is a simple table to provide a general comparison. Additional factors may be present, and ultimately your local solar professional can help choose what will provide the best value for money and energy savings for your application.

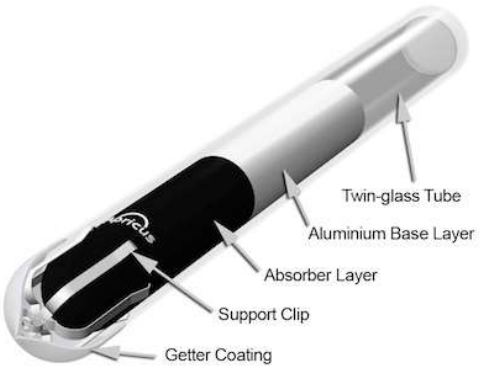


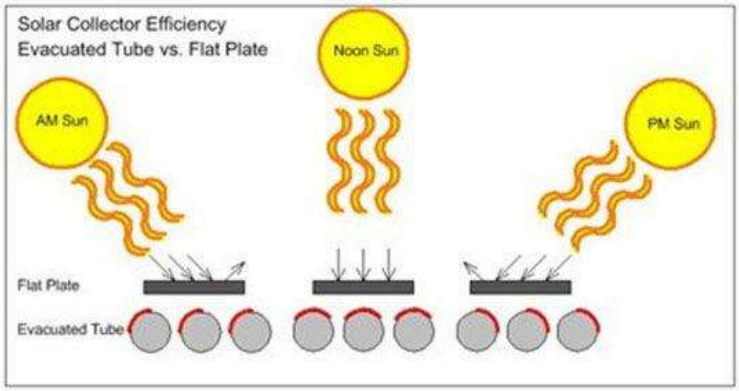

The Evacuate Tube collector has minimal power loss when the installation azimuth is out of optimal (out of south direction) – Flat Plate collector loses over half of its power and daily consumption.

Flat Plate vs Evacuated Tubes (table)

| Factor | Evacuated Tube | Flat Plate | Comments |
|---|---|---|---|
| **Cost of Collector** | MODERATE | LOW | Comparing the purchase price of the collector alone is NOT useful. The final installed cost and expected annual energy output for the specific application should be considered in order to make a sound choice. |
| **Installation Cost** | MODERATE | HIGH | FP installation cost can be higher if hydraulic lift platform (cherry picker) is required due to the size and weight of the panel. |
| **Component Weight** | LIGHT | HEAVY | ET collector components are lightweight and can be carried up a ladder. Flat Plate is heavy single components so may require lift platform. |
| **Low Temp Applications** | GOOD | GOOD | FP collectors are suitable for domestic hot water applications (<60°C/ 140°F) as heat loss at higher temperatures results in poor solar conversion efficiency. ET collectors are suitable for both domestic & industrial high temp applications (<120°C/250°F) with high solar conversion efficiency even at higher temperatures. |
| **High Temp Applications** | GOOD | POOR | |
| **Cold Weather** | GOOD | POOR | FP collectors perform poorly in cold conditions. ET collectors perform well in cold conditions due to the vacuum insulation. |
| **Vertical Orientation** | YES | YES | Both ET and FP collectors can be installation in the vertical orientation, but note also the installation angle requirements for the ET collector is 20-80° range. |
| **Horizontal Orientation** | NO | YES | ET collector can only be installed with the evacuated tubes in the up-down orientation, not left-right. FP can be installed in either orientation. |
| **Installation Angle** | 20-80° | 0-90° | ET must be 20-80° to ensure optimum heat pipe operation. FP can be installed at 0° (vertical) or 90° (flat), although these are not ideal for best solar exposure, as angle should ideally be close to latitude. |
| **Hail Resistance** | MODERATE | HIGH | ET and FP can withstand hail of >25mm / 1" in diameter, however FP is stronger. |
| **Repairability** | YES | NO | If a tube is damaged by extreme hail or branch falling on the roof, individual tubes can be replace. If a FP is damaged the whole panel must be replaced. |
| **Limescale Susceptibility** | GOOD | POOR | Because of the small diameter of the riser copper pipes in the FP collector, limescale may block the pipes more easily than the ET collector which has a large diameter header pipe. |

Evacuated Tubes are responsible for absorbing sunlight and converting it into usable heat by best way. Evacuated Tubes possession of full capacity throughout the time of sun's rays and does not reflect energy back - Flat Plate collector loses cross-sectional surface, big a sun rays back reflection and heat loss thru the glass.



