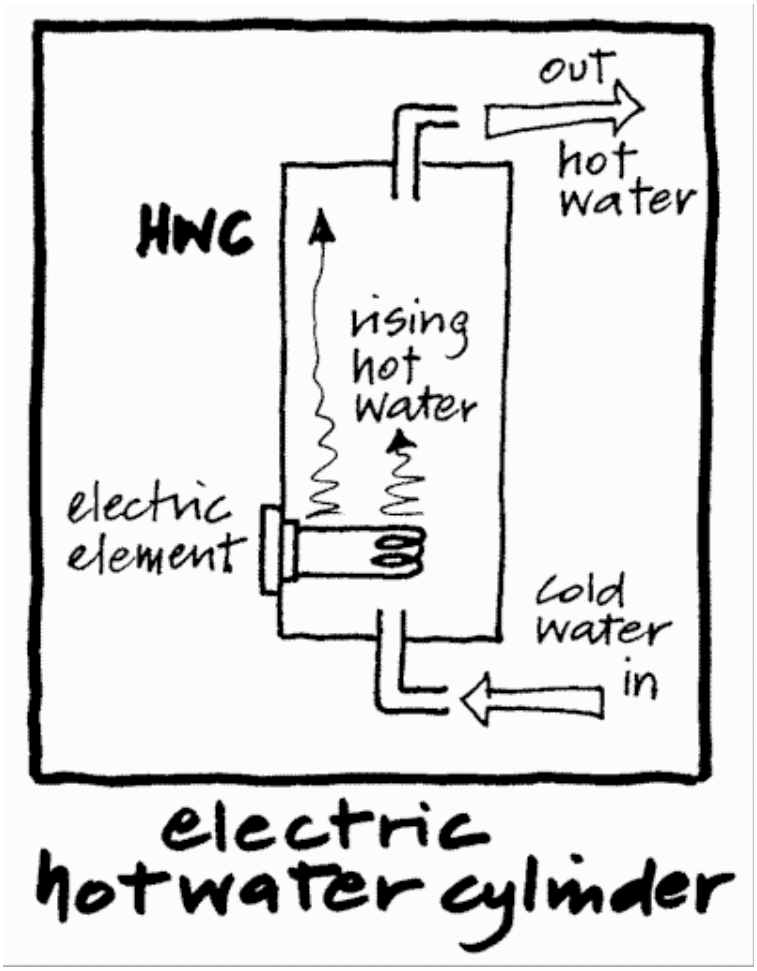
HEATING WATER

Why worry about your hot water system?

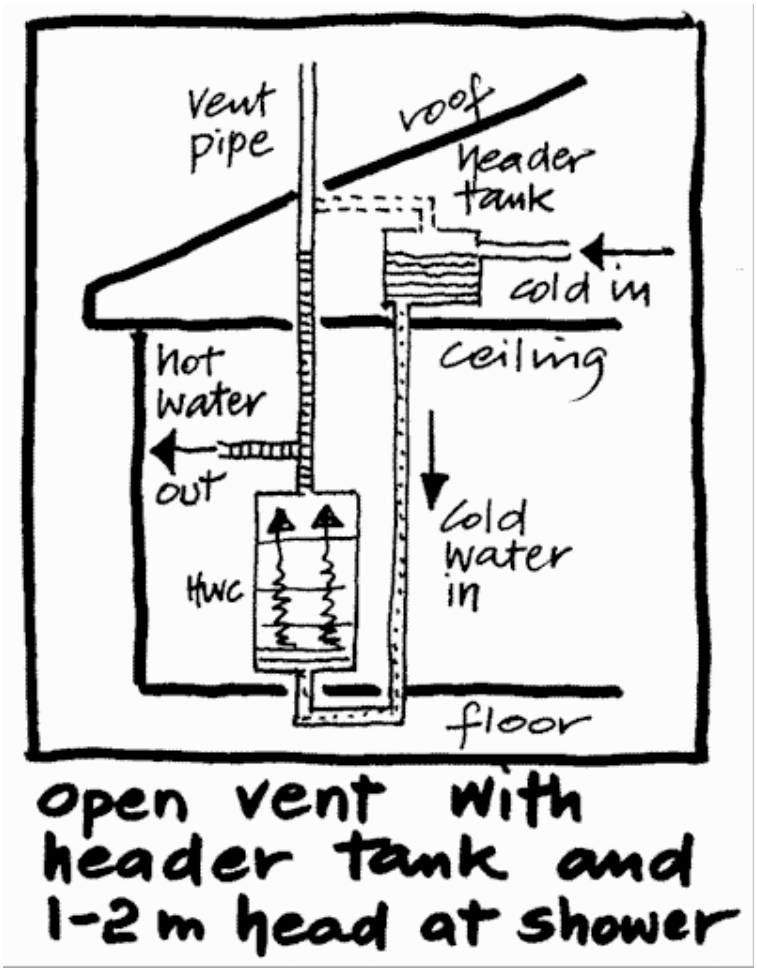
Water heating probably accounts for 45 % of your annual household energy use. Most of us have electric storage hot water systems, which are often inefficient and wasteful. Poorly insulated cylinders, long pipe runs without lagging, and inadequate appliances and fittings all waste energy. Inefficient layout and design of the system can create huge losses too.

