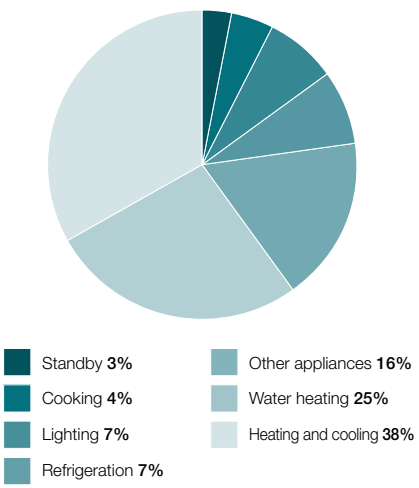
Hot Water Service

Water heating accounts for 25 per cent of the energy used in an average home and is responsible for 23 per cent of the total greenhouse gas emissions from home energy use. Reducing your hot water use and using renewable energy sources to heat water are great ways to reduce your environmental impact.

Home energy use
(Baseline Energy Estimates, 2008)



By installing the most appropriate and efficient water heater for your household size and water use patterns you can save money and reduce greenhouse gas emissions without compromising your lifestyle. An efficient water heater may cost more to buy but it will usually pay for itself over time through energy savings. An efficient hot water system can also add value to your home and help you to meet local council or State regulations.

More than half of hot water use is in the bathroom, a third is in the laundry and the remainder is in the kitchen. One of the best ways to reduce your energy bills is to reduce hot water use by installing water efficient showerheads and taps – you will save on energy and water.

25 per cent of energy used in the home is used to heat water.

TYPES OF HOT WATER SYSTEM

There are two basic types of water heater – storage systems and instantaneous (or continuous flow) systems. Each system can use a variety of energy sources to heat water.

Storage water heaters

Water is heated and stored in an insulated tank for use when it is required. These systems can operate on mains pressure or from a gravity feed (constant pressure) tank.

Mains Pressure – Hot water is delivered at a similar pressure and flow rate to cold water so more than one outlet can usually be turned on without greatly affecting pressure. The storage tank is usually located at ground level inside or outside the house. Mains pressure systems have been the most popular systems in recent decades.

Constant Pressure or gravity feed – Hot water is delivered at lower than mains pressure from a tank located in the roof of the house. Pressure depends on the height difference between the tank and the point of use. Gravity feed systems are most common for older properties and properties not connected to mains water. They are often cheaper to purchase and last longer than mains pressure systems.

For either type of system, storage tanks may be made of copper, glass (enamel) lined steel or stainless steel. Copper and glass-lined tanks typically have a sacrificial anode to reduce tank corrosion, which needs to be replaced every few years. Warranties offered for tanks typically range from five to 10 years.

Instantaneous water heaters

Instantaneous systems heat only the water required and do not use a storage tank. They can operate on natural gas, LPG or electricity. Gas models are available with either electronic ignition or a pilot flame. They can be mounted internally or externally.

Because instantaneous systems heat the water as it is used, they cannot run out of hot water. Standard units can only deliver adequate hot water to one or two points at the same time but high performance gas units can supply several points at once.

Instantaneous water heaters can be fitted with sophisticated temperature controls, including controls that allow the user to set the desired water temperature at the point of use (eg in the shower). This means that water is not overheated and that hot water does not need to be diluted with cold water to achieve a suitable temperature, resulting in energy savings.

ENERGY SOURCES FOR HEATING WATER

Solar energy

Solar hot water systems are storage systems and, depending on your climate, can provide up to 90 per cent of your hot water for free using the sun's energy. Solar systems cost more to buy and install but the extra upfront cost will be recovered over the life of the system through reduced energy bills. Solar systems will take longer to recover their costs in smaller households, in cooler parts of the country, or where access to sunlight is restricted.


Courtesy Solahart Pty Ltd

To provide hot water on cloudy days or when demand exceeds supply, most solar water heaters come with a gas or electric booster. A gas booster produces less greenhouse gas emissions.

Booster systems located inside the storage tank can be inefficient – cutting in and pre-empting the sun. Override switches and timers can correct this problem if well managed. An increasingly popular approach is to use an inline gas booster that works like an instantaneous water heater – it guarantees a suitable temperature while maximising the solar contribution.

The solar collector and storage tank is generally located on the roof of your home, facing north. The storage tank can also be located inside the roof or at ground level.

Rebates are available to assist with the purchase cost of solar water heaters. Rebates are currently available from the Australian Government and State Governments in NSW, Victoria, South Australia and Western Australia.

