consumer
Making decisions easy

Appliances

Heat pumps

Updated 02 Nov 2010

Introduction

The right information is essential when choosing a heat pump. Our report brings together everything you need to make the decision easy.

Our guide to **choosing a heat pump** takes you through the steps from finding the right type and size to considering reliability and installation.

Then use our **database of over 100 models** to find one with the right price, specifications and features for your needs.

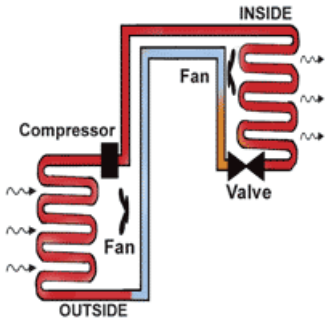
What is a heat pump?

Heat pumps are basically space heaters. They provide convenient, efficient, thermostatically-controlled heating that can be set to come on and off automatically at different times of the day.

The simplest versions are designed for a single room; the most complex, for a whole house. It takes 20 to 40 minutes to bring a room up to temperature, after which the level will be maintained within one or two degrees.

How heat pumps work

A heat pump works by extracting heat from the air outside your house and bringing it indoors. It's like a refrigerator in reverse. By trying to cool the world it can extract heat, or vice versa.



Use an old-style bicycle pump for a while and it will get hot. That's because gas (air) is being compressed. Spray an aerosol can and the valve area will become cold. That's because the compressed gas in the aerosol can is expanding.

Heat pumps (like refrigerators) have a system of pipes containing gas (refrigerant) that is continuously expanding in one part of the system and compressing in another. When the gas is being compressed, it gets hot. A heat pump's exterior unit compresses the gas, then pumps it to the interior unit where the gas runs over a series of finned coils, giving off its heat.

The gas is then returned to the outside unit, where it expands and runs through another set of finned coils, which become cold. The cold gas is then recompressed and the cycle continues. For summer cooling, the refrigerant flow is reversed, so the interior unit becomes cool, while the exterior cold.

Heat pumps shift more heat than the electrical energy consumed in compressing the refrigerant and running the fans, making them highly-efficient methods of heating - up to three times as much in the right conditions.

Is a heat pump the same as a ventilation system?

No. A heat pump uses refrigeration principles to shift relatively large amounts of heat in or out of your home to warm or cool it. A domestic ventilation system shifts drier air from the ceiling space into the living space, and is designed to reduce condensation.

Will a heat pump suit me?

Before you begin choosing a size, style or model of heat pump, you need to consider their pros, cons and cost-effectiveness.

Positives

Warm, dry and comfortable

Heat pumps can provide a level of all-round comfort not easily obtained by plug-in electric heaters. They can quickly bring a room up to temperature and then maintain it.

Lower heating costs

If you install a heat pump and keep your home about as warm as you do now, you could save a considerable amount in heating costs. But some of our subscribers with heat pumps tell us they use their units to keep their homes warmer than before, so their heating bills haven't dropped by much.

No gas charge

If you install a gas heater, you'll have to pay a gas connection charge (often around $30 per month) all year round, for a heating appliance you use for a few months.

Cooling

A reverse-cycle heat pump is the only type of home heating system that can both heat and cool a room.

Dehumidifying

Do heat pumps dehumidify?

> Yes … in *cooling* mode, the cooled air can't hold as much water so the water condenses out of the air inside the heat pump and is drained away.
>
> Yes … in *dehumidifying* ("dry") mode, the heat pump alternates between cooling and heating modes to keep the room at an approximately constant temperature. Water is extracted during the cooling part of this cycle.
>
> No … in *heating* mode, the heat pump doesn't remove water from the air. However, because warm air can hold more water than cool air, the "relative humidity" decreases as the heat pump raises the air temperature. So the warmer air feels drier.

Air filtering

Many modern heat pumps incorporate a washable filter unit that removes dust and particles from the air. This could be an important feature for people with asthma and allergies. The filters need regular cleaning to keep the unit working at maximum efficiency. Some have a deodorising function as well.

House value

A heat pump installation may also add to your home's resale value.

