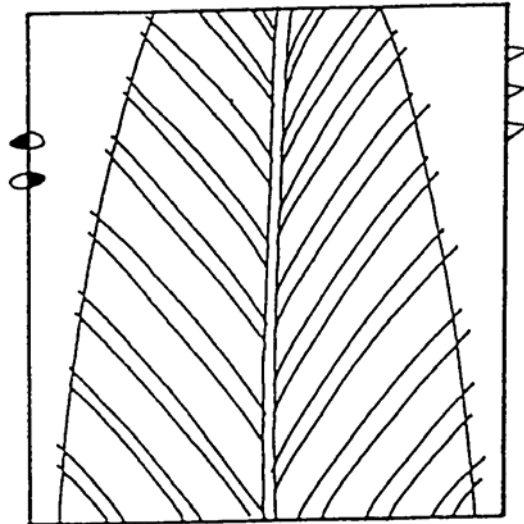


# HEATING WATER



Waitakere City Council  
*Te Taiao o Waitakere*

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*This chapter is part of the Waitakere City Council's Sustainable Home Guidelines. The complete set can be obtained through most libraries or from the Waitakere City Council, Private Bag 93109, Henderson, Waitakere City 0650, New Zealand, phone 09-839 0400, email: [info@waitakere.govt.nz](mailto:info@waitakere.govt.nz).*

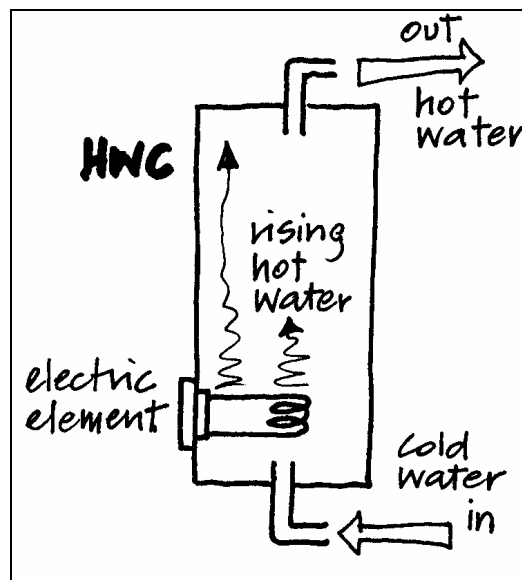
*The guidelines are also available on the council's web site: <http://www.waitakere.govt.nz>*



## Why worry about your hotwater system?

Water heating probably accounts for 30-40% of your annual household energy use. Most of us have electric storage hotwater 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.

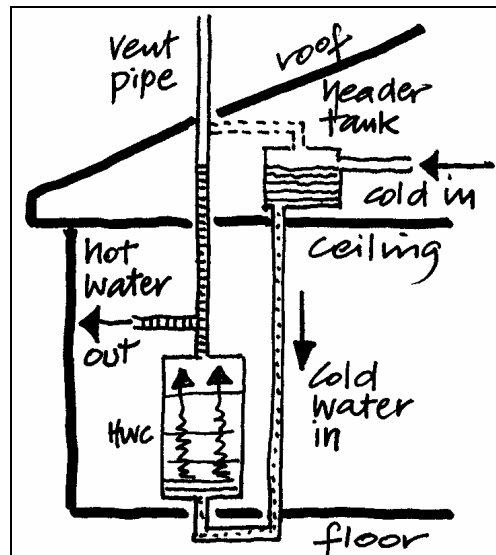
So check out your system and find out how to improve it, or at least how to use it more efficiently. As well as saving water and energy you'll probably find that you can have a safer, more user-friendly hotwater system. You'll also be doing your bit to reduce greenhouse gas emissions and peak demand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



*Electric hotwater cylinder*

## The Standard Kiwi Hotwater System

The standard New Zealand hotwater 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 ready for use.

