choose Energy Smart.

Choosing an air-conditioner

Throughout human history, appropriate garden and home design were the main ways people kept their homes cool and comfortable in hot climates. When the electrically operated air-conditioner was invented, it became possible to artificially cool living spaces. Issues of style, fashion and reducing initial costs have led to sensible climatic house design gradually becoming less common, with many people suffering uncomfortably hot summers inside their homes.

Why your home gets hot

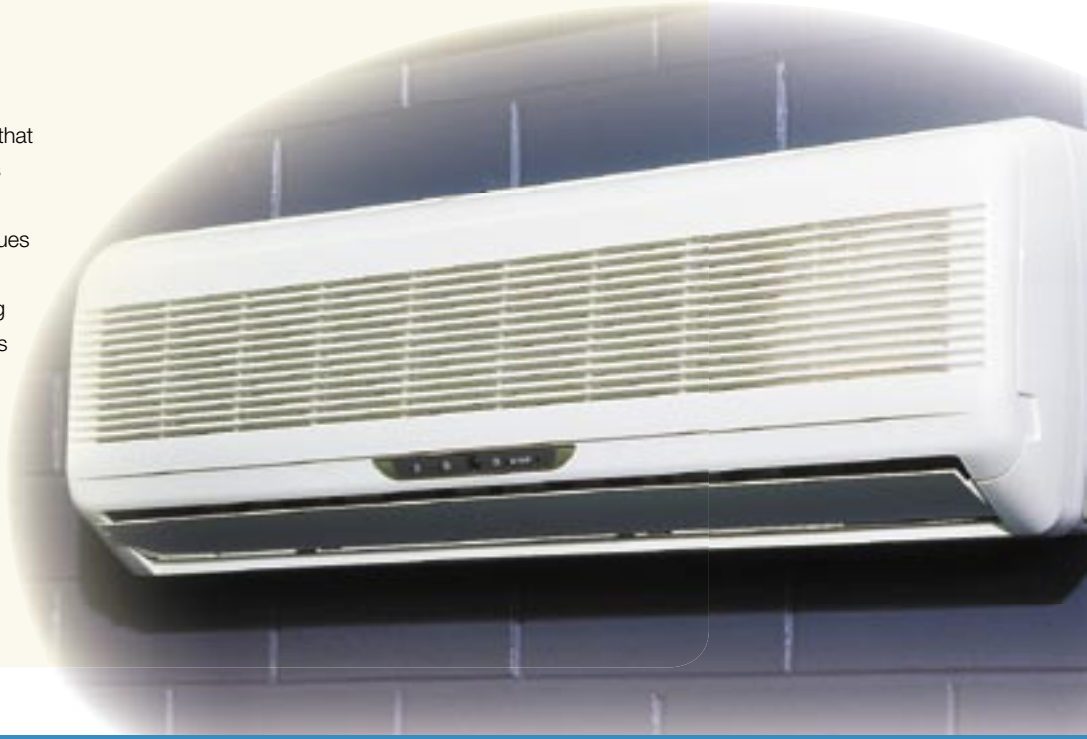
The main ways that heat enters the home in summer are through:

- Heat transfer from the external surfaces of the house that are warmed by the outside air temperature and the sun
- The sun shining through windows, directly heating the home interior
- Hot air infiltration through open windows, doors, air vents and gaps around doors and windows
- Internal heat generated by the people inside and the appliances being used.

In choosing an air-conditioner remember that the problem is mainly that the house lets in too much of the day's heat. It may be possible to use 'passive' cooling techniques to reduce your heat gain, such as installing ceiling and wall insulation, using appropriate window shadings and covers and ensuring good garden and landscaping design around the house.

Further information about making your home energy efficient is available from the Energy Smart Line (see back page for contact details).

Restrictions on the use of passive cooling techniques caused by house design, layout, construction materials or even by proximity to paved surfaces or fence lines could mean that these steps will not reduce your heat gain sufficiently. However, adopting these measures may reduce the size of the air-conditioner you require and its associated purchase and running costs.



TYPES OF SYSTEMS

There are two main types of air-conditioners on the market – evaporative and refrigerative.

