going solar

Renewable Energy & Sustainable Living

# Guide to Buying Solar Hot Water Systems in Victoria

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Solar hot water systems (which generate thermal energy in water using the heat from the Sun) differ from photovoltaic panels (which generate electricity using the light from the Sun) but both make a valuable contribution in our quest to be more sustainable.

These days, solar hot water comes in a number of different guises and choosing the most appropriate configuration can be a bit of a maze, but basically a solar hot water system consists of a storage tank (to store the hot water until required) and a means of harvesting the energy from the Sun. All solar hot water services need to have a supplementary form of heating known as 'boosting' - electricity, natural gas, LP gas, wood heat, or a combination of these, for periods when the hot water demand is too high and/or when the available solar energy is too low. The aim of a quality design and installation is to maximise the solar energy contribution and minimise the need for boosting.

Part of the role of a good merchant is to represent the consumer – to provide clients with the best options for their needs. Ultimately, products provided and installed need to be 'fit for purpose' – that is they need to work, (in this case) provided sufficient hot water, and (as far as we are concerned) the product needs to have a reasonable life span.

The most appropriate system for your needs will depend on the amount of hot water required, the amount of available roof space, the quality of the cold water supply and the proposed location of the system (ie will it be subject to shading or heavy frost?).

In Australia, the typically available solar hot water systems fall into two types: [1] Solar Thermal Collector Systems; and [2] Heat Pump Systems. There is an emerging third group where PV panels are used to generate electricity which is then used to produce hot water.

The following notes apply to systems installed in Victoria (or other places with similar temperatures).

It should be noted that solar hot water systems can work 'too well', particularly over the summer months, creating unwanted hot water. This excess could be used for solar space cooling and while this technology exists, it does not tend to be cost-effective at the domestic level. For the same reason, using solar panels to 'actively' heat houses in winter is not recommended because there would be a considerable capital cost and unwanted hot water would be produced for much of the year. The best way to sustainably keep houses warm in winter is through 'passive solar' harvesting (eg Sun shining through north-facing windows with an appropriate eave) and maximising insulation and materials with high thermal mass.

Domestic solar hot water systems therefore are typically designed to harvest 100% of the heating requirement from their collectors over the summer months, decreasing to a typical average of 40% over the winter months. Obviously you will still need hot water and this is where the auxiliary heating comes into play. Overall we aim to harvest around 80% of a yearly hot water requirement from the Sun – which in turn should reduce the hot water component of the utility bill concerned by about 80%.

Despite its reputation, Melbourne can have sunny days during winter and on such days solar hot water can provide a significant contribution. Consider sitting in a car on a cool sunny day – because you are out of the wind you can be quite warm. Solar hot water panels work in the same way.

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**[1] Solar Thermal Collector Systems**

Evacuated tubes on the left hand side
and flat plate panels on the right.
(PV panels are on the roof in the background)

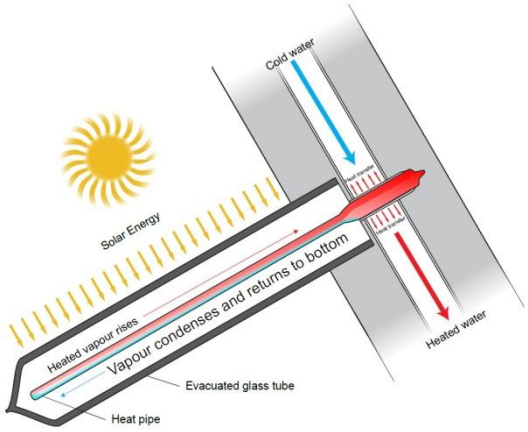
The two common collector technologies used for directly heating clean (potable) water are flat plate collectors and evacuated tube collectors.

Flat plate solar collectors consist of a sheet of metal laid over - and closely bonded to - a series of riser tubes which carry the water (and heat) to the storage tank. The flat plate and pipes sit within an insulated, glass-covered box. The quality and thickness of the insulation, glass, metal plate and pipes, and the quality of construction determines the efficiency of the panel. The metal used for the flat plate (copper is considered the best conductor and is the most durable over the long term) and the special, solar heat trapping 'selective surface' coating will also determine the quality of the hot water panel.

These panels (the rule of thumb is to use one for every two people in the house) are connected to a storage tank which can either sit above the solar panels (known as a 'close coupled' system) or at ground level (known as a 'split' system). In the latter system the panels are still mounted upon the roof and the water is circulated between the tank and panels by a small pump.

**Recommendation:** For normal domestic hot water use, in areas not subject to heavy frosts, flat plate collectors should give the best performance.