At the end of this fact sheet is detailed information on solar hot water systems.

Natural gas

Natural gas water heaters generate far fewer greenhouse gas emissions than electric storage systems using mainland grid electricity. This is because natural gas burns cleaner than the coal that is burnt to generate most electricity in mainland Australia. Using gas directly in the home also avoids the energy losses associated with the generation and distribution of electricity.

Natural gas water heaters generate far fewer greenhouse gas emissions than standard electric storage systems.

Gas storage systems have quicker heat recovery times and generally use a smaller tank than a comparable electric storage system. This improves efficiency and makes indoor installation easier. Systems installed inside the house need a flue that leads outside to vent exhaust gas.

Instantaneous systems usually use natural gas as it is cheaper for this application than LPG and electricity.

To compare energy use of gas storage and instantaneous gas water heaters, check the star rating label. [See: 6.1 Energy Use Introduction]

As of October 2007, the highest rated gas storage system on the market has a 5.2 star rating and the highest rated instantaneous gas system has a 6 star rating.

Electricity

Quantum Energy Systems

Electricity can be used for standard storage heaters, for heat pump systems or for boosting solar systems. Expensive three-phase electricity supply is needed for instantaneous systems.

Electric heat pumps are an efficient type of electric storage water heater that extracts heat from the environment (air, water or ground) to heat water. Like solar water heaters, they cost more to purchase and install but will pay back the extra initial investment over time through reduced energy bills.

Heat pumps that draw heat from the air use only about one quarter to one third of the energy of a standard electric storage system and can be made even more efficient by using a solar booster. They operate like a refrigerator but in reverse. The ambient air is used to heat a refrigerant, which converts to a gas. The gas is then compressed, generating heat, which is transferred to the water. The refrigerant is expanded back to a liquid and the cycle repeats.

Electricity is not used to directly heat the water but to move the refrigerant around the system. This is why the electricity use is much less than for storage systems.

Ground source (or geothermal) heat pumps use a water body, shallow trench or deep bore instead of the air as a heat source. They usually provide both space heating and water heating. Electricity is used to pump water around a loop buried in the ground or immersed in a water body. The enclosed water absorbs heat from the surroundings. Geothermal heat pumps can produce more than four units of heat energy for every unit of electrical energy used. They are best suited to multi-residential applications, where plenty of space is available.

Heat pumps can be located and designed to utilise waste heat from air conditioners and refrigerators.

Government rebates may be available to assist with the purchase cost of heat pumps, particularly if the heat pump is solar boosted. For details of existing rebate schemes.

Electric storage water heaters – Standard electric storage water heaters use a heating element inside the tank to heat the water, just like an electric kettle. When powered using mainland grid power in Australia, they are responsible for the most greenhouse gases of any water heater and are not recommended. Emissions from electric storage water heaters can be greatly reduced by using GreenPower or other renewable energy to run the water heater.

Electric storage water heaters of less than about 150L usually use peak electricity and are the most expensive of all to run.

Larger electric storage water heaters generally use cheaper off-peak electricity tariffs, where available, heating water at restricted times (usually overnight).

To reduce the chance of running out of hot water, tanks are often oversized and overheated, increasing energy consumption and greenhouse gas emissions. An electric storage water heater can indirectly produce as much carbon dioxide each year as the average family car.

While an electric storage water heater may be cheap to buy, it is expensive to run and this should be taken into account when deciding which water heater to buy.

CHOOSING A HOT WATER SYSTEM

Of the many different types of water heaters on the market, the best hot water system for your home will depend on your situation. Consider the following.

Household size – The number of people living in your home and your water consumption patterns (ie whether you all shower at the same time of day; run the dishwasher, washing machine and bath at the same time) will determine the size of the system you need and help to identify the best system and energy source for your needs.

Cost – The purchase cost and operating costs of your hot water system both need to be considered. The energy used by your water heater will impact on your energy bill for years to come so consider carefully before buying.

Any extra purchase cost of an efficient water heater is usually recovered within the life of the unit. Government rebates are also available on some energy efficient systems.

Space available – In existing homes it may not be possible to install some systems due to lack of space or a difficult layout.

Existing water heater – Some existing hot water systems can be easily converted to more sustainable types. For example, the best replacement for the old style ceiling mounted gravity service is often a roof-mounted solar system, as plumbing usually requires minimal alteration.

Available energy sources – Your choice may also be limited by the available energy sources. Natural gas is not available in some areas and solar energy may not be ideal in cooler climates or shaded areas.