Negatives

Noise

Whirring fans can be very annoying. Fans run in both the interior and exterior units all the time they are switched on. The fan in the inside unit of a heat pump should produce little more than a low hum in low-speed mode, but the compressor plus fan of the outside unit can be quite noisy. Check the manufacturer's specifications. Also, consider the impact on neighbours if the outdoor unit must be mounted near their sleeping areas.

Our 2009 member survey found noise was more likely to be an issue with older heat pumps - 15 percent of those bought before 2004 made enough noise to be "mildly disturbing". This fell to 7 percent for models less than two years old.

Not so good in low temperatures

Extracting heat from outdoor air gets more difficult as the temperature drops. Sometimes, especially on frosty nights, exterior heat pump units freeze-up and have to stop working for several minutes while they defrost. If you live in a frosty area see What are your needs for more about this problem.

Fifteen percent of owners in our reliability survey said their heat pump performed poorly in very cold weather. This was more likely to be a problem with older models that weren't inverter heat pumps - 25 percent didn't cope well with very low temperatures.

What type of system explains more about types of heat pump.

Draughts

Circulating air can cause draughts - which means you need to think about where to place the unit. You don't want one on the wall just above your favourite armchair.

How much can you save on heating costs?

The answer isn't as simple as you might think. Modern inverter-style heat pumps can adjust their power output to suit the heating requirements of the moment and are most efficient when working at **part** load.

Just where this efficiency "sweet spot" is to be found is difficult for us to test. Our testing procedure pushes the units on reverse-cycle heating mode towards their maximum output, where they are less efficient.

So if your installer makes sure the unit is large enough (or even a little too large) for your needs, you should get **more** heat per dollar of electricity than our test results suggest.

But - even if they're not always running at an optimum setting - all the models in our tests will give three or more times the heat value of every dollar you spend on electricity.

How to choose a heat pump

If you've decided a heat pump is suitable for your needs, there are a number of things to think about before you choose a model.

Following our step-by-step guide will help you through the process:

What type of system do you need? - choose a type of heat pump that suits your house or room layout.

What is your main need? - is heating or cooling more important? If you live in a frost-prone area there are essential things to know. What features will be useful?

Find the right size - make sure the cooling and heating capacity is right for the size of your room. Our interactive calculator will work out what you need.

Efficiency ratings explained - understanding the ratings can save you money. Learn about Energy Star, Star ratings, COP, MEPS and more.

Choose a reliable brand - the brand is one of the most important choices you can make. Our reliability survey will put you on the right track.

The importance of installation - the right installer can make a big difference.

Select your model - prices, specifications, features and recommendations for over 100 heat pumps.

Check our test results for small-medium and large heat pumps - if it's a model we've tested you can see how it performed.

Warm Up New Zealand heat pump subsidies

EECA (the Energy Efficency and Conservation Authority) is offering funding assistance to qualifying home owners who install clean efficient heating devices.

To get funding to assist when installing a heat pump, you must already have insulation that meets EECA's standards. Only heat pumps which have the Energy Star qualification are eligible for Warm Up subsidies.

More information

EECA: www.energywise.govt.nz/funding-available/insulation-and-clean-heating

Our August 2009 news item: Heat Smart insulation & heating funding

What type of system?

Reverse cycle heat pumps can heat the room or cool it at the touch of a button. There are several types of technology and heat distribution to choose from.

Types of heat pump

Inverter or constant speed

Inverter systems use a variable-speed electric motor which slows down and speeds up as needed to hold a chosen temperature.

Before inverter technology arrived, heat pumps used single-speed motors that were either on or off (like a fan heater that turns off when the desired temperature is reached and then switches on when the temperature drops a bit).

Inverter models are more efficient, cope better in cold conditions, and electricity companies like them because they don't create surges in the demand for electricity. We strongly recommend inverter systems, which have mostly replaced fixed-speed models in show rooms.

Distributing the heat

Split

A split system has an exterior compressor unit connected to an interior ceiling or wall unit by copper pipes (for the refrigerant) and wiring. The interior unit is made up of electrical/electronic controls and a fan which circulates air over finned tubing for either cooling or heating, depending on the setting of the unit. Much of the installation cost of split systems comes from running the pipes and wires from the exterior to the interior locations.

Split systems work well in a large lounge or the main living area of an open-plan home.

Multi-split

In a multi-split system the exterior unit connects to more than one interior unit. Often, one interior unit is located in the living space and another in the bedroom area. The interior units can have separate controllers - but it is not possible to have one interior unit cooling while the other is heating.