So check out your system and find out how to improve it, or at least how to use it more efficiently. As well as saving water and energy you will probably find that you can have a safer more user-friendly hot water system. You'll also be doing your bit to reduce peak demand on our electricity generating system



The standard Kiwi hot water system

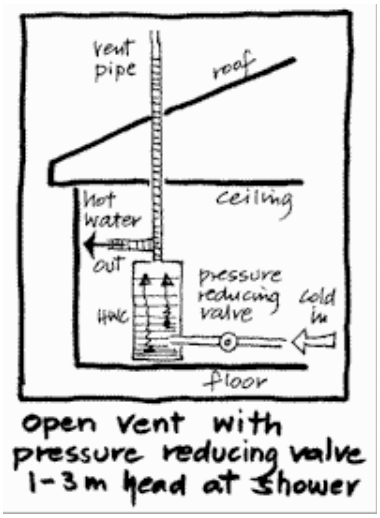
The standard New Zealand hot water cylinder uses an electric element to heat water, which is then stored until needed inside the insulated cylinder. Whenever you turn on a hot tap water is drawn off from the top of the cylinder and cold water enters at the bottom of the cylinder to replace it and be heated up ready for use.

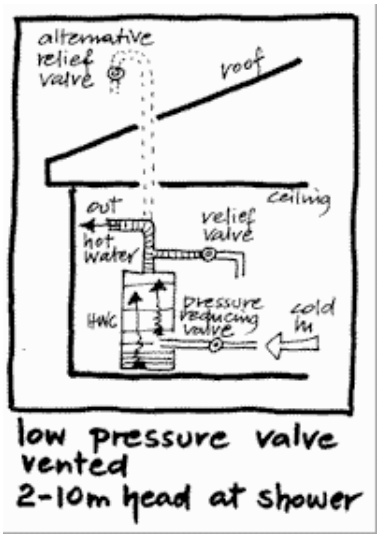


Most of our houses were built with low-pressure cylinders. They are made of copper, which is durable but can withstand only limited pressure. Pressure was reduced by running the mains water into a header tank, just like a toilet cistern, which in turn fed water into the hot water cylinder. As the water is heated it expands and the pressure is relieved by the water rising in a vent pipe up through the roof.