The energy source of a hot water system has a large impact on greenhouse gas emissions. For example, electric systems generate fewer emissions in Tasmania because the electricity is primarily sourced from hydro-electric power. Natural gas hot water systems typically generate fewer greenhouse gas emissions than electric storage hot water systems and solar hot water systems can further reduce greenhouse gas emissions.

Local climate – Sunny locations with good solar radiation allow solar hot water systems to operate most effectively. In warm climates there is also less energy needed to raise the temperature of the water storage tanks if they are located outside, as the difference between the air temperature and the temperature of the hot water is smaller.

The tables on the following page compare average greenhouse gas emissions for different types of systems, different household sizes and different climates. For example, the greenhouse gas emissions for a medium-sized household in Sydney would be 4.2 tonnes for an off-peak electric system, 1.4 tonnes for a 5 star storage gas system or 0.2 tonnes for a flat-plate solar system with a gas booster.

These calculations are based on average system performance, average climatic data and hot water consumption calculations determined by the relevant Australian Standards and industry protocols. Please note that the performance of your hot water system may differ from the information provided.

Key considerations for calculating the emissions generated by your hot water system include:

> Greenhouse intensity of the energy source.

> Age and efficiency of the hot water appliance.

> Amount of solar radiation available for solar hot water systems.

> Heat lost by hot water storage tanks to the outside air.

> Volume of hot water consumed.

The following recommendations can be used to minimise greenhouse gas emissions:

> Where gas is available and solar access is good, a gas boosted solar water heater will generate the lowest greenhouse gas emissions.

> Where gas is available but solar access is poor, an instantaneous gas system or electric heat pump is usually the best option for small to medium households.

> For large households, a gas storage system gives similar performance to an instantaneous gas system at lower cost.

> Where gas is not available an electric-boosted solar system or an electric heat pump will minimise emissions.

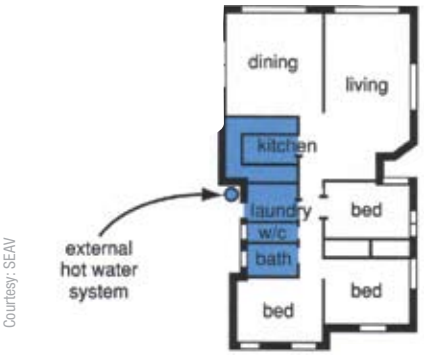
> For multi-residential developments, a large, cost-effective solar water heater can be effectively combined with instantaneous gas boosters in each unit, or a geothermal heat pump could be cost-effective for blocks of five or more units.

DESIGN AND INSTALLATION

About 30 per cent of the energy used to heat water in a storage system is wasted due to heat loss from the tank and associated pipework. This can be reduced through careful design and installation.

Keep hot water pipes as short as possible to minimise heat loss. In new or renovated homes, locate wet areas close together with the water heater close to all points of hot water use. If this is not possible, locate it close to the kitchen where small, frequent amounts of hot water are used. Another alternative is to install a water recirculation system. These systems are generally compatible with any hot water system type. They recirculate water in the pipes until hot water is detected, to avoid wastage.

Estimate your hot water needs accurately to ensure your system is not oversized or



Courtesy: SEAV

undersized for your household. If storage system tanks are too small for the number of people in the house hot water can run out. If the tank is too large, operating costs will be excessive.

Storage systems lose heat through the tank walls. Reduce heat loss by wrapping the tank with an insulation blanket. Ensure that the air supply to gas systems is not affected.

In cool and cold climates, try and locate the tank inside as part of a drying or heating cupboard. This will save heat leakage to cold air and re-use leaked heat for drying.

Insulate hot water pipes, particularly externally exposed pipe leading from the water heater to the house and the pipe leading to the relief valve (on storage systems). Note: Standard lagged hot water pipes are inadequate external protection in cold and cool temperate climates. Apply additional insulation or 'lagging'.

For storage systems consider installing a timer to ensure water is not heated when it's not needed, and a switch so the system can be turned off when you go on holiday.

Design new homes with a roof pitch and orientation suitable for a solar water heater. You may not want to install one now but it leaves the option open for the future. A north-facing roof with a pitch of between 22° and 40° is usually adequate.

A hot water supply system must be designed and installed in accordance with Section 8 of AS/NZS 3500.4:2003 Heated Water Services (including amendment 1) or clause 3.38 of AS/NZS 3500.5:2000 (including amendments 1,2 and 3). A solar hot water supply system located in climate zones 1,2 and 3 is exempted from complying with the above mentioned requirements. For further information please refer to the BCA Volume Two, Clause 3.12.5.0.