Multi-split systems can be cheaper than having separate external units for different parts of the house, but there may be extra installation costs from longer piping runs and some extra control complexity.

Ducted

These have a single, large capacity interior unit mounted in the ceiling space, or under the floor. The heated (or cooled) air is pumped through insulated ducts to ceiling or floor outlets in many or all of the rooms in the house.

Ducted systems have the least visual impact of any heat pump system - just small flush vents in each room. Because there is some heat loss from ducts themselves, they are slightly less efficient than other systems. They are also expensive to install - costs can be as much as $15,000 or more for a 150sqm home, depending on ceiling height.

Internal unit position

High wall

These are the most common heat pumps in New Zealand. They're usually long and thin, are mounted close to the ceiling and circulate enough air to heat a room evenly. They should be located so the airflow can reach as much of the room as possible, but not close to where you'd normally sit (so you don't have to put up with fan noise in your ear while you're watching TV).

High wall units can cause the surrounding wall and ceiling area to become covered in dirt and grime, and the high location makes filter cleaning difficult, particularly for the elderly and disabled. Some makers offer self-cleaning filter models to solve this problem.

Ceiling

These either hang off the ceiling or are fitted into the ceiling. One advantage of ceiling units is they can be installed where wall space is at a premium. They have the same dirt and filter changing drawbacks as high wall units.

Low wall or floor

These sit on the floor, alongside a wall. They must be sited so furniture does not obstruct the airflow, and should be located where they can distribute the warm air to as much of the house as possible. Filter cleaning is a breeze.

Floor vs ceiling units - which is better?

Some suppliers suggest that for the best heating effectiveness, the internal unit should be floor mounted. This could be particularly important if you have high ceilings. Hot air rises and, if your unit is up on the wall, all your lovely heat could end up keeping the roof warm. But floor-mounting may not be possible. Also, we're not saying a wall-mounted unit won't work. You should carefully discuss your options with the supplier before you sign up.

For best cooling effectiveness, a unit mounted high on the wall or on the ceiling is best. This is because cold air falls.

What are your needs?

If you're thinking about buying a heat pump, you need to consider the climate you live in and the features you require.

Climate

In areas with hot humid summers, good cooling performance may be important. If you live in a colder area, you'll want a model that has good heating performance. Look for a model that claims to be able to operate at temperatures below the worst you'd expect.

When the outside unit of a heat pump detects ice, it will automatically de-ice and stop producing heat. This is most likely to occur as the air temperature approaches freezing (at below-zero temperatures all the water in the air will have frozen and formed frost or snow, so the unit should no longer ice up). This can happen to all heat pumps but some do a better job of cold-weather performance than others.

H2 output capacity

This shows the heat output capacity of the heat pump when the air temperature is 2℃. The H2 output capacity really matters if you live in a colder area, especially where the night temperatures go below 5℃ but don't often dip below zero. If this is your climate, insist on being told what the H2 output capacity is.

The bigger the H2 output capacity the better. It's optional to have H2 output capacity on energy labels, but we hope makers will adopt it. Where it's available, we include it in our database of specifications.

If the H2 information can't be supplied make sure your contract with the supplier says that you'll get adequate heating during cold nights.

Features

Think about the features you particularly want in your heat pump. These may include:

Automatic de-icing is vital if you live in a cold area - otherwise, in winter, the pump will stop providing heat because of frost build-up on the outdoor heat-exchanger coils. This is a standard feature on newer inverter models.

A timer lets you switch the heat pump on and/or off automatically at certain times. However, there are big differences. A clock-based timer allows you to programme an actual "on" and "off" time, and the times you set remain active until they're cancelled. A 7 (or more) day timer usually allows multiple on and off times.

Sleep mode adjusts the temperature in several steps (up when cooling, down when heating) so that the system works less hard and more quietly when you're sleeping. You can programme how long you want the sleep mode to operate.

Airflow-control settings provide reduced airflow for quiet operation and/or extra-high airflow (may be called fast or jet operation). Ideally, you want your heat-pump/air-conditioner to have a big range of airflow settings. A high airflow will help distribute the air in a room more quickly - but the higher the airflow, the noisier and draughtier it is. So you want a low fan-setting that circulates the air but does so quietly, especially if you're using the inside unit in your bedroom.