The second type of collector consists of series of glass tubes where the air has been removed (evacuated). The radiant energy from the Sun passes through the tube wall and is collected on a slender inner tube containing anti-freeze liquid. When this liquid is heated enough by the Sun, it becomes a hot vapour which rises inside the inner tube to the top where the heat is transferred in a manifold and in turn via a pump to a storage tank. The absence of air within the outer tube reduces unwanted heat loss.




**Recommendation:** Where frost is a problem or where higher temperatures are required (eg in a commercial kitchen or laundry) then evacuated tubes are likely to be the best option.

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### [2] Heat Pumps

A heat pump works like an electric refrigerator 'in reverse', harvesting the available ambient temperature (eg from the air) through compressors and heat exchangers and storing the energy in a hot water tank. Air-sourced heat pumps work best in areas of high humidity and temperature but have to work harder, are more prone to breakdown and wear out more quickly in cooler, dry air areas. Heat pumps run on electricity and will, depending on the location, use between 20% and 50% of the electrical energy used by a traditional electric storage hot water tank. Ideally, heat pumps are powered 100% by solar PV panels or 'green power' (from renewables) purchased from the grid.

**Recommendation:** As a general rule heat pumps are not recommended for anywhere in Victoria unless they form part of a system powered by PV panels and are not overworked. However in situations where there is no space for solar collectors, the heat pump hot water systems may be an option (being mindful of their likely reduced lifetime).

### [3] PV Panels for Hot Water

As the cost of photovoltaic (PV) panels reduces and efficiency increases it may become cost-effective to use these panels to heat water. Option (1) would be to divert excess power from an existing PV system into an immersion element in a storage tank. This would only be a supplement to a hot water service otherwise being heated by solar thermal collectors, wood heat, grid electricity or gas but it may be a better option than exporting to the reticulated grid given the very low tariffs being paid by the utilities. Option (2) would be to have a dedicated PV system to provide 100% of your hot water needs all year round – including winter – with excess power in summer from the large system required ideally being used on site (eg for air-conditioning) instead of being exported to the grid. There are advantages of using PV panels in lieu of solar thermal panels in that PV panels can be remote from the storage tank and electrical cabling is likely to less expensive than copper piping. However sufficient shade-free space will be needed for the PV panels.

**Recommendation:** If shade-free space is not an issue it might be worth considering PV panels as part of a solar hot water system.

Solar flat plate collectors (top row) and photovoltaic panels (lower row)

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**Notes:**

**(1) Frost –** Water (unlike most substances) expands when it freezes. This is a particular problem where water is trapped in pipes in a solar thermal collector as the expansion will eventually damage the collector. In areas subject to heavy frosts, evacuated tube collectors are the preferred option.

**(2) Tanks –** The hot water storage tanks are a key component of the system and our preference is for high quality tanks, well-constructed and with high levels of insulation. Our general recommendation is for stainless steel tanks over glass-lined mild-steel tanks. The quality is usually reflected in the length of the tank warranty. (Note however that stainless steel tanks are only suitable for areas with good water quality and are not suitable for areas with hard water). As a general rule, the more storage capacity the better to store the available solar energy.

Existing gas-boosted storage tank on the left coupled with a new solar storage tank on the right. (The more storage the better).

**(3) Aesthetics –** Solar hot water systems should look good on your house. If you don't like the appearance of a tank on the roof, the storage tank can usually be located in a convenient spot at ground level. Ideally the tanks are located as close as possible to the key water usage points.

**(4) Pumps –** The pumps on solar systems are for circulating (rather than lifting) water and therefore consume minimal power in operation.

**(5) Shade –** Solar panels, as the name indicates, require good solar access for most of the day – at least from 10am to 4pm. Solar thermal panels (flat-plate and evacuated tubes) can tolerate partial shading, however PV panels require full Sun as much as possible. The more access to full Sun the better for all types of solar panels.

**(6) Inputs –** Hot water storage tanks can have a combination of energy inputs. For example see the award winning case study with solar hot water panels, backed up by a wood stove and an LP gas supply: www.goingsolar.com.au/case-studies/solar-hot-water-wood-stove-back If desired such a system could also have an electric element powered by photovoltaic panels.

**(7) Installation –**The quality of the installation will affect both the system performance and the appearance. For example a good installation will have well insulated pipework which in turn will be protected from the ultraviolet rays to provide a long-life system.

**(8) Warranty –** Good solar hot water systems will have long warranties, typically 10 years for tanks 7 years for solar panels (for domestic systems).