Evaporative coolers

Evaporative coolers range from small mobile units that cool one room, up to large units that can cool a whole house. They consist of a fan or blower that draws in outside air and passes it through a wet filter. As hot dry air moves through the filter, water evaporates, cooling and humidifying the air. The cool air is then blown through the room or house.

Evaporative systems cool best when the air is drawn slowly over the wet filter pad, which allows maximum evaporation to occur. Systems with larger total filter areas will provide better cooling because the air can flow more slowly over the filter pads.

Care should be taken when purchasing evaporative systems to ensure that the unit is adequately sized for your particular requirements. As a guide, the entire volume of the space(s) to be cooled should be flushed through every 2 minutes (or around 30 air changes per hour). Make sure you obtain an accurate sizing quote from your air-conditioning specialist before purchasing your system.

The performance of evaporative systems deteriorates as air humidity increases. Consequently, evaporative systems are not suitable for the humid northern, coastal regions of Western Australia. They are generally suitable for areas with dry summers, such as inland and southern regions (including Perth), although their effectiveness will be reduced during the occasional periods of humid weather that these areas can experience.

Like all electrical appliances, there are ongoing running costs. Water is required for the cooling process and electricity is required to move the air and run the control system. However, the amount of electricity required to run an evaporative air-conditioner is much less than for equivalent sized refrigerative air-conditioners.

Portable units

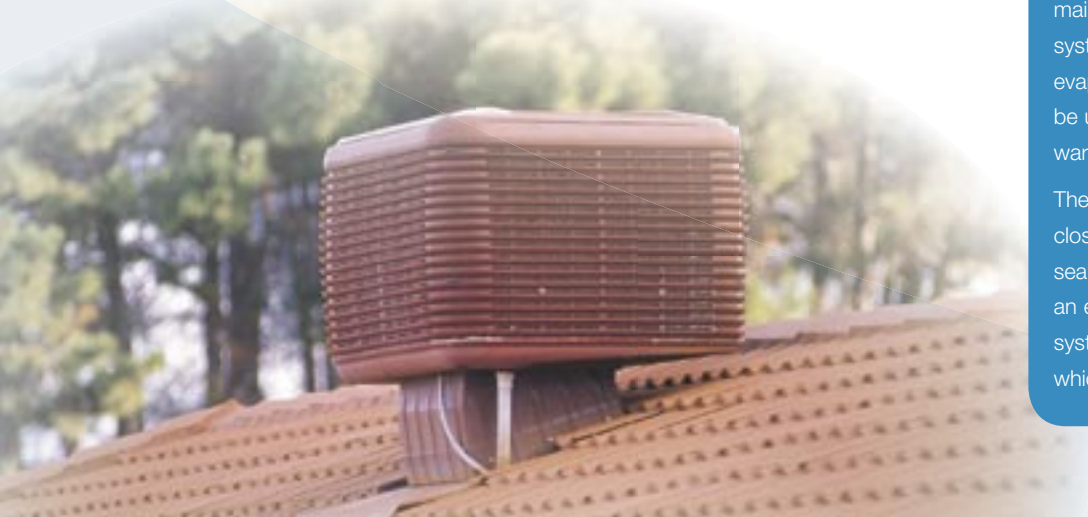
These units cool one room at a time and are usually on a stand with legs and wheels so you can move them around the home. They plug into a mains wall power socket and need to be filled with water. Although a few models have electric heating elements to provide winter warmth, most do not have this capability. The best location for portable units is near a slightly open window or door with an opening on the other side of the room.

Fixed or fascia units

These units are mounted through a wall or window and have permanent wiring, water connections and fresh air supply. They can cool larger areas than the portable units.

Ducted systems

Ducted systems are usually mounted on the roof. They typically use 10 to 30 litres of water per hour, depending on size, water hardness, air humidity and operation. After filtering, humidification and cooling, the air is ducted through the roof space to all rooms in the house. Most roof-mounted systems are quite large and some can be noisy outside so you should consider the visual and noise aspects when choosing placement.