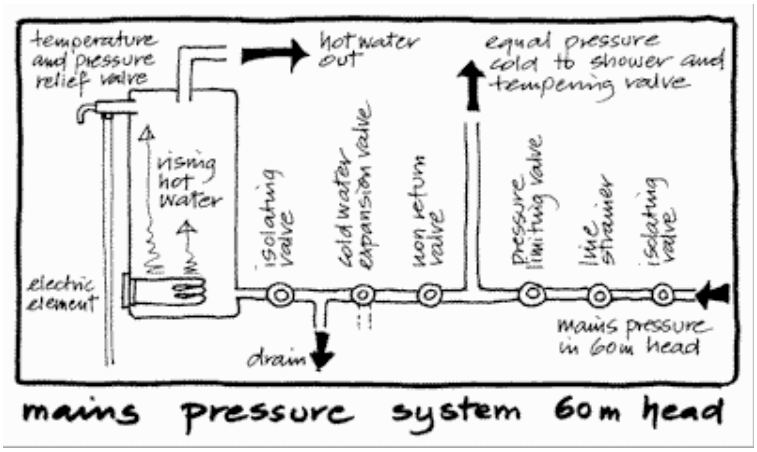
The header tank was usually placed in the roof space. The pressure of water from your showerhead, or any other fitting, is determined by the height of the fitting below the header tank. If it has not already been upgraded you can get more pressure out of such a system by progressively replacing:

1. the header tank with a pressure reducing valve
2. the vent pipe with a pressure relief valve





These days, however, many new or replacement systems are full mains pressure. This requires a steel cylinder (which will not last as long as a low-pressure copper one) and a combination of valves and filters to give consistent hot and cold flow that will work best with efficient modern fittings. Mains pressure cylinders generally have a larger capacity and a combination of more powerful elements, so they can take better advantage of cheaper night rates for electricity.



The following sections look progressively at:

1. using your existing set up efficiently
2. tuning up your system to reduce waste and improve performance
3. designing and instaling a new system

Using your hot water efficiently

There are many common sense ways you can save hot water right away without the need for any new fittings or a plumber.

Hot tap – cold pipe

The main thing to remember when you turn on a hot tap is that the cold water that flows out first has already been heated and then cooled down in the pipework between the cylinder and the tap. As it flows out it is being replaced by an equal quantity of cold water flowing into the cylinder to be heated. This has a number of implications, in particular:

- don't turn on the hot tap for a quick rinse of your hands. You may turn off the tap before the hot water arrives, but you have still wasted electricity
- the same applies to rinsing dishes or vegetables – use cold water.
- if you do need hot water for rinsing hands or dishes, always put the plug in or use a bowl - two minutes of rinsing can sluice 20 litres of hot water down the plughole

Heat the water where you need it

Flowing on from the above principle, it is more efficient to start with cold water and heat it where you actually need to use it:

- use cold water in a saucepan or electric jug – heat just what you need rather than running several litres of water out of your hotwater piping system.
- if your dishwasher and washing machine have their own heating elements (and most do) make sure you are using the cold water supply. And use the economy cycles.
- better still use the cold wash cycle in your washing machine

Do full loads

Whether you wash by hand or machine, full loads are more efficient:

- wait till you have a full load of clothes or dishes before doing a wash.
- if you must do a half load adjust the settings accordingly.
- if you need to wash a few dishes by hand use a small plastic bowl in the sink to reduce the volume of hot water needed.

Showers and baths

People are quite emotionally attached to their showering and bathing habits, but large quantities of expensively heated water can be wasted. Try asking yourself the following questions:

- do you want a long relaxing soak? A bath would be more efficient than a half-hour shower.
- normally, a five-minute shower uses a lot less water than a bath.
- if children have trouble judging how long a five-minute shower is, give them an egg timer, or put the plug in the outlet drain.

Tuning up your hot water system

Dripping away your electricity

A hot tap dripping at the rate of one drip per second will cost you $50 in electricity each year. It is worth keeping your washers in good shape. Call a plumber or learn how to change them. Other potential leaks worth checking are:

- valves around the hotwater cylinder
- showerheads. Some of the common brands wear and need replacement after a few years – consider replacement with a low-flow fitting
- a leaking vent pipe from your hot water cylinder. It will leave water stains on your roof or the outside wall of the house – you can adjust the pressure, or replace the vent altogether with a pressure relief valve.