	TONNES OF GREENHOUSE GAS EMISSIONS PER YEAR		
	HOUSEHOLD SIZE (number of people)		
	Small (1-2)	Medium (3-4)	Large (5+)
ADELAIDE (SA) CLIMATE: TEMPERATE			
Electric Storage (off-peak)	2.7	4.1	5.6
Electric Storage	2.7	4.1	5.9
Electric Heat Pump Storage	0.7	1.1	1.5
Solar (Flat-plate) Electric Boost	0.6	1.3	2.4
Solar (Flat-plate) Gas Boost	0.1	0.3	0.6
Gas 3 Star Storage	1.4	1.8	2.4
Gas 5 Star Storage	1.0	1.5	2.0
Gas 5 Star Instantaneous	0.8	1.3	1.8
ALICE SPRINGS (NT) CLIMATE: HOT DRY, COLD WINTER			
Electric Storage (off-peak)	NA	NA	NA
Electric Storage	1.5	2.3	3.3
Electric Heat Pump Storage	0.4	0.6	0.8
Solar (Flat-plate) Electric Boost	0.1	0.2	0.5
Solar (Flat-plate) Gas Boost	0.1	0.1	0.1
Gas 3 Star Storage	1.1	1.4	1.8
Gas 5 Star Storage	0.8	1.1	1.5
Gas 5 Star Instantaneous	0.6	0.9	1.3
BRISBANE (QLD) CLIMATE: WARM HUMID			
Electric Storage (off-peak)	2.7	4.1	5.6
Electric Storage	2.6	4.1	5.9
Electric Heat Pump Storage	0.7	1.1	1.7
Solar (Flat-plate) Electric Boost	0.4	1.1	2.2
Solar (Flat-plate) Gas Boost	0.1	0.2	0.5
Gas 3 Star Storage	1.2	1.6	2.1
Gas 5 Star Storage	0.9	1.3	1.8
Gas 5 Star Instantaneous	0.7	1.2	1.7
CANBERRA (ACT) CLIMATE: TEMPERATE			
Electric Storage (off-peak)	2.9	4.3	5.8
Electric Storage	2.8	4.3	6.2
Electric Heat Pump Storage	0.8	1.2	1.7
Solar (Flat-plate) Electric Boost	0.8	1.6	2.8
Solar (Flat-plate) Gas Boost	0.2	0.3	0.7
Gas 3 Star Storage	1.4	1.8	2.3
Gas 5 Star Storage	1.0	1.4	1.9
Gas 5 Star Instantaneous	0.8	1.2	1.8
DARWIN (NT) CLIMATE: HIGH HUMID			
Electric Storage (off-peak)	NA	NA	NA
Electric Storage	1.4	2.2	3.2
Electric Heat Pump Storage	0.4	0.5	0.8
Solar (Flat-plate) Electric Boost	0.0	0.1	0.3
Solar (Flat-plate) Gas Boost	0.1	0.1	0.1
Gas 3 Star Storage	1.0	1.3	1.7
Gas 5 Star Storage	0.7	1.0	1.4
Gas 5 Star Instantaneous	0.6	0.9	1.3