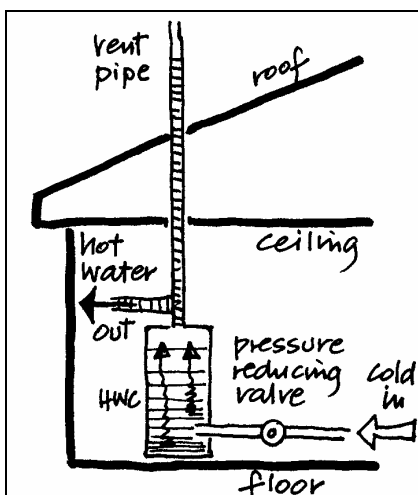


*Open vent with header tank and 1-2m head at shower*

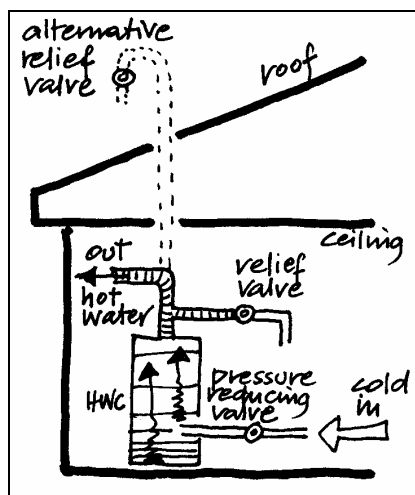
Most of our older houses were built with low-pressure cylinders made of copper, which is durable but can withstand only limited pressure. Pressure was reduced by running the mains water into a header tank, just like a toilet cistern, which in turn fed water into the hotwater cylinder. As the water is 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

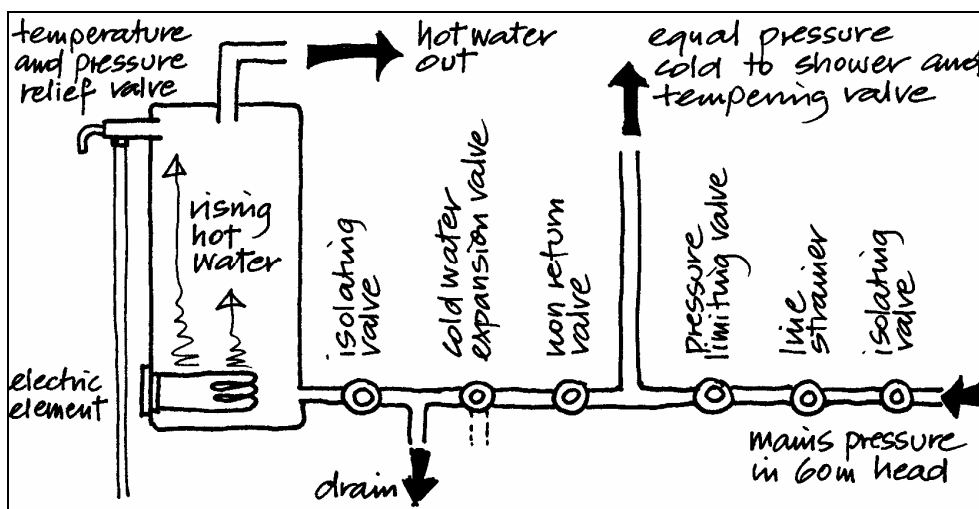


Open vent with pressure reducing valve 1-3m head at shower



Low pressure valve vented 2-10m head at shower

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) or a stainless steel cylinder (which should last as long as copper) 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.



Mains pressure system 60m head

The following sections look progressively at:

1. using your existing setup efficiently
2. tuning up your system to reduce waste and improve performance
3. designing and installing 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 to 40 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.
- If you like long showers, you can get heat exchangers which pre-warm the shower cold water using the heat in the warm wastewater that runs down the drain. You would need a plumber to install one of these.