**Tube Design**

The evacuated tube design used by SOLARIS was originally developed in the 1980s and has proven to be extremely robust. Referred to as the "Sydney" tube, "twin-tube" or "all-glass", the tube is essentially two glass tubes that are fused at the top and bottom. The inner tube has a solar absorbing coating, and the space between the two tubes is evacuated to form a vacuum.

Let's look at the design features of the evacuated tube in more detail.

**Strong Glass**

The tubes are made from a type of glass called Borosilicate, the same base material as used in many Pyrex glass products used in kitchens around the world. Borosilicate glass has the characteristic of being very strong and also has excellent light transparency (>92% @ 2mm thick) .

The wall thickness of the glass greatly impacts the strength, longevity and naturally also the cost. SOLARIS evacuated tubes are custom made to strict requirements that exceed the industry

**Vacuum Insulation**

The name "evacuated" is used to describe the process that expels the air from within the space between the tube tubes, forming a vacuum. A vacuum is an excellent insulator against heat loss, and so evacuated tubes are able to operate very efficiently when there is a big difference between the inside of the tube and the outside ambient air. For this reason evacuated tubes are the ideal choice for high temperature hot water applications or locations that get cold in the winter.

**Barium Getter**

In order to help maintain the vacuum over the 15-25 year life of the evacuated tube, a barium getter "soaks up" any remaining gases in the evacuated chamber plus any fresh gases such as Nitrogen that can slowly permeate through the glass over time, a process known as out-gassing. This barium layer also provides a clear visual indication of the vacuum status; the silver-coloured barium layer turns white if the vacuum is lost making it easy to identify a fault tube.

**Solar Absorber**

The absorber coating comprises a base layer of Aluminium on the outside of the inner glass tube followed by thin layer of the dark coloured AL/N material. These coatings are applied using a method called dc reactive sputtering which is extremely reliable after having been finetuned over the past 20 years since it was developed.

**Efficiency up to 95%**

The combination of the highly efficient absorber coating and the vacuum insulation means that the coating can be well over 200°C / 392°F and the outer glass is cool to touch. In strong sunlight, each evacuated tube can provide over 60 Watts / 204 Btu of water heating output.

**Thermosiphon** (or **thermosyphon**) is a method of passive heat exchange, based on natural convection, which circulates a fluid without the necessity of a mechanical pump. This circulation can either be open-loop, as when the substance in a holding tank is passed in one direction via a heated transfer tube mounted at the bottom of the tank to a distribution point—even one mounted above the originating tank—or it can be a vertical closed-loop circuit with return to the original container. Its purpose is to simplify the transfer of liquid or gas while avoiding the cost and complexity of a conventional pump.

SOLARIS thermosiphon systems are the low cost type solar water heaters which supply solar hot water for domestic hot water applications. SOLARIS provides two choices based on water supply situation, with available capacity of 100L, 120L and 150L.

**SOLARIS Thermosiphon System – Non-pressurized**

SOLARIS vented thermosiphon solar water heaters are a great choice for consumers who want a cost effective hot water solution. When mounted on the roof the house is provided with gravity fed hot water. In high solar radiation areas, Wombat solar water heaters can be the sole energy source for hot water supply. In cooler climates this systems can provide pre-heated hot water which saves on traditional energy costs such as electricity or gas. The tank has an optional electrical heating element for boosting for when the water is not hot enough.

**Basic Operation**

Evacuated tubes absorb sunlight and heat up the water inside. The warmer water rises into the storage tank while cooler water in the bottom of the tank flows down to the bottom of the tubes to repeat the cycle. This thermosiphon process occurs throughout the day, gradually heating up the water in the tank.

When hot water is used it drains from the bottom of the tank. The tank is slowly refilled with cold water, either manual via opening a cold water filling tap, or automatically if a optional small header tank is fitted to the top of the tank.