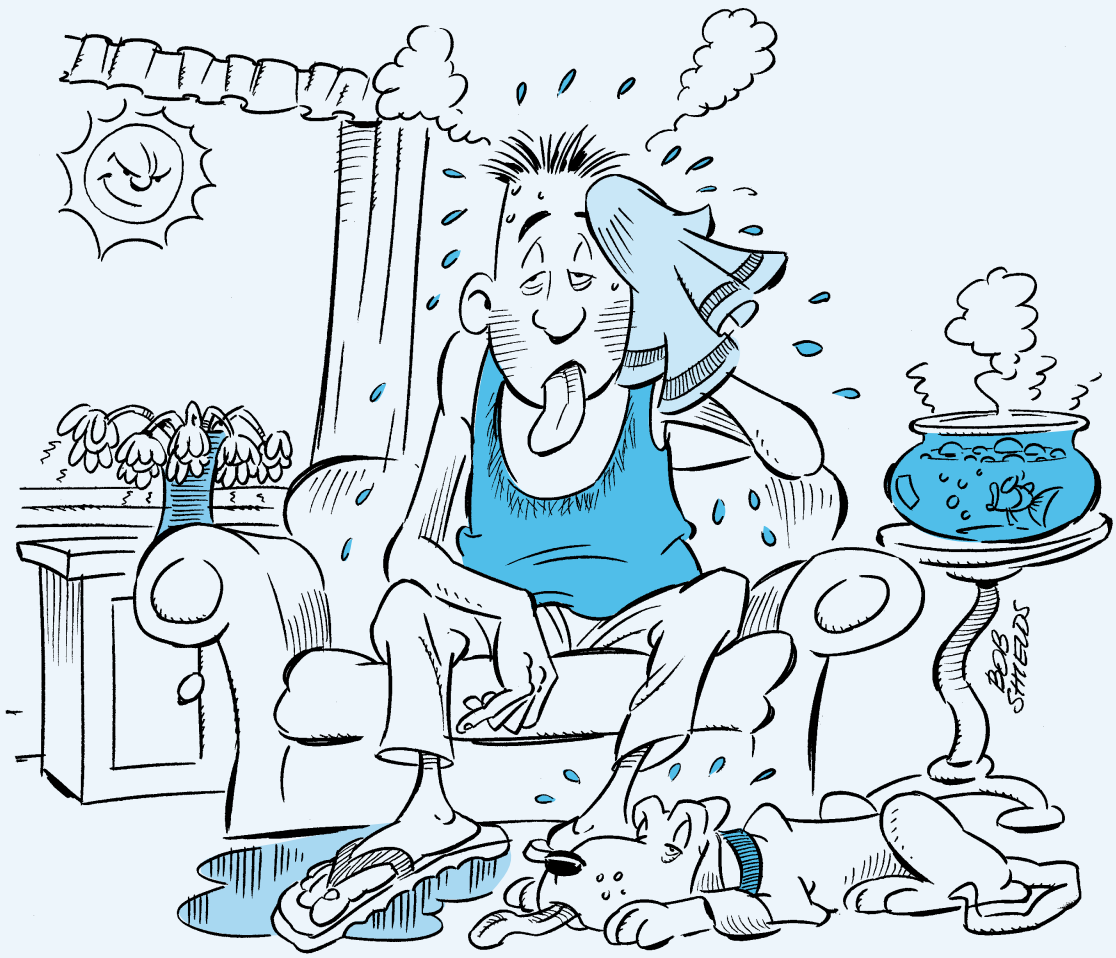
CHOOSING A COOLING SYSTEM



Do you dread the thought of enduring another sweltering summer of sleepless nights?

Can you no longer bear living in a hot box and want to install a cooling system but don't know where to start?

This brochure outlines various cooling options to help you choose the most effective system for your needs. If you are building or renovating a house, ask for our brochures *Energy smart house design* and *Energy smart renovations* to minimise your cooling needs right from the start.