Reducing the flow

You can check the flow rates from your taps and showers by holding a 1-litre jug under them and timing how long it takes to fill. If it fills in less than six and a half seconds you are using more water than you need. Taps and showerheads can operate perfectly well at flow rates of less than 9 litres per minute.

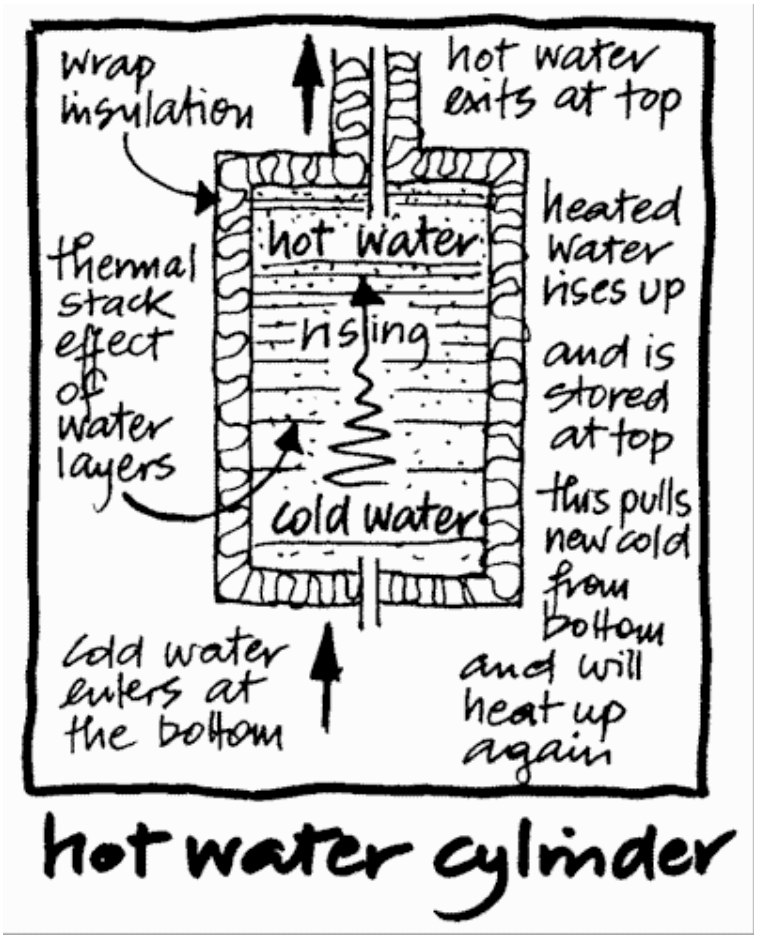
You can fine-tune your plumbing system with fittings to reduce water flow. These are things that need to be instaled by a plumber. And because the choice of water-saving devices is dependent on water pressure and the other components of your system, we strongly recommend that you consult a competent plumber before you go out and buy any fittings or hardware - things that work well in one home might not work in others.

Some companies offer comprehensive packages to retrofit homes with water saving flow restrictors. This is an attractive option because the system can be tailor-made to suit your home and habits. These systems generally ensure that temperature and flow fluctuations are controlled, resulting in good water and energy savings while offering good performance. For more details on flow-reducing fittings see the *Saving Water* chapter of these guidelines.

Saving energy at the cylinder

If your hot water cupboard makes a great clothes drier you're probably wasting energy. Most of the heat disappears through the ceiling, and an internal cupboard is not the best ventilated place to dry clothes anyway.

If your hot water cylinder has an 'A' grade "Watermark" it is already well insulated. If not, you will save up to $70 a year simply by dressing it in a cylinder wrap. You will still have a good airing cupboard, but you should sort out something more efficient for the high-powered clothes drying.



Insulating your hot water pipes, especially the first metre, also helps. Also look for hot water pipes running under the floor to the kitchen or outside the house (as they do for an external cylinder). These pipes will lose more heat than ones in the walls or ceiling.