Oscillating louvres allow the air to be distributed more evenly.

Adjustable louvres can be pointed up for cool air and down for warm. Left and right adjustability helps direct air where it's needed.

Fan-only mode blows air without heating, cooling, or drying. This can provide adequate cooling at some times of the year, without the cost of running the heat pump.

Restart delay is a protective feature that prevents the heat pump from starting up again too soon after being switched off.

Efficiency ratings

To get the best value for money, look for a heat pump system with good star ratings. A system with more stars will give you more heating or cooling energy per unit of electricity than one with fewer stars.

Star ratings

These cooling and heating star ratings tell you how efficient a heat pump is. More-efficient models get more stars and are cheaper to run.

But because heat pumps are becoming more efficient, the rating system has run out of stars. So the ratings are being “dialled back” by about 2 stars.

Revised labels are also being phased in: instead of the old combined heating/cooling label, there’s one that shows cooling and heating side-by-side. (During the phase-in period the old rating can still be listed in a panel at the bottom of the revised label.) We list both the old and new star ratings in our database.

Energy Star label

The Energy Star labelling system (as pictured right) is the benchmark for efficient performance. Energy Star is an international energy-rating symbol used to identify the most energy-efficient products in the US, Canada, Europe, Australia, Asia and New Zealand.

There are so many heat pumps on the market that we can't possibly test them all. If we haven't yet tested the model you're interested in, the Energy Star rating provides a good guide. We list Energy Star models in our database.

From 1 April 2010 Energy Star requirements for heat pumps changed to require a manufacturer's statement of performance at an outside temperature of 2°. Some manufacturers have provided this information while others haven't. Unfortunately a “statement of performance” is not the same as lab test results. But that’s not far away: to qualify for Energy Star from April 2011, manufacturers will be required to supply laboratory test results for a heat pump’s performance at 2℃.

Other ratings

COP (Co-efficient of Performance)

The COP is a technical calculation of heating efficiency which is used in the formula for calculating star ratings. For heating, a good unit has a COP of three or more. The heating COP can be reduced by cold temperatures because de-icing takes extra energy.

Energy efficiency ratio (EER)

This is the calculated cooling efficiency, and is also used to calculate the star rating. The higher the rating, or the more stars, the better. An EER of three or more is good.

MEPS

All heat-pump/air-conditioner units imported or manufactured after 16 June 2006 must meet a new Minimum Energy Performance Standard or MEPS. But these minimums are set quite low, particularly for larger units.

MEPS has little relevance to your buying decision - it's there to make sure manufacturers don't sell unacceptably inefficient heat pumps to unsuspecting consumers. If you look for heat pumps that rate 5 stars for models up to 4kW and 4 stars from 4kW to 7.5kW, you'll be in no danger of buying a model that does not meet MEPS.

TESAW

If a heat-pump/air-conditioner system has been given a Top Energy Saving Award (TESAW), this can be shown on the energy label. The Australian Energy Ratings website can also tell you which systems have a TESAW. Energy Star (see above) now replaces TESAW.

Choose a reliable brand

Members who took part in our 2009 heat-pump reliability survey were overwhelmingly enthusiastic about their heat pump. Some 98 percent of owners said they'd recommend a heat pump to a friend - but a slightly lower 94 percent said they'd recommend the brand they owned.

Our survey found 93 percent of heat pumps up to five years old had never needed repair. This puts them on a par with the clothes dryers in our 2008 survey.

Among the big brands - Daikin, Fujitsu, Mitsubishi Electric, Panasonic and Toshiba - reliability ranged between 95 and 93 percent. The differences between them were too small to be meaningful. There weren't enough of the other brands to analyse their results separately.

About our survey

We surveyed members in February 2009, as part of our annual appliance reliability survey. More than 2500 told us about heat pumps they'd bought since 1 January 1999.

Some statistics:

- 87 percent of heat pumps in our survey were five years old or less.
- 97 percent were inverter models.
- 72 percent were mounted high on the wall and 20 percent were mounted low.
- 79 percent of those who took part in our survey bought their heat pump from a specialist supplier.

