

What is Solar Water Heating & How does it work?

What is solar water heating?

Solar water heaters use two natural phenomena to work: dark-coloured objects absorb heat and hot water rises. Technology has now made it possible to harness these phenomena to produce a reliable source of hot water in our homes.

A solar water heater is a combination of three elements:

1. A solar collector is an energy device that is designed to absorb solar radiation and transfer the energy to the energy transfer fluid or material passing through the collector.
2. The energy transfer medium transfers the absorbed heat to the water, through conduction or convection. The type of material used is dependent on the design and needs of the installation. Where the possibility of the transfer medium freezing is a concern, the liquid used should be mixed with a non-toxic coloured anti-freeze liquid and a corrosion inhibitor.
3. And finally thermally insulated hot water storage vessel or geyser with a protected inner lining, copper, steel or a polymer is needed. There are solar water heating systems that work on low pressure, but most are pressurised from 100 k.P.a to 600 k.P.a depending on the materials used. (Note: the municipal water supply comes in at a high pressure)

The solar water system tanks/storage vessels should always be larger than conventional household geysers. This is because the sun is heating the total volume of hot water that is required for the day. In order for your conventional 150 litre electric geyser to heat 300 litres it will need to work on a cycle and heat the extra body of water as well.

How does Solar Water Heating Work?

Solar water heating systems include storage tanks and solar collectors. There are two types of solar water heating systems: active, which have circulating pumps and controls, and passive, which don't.

Most solar water heaters require a well-insulated storage tank. Solar storage tanks have an additional outlet and inlet connected to and from the collector. In two-tank systems, the solar water heater preheats water before it enters the conventional water heater. In one-tank systems, the back-up heater is combined with the solar storage in one tank.



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Three types of solar collectors are used for residential applications:

- **Flat-plate collector**

Glazed flat-plate collectors are insulated, weatherproofed boxes that contain a dark absorber plate under one or more glass or plastic (polymer) covers. Unglazed flat-plate collectors—typically used for solar pool heating—have a dark absorber plate, made of metal or polymer, without a cover or enclosure.

- **Integral collector-storage systems**

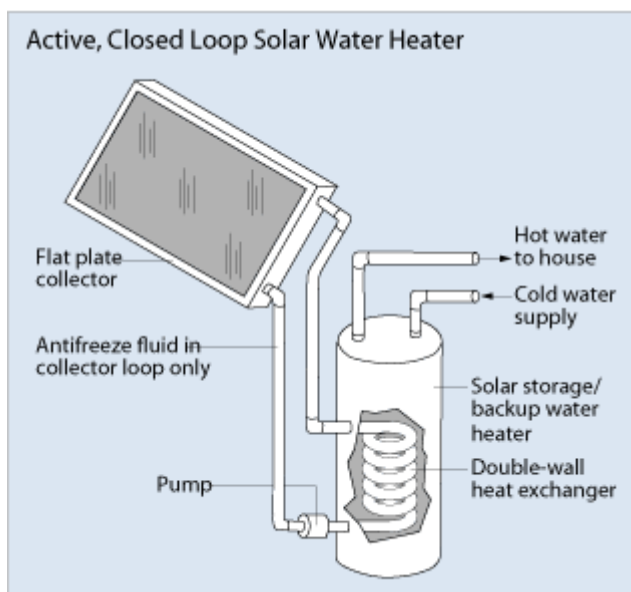
Also known as ICS or *batch* systems, they feature one or more black tanks or tubes in an insulated, glazed box. Cold water first passes through the solar collector, which preheats the water. The water then continues on to the conventional backup water heater, providing a reliable source of hot water. They should be installed only in mild-freeze climates because the outdoor pipes could freeze in severe, cold weather.

- **Evacuated-tube solar collectors**

They feature parallel rows of transparent glass tubes. Each tube contains a glass outer tube and metal absorber tube attached to a fin. The fin's coating absorbs solar energy but inhibits radiative heat loss.

There are two types of active solar water heating systems: Active and Passive

Active Systems



- **Direct circulation systems**

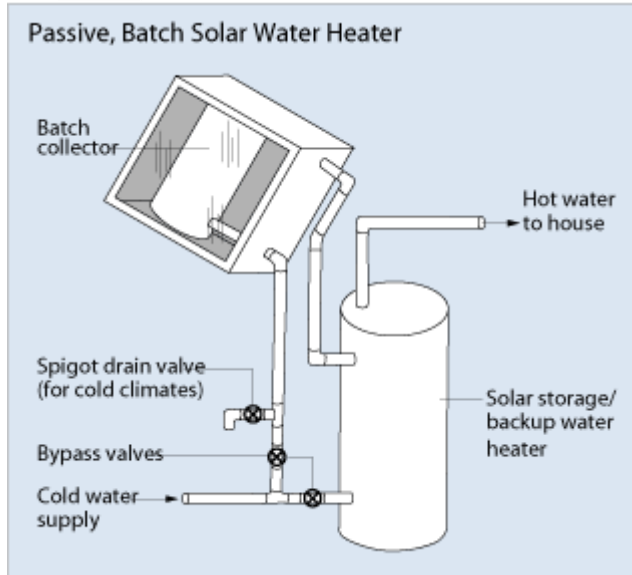
Pumps circulate household water through the collectors and into the home. They work well in climates where it rarely freezes.

- **Indirect circulation systems**

Pumps circulate a non-freezing, heat-transfer fluid through the collectors and a heat exchanger. This heats the water that then flows into the home. They are popular in climates prone to freezing temperatures. Indirect systems are also used where hard/calcified water is found.

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Passive Systems



Passive solar water heating systems are typically less expensive than active systems, but they're usually not as efficient. However, passive systems can be more reliable and may last longer. There are two basic types of passive systems:

- **Integral collector-storage passive systems**

These work best in areas where temperatures rarely fall below freezing. They also work well in households with significant daytime and evening hot-water needs.

- **Thermosyphon systems**

Water flows through the system when warm water rises as cooler water sinks. The collector must be installed below the storage tank so that warm water

will rise into the tank. These systems are reliable, but contractors must pay careful attention to the roof design because of the heavy storage tank. They are usually more expensive than integral collector-storage passive systems.

Back-up for cloudy days

Solar water heating systems almost always require a backup system for cloudy days and times of increased demand. Conventional storage water heaters usually provide backup and may already be part of the solar system package. A backup system may also be part of the solar collector, such as rooftop tanks with thermosyphon systems. Since an integral-collector storage system already stores hot water in addition to collecting solar heat, it may be packaged with a demand (tankless or instantaneous) water heater for backup.

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References:

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