There are other things you can do with your cylinder:

- fit a tempering valve so the hot water is mixed with cold before it can scald. It takes only five seconds to burn at 60 degrees, one second at 70 degrees. Temperature at the tap is safer at 50-55 degrees.
- for health reasons the thermostat should not be set below 60 degrees. If you run out of hot water often, you may want to eke it out by setting a higher storage temperature, but be aware that the heat will leak out faster.
- an alternative may be to replace a 1kW element with 2-3kW to reduce the heating time, or to instal a larger cylinder.
- instal a heat trap in the vent pipe before it exits through the roof
- replace an open vent pipe with a pressure relief valve
- replace a roof mounted relief valve with one fitted at the cylinder
- check for long hot water pipe runs and consider alternatives

Apart from re-setting the thermostat, all these adjustments require a competent plumber.

A spa pool
Of course, if you have a spa pool, the same principles apply. A spa pool can easily leak $600 worth of heat into the atmosphere in a year.
The best energy saver is to keep it well insulated. A tightly fitted pool cover is essential. The next best thing is to turn it off whenever you won't be using it. It's cheaper to heat the pool up from cold than to be constantly feeding in energy while it sits unused.

Buying cheap electricity
Household power use varies over 24 hours and the peaks in power usage are a problem for our national generating system – it is the peak capacity rather than the total energy usage that causes new dams and power stations to be built. Some Power companies, therefore, offer price incentives to us to switch electricity use more to off-peak times. With a hot ,water cylinder of sufficient capacity these incentives can save us money as well as helping to avoid the need for future dams.

Costs and benefits
The improvements listed on the following page will result in reduced running costs if the same quantity of hot water is used. The "Costs of Improvements" listed include labour – they would be cheaper if you can do it yourself.

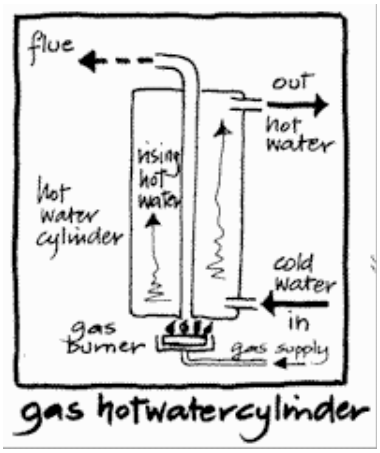
Hot water systems

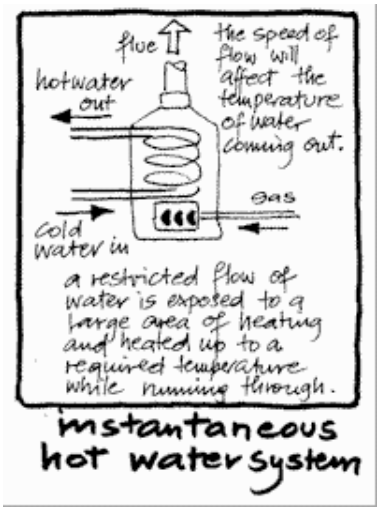
If you are building a new house or have to replace your hot water cylinder, you have the chance to think about the best system for your needs. A house should be designed so that the hot water cylinder is in a central position with relatively short pipe runs to the points where hot water is most frequently used.

Most people these days instal a large capacity mains-pressure cylinder with a powerful electric element, and often a booster element at the top for quick daytime re-heating. This gives good performance, comfortable showers, plenty of hot water etc, but may be wasteful if it's used thoughtlessly and with old inefficient fittings. On the other hand it can also open up energy-saving opportunities. It enables modern low-flow fittings and tempering valves to work efficiently, and its extra capacity enables you to take advantage of the best night rates for heating water.

There are other options for heating water you may like to consider. Most of them use alternative energy sources.

Gas storage water heating
A gas burner controlled by a thermostat will heat up water fast and efficiently. If you are in an area reticulated for gas, the running cost of gas appliances will generally be less than electricity. The quickest way to regain the initial cost of connecting to the gas main is to use the gas supply for space heating and a cook-top as well as for water heating.