	TONNES OF GREENHOUSE GAS EMISSIONS PER YEAR		
	HOUSEHOLD SIZE (number of people)		
	Small (1-2)	Medium (3-4)	Large (5+)
HOBART (TAS) CLIMATE: COOL TEMPERATE			
Electric Storage (off-peak)	0.2	0.2	0.3
Electric Storage	0.2	0.2	0.4
Electric Heat Pump Storage	0.0	0.1	0.1
Solar (Flat-plate) Electric Boost	0.1	0.1	0.2
Solar (Flat-plate) Gas Boost	0.2	0.5	1.0
Gas 3 Star Storage	1.2	1.6	2.2
Gas 5 Star Storage	0.9	1.3	1.9
Gas 5 Star Instantaneous	0.6	1.1	1.7
MELBOURNE (VIC) CLIMATE: TEMPERATE			
Electric Storage (off-peak)	3.6	5.8	7.4
Electric Storage	3.4	5.8	8.3
Electric Heat Pump Storage	0.9	1.5	2.2
Solar (Flat-plate) Electric Boost	1.4	3.3	4.7
Solar (Flat-plate) Gas Boost	0.2	0.5	0.9
Gas 3 Star Storage	1.2	1.7	2.2
Gas 5 Star Storage	0.9	1.4	1.9
Gas 5 Star Instantaneous	0.7	1.2	1.8
PERTH (WA) CLIMATE: TEMPERATE			
Electric Storage (off-peak)	2.4	3.7	5.0
Electric Storage	2.4	3.7	5.3
Electric Heat Pump Storage	0.6	1.0	1.4
Solar (Flat-plate) Electric Boost	0.4	1.0	1.9
Solar (Flat-plate) Gas Boost	0.1	0.2	0.4
Gas 3 Star Storage	1.1	1.5	1.9
Gas 5 Star Storage	0.8	1.2	1.6
Gas 5 Star Instantaneous	0.6	1.0	1.5
		0.1	
SYDNEY (NSW) CLIMATE: TEMPERATE			
Electric Storage (off-peak)	2.8	4.2	5.8
Electric Storage	2.7	4.2	6.1
Electric Heat Pump Storage	0.7	1.1	1.6
Solar (Flat-plate) Electric Boost	0.7	1.5	2.8
Solar (Flat-plate) Gas Boost	0.1	0.3	0.6
Gas 3 Star Storage	1.3	1.7	2.3
Gas 5 Star Storage	1.0	1.4	1.9
Gas 5 Star Instantaneous	0.8	1.2	1.8
TOWNSVILLE (QLD) CLIMATE: TEMPERATE			
Electric Storage (off-peak)	2.2	3.3	4.4
Electric Storage	2.2	3.3	4.7
Electric Heat Pump Storage	0.6	0.8	1.2
Solar (Flat-plate) Electric Boost	0.1	0.4	1.0
Solar (Flat-plate) Gas Boost	0.1	0.1	0.2
Gas 3 Star Storage	1.0	1.4	1.8
Gas 5 Star Storage	0.8	1.1	1.5
Gas 5 Star Instantaneous	0.6	0.9	1.4

Source: Energy Strategies, 2007

HOT WATER TIPS

Reducing your use of hot water is a great way to save on your energy bills, regardless of what type of water heater you have. For tips on reducing your water use see 7.2 Reducing Water Demand.

Showering uses the most hot water in a household. Installing a water efficient (3-star) showerhead can reduce this use by about half. If you have an instantaneous water heater, make sure that your water efficient showerhead is compatible and does not reduce flow excessively. Check with the manufacturer of your heater.

Use a shower time to remind everyone in the household to save water.

Buy washing machines and dishwashers that have a cold or warm water or economy cycle option and use these cycles as much as possible.

Immediately repair dripping hot water taps and leaking appliances, including the relief valve from your water heater.

Ensure that the temperature gauge on storage hot water systems is set at 60°C. A higher temperature than this means that energy is used unnecessarily and a lower temperature than this may allow harmful bacteria to thrive. Instantaneous hot water systems should be set to no more than 50°C.

Turn off your water heater when you go on holidays.

Maintain your system and have it serviced according to manufacturer's instructions.

SOLAR HOT WATER

Installing a solar water heater can greatly reduce your energy bills as it will use energy from the sun to heat water at zero cost.

Using solar energy to heat water produces no harmful greenhouse gas emissions. A solar water heater can provide between 50 per cent and 90 per cent of your total hot water requirements, depending on the climate and the model of heater.

The upfront cost of a solar water heater (including installation) is higher than electric or gas water heaters. Government rebates are available from the Australian Government and several State Governments to assist with the initial purchase cost of a solar water heater.

Although the initial cost of a solar water heater is higher, it will pay back the difference in cost over the life of the system. The time required to break even (the payback period) depends on the climate and the type of system installed, but is typically five to 10 years. Solar water heaters have additional benefits, as they last longer than conventional water heaters and add to the value of your home.

A solar water heater will pay back its higher initial cost over the life of the system through reduced energy bills.

HOW DO THEY WORK?

Most solar hot water systems use solar collectors or panels to absorb energy from the sun. Water is heated by the sun as it passes through the collectors. It then flows into an insulated storage tank for later use.

In passive systems, water flows due to a thermosiphon effect between the collectors and the tank. In active systems, water is pumped between the collectors and the tank.

The storage tank is usually fitted with an electric, gas or solid fuel booster that heats the water when sunlight is insufficient. Some solar water heaters also have frost protection to prevent damage in frost prone areas.

Solar hot water supply located in climate zones 4,5,6,7 and 8 is required to comply with Section 8 of AS/NZS 3500.4 2003 Heated Water Services (including amendments:1, 2 and 3.) For further information please refer to the BCA Volume Two, Clause 3.12.5.0.