## Tuning up your hotwater system

### *Dripping away your electricity*

A hot tap dripping at the rate of one drip per second will cost you up to 100 units of 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 faster than six and a half seconds you are using more water than you need. Taps and showerheads can operate perfectly well at flow rates less than 9 litres per minute.

If you take a 5-minute shower each day, for every litre per minute that you reduce your shower flow you save about 65 units of electricity over the year. That means if a family of four replace a 20-litre-per-minute shower head with a 9-litre-per-minute one, they could save \$600 a year at 2008 prices. Not bad for a shower head that will cost between \$40 and \$100!

You can fine-tune your plumbing system with fittings to reduce water flow. These are things that need to be installed 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.

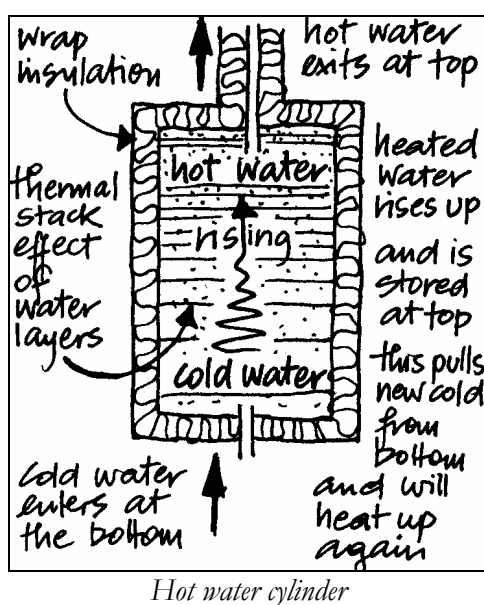
Some companies and community trusts offer comprehensive packages to retrofit homes with water-saving flow restrictors. This is an attractive option because the system can be tailor-made to suit your home and habits. These systems generally ensure that temperature and flow fluctuations are controlled, 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 hotwater 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 hotwater cylinder has an 'A' grade "Watermark" it is already well insulated. If not, you will save up to 50 to 100 units 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 hotwater 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 those 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. This is to prevent the growth of harmful micro-organisms. 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 install a larger cylinder.
- Install 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 hotwater 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 5000 units of heat into the atmosphere in a year.

The best energy saver is to keep it well insulated. A thick, tightly fitted pool cover is essential. The next best thing is to turn it off whenever you won't be using it for a few days or more. 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. Power companies therefore offer price incentives to us to switch electricity use to more off-peak times. With a hotwater cylinder of sufficient capacity these incentives can save us money as well as helping to avoid the need for future dams.

Check with your electricity retailer about tariffs or metering options that would suit your usage and save you money. Or find out if another retailer could offer you a better deal at Consumer Powerswitch, [www.consumer.org.nz/powerswitch](http://www.consumer.org.nz/powerswitch).

### ***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. The following figures are estimates as at September 2008.



<b>Improvement</b>	<b>Cost of Improvement</b>	<b>Annual Energy Savings (cents/kWh)</b>	<b>Benefit</b>
Fit insulation wrap to electric cylinder	\$ 60 - \$ 100	\$ 40 - \$ 140	Reduced running cost
Insulate pipes close to water heater	\$ 20 - \$ 50	\$ 40 - \$ 100	Reduced running cost
Insulate pipe to kitchen sink	\$ 80 - \$ 200	\$ 40 - \$ 80	Reduced running cost, faster hot water delivery
Insulate vent pipe OR Fit heat trap in vent pipe OR Convert to valve vented system	\$ 50 - \$ 20 \$ 150 - \$ 250 \$ 800	\$ 40 - \$ 120 \$ 60 - \$ 140 \$ 60 - \$ 140	Reduced running costs Reduced running costs Reduced running costs, improved water pressure
Insulate pipe to roof mounted relief valve OR Remove roof mounted relief valve	\$ 40 - \$ 150 \$ 250 - \$ 450	\$ 40 - \$ 100 \$ 60 - \$ 140	Reduced running costs Reduced running costs
Fit cold water expansion valve to valve vented system	\$ 150	\$ 15 - \$ 30	Reduced running costs
Fit efficient shower head	\$ 40 - \$ 100	\$ 40 - \$ 500	Reduced running costs, more hot water
Service gas heater	\$ 50 - \$ 100	Possible	Checked efficiency & safety
Fit tempering valve to system	\$ 200 - \$ 400	Possible	More hot water delivered, safer water temperature
Fit a customer adjustable thermostat	\$ 50 - \$ 100	Negligible	Better control of water temperature, safer water temperature