SUSTAINABLE ENERGY AUTHORITY VICTORIA

Victoria
The Place To Be

THE FIRST STEP

Summer comfort in your home does not have to be expensive. Stop the heat getting in, and you can avoid purchasing unnecessary cooling equipment with high operating costs.

By paying close attention to the aspects described below, you can reduce heat entering your home by up to 90%.

- **Insulating** your ceiling (and walls if possible)
- **Draught sealing** around windows, doors and any other gaps
- **External shading** to north, east and west windows
- **Ventilation** to allow cool outside air into the house
- **Landscaping**

In Melbourne, the temperature only reaches an uncomfortable 30°C plus around 30 days each year and remains above 20°C eight nights per year. So think carefully before purchasing an air conditioning unit.

For more information on keeping your home cool without air conditioning, ask for our brochure *Home cooling hints*.

Being comfortable

The most appropriate type of cooling system for your home depends not only on local climatic conditions such as air temperature, humidity and air movement, but also on factors such as the time of day cooling is desired, the type of activities you undertake, the clothing you wear and the appliances you use. What is comfortable for one person may not be comfortable for another.

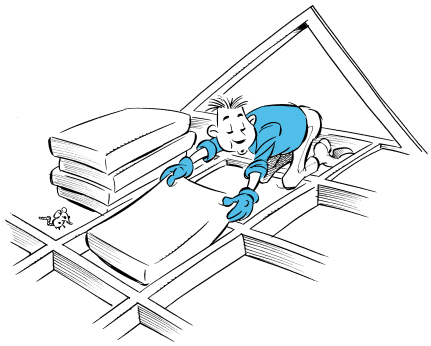
Comfortable indoor temperatures during summer are in the range of 24°C to 27°C with less than 60% relative humidity. These conditions are our preferred 'comfort range' or what we can put up with. If the humidity level is lower or a breeze exists, such as from a fan, we can be just as comfortable even at higher temperatures.

Remember, you do not have to use a lot of energy to cool the house and be comfortable.

Questions to ask yourself

Thinking about these questions will help you determine your cooling requirements.

- Do I need to cool the whole home or just one room?
- How big an area do I need to cool?
- Do I need to lower the inside temperature or will creating a cool breeze be sufficient?
- Is cooling required for short periods or all day?
- Will the running costs affect my choice?
- Is the purchase price the biggest consideration?
- Do I want a portable or fixed unit?
- Will noise bother me or my neighbours?



TYPES OF COOLING SYSTEMS

The following summary will help you select which system or combination of systems is right for your home. All the systems listed can provide cooling for single rooms or the whole house. More details on each are given in the following pages.

Fans

Fans produce a cooling effect by moving air. The air is either directed around a room or at a person.

Fans are an attractive option for summer cooling as they are inexpensive to purchase and operate, yet will often provide an adequate level of comfort.

- Lowest energy use
- Lowest running costs
- Lowest purchase cost
- Move air, don't reduce temperatures
- Portable or fixed
- Quiet operation
- Lowest greenhouse gas emissions

Evaporative coolers

Evaporative coolers cool and filter the air. Hot outside air is drawn through a water-moistened filter and then blown through the house. To work effectively, windows and/or doors must be left open so this moist air can be exhausted from the house.

- Low energy use
- Low running costs
- Medium purchase cost
- Cool air but increase humidity
- Portable or fixed
- Require water
- Must have windows or doors open
- Lower greenhouse gas emissions than refrigerated air conditioners

Refrigerated air conditioners

Refrigerated air conditioners remove heat from the air inside the home and transfer it outside.

For every unit of electricity they use, they can provide from 1.5 to over three units of cooling, making them very efficient.

- Highest energy use
- Highest running costs
- Highest purchase cost
- Cool, dehumidify and recirculate room air
- Reverse-cycle models also provide heating
- Closed system—windows and doors must be shut
- Highest greenhouse gas emissions

FANS

How do fans work?

By moving air over your warm body, fans help evaporate the moisture from your skin, causing a cooling effect. Generally, the higher the air movement, the cooler you will feel. Fans do not reduce actual room temperatures or humidity levels.