Solar collectors

Solar collectors trap and use heat from the sun to raise the temperature of water. There are two main types of solar collector: flat-plate and evacuated tube collectors.

Flat-plate solar collectors – These are the most common type. They are comprised of:

> An airtight box with a transparent cover.

> A dark coloured, metallic absorbing plate containing water pipes.

> Insulation to reduce heat loss from the back and sides of the absorber plate.

One slight disadvantage of flat-plate collectors is that they only operate at maximum efficiency when the sun's rays strike perpendicular to the flat plate. They also suffer some heat loss in cold weather.

Solar evacuated tube hot water system.

Evacuated tube solar collectors – This kind of collector consists of:

> A series of transparent outer glass tubes that allow light rays to pass through with minimal reflection.

> Each tube contains an inner water pipe coated with a layer that absorbs the sun's rays, generating heat. Water runs through this inner tube and is heated.

> A vacuum (hence 'evacuated') exists between the outer tube and the water pipe, which acts as insulation, reducing heat loss.

Evacuated tube systems are more efficient than flat-plate systems, particularly in the cooler months and on cloudy days. This is due partly to the vacuum insulation (which minimises heat loss) and partly to the fact that the curved surface of the tubes allows the sun's rays to strike perpendicular to the water for a greater part of the day. Evacuated tube systems weigh much less than flat-plate systems but cost significantly more. Individual tubes can be replaced in the event of damage, making long term maintenance potentially less costly.

Properly maintained solar thermal collectors should outlast the life of the storage tank. When the tank needs replacing, the existing collectors can be connected to the new tank.

Frost protection

Frost protection for solar collectors is essential in frost prone areas. During a frost, water can freeze in the solar collector and damage it unless preventative measures are taken. Common types of frost protection include:

> Knock valves (mechanical drain down valves). These valves can be problematic as they often jam open and drain the tank, or fail to operate, causing severe damage.

> Electric heating elements, which are vulnerable in the event of power failure.

> Closed circuit systems, which separate the heating fluid from the water (see illustration next page). Closed circuit systems are usually the best option in frost prone areas as they ensure that water does not flow through the solar collectors and therefore cannot freeze in the collectors.

Open circuit vs closed circuit

In an open circuit system, water flows directly through the solar collectors, into the storage tank and then through pipes into your home.

In a closed circuit system a fluid other than water flows through the collectors, picks up heat from the sun, and transfers this heat to water in the storage tank through a heat exchanger.

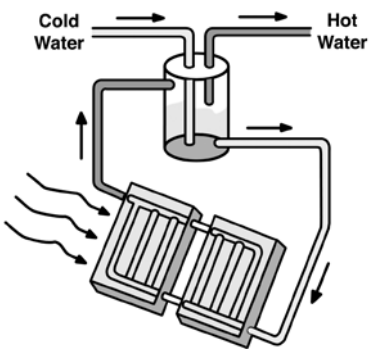
Closed circuit systems are most commonly used for frost protection (see illustration next page). A fluid with a lower freezing point than water is used to avoid ice formation in the solar collectors. It is important to choose the fluid carefully as some become 'gluggy' and reduce efficiency.

Some closed circuit systems pump hot water through the collectors when temperatures approach freezing. This lowers efficiency significantly. Avoid systems with this feature.

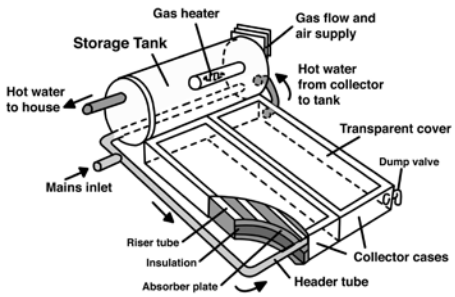
Passive vs active systems

Passive (or thermosiphon) systems

In Passive systems (or thermosiphon systems) the tank is placed above the solar collectors so that cold water sinks into the collectors, where it is warmed by the sun, and rises into the tank. A continuous flow of water through the collectors is created without the need for pumps.



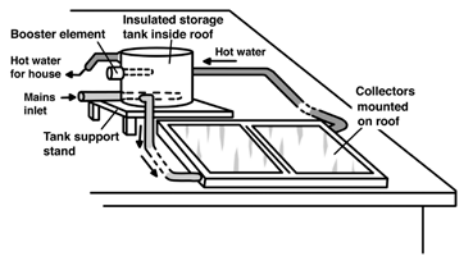
Passive systems come in two types: closed-coupled or gravity feed.