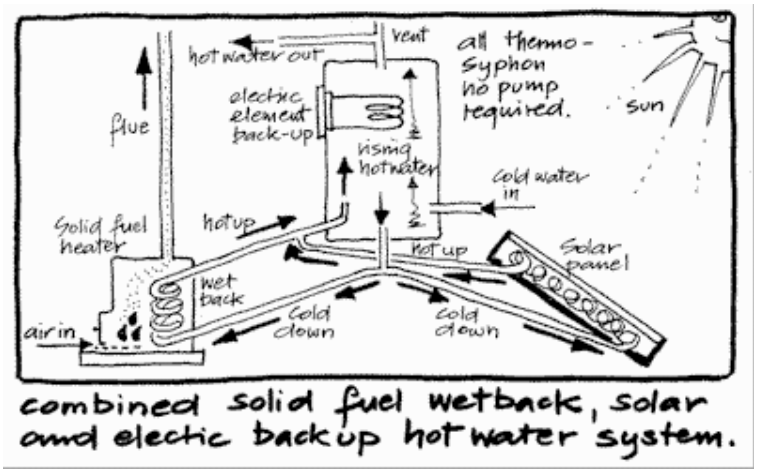
Instantaneous or continuous hot water system

In an instantaneous system the water is heated up - by a very powerful heat source - only when it is needed. This system is inherently more efficient than the standard storage systems, because it does not lose heat from hot water sitting around in the cylinder and pipework. In reality, limits to the flow of hot water from an instantaneous system and the cost of instalation make it impractical for most houses. The system works best where the hot water is needed at a point remote from the main cylinder, or the use is small and infrequent – the guest wing of a house for instance, or a church hall.

Electric instantaneous units are cheapest for limited use, such as hand washing. Gas units can provide more hot water but still have limits to the temperature and flow you can get from them.

Solid fuel wetback

If you enjoy the warmth of a solid fuel heater or like cooking the old-fashioned way, you could instal a wetback to heat your hot water at the same time. This works particularly well when combined with a solar system, which can heat the water through the summer, while the wetback will take it through the winter.