Types of fans

Portable fans

- Require standard power outlet
- Styles include desk, box or pedestal
- Fan diameters 15–45 cm
- Look for oscillating feature and variable speed control

Suitable for: personal cooling

Purchase cost: $20–$170

Ceiling fans

- Permanently wired
- Can be suspended with a down rod in rooms with high ceilings
- Light fitting can be included
- Look for reversing function for winter use and variable speed control
- Curved blades produce more air movement
- Low installation costs
- The number of blades has no effect on cooling capability

Suitable for: all rooms

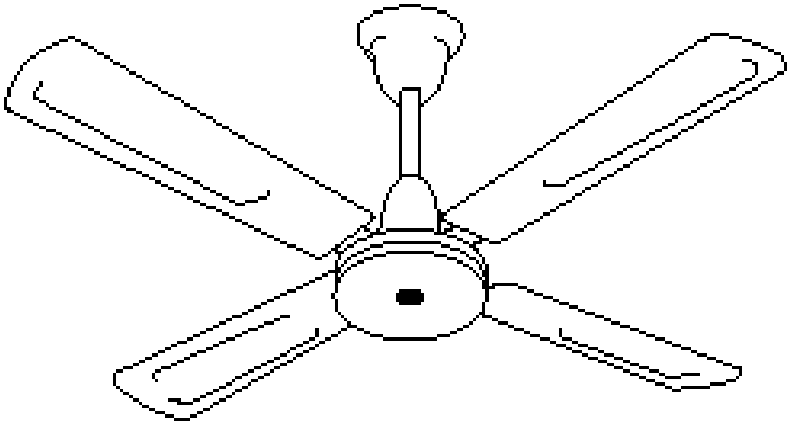
Purchase cost: $50–$200 plus installation

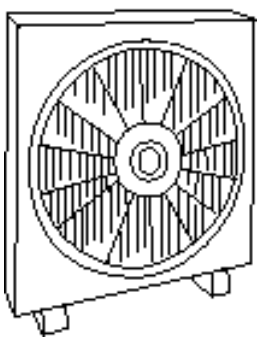
Sizing (ceiling fans)	
Room area (m^2)	**Fan width (sweep)**
Up to 10	900 mm (36 inches)
10–20	1200 mm (48 inches)
15–30	1400 mm (56 inches)
30+	two or more fans

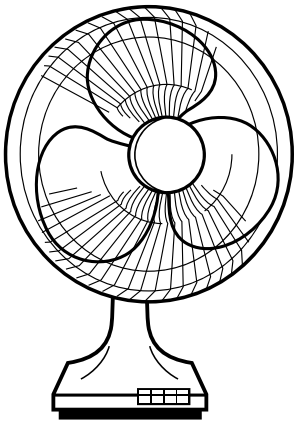
Note: if more than one fan is required, the spacing between fans should be approximately three times the fan width.

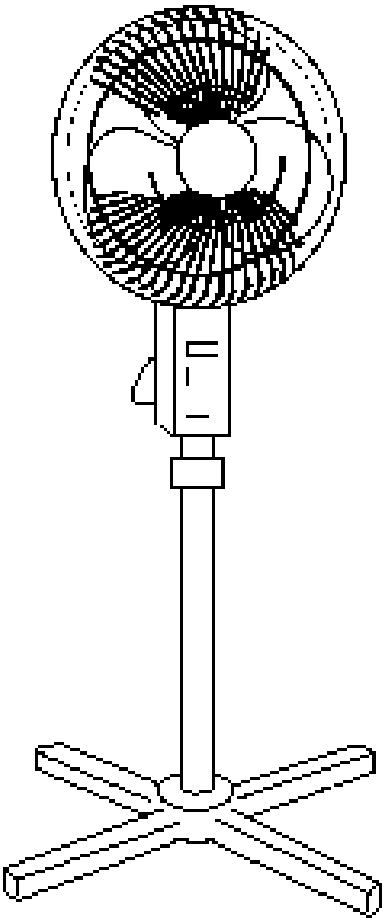
Considerations

- Ceiling fans should be installed with a clearance of at least 2100 mm above floor level.
- Mount ceiling fans higher than existing light fittings to avoid flickering shadows, or install a unit with light attached.
- Ceiling fans should be reversible to assist with heating in winter.