The importance of installation

It's essential that you use an experienced installer to advise you on the type of heat pump that's best for your home - and to ensure that it works properly. If you are being advised by someone who has been installing heat pumps for many years, you stand a much better chance of getting the right unit for the area you want to heat.

A good installer will ensure you get the right size for your room and climate. In frosty areas you may need a higher heating capacity model to keep the heat flowing (see What are your needs? for more on this).

Costs

Installation costs can be significant. Our price survey shows the cost of installation varies more than the units themselves - from $750 to $1350. Make sure the cost of installation is included in your quote. We quote uninstalled prices in our test results and database.

Positioning the outside unit

Look for an unobtrusive place on a north, west, or east wall, not too close to the neighbours or they could be upset by the noise, and somewhere where air can circulate freely around the unit. If you live in a coastal area, make sure you get a corrosion-resistant exterior unit. Avoid south facing walls - heat pumps work better with a little sun and as little frost as possible.

If the installer suggests the outdoor unit be mounted in a spot that does not suit you, think carefully before changing it. Mounting the outside unit in an inconspicuous, cold location may lead to excessive icing.

Satisfaction

We asked our members to rate the service they received when their heat pump was installed. Overall, members were pleased with the service: 90 percent rated it good or very good.

But satisfaction plummeted once problems appeared. Only 70 percent of those whose heat pump had needed repair were satisfied with their after-sales service.

Members rated the service they'd received from a specialist supplier significantly higher (91 percent satisfaction for installation and 74 percent for repairs) than those who'd bought their heat pump from a general appliance retailer (85 percent and 57 percent).

Good practice guide

The government energy agency, EECA, has developed a heat pump installation good practice guide which covers the unit's location, pipework, electrical requirements, testing and commissioning. Make sure your installer follows this guide.

We recommend

Recommended models have been chosen because they performed well in our tests. For performance details see the test results for small and medium models and large models. Note: some tested and recommended models **do not** qualify for the EECA 'Warm up New Zealand" subsidy.

Worth considering models are alternatives to consider if the size and type we have tested is not suited to your room or house. Any model with the Energy Star qualification is worth considering, especially as these models qualify for the EECA "Warm up New Zealand" subsidy. Any model rated worth considering should perform well if it is the appropriate size, and correctly installed by an experienced installer.

For details of the performance of the tested models see the Test results, and for specifications and features of all the models see our Heat pump database.

Small models (under 4 kW heating capacity)

Worth considering

- Carrier 42NQV025H-A/38NYV025H-A
- Daikin FTXS25GVMA
- Daikin FTXS25J2VMA
- Fujitsu AGTV09LAC
- Fujitsu ASTA09LCC
- Fujitsu ASTA09LFC
- Fujitsu ASTB09LDC
- MHI SRF25ZIX
- MHI SRK25ZIX
- MHI SRK25ZJ

Mitsubishi Electric MFZ-KA25VA RECESSABLE
Mitsubishi Electric MFZ-KA25VA-A1/A2
Mitsubishi Electric MSZ-FB25VA-A1/A2 PLASMA
Mitsubishi Electric MSZ-GE25VA-A1
Panasonic CS/CU-E7JKR
Panasonic CS/CU-E9GFE
Panasonic CS/CU-E9JKR
Toshiba RAS-10SKVR-A/RAS-10SAVR-A
Toshiba RAS-B10SKVP-E/RAS-10SAVP-E

Medium-sized models (4-6 kW heating capacity)

Recommended

Daikin FTXS35J2VMA
Fujitsu ASTA12LFC
LG R012AWN
Mitsubishi Electric MSZ-GE35VA-A1
Panasonic CS/CU-E12JKR

Worth considering

Carrier 42NQV045H-A/38NYV045H-A
Daikin FTYN50GV1A
Daikin FVXS50GV1A
Fujitsu ABTF18LAT
Fujitsu AGTV14LAC
Fujitsu ASTA12LCC
Fujitsu ASTB12LDC
Fujitsu AWTZ14LBC
MHI SRF35ZIX
MHI SRF50ZIX
MHI SRK50ZIX
Mitsubishi Electric MFZ-FB50VA-A2 HyperCore
Mitsubishi Electric MSZ-FB35VA-A1/A2 PLASMA
Mitsubishi Electric MSZ-FB35VAH HyperCore
Mitsubishi Electric MSZ-FB50VA-A1/A2 PLASMA
Mitsubishi Electric MSZ-FB50VAH HyperCore
Mitsubishi Electric MSZ-GE50VA-A1
Toshiba RAS-16SKVR-A/RAS-16SAVR-A
Toshiba RAS-B13SKVP-E/RAS-13SAVP-E
Toshiba RAS-B16SKVP-E/RAS-16SAVP-E

