

# The low-down on heat pumps

Heat pumps are now commonplace in New Zealand homes. People are happy with their purchase, but BRANZ research shows they aren't being operated to perform as well as they might.

**BRANZ HAS RECENTLY** concluded a study of how people use heat pumps in their homes. The study examined 160 households from around the country with heat pumps and assessed how they were installed, what the occupants thought of them and how they used them. Measurements were also made of how much energy the heat pumps used, as well as the resulting indoor conditions from their use.

## **Heat pumps in half of new homes**

It is remarkable how quickly heat pumps have become an accepted part of the way we heat our homes.

The BRANZ Household Energy End-use Project (HEEP) was a large-scale project looking at how we use energy in our homes. When HEEP finished collecting data around 10 years ago, only 4% of households had heat pumps. In fact, these devices weren't even called heat pumps but reverse-cycle air conditioners.

Today, heat pumps are very popular, with over half of new homes including at least one.

## **Most happy to recommend**

People who examine the uptake of new technologies talk about bridging the chasm between the small numbers of early adopters and the majority that eventually take up that technology. A sign that the chasm has been breached is that discussions of the technology move into general conversations and change from being of a technical nature to one of social acceptance.

Householders interviewed as part of the heat pump study frequently stated that seeing others purchasing heat pumps motivated them to also purchase one. TV advertisements featuring heat pumps are now common and frequently include sporting stars endorsing particular models. A web search of 'heat pumps in New Zealand' provides an occasional link to EECA or Consumer but also a deluge of information from retailers, suppliers and installers recommending a particular brand.

The householders taking part in the heat pumps study were very happy with their heat pumps, with over 94% willing to recommend heat pumps to friends and family.

## **Heat pumps have changed heating patterns**

An important finding in the heat pumps project was that heating behaviours are changing. HEEP found that over one-third of households used heaters in the morning, while in the heat pumps project, those using heat pumps leapt to over 85% of households.

The relative percentage change for 24-hour heating is even greater, with over a quarter of houses with heat pumps reporting that they are left on continuously. For general heating, HEEP found that just over 10% of houses had 24-hour heating (see Figure 1).

## **Efficiency drops with temperature**

Heat pumps are advertised as an efficient means of heating, but there is very little information about how they work in practice. Heat pump models can have high laboratory efficiency levels. These

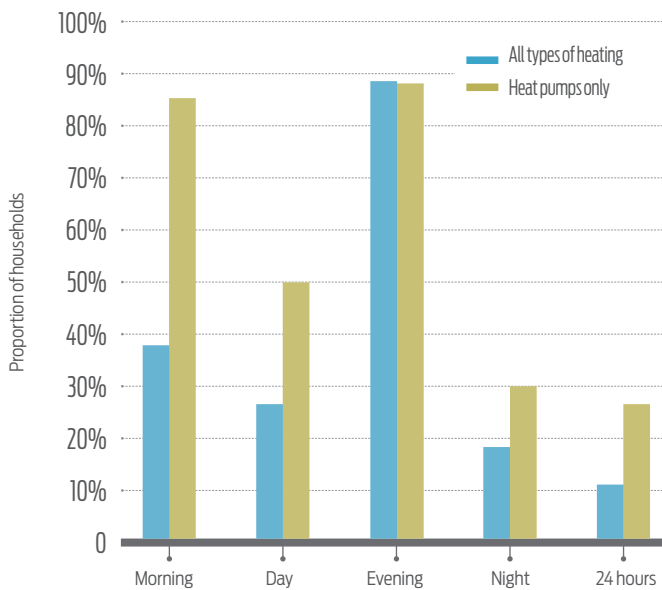


Figure 1: General household heating.

can be misleading however, as these values are typically determined when the outdoor temperature is 7°C, much warmer than a cold winter's day. When the temperature outside drops, the efficiency of the heat pump is also reduced.

It is often when the outdoor temperatures are lowest that heat is required from heat pumps. A typical case may be after an evening of heating, the occupants all go to bed and turn off the heat pump. The cold overnight temperatures then drive the indoor temperatures down to their lowest point just before people start getting up. The heat pump is then turned on and operates at its hardest to get the room back up to a comfortable temperature.

The outdoor conditions at this time may also cause frosting problems with the outdoor unit. There are a variety of defrosting approaches. One approach is to reverse the heat pump cycle so the outdoor unit is defrosted by pumping heat from the inside of the house. This requires a blast of cold air from the indoor unit. This defrosting approach also reduces the energy performance of the heat pump.

#### **Typically 2 times the heat output as energy input**

An often quoted performance factor for heat pumps is that they provide 3 times the heat output as the energy input going into them. This figure tends to align with the laboratory test method of assessing performance.

Measuring the heat output of a heat pump in actual use in a real house is difficult. A method to estimate the performance in actual

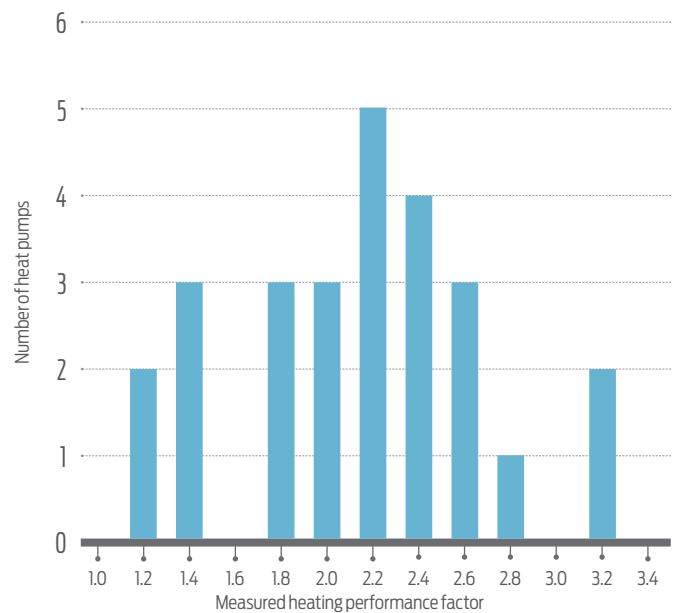


Figure 2: Heat pump performance values from study.

practice was examined for a small subsample of the heat pumps in the heat pump study.

While these performance values are somewhat appropriate, on average, the performance of the heat pumps in actual use was to provide 2 times the heat output for the energy input into the system. This is somewhat less than the commonly used 3 times. The range of performance values using this method is shown in Figure 2 and was mostly between 1.5 and 3 times the energy input.

#### **Reasons for poorer performance**

In addition to operating at times when the outdoor conditions are cooler, other factors that may reduce heat pump performance in actual use are:

- non-ideal airflows from the indoor unit
- poor location and placement of the outdoor unit
- operating at elevated temperature or using incorrect settings
- on-off operation of the heat pump.

#### **Getting better all the time**

Heat pumps have become a well established technology, and occupants tend to readily recommend them to others. Their performance in actual use tends to be lower than the declared value. However, manufacturers are improving heat pump technologies all the time, and newer models generally perform better than older ones. ◀

**For more** ▶ This work is reported in BRANZ Study Report 329 *Heat pumps in New Zealand*, which can be freely downloaded from [www.branz.co.nz/shop](http://www.branz.co.nz/shop).