EVAPORATIVE COOLERS

How do they work?

Warm outside air is drawn into the unit through a series of wet filter pads. Water is evaporated into this air stream, cooling and humidifying it. The cool air is then blown through the house (see figure 1).

To work effectively it is vital that windows and/or doors are kept open when the cooler is operating to expel moist air. The area of open windows and doors should be approximately one metre square, for each cubic metre of air flow per second from the unit. For example, a unit rated at 1.5 cubic metres per second would require open windows or doors totalling roughly 1.5 m^2 in area. If flywire screens are fitted, this area may need to be doubled.

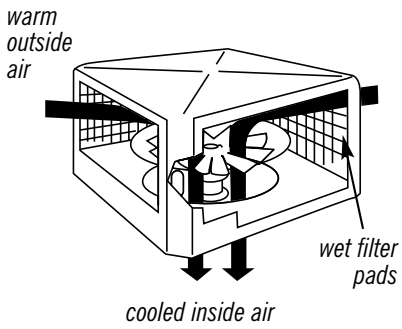


Figure 1: How evaporative coolers work

Where are they most suitable?

Evaporative coolers are generally more suitable for areas where humidity is low. If the outside air is already humid then the cooling effect of the unit is limited. As a guide, the average relative humidity for Melbourne on a summer afternoon is between 40–50%, whilst in Mildura it is 20–30%. Both these areas can use evaporative coolers although they would be more effective in Mildura.

Sizing

The sizing guidelines for these units are based on air flow and volume of the room. The rate of air flow or 'delivery' is specified as litres per second or cubic metres per hour (1 cubic metre = 1000 litres). Select a cooler rated to provide enough air to fill the room or house in around 90 seconds to two minutes (30–40 air changes per hour). To calculate volume, multiply your floor area by ceiling height, e.g. a 200 m^2 area with 2.5 m high ceiling = 500 cubic metres. Make sure you obtain an accurate sizing quote from a local or installer.

Types of evaporative coolers

Portable units

- Require standard power outlet
- Best positioned near an open window or external door with an opening on opposite side of room
- Look for models with water level gauge, variable fan speed and directional louvres

Suitable for: small rooms (up to 25 m^2)

Purchase cost: $200–$400

Fixed room units

- Location—external wall/window
- Permanently wired and plumbed
- Install towards prevailing summer winds

Suitable for: open areas 30–50 m^2

Purchase cost:$1000–$1300 plus installation

Ducted whole house (central systems)

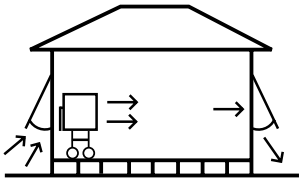
- Roof installation
- Cool air is ducted into rooms through ceiling outlets
- Existing heating ductwork is not suitable
- Consider carefully in water restricted areas or when dependent on limited water supply

Suitable for: whole home cooling

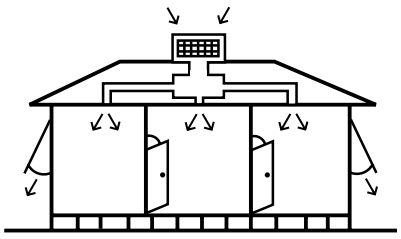
Purchase cost: $2500–$5000 (includes installation)

Considerations

- Open windows and doors on the side of the house opposite to the hot prevailing winds to avoid heat entering the house.
- On high humidity days the highest fan speed should be used. If it is a very humid day, turn off the water supply to the cooler and run the fan only.
- Water consumption for evaporative coolers depends on the natural humidity of the day. A portable unit might use four litres per hour while a central system could use as much as 25 litres per hour.
- Evaporative coolers do not work on a thermostat. They run for as long as you leave them on.
- During winter ducted units on the roof should have covers placed over them and ceiling vents closed to stop excessive heat loss. Alternatively, consider purchasing a unit with a motorised self-closing winter seal.