In a close-coupled system the horizontal storage tank is mounted directly above the collector on the roof. Heated water is supplied at mains pressure. This arrangement is the most cost effective to install but efficiency is reduced in cool and cold climates by heat loss from the tank.

Additional insulation of tanks is desirable in these climates. Alternatively, tanks can be detached and moved inside the roof space, although this increases the cost.

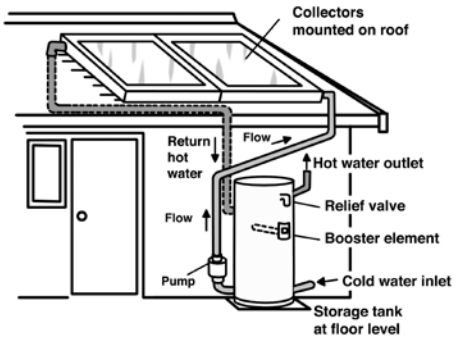
In a gravity-feed system, the storage tank is installed in the roof cavity. These systems are cheapest to purchase but household plumbing must be suitable for gravity feeding, including larger diameter pipes between the water heater and the taps. A common alternative is to use a closed circuit gravity feed system to heat mains pressure water using a heat exchanger.



Active (or pumped) systems

In active systems (also known as pump systems or split systems), solar panels are installed on the roof and the storage tank is located on the ground or another convenient location, that does not have to be above the solar collectors. Water (or another fluid) is pumped through the solar collectors using a small electric pump.

Because active systems do not require a roof-mounted tank they have less visual impact, particularly when the solar collectors are mounted flush with the roof. However, active systems are usually more expensive to purchase and require more maintenance than passive systems.



Active systems use more energy than passive systems because extra energy is required to pump fluid around the system. There are also additional heat losses in the pipes between the tank and the solar collectors. However, if renewable energy is used to power the pump and a high level of insulation is used for the pipes and tank, active systems can reduce greenhouse gas emissions as much as a passive system. [See: 6.1 Energy Use Introduction]

Active systems are often used for solar conversions, when solar collectors are added to an existing hot water system. They may also be used when the roof can't support a passive system.

Storage tanks

Tanks are manufactured from stainless steel, copper or mild steel coated with vitreous enamel.

Copper-lined tanks are only suitable for low-pressure systems. The other tanks are suitable for mains pressure.

Vitreous enamel tanks are fitted with a 'sacrificial anode' that needs to be replaced every few years to protect against corrosion (more frequently where water quality is poor). Other tanks do not require this protection.

Outdoor storage tanks can suffer frost damage and significant heat losses in cool climates. In such climates they should be located indoors whenever possible, as part of a drying cupboard.

Booster systems

Solar water heaters can be gas, electric or solid fuel boosted.

Electric boosters use an electric element inside the storage tank to heat water.

Gas boosters use a natural gas burner to heat water either in the storage tank or more commonly as a separate unit downstream from the storage

tank. Inline gas boosters are becoming more common as they guarantee that hot water will be delivered at the desired temperature, while maximising the solar contribution.

Solid fuel boosters heat water through a heat exchanger, commonly known as a 'wet back' system.

Gas and solid fuel boosted systems produce less greenhouse gas emissions.

Boosters can be manually operated or automatically controlled by a thermostat that cuts in when tank temperatures fall below desired levels. If boosters are not appropriately designed and operated they can defeat the purpose of having a solar water heater by reducing the solar contribution.

For example, thermostat controlled boosters located inside the tank often cut in at night, which means that when the sun rises, there is little useful heating to be done.

In well designed solar water heaters that use an electric booster inside the tank, the booster heating element will be positioned to maximise solar contribution. Hot water enters the tank at the bottom, so the element should be high up in the tank to avoid interference with hot water coming in. However, if it is too high in the tank it will not be able to heat enough water on cloudy days.

Timers can also be used to manage boosters and ensure that you get the maximum solar contribution. Talk to your supplier about correct operation of timers.

Solar boosted heat pumps

Heat pumps work like a refrigerator in reverse, absorbing heat from the air and transferring it to the water.

Solar boosted heat pumps use solar collectors to further improve the efficiency of a heat pump system. They are active closed circuit systems that use a refrigerant as the heat transfer fluid and do not require frost protection. Heat pumps work even when the sun is not shining, as the refrigerant can absorb heat from the ambient air.

Although heat pumps use electricity, they are very efficient and can operate 24 hours a day without a booster. They also require a smaller storage tank than other solar hot water systems.

