

HEAT PUMPS RISE IN POPULARITY

New Zealand has experienced rapid growth in heat pump sales in the last few years. So how are heat pumps being used and how are they affecting electricity demand?

By Lisa French, BRANZ Building Energy Scientist

Heat pumps are currently the most efficient form of electric heating/cooling available in New Zealand. As a result of their growing popularity, a new Building Research Levy funded project is looking at how heat pumps are affecting our electricity networks. The project is also developing a tool to help designers, home owners and builders design houses that will be more comfortable in summer, without the need for cooling.

A survey was sent to 3,500 homes throughout New Zealand to determine the number of heat pumps in houses, what types are being installed and how they are being used. Some of the early results are discussed below.

Not all heat pumps are equal

The most common type of heat pump in New Zealand is the air source heat pump, also known as a reverse cycle air conditioner. Heat pumps work like a refrigerator – pulling heat out of the air and moving it inside (see Figure 1). In the external unit the liquid refrigerant evaporates to become a gas. Once energy from the air is absorbed, the gas is pushed to the inside coil. In the internal unit the gas condenses to a liquid,

giving off heat. The opposite occurs when cooling.

Heat pumps work best when there is little difference between inside and outside temperatures. The colder it is outside, the less efficiently they are able to heat. The type of heat pumps commonly available in New Zealand work best at temperatures over 7°C.

But not all heat pumps are equal. All heat pumps sold in New Zealand are now required to comply with the Minimum Energy Performance Standards. This ensures that less efficient ones don't reach the market. The Coefficient of Performance (COP) rates the efficiency – the higher the COP the more efficient the heat pump.

To get the most from the heat pump it needs to be right for the climate, correctly sized for the rooms being heated, and properly maintained. It is recommended that they be installed by a HVAC engineer and the homeowner be given advice on maintenance.

Heat pumps in 19% of houses

The BRANZ survey carried out in August 2007 found that 19% ($\pm 3\%$) of houses across New Zealand currently have a heat pump. This is up from 4% in 2000. The quarterly BRANZ Materials Survey found that