Portable unit



Ducted evaporative cooling system

REFRIGERATED AIR CONDITIONERS

How do they work?

Refrigerated air conditioners consist of an indoor and outdoor coil. These are connected by a pipe carrying a refrigerant gas. As warm room air is drawn over the internal coil, heat from this air is absorbed by the refrigerant and carried to the external coil where it is released outside. At the same time any water in the room air condenses on the cold internal coil and is then drained away. The resulting air blown back into the room is now cooler, less humid and usually filtered. Some units also provide a small amount of fresh air from outside into the room (see figure 2).

Where are they most suitable?

Refrigerated air conditioners are effective in any climate. They are particularly useful in humid areas because they dehumidify the room air.

Sizing

The correct sizing of an air conditioner is vital for efficient operation. Never oversize an air conditioner. Oversizing will result in short cooling cycles (switching on and off), with little reduction in humidity. Also, frequent cycling (on and off) is not efficient and adds to the wear and tear on the unit. An undersized air conditioner will not provide adequate cooling.

Air conditioners should be sized based on their **output power** or cooling capacity (not to be confused with the electrical input). The output is normally expressed as kW (kilowatts). 1 kW = 1000 Watts. Sizing is sometimes quoted in horsepower (HP), which is generally the input power, which can lead to inaccurate sizing and should be avoided.

As an approximate guide for sizing a room unit in Melbourne, allow 125 Watts or 0.125 kW per square metre of floor space for living areas and 80 Watts per square metre for bedrooms.

Remember, have a full cooling load calculation carried out by an authorised air conditioning installer or manufacturer before purchase.

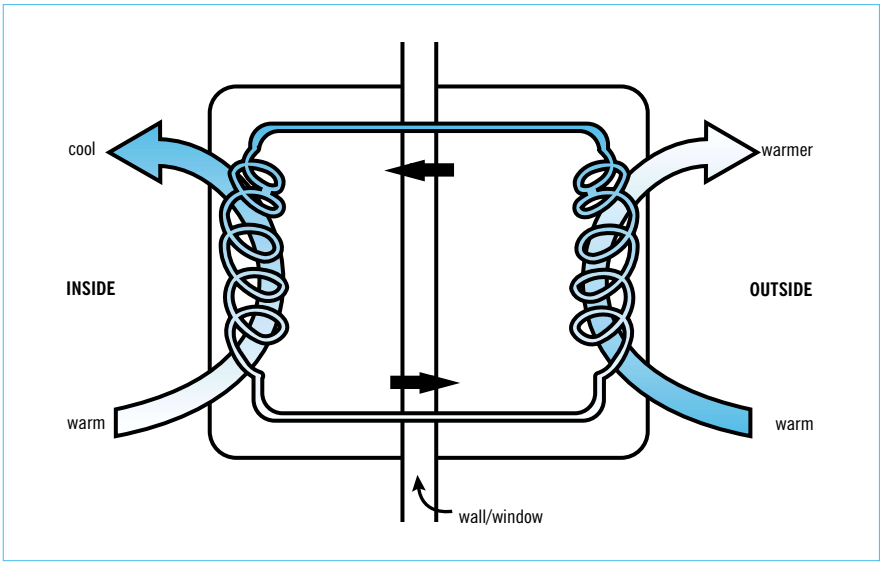


Figure 2: How refrigerated air conditioners work

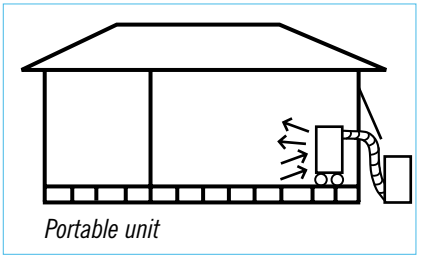
Types of refrigerated air conditioners

Portable units

- Separate indoor and outdoor unit connected by a flexible hose through an open window or external door
- Plugs into standard power outlet