## New hotwater systems

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

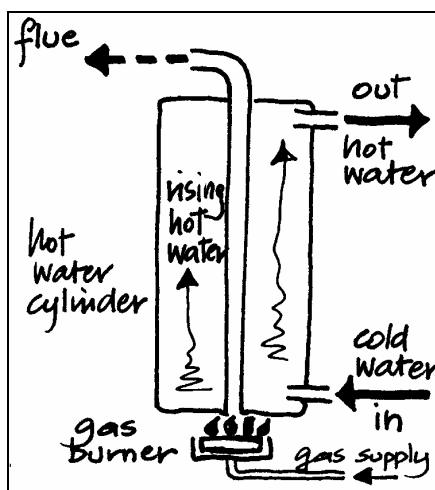
Most people these days install a large capacity mains-pressure cylinder with a powerful electric element, and often a booster element at the top for quick daytime re-heating. This gives good performance, comfortable showers, plenty of hot water etc, but may be wasteful if it's used thoughtlessly and 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.

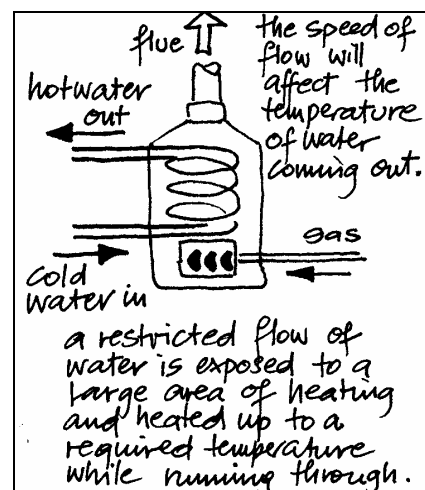
### *Gas storage water heating*

A gas burner controlled by a thermostat will heat water fast. However, the only type of gas storage systems that are more energy-efficient than electric storage systems are the newer condensing types.

If you are in an area reticulated for gas, the running cost of gas appliances will generally be lower than for 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 instantaneous water heating.



*Gas hotwater cylinder*



*Instantaneous hotwater system*



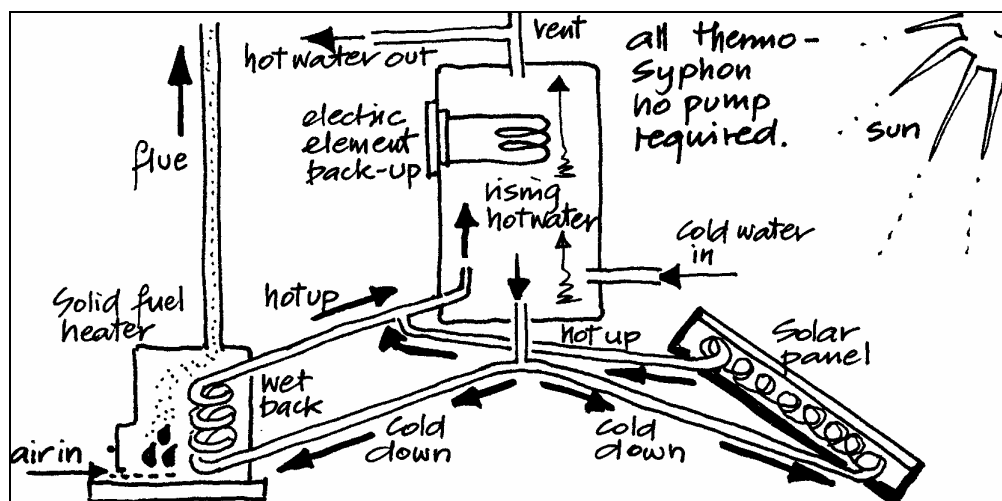
## *Instantaneous or continuous hot water systems*