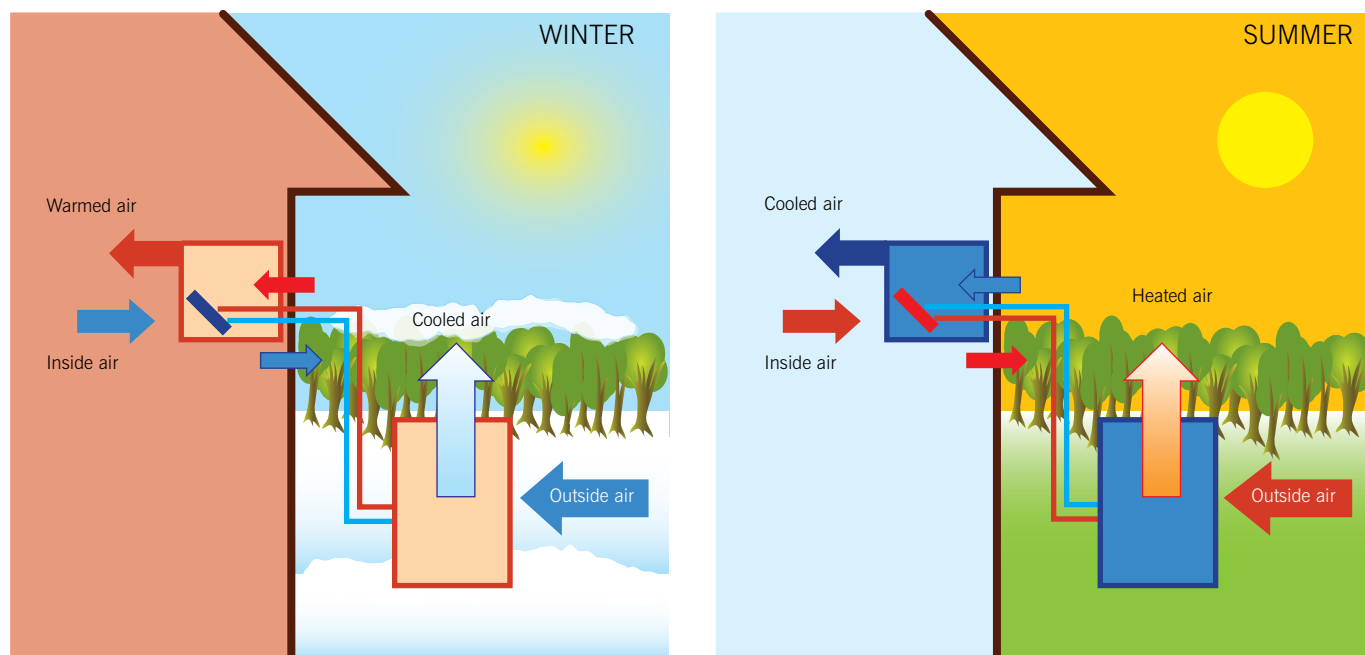


Figure 1: How heat pumps work for heating and cooling.

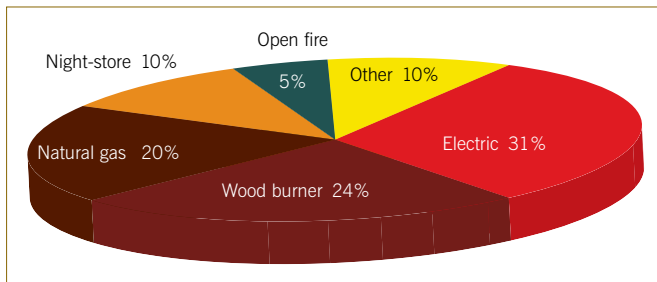


Figure 2: The heaters which are being replaced by heat pumps.

close to half of new houses now being built have heat pumps installed. Sales data reported from dealers to EECA report 78,000 heat pumps sold in 2006.

Houses heated more

Many people reported how convenient a heat pump was. Convenience may be the reason people are choosing to use their heat pumps more than was found by the Household Energy End-use Project (HEEP), although HEEP measured all fuels. The number of occupants with heat pumps that reported using heating in the morning has doubled from that reported by HEEP. Heating use also increased at all other times of day.

Heat pump thermostats are also being set much higher (average 21°C) than the HEEP houses were achieving (average evening 17.8°C). Typically New Zealand houses are cold. Having a warmer house is ideal but people can't always expect to use less electricity because of this. There was a range from 15°C to 30°C for the set-points, suggesting occupants are using their heat pumps in different ways. Some heat pumps may have been undersized so thermostats need to be set higher to achieve a comfortable temperature.

Research suggests occupants often don't understand how a thermostat works and therefore how to get the best out of their heat pump. More education is needed in this area.

Concern over fuel changes

With the increase in numbers of electric heat pumps it is expected that other fuels will provide less heating. In 2000, HEEP found 32% of gross house heating energy was from electricity and 45% from solid fuel. The 2007 survey found that 40% of occupants installing heat pumps were replacing another heater and 60% reported they installed a heat pump to be used as an additional heater.

The main types of heaters being replaced are wood burners and natural gas heaters (see Figure 2). This shift from another fuel source



Most heat pumps in New Zealand are air source heat pumps like this one.

to electricity creates an extra load on the electricity network. As occupants heat when it's cold, all houses tend to demand heating energy at the same time, causing higher peak loads and possible transmission issues.

Cooling creating extra load

In 2000, HEEP found only 4% of houses had the ability to cool. Now 19% of houses have the ability to cool and 60% of this group are choosing to do so. This is a new electric load that has been created. Many occupants who are using cooling are doing so because of convenience and speed of cooling. A small number of people reported they did not like having windows open due to security and noise issues.

Growth set to continue

The number of heat pump installations is expected to increase. Users are reporting high satisfaction with heat pumps and there is strong marketing from the manufacturers. Heat pumps are also the most popular choice for 'clean' heating. Many areas in New Zealand are bringing in clean air regulations, which will see many more heat pumps being installed.

Due to the growth in heat pump popularity and the way they are being used, an increase in the amount of electricity used for heating can be expected. There must be planning to ensure the electricity network can cope with the new loads being created both in winter for heating and in summer for cooling.

Cooling design tool

This project will continue with the development of a cooling design tool and guidelines to design houses that are suitable for the climate, and therefore require less cooling. Modelling work will look at the electricity use of heat pumps in New Zealand for both heating and cooling. The project is due for completion in March 2009. ◀