Larger models (over 6 kW heating capacity)

Recommended

- Fujitsu ASTA24LCC
- Fujitsu ASTA30LCC
- LG R22AWN-NC10/R22AWN-UC10
- MHI SRK63ZEA
- MHI SRK71ZEA
- Mitsubishi Electric MSZ-GE71VA-A1

Worth considering

- Fujitsu ABTF24LAT
- Fujitsu ASTA18LCC
- Fujitsu ASTB18LDC
- Fujitsu ASTB30LDC
- Fujitsu AWTZ18LBC
- MHI SRK60ZIX
- Mitsubishi Electric MSZ-GE60VA-A1
- Mitsubishi Electric MSZ-GE80VA-A1

Heat pump FAQs

Is it more efficient to leave heat pumps on 24/7 using the “away from home” settings or to turn them on when heat is required?

We think the answer for most households is that it’s more efficient and less costly to turn them on as required - but it depends on how well your house is insulated. Or perhaps on how much of your heat is lost almost as soon as it reaches your room.

If you have a near new house that is **air-tight** (has no gaps around doors and windows, so no draughts), and has **insulation** that far exceeds the building code requirements, has **double glazing**, and **thermal drapes**, and a true **heat exchanger ventilation** system so you never need to open windows, it *could* be more efficient to leave the heat pump on all day every day.

But in an old draughty un-insulated Victorian villa, you'll be wasting a lot of energy moving heat into your house then leaking it out the walls and windows and gaps to the outside air, where the heat pump outside unit will take it back out of the air and pump it in again.

If you live in a house like this we advise running the heat pump in much the same way as you ran your old heating system. Use the timer to start the heat pump an hour or so before you normally would. If the heat pump replaced electric heaters, you’ll at least be able to get the same amount of heat for a lot lower cost.

We know that far too many NZ houses are poorly insulated, have “natural” ventilation from gaps and cracks, have poor moisture control and so on, which leads us to believe running a heat pump 24/7 in many cases will be wasteful.

Your house could be anywhere between the two extremes and we'll have to leave it up to you to decide what is the best way of running the pump. Check out “Saving Energy” and “Insulation” for tips on how to cut down on loss.

It’s essential you stop as much of the heat-loss as you can before you run your heat pump constantly.

Why does my heat pump stop heating every now and then when it's frosty?

The short answer is that it's defrosting. The reason why is quite complicated.

First, it's important to know that your heat pump gets heat out of the air by trying to cool the whole planet. It's like a fridge running in reverse. The outside unit of the heat pump has a panel like the inside cooling plate in a fridge. You'll often see ice form on the evaporator panel in your fridge – because it's a very cold panel in a cool "climate". Something very similar happens outside on your heat pump external unit.

On a cold night when temperatures are heading towards a frost, as the air cools it loses its ability to hold water. Relative humidity rises as the temperature drops. Eventually the air temperature falls to the dew point, which is where relative humidity has risen to 100 percent. A relative humidity of 101 percent is against the laws of physics, so below the dew point excess water can't stay in the air any longer. This excess water separates out of the air as dew, condensing onto everything that's not under shelter. If the air cools further, to zero or below, frost forms.

Your heat pump's outside evaporator panel is out there in that dewy air, being kept very cold so that it can pull heat out of the air. Ice is inevitably going to form on the panel at low temperatures and high humidity. When the ice gets thicker, it will act as an insulator, and limit the amount of heat that can be extracted. The heat pump senses this and changes to a defrost cycle. While defrosting it won't deliver heat.

The worst conditions for ice formation are when the dew point is close to, but still above, zero. On a still day the actual dew point temperature in the evening depends on the relative humidity at the highest air temperature during the day.

So if you have a relatively humid climate where the overnight temperature regularly drops to the dew point, but not quite to freezing, your heat pump is going to suffer from severe icing. And it will have to stop heating fairly often to defrost itself. It's the Achilles heel of the heat pump.