In an instantaneous system the water is heated – 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 installation make it impractical for many 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. Modern condensing gas boilers are extremely efficient (up to 95% compared with 70% for earlier types). Instantaneous gas systems produce lower greenhouse gas emissions than electric systems supplied from non-renewable sources, because the losses in thermal electricity generation and in transmission are significant (up to 70%).

## *Solid fuel wetback*

If you enjoy the warmth of a solid fuel heater or like cooking the old-fashioned way, you could install 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.



*Combined solid fuel wetback, solar and electric backup hot water system*

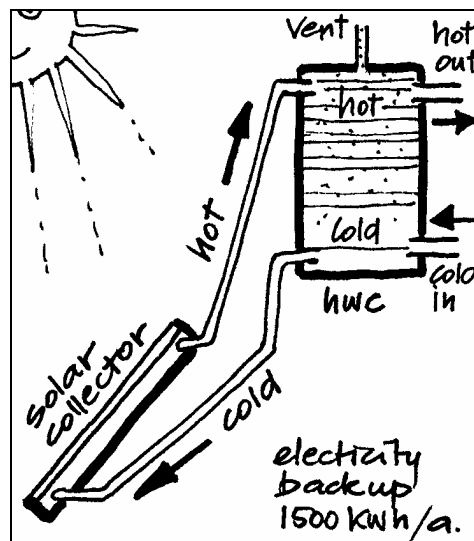
The wetback, the burner and the pipework must be designed and sized to work efficiently together. Otherwise, there is a risk that the cold water will reduce temperatures in the burning chamber too much, preventing double combustion of the flue gases, and resulting in air pollution and inefficiency. For this reason, burners with wetbacks must be on the Ministry for the Environment approved list before the installation can be granted building consent.



One New Zealand product 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 can generate 4kWh per day of free renewable non-polluting energy. In summer you can generally provide all your hotwater needs, but you need a winter backup from electricity, gas, or a wetback. A well designed and well installed solar system can heat up to 75% of your hot water every year.



*Solar hot water thermosyphon system*

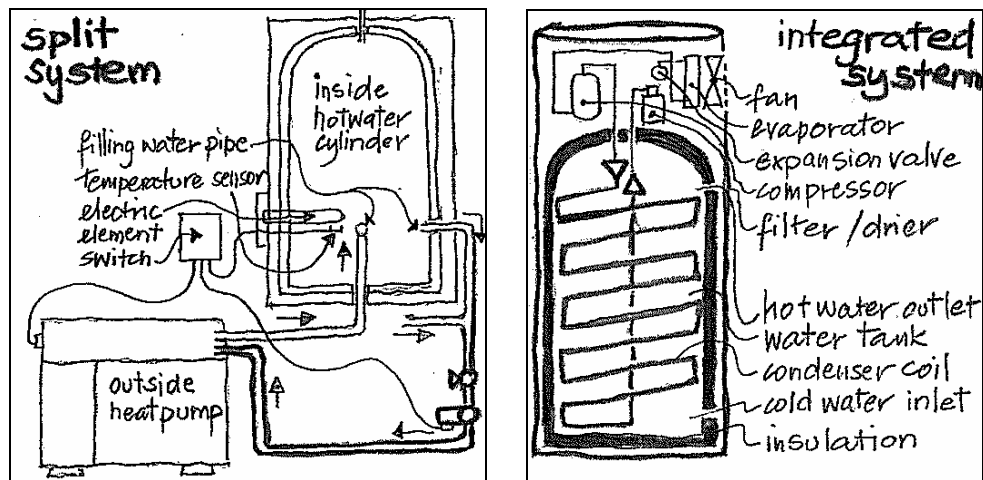
Solar collectors are usually mounted on a sloping roof facing within 20 degrees of north. The best angle is 35 degrees from horizontal, but this is not highly critical. The most effective systems absorb over 90% of the available solar radiation and provide more than two-thirds of your annual water heating requirement. They may comprise copper tube bonded to heat absorbing fins and covered with an optically efficient selective surface, evacuated glass tubes connected to a manifold, or other designs. At the other end of the spectrum are home-made systems using coiled black plastic tubing.