Suitable for: rooms up to 35 m^2

Purchase cost: $800–$3000



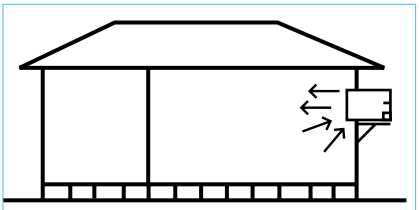
Portable unit

Window/wall

- Requires external window or wall
- Small units can use existing power outlets
- Larger facia units may require additional wiring
- Outside coil should be shaded if possible

Suitable for: single room cooling up to 60 m^2

Purchase cost: $500–$1600 plus installation



Window/wall unit

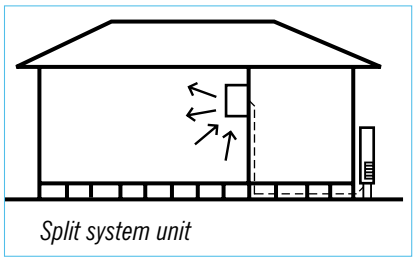
Split system units

- Separate indoor and outdoor section
- Ideal where no suitable window or external wall location exists
- Very quiet indoor operation
- The indoor unit can be located up to 15 metres away from the outdoor unit. The indoor unit can be wall, ceiling or floor mounted
- Multi split systems—can have up to seven indoor units running off one outdoor unit

Inverter technology is available with several brands of reverse-cycle split air conditioners. This allows the compressor to operate at variable speeds depending on the output required, and can potentially reduce running costs, particularly over longer operating periods.

Suitable for: one or more rooms up to 60 m^2. For larger areas, three phase powered units will be required.

Purchase cost: $1000–$10 000 (multi splits) plus installation



Split system unit

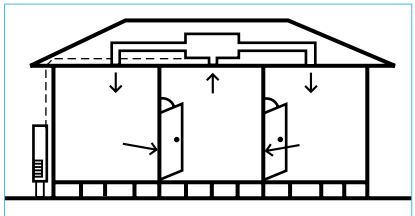
Ducted systems

- Roof or ground mounted, connected to ductwork
- Generally less efficient than split or window/wall units due to ducting losses
- Systems should be zoned to cool living and sleeping areas at different times
- Ductwork should be well insulated and sealed to prevent condensation
- Works best if ceiling mounted
- Suits pitched roof homes

Suitable for: whole home cooling

Purchase cost: $6000–$12 000 (includes installation)

Geo-exchange (or geothermal) heat pumps use the heating and cooling capacity of the earth to provide the air conditioning requirements of a home. These systems remove heat from the air inside the home and transfer it to the ground or ground water. In winter the process is reversed to provide heating. They are extremely efficient but more expensive to purchase than conventional ducted air conditioning systems.



Ducted system

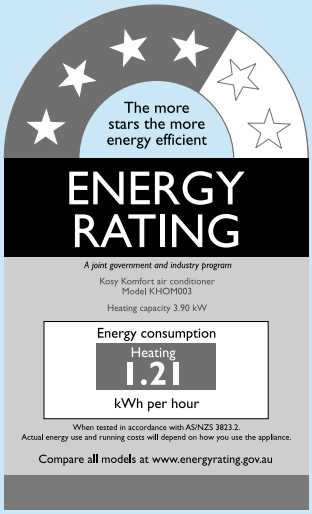
Considerations

- Rooms in which the air conditioner is being used should be closed off so the room air is recirculated. For example, windows and doors should remain shut.
- If possible locate window/wall units on the south side of the house. If the unit is exposed to full sun during the day, shade it with an awning or canopy of shade trees. However, do not restrict air flow over it.
- Set thermostats at 26–27°C for summer cooling. Each degree you lower the thermostat can increase running costs by up to 15%.
- Look for economy settings.
- Multi-speed fans allow you to select high speeds for fast circulation and quick cooling.
- Adjustable and rotating louvres also help to direct air movement more evenly around the room.
- Directional louvres set either horizontally or upwards toward the ceiling assist in cooling.
- Programmable timers allow the system to be switched on or off as required.