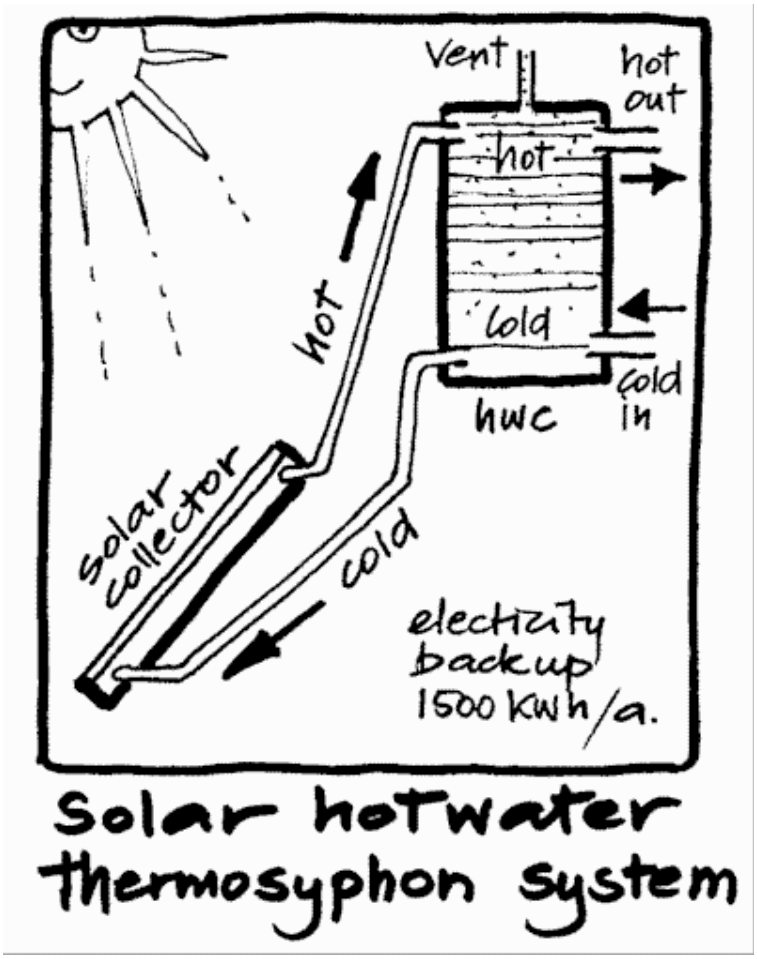


The wetback, the burner and the pipework must be designed and sized to work efficiently together. Otherwise there is a risk that the cold water will reduce temperatures in the burning chamber too low, preventing double combustion of the flue gases, and resulting in air pollution and inefficiency.

A more recently developed product in New Zealand is purely a solid fuel water heater. Using modern combustion technology and highly insulated, it is most cost-effective when the wood is free (as on a farm) and large quantities of hotwater are being brewed (as when it is also used for central heating).

Solar water heater

Heat energy from the sun can produce large quantities of hot water to supplement the use of electricity. A square metre of north-facing roof in Waitakere City can generate 4kW of free renewable non-polluting energy. In summer you can generally provide all your hot water needs, but you need a winter backup from electricity or a wetback.



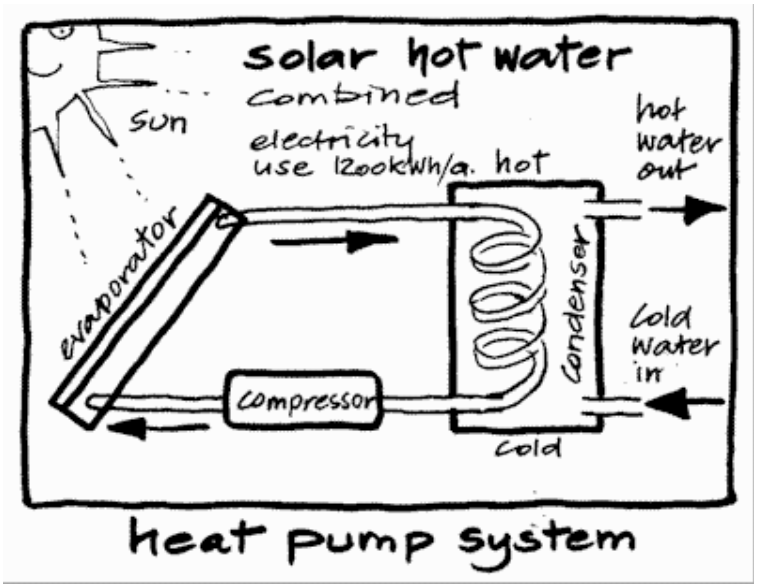
Solar collectors are usually mounted on a sloping roof facing north. The best angle is 35 degrees from horizontal. The most effective systems absorb over 90 % of the available solar radiation and provide two-thirds of your annual water heating requirement. They comprise copper tube bonded to aluminium heat absorbing fins and covered with an optically efficient selective surface. At the other end of the spectrum are home-made systems using coiled black plastic tubing.

Each year about 700 solar systems are instaled in New Zealand. They cost $4500 on average, and save about $400 worth of electricity annually.

Heat pump

A relatively recent option that looks very promising is the heat pump. It operates on the same principle as your fridge – only in reverse. Like a solar system it also has tubing up on the roof, but the liquid inside is a refrigerant that extracts molecular

energy from its surroundings as it evaporates. Back in your hot water cylinder a compressor condenses it back to a liquid, thus releasing the heat into the water.



This system doesn't need a supplementary electric element because it works night and day, year round (It can even extract molecular energy from snow – though it does so rather slowly). Electricity – about a third of what a normal hotwater cylinder would use - is needed only for the compressor pump. The payback period can be as little as four years, depending on the initial cost of your system.

Further information

Making the most of your hot water system. Energy Efficiency & Conservation Authority, 1995
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