Each year several thousand solar systems are installed in New Zealand. They cost about \$4,000 - \$7,000 on average, and save up to 75% of waterheating energy (about \$400-\$500 per year depending on your energy supplier). There are government and council incentives for installing them (see [www.energywise.govt.nz/solar](http://www.energywise.govt.nz/solar) and [www.waitakere.govt.nz](http://www.waitakere.govt.nz) )

### ***Heat pump***

A heat pump operates on the same principle as your fridge – only in reverse. It takes heat from the outside air and transfers it to water in the hotwater cylinder.





*Domestic hotwater heat pump*

Most of these systems don't need a supplementary electric element because they work night and day, year round. Heat pumps that do need an electric element boost are a lot less efficient. A heat pump uses electricity only to run the compressor and a small pump, not to generate the heat itself, so it uses only a third to a quarter of what a normal hotwater cylinder would use. For every kilowatt-hour of electricity it uses, it transfers 3 to 4 kilowatt-hours of heat to the water. Heat pumps are available packaged with the cylinder for outside installation, or as an external unit connected to a cylinder inside. The payback period can be as little as four years, depending on the initial cost of your system.

You can also get heat pumps to heat water for underfloor heating or spa pools.

Hotwater heat pumps generally cost \$1,000 - \$2,000 less than solar water heating. They are often used where solar access is poor, such as south-facing or shaded sites. They do emit some noise, so the external unit needs to be mounted away from quiet areas of the house and from neighbours.



## Further information

### Advice at the Waitakere City Council:

Phone the call centre (09) 839 0400  
Ask for:       Eco Design Advisor  
                  Building Consents  
                  Duty Planner

### In print

*Your Home Technical Manual*, Australian Government. A comprehensive printed resource, much of it relevant to New Zealand.

### On the web

[www.smarterhomes.org.nz](http://www.smarterhomes.org.nz) is a mine of up-to-date and independent information. Designed for the general public, it's easy to use, has case studies, and includes features such as Homesmarts, a calculator you can use to find information relevant to your needs or simply to run a home-health check.

If there are questions you can't find answers to on Smarterhomes, [www.level.org.nz](http://www.level.org.nz) goes into more depth and is aimed at the design and building industries, with drawings and links to Building Code compliance documents.

EECA, [www.energywise.govt.nz](http://www.energywise.govt.nz)

Ministry for the Environment, search keyword “woodburners” [www.mfe.govt.nz](http://www.mfe.govt.nz)

Consumer, [www.consumer.org.nz](http://www.consumer.org.nz); Power-switch, [www.consumer.org.nz/powerswitch](http://www.consumer.org.nz/powerswitch)

*Eco-building Products and Services Directory*, Building Biology and Ecology Institute, phone Auckland (09) 376 6767, Wellington 0800 223 272. This is updated regularly and can be obtained from the website [www.ecoprojects.co.nz](http://www.ecoprojects.co.nz).

This chapter was last reviewed in September 2008.

*Printed on recycled paper*