Look for Energy Rating labels

The energy efficiency of air conditioners sold in Victoria is reflected in a compulsory energy star rating labelling scheme for units up to 7.5 kW cooling capacity (most ducted systems are not rated). The more stars shown on the label the more efficient the unit. The label also gives an estimate of the annual electricity consumption. Check the Energy Rating label on air conditioners in retail showrooms or visit the Energy Rating website (www.energyrating.gov.au) for a detailed, up-to-date list of appliances.

High-efficiency units may cost more but can easily pay for themselves over a few years through lower running costs.



OTHER CONSIDERATIONS

Heating and cooling

Reverse-cycle air conditioners (or heat pumps)

A reverse-cycle air conditioner provides efficient heating and cooling. As they are only marginally more expensive to purchase than cooling only units, they should be considered when looking for an air conditioner. For more information see our factsheet *Reverse-cycle air conditioners*.

Using existing central heating ductwork

An effective cooling system needs much greater air flow than a heating system and therefore requires larger ductwork. It is generally not possible to use your existing ductwork unless the duct was initially sized to take both heating and cooling. If ductwork is compatible, a cooling unit can be included in the system. Registers or outlets are best positioned at ceiling level for effective and efficient cooling.

Resistance heating

Some air conditioners also provide heating through an electric resistance element. This is a more expensive heating option than using a reverse-cycle unit and you should think carefully before choosing this heating option.

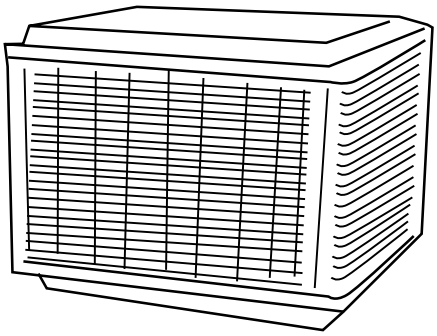
Noise

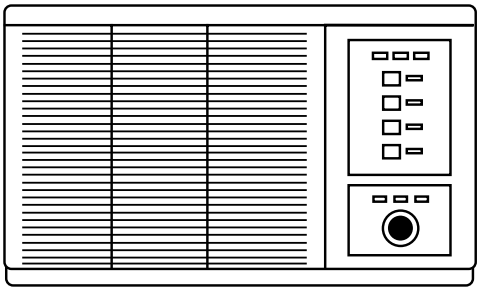
Outside the home

An air conditioner can be a noisy and annoying appliance, particularly if you are installing the system close to neighbours. There are laws to stop noisy air conditioners from being used. Most air conditioners sold in Australia now have a Noise (dB) Rating label on them. The best approach is to buy the quietest unit for your needs and have it installed as far away as possible from your neighbours, or in a well-shielded position. Contact the Environment Protection Authority or your local council for guidelines on acceptable noise limits.

Inside the home

Evaporative coolers tend to give a higher inside noise than refrigerated air conditioners, especially at high fan speeds. Refrigerated room units are noisier than split systems. Ducted or split systems tend to be the quietest due to the remoteness of the operating components.





Controls

Most refrigerated air conditioning systems let you maintain a particular temperature in the room, and the unit uses a thermostat which will cycle on and off as necessary to achieve this temperature.

Programmable thermostats are also available and should be considered. These allow you to switch the unit on and off at preset times, potentially saving energy and reducing running costs.

Some central evaporative coolers can be purchased with 'off' timers. These can save energy and provide greater convenience as the unit can be switched off automatically when cooling is not desired (e.g. in the early hours of the morning).