All of this is why we think all heat pumps sold in New Zealand should be tested at 2°C in air that is at the dew point. We also say it should be mandatory to have the tested heat output at 2°C on the energy rating label.

If my heat pump does not deliver full heat at 2°C in the Waikato, how can it work at all in Otago?

It's very simple. It's colder in Otago. Heat pumps work just fine in Canada where it's colder still. They get to minus 20°C and more over there, but it's no problem. OK, OK, you're not convinced! Read the FAQ above, and we'll carry on down below the frost point.

What has just happened? Frost has formed because it's below freezing and the dew has settled out of the air that could no longer hold all the water it did earlier in the day, at say 12°C. Below zero, and below the dew point, there's almost no water left in the air and your heat pump should not have to defrost at all.

But - it's freezing - there's no heat left in the air either. Not at all. There's plenty. There's still heat in air at minus 270°C. Not much mind you, as that's just 3° above absolute zero. There is no heat left at minus 273°C. Obviously there's less heat at minus 10°C compared to 10°C. But it's not a lot less.

Heat pumps don't have a problem getting heat out of the air if it's just below freezing, as long as they've been designed to work down to say minus 10°C or so. Which is plenty for most parts of NZ.

So, at 6am, when it's minus 3°C in Queenstown and plus 3°C in Hamilton, who has the defrosting problems? Not the Southerners.

Can the heat pump be made to perform better in frosting conditions?

Maybe. There are a few things worth trying.

Part of the problem could be that it's trying too hard to heat up your room. This could be because it's a little too small for the job. If it was recently installed, and it's the size recommended by the installer, discuss it with them. Ask if you can have it replaced with one that has a little more heating capacity at 2°C installed. (For more information see What size heat pump and What are your needs.)

If it was installed to heat one room and you leave the doors open to other rooms – shut the doors. It's almost certainly too small to heat your whole house.

You may have turned the thermostat up to try and get more heat out of it. Sorry – that's wrong. You are forcing the heat pump to work harder, making the outside evaporator plate even colder, and ice form faster. The harder it works, the more ice. It's also less efficient at maximum output, so your running costs can increase.

Try setting the thermostat lower, to around 18℃, so the unit doesn't have to work so hard to get up to temperature. 18℃ is much warmer in the morning rush than 10℃!

Another way of easing the load is to set the timer's starting point a bit earlier, so it has more time to achieve the desired temperature.

Part of the problem could also be restricted air flow through the outside unit. Check that the fins are not blocked, and the intake and fans etc are not covered in debris, dust or cobwebs. It should work better if there is a bit of a breeze. Or it may be that you've got it alongside the coldest wall of your house. It will work better if moved to a warmer spot. The north side of the house is usually warmest.

And finally, if you only have occasional problems because it's only rarely frosty, keep a cheap 2000 watt electric fan heater for backup. Run the heater on full to ease the heat pump load until the room warms up to the point where the heat pump can maintain an acceptable temperature. If it takes 30 minutes to do this, you've only used one unit of electricity or less than 30c worth.

Should I install a DVS/HRV system or a heat pump? Or both?

First we'll deal with a misconception. The heavily advertised HRV systems are **not** heaters. They, and other similar products, are positive pressure ventilation (PPV) systems. In ideal circumstances, like sunny days if you have a corrugated iron roof, they can provide warm drier air sourced from the roof space which is effective at reducing condensation.

If you want cheaper heating when the sun is not shining, install a heat pump first, not a PPV system. Increasing the temperature in your house will help fight condensation as relative humidity drops when the temperature rises.

PPV systems are not an ideal match to heat pumps, because they work a little **against** a heat pump by pushing air into your house to force out the warm damp air which is the cause of condensation. This means pushing out some of that warm air your heat pump has worked so hard to warm up.

A true heat-exchanger (or balanced pressure) system will work **with** a heat pump, by extracting heat from warm damp air it extracts from kitchens and bathrooms and transferring that heat into incoming cold drier, fresh air. A balanced pressure (BP) system can also act as a heat transfer system by delivering the warm dry air to colder rooms not serviced by the heat pump, but your house must be reasonably air-tight.

Though BP systems are expensive, nowadays they can be competitive with multi-vent, electronically controlled PPV systems, which can cost $5000 and more. DVS and other PPV suppliers now offer BP systems as an alternative to their traditional range.