Across much of Australia, greenhouse gas emissions from solar boosted heat pump systems can be similar to or less than those from a solar water heater with an electric booster. In northern and central Australia, a solar water heater with an electric booster will have fewer greenhouse gas emissions than a heat pump system.

CHOOSING A SOLAR WATER HEATER

Seek expert advice before deciding which solar water heater to buy.

Climate considerations are very important when selecting a solar water heater and your state government advisory centres can provide excellent local advice.

The Australian Consumers' Association (Choice) provides detailed information to help you choose the best solar water heater for your location and budget.

Manufacturers and retailers may also be able to help with detailed selection guidelines.

Choosing the right size

The best size of storage tanks and solar panels depends on the number of people in the home, how efficiently they use water, the climate and the efficiency of the water heater.

Reducing your hot water demand can reduce the size and cost of the system you need. [See: 7.2 Reducing Water Demand]

Manufacturers or suppliers will advise the best size for your application.

POSITIONING YOUR SOLAR WATER HEATER

For optimum performance throughout Australia solar hot water systems should face solar north. Orientation can deviate up to 45° from north without significant loss of efficiency. Use a compass to check orientation. [See: 4.3 Orientation]

For maximum efficiency, ensure that the solar collectors are not shaded by trees or nearby buildings, particularly in winter when the sun is low in the sky.

For best performance, solar collectors need to be installed at an angle to the horizontal. This maximises the annual amount of sunlight falling on the panels. It is usually recommended that the solar collectors are installed at the same angle to the horizontal as the angle of latitude at the installation location. In Australia, this angle varies from 17.5° in Darwin to 53° in Hobart. In some cases, it may be desirable to increase the angle somewhat to improve winter performance and reduce overheating in summer.

In practice, many solar water heaters are installed at the roof pitch angle as it is cheaper and usually more aesthetically pleasing to install solar collectors flush with the roof, rather than use supports to achieve a greater angle. Roof pitch angles in Australia are commonly between 20° and 30°, so this will often reduce performance in winter. In existing homes, the benefits will usually outweigh the costs. In new homes, design of roof areas to accommodate a suitable solar collector angle may be possible.

OTHER INSTALLATION TIPS

A complete thermosiphon system, when full of water, can weigh several hundred kilograms. Most roofs can support a storage tank without reinforcement but you need to check this before installation. Talk to your builder, designer or engineer to find out.

Be sure to insulate all components, including pipes, to get the best performance from your system. This is particularly important for thermosiphon systems where there is a long distance between the tank and the hot water taps. It is critical in cold climates.

Make sure the booster control is in an accessible location and has an indicator light you can see from inside to remind you to turn it off when not required.

OPERATING AND MAINTAINING YOUR SYSTEM

Follow the manufacturer's maintenance recommendations.

Set the temperature of your booster thermostat to about 60°C. A lower setting will use less energy but you should stay above 55°C to prevent growth of harmful bacteria.

In favourable climates during summer, water temperatures in a solar water heater can approach boiling point. Heat dissipation devices may be required to prevent water from boiling. It may also be necessary to fit a mixing valve to reduce water temperatures experienced at the tap to safe levels during summer.

Carry out jobs that need hot water early in the day so that the water left in the tank will be reheated by the sun, ready for use at night.

Regularly clean solar panels to remove dust. You can use a broom with some detergent to give them a scrub.

Flush out collectors to remove sludge. Heat pump systems do not require flushing.

Make sure you turn the booster off when going on holidays and consider turning it off during summer if conditions are favourable.

ADDITIONAL READING

Contact your State / Territory government or local council for further information on hot water systems, including what rebates are available.
www.gov.au

Australian Consumer Association
www.choice.com.au

Department of the Environment, Water, Heritage and the Arts (2008), *Australian Residential Sector Baseline Energy Estimates 1990 – 2020.*

Energy Strategies (2007), *DRAFT REPORT: Review and Update of Residential Hot Water System Greenhouse Gas and Cost.*

Horman R (2003), *Solar Hot Water: Plan your own solar hot water system*, Alternative Technology Association.
www.ata.org.au

Office of the Renewable Energy Regulator
www.orer.gov.au/swh

ReNew: technology for a sustainable future magazine, *Solar Hot Water Buyers Guide*, Issue 97
www.renew.org.au

Solar Hot Water Rebate Programme, Australian Government
www.greenhouse.gov.au/solarhotwater

Solar training
www.solartraining.org.au/content/view/12/26/

Principal author:
Chris Riedy

Contributing authors:
Geoff Milne
Chris Reardon