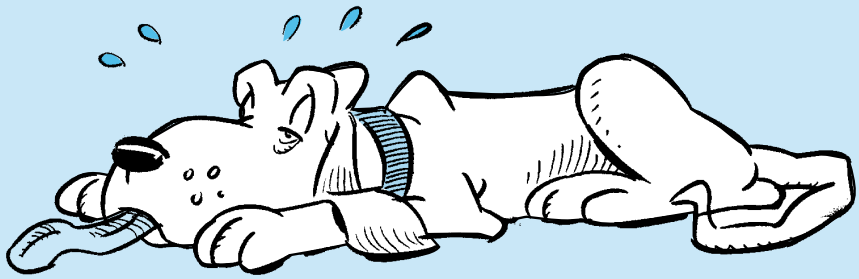
Maintenance

Both air conditioners and evaporative coolers should be regularly maintained. Each year at both the start and end of the cooling season you should check the filter pads and clean or replace them if necessary. If your area is particularly dusty you may need to clean them more frequently. Because refrigerated units recirculate the air they filter, it is very important to keep filters clean to reduce dust circulation and maintain air flow. Remove any dust that has built up over the fan and the condenser coils at the back of the unit.

For evaporative coolers, removal of blockages will ensure increased saturation of the filter pads and greater operating efficiency. Check evaporative units regularly, especially if any water has been sitting idle in the unit for any length of time (some units have self-cleaning mechanisms which flush the water reservoir after the unit is switched off).

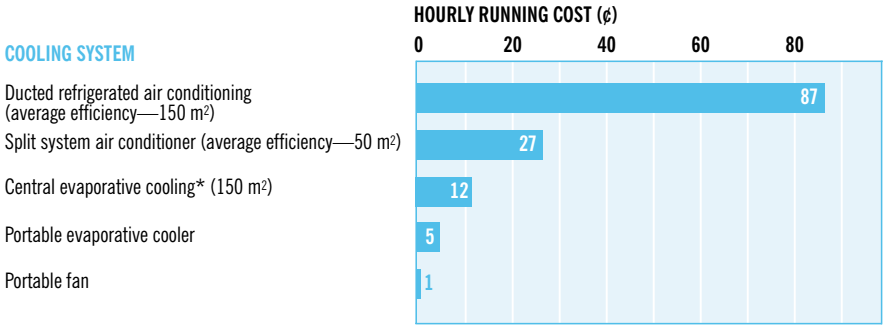
During winter, if your system is not going to be used for heating, protect any external equipment with a weatherproof cover.

Always follow any specific directions provided by the manufacturers for maintenance of the equipment.



RUNNING COSTS AND CO_2 EMISSIONS

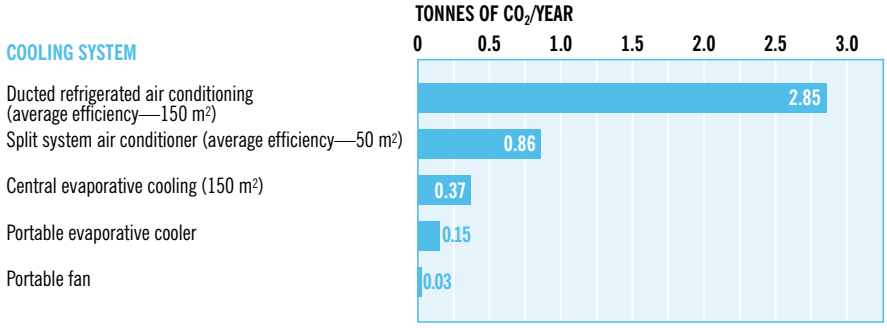
The following chart provides comparisons of average hourly running costs for various cooling systems.



**Evaporative coolers may need to operate for longer periods to achieve a cooling effect comparable to refrigerated systems. Water consumption costs are not included.*

The energy used to operate cooling systems produces gases which contribute to the enhanced greenhouse effect. Carbon dioxide (CO_2) is by far the main greenhouse gas, but others such as methane, nitrous oxide and chloroflourocarbons (CFC's) also contribute.

The chart below compares the amounts of greenhouse gases (CO_2 equivalents) released annually by different cooling systems when cooling a typical home. Figures are based on four hours operation per day over the summer period.



Important note

The costs in this brochure are based on an electricity tariff of 15 cents/kWh (GST inclusive). As tariffs will vary over time and between electricity retailers, check with your supplier for the tariff applicable to your home and adjust running costs accordingly.

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