Heat pump corrosion

FAQ: Does my heat pump warranty cover corrosion damage?

We've had a complaint from Rotorua where a heat pump has failed after 3 years and the warranty claim has been declined because corrosion is not covered in geothermal areas.

In our opinion manufacturers' warranties should cover corrosion damage in geothermal and seaside areas unless owners have been specifically warned the local environment is corrosive and that the warranty cover is reduced. If the cover is to be reduced customers should be given written notification of the extent and period of the reduced cover. We think the buyer should sign a separate clause in the warranty to ensure both parties are aware of their responsibilities.

What about the Consumer Guarantees Act?

The Consumer Guarantees Act (GGA) provides a guarantee over and above any maker's warranty. The CGA says products must be durable. Most heat pump manufacturers offer 5 years parts and labour warranties which says they should be durable for at least 5 years. In our view, at least double that life is a reasonable expectation.

If an installer is prepared to supply and install a heat pump in Rotorua, we say they should have to repair or replace the heat pump for corrosion damage for at least the life of the factory warranty.

Installers are service providers, who must use reasonable care and skill when they provide their service. To supply and install a heat pump in Rotorua (or by the seaside) without any required extra protective anti-corrosion coatings, while knowing it might fail prematurely due to corrosion, is failing to use reasonable care and skill.

What's in the warranties

We checked some makers' brochures to see what was in the fine print.

Mitsubishi Electric: 5 years parts and labour. Warranty contains a special exclusion for damage caused by "salt (seaside) and sulphur (Rotorua)". Under 'Owner's responsibility': "the application of additional corrosive protection if the product is installed in a corrosive environment (for example, sea air, industrial environment, geothermal sulphur contamination)".

We think this should be the installer's responsibility under the reasonable care and skill provisions of the Consumer Guarantees Act.

Fujitsu website: "We offer New Zealand's longest warranty - 6 years full parts and labour warranty in fact - when you use a Fujitsu Accredited Installer." This is repeated in the brochure which also says the warranty does not cover "environmental damage".

Fujitsu told us it has only had one instance of premature corrosion in Rotorua, which was due to an inexperienced installer. It would repair or replace anything caused by factory failure.

Carrier and Toshiba: 5 years parts and labour warranty. Under 'Exclusions': “damage, problems or failure caused by weather including, but not limited to, hail, salt or other corrosive substances.” Under 'Purchaser’s Responsibilities': ensuring that additional corrosive protection is applied to the product if it is installed in a corrosive environment, for example, close to the sea.

We think this should be the installer’s responsibility under the reasonable care and skill provisions of the Consumer Guarantees Act.

Panasonic: The brochure claims “blue fin” technology has tripled the life of the condenser. 5 years parts and labour warranty. Under 'Warranty Exclusions': rust or damage caused by a corrosive atmosphere (for example, salt and sulphur).

Panasonic told us it will stand by the normal warranty on its products in Rotorua (or seaside locations), provided the heat pump is installed by a Panasonic approved installer or dealer in accordance with the factory specifications, including the application of extra anti-corrosive coatings. The warranty covers failure to operate due to corrosion, but not cosmetic corrosion or surface rust.

Daikin: 5 years parts and labour warranty. This warranty does not cover: “damage or deterioration to the external surfaces or refrigeration coils caused by normal weathering or corrosive atmospheric conditions.” Under 'Owner’s Responsibility': “the application of additional corrosion protection if the product is installed in a corrosive environment (for example, industrial pollution, sea air).”

We think this should be the installer’s responsibility under the reasonable care and skill provisions of the Consumer Guarantees Act.

MHI (Mitsubishi Heavy Industries): 5 years parts and labour warranty: “corrosion in toxic or excessive environments” is not covered. MHI told us it did not offer any warranty on corrosion in Rotorua.

We say

Heat pump installers in geothermal or coastal areas should take note of the CGA provisions and ensure their customers clearly understand any reduced warranties before installation, as well as installing any recommended corrosion protection.

If you live near the sea, or in a geothermal area, make sure you ask the installer about warranty cover before you go ahead with a heat-pump installation.

If you think you have a claim for corrosion repair, try the Disputes Tribunal - and let us know how you get on, it will be useful for others in a similar position.