Operating tips

When operating an evaporative cooler, always ensure that some doors or windows are slightly open so that the fresh, cool air produced by the air-conditioner can easily flush out the hot air inside your home. Some ducted coolers have self-closing ceiling vents which allow the air to be exhausted into the roof space. These may provide security advantages over opening windows or doors, but may also increase heat loss in winter.

With all evaporative coolers always make sure that the water supply is clean and fresh. In areas where the water is hard (containing minerals), frequent filter changes may be necessary. In severe cases of water hardness corrosion of the unit can occur. This is due to water evaporation inside the unit, allowing dissolved salts or minerals to leave a residue on the filters. To overcome this problem, most systems use excess water to flush the filter pads. In most areas of the south west, including the Perth metropolitan region, water quality is perfectly acceptable and only minimal flushing is necessary.

Where portable units have not been used for a week or more the water reservoir should be drained so that bacteria and algae do not grow in the reservoir or filter pads, causing a health hazard. The reservoir should also be flushed out regularly to remove dirt and residues.

Ducted systems are permanently connected to power and water and require little maintenance apart from cleaning the air filters, which is usually done by a maintenance contractor. Some ducted systems have a fresh air mode where no evaporative cooling occurs. This mode can be used to flush cool outdoor air through a warm home (e.g. summer nights).

The vents of ducted systems should be closed off in winter. Some vents do not seal well and it may be worthwhile placing an extra cover over the vent. Most ducted systems should also be covered in winter which will assist in reducing heat loss.

Refrigerative air-conditioners

Refrigerative air-conditioners use the same operating principle as refrigerators, they "pump" heat from one place to another. Like refrigerators, they have two connected coils - an inside coil and outside coil. The coils are connected by pipes filled with refrigerant which is pumped around the circuit by a compressor. As warm air passes over the indoor coil, heat is transferred to the refrigerant passing through the coil and pumped to the outdoor coil where it is dissipated into the atmosphere. This is the reason why air-conditioners are also called heat pumps.

Some refrigerative air-conditioners also work in reverse to provide heat in winter. Rather than making their own heat from electricity, they use the electricity to pump heat from outside the building to inside. Even on fairly cold days, energy can still be extracted from the outside air and pumped inside. However, reverse cycle air-conditioners may perform poorly when the temperature is less than about 4ºC (unless optimised for these conditions).

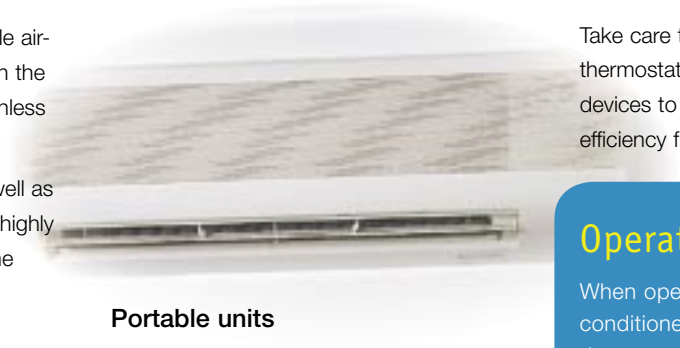
Refrigerative systems dehumidify as well as cool the air. This feature makes them highly suitable for hot, humid climates like the coastal regions of the Kimberley.

Appropriate system size is particularly important with refrigerative air-conditioners as choosing a system that's too small won't provide effective cooling and choosing one that's too large will result in frequent cycling (turning on and off), wasting energy and money and increasing the system's wear and tear. An oversized system may also be less effective at dehumidifying the air.

Refrigerative air-conditioners should be sized based on output capacity. The output is normally expressed in kilowatts (kW). If you're considering purchasing a room unit, an approximate guide is to allow 0.125 kW per square metre of floor area to be cooled in living areas and 0.08 kW per square metre of floor area in bedrooms. This guide applies to standard 2.4 m high ceilings with insulation. For example, a living room with an area of 30m^2 will require an air-conditioner with an output of around 3.75 kW, while a bedroom with the same floor area will require an air conditioner with an output of around 2.4 kW.

As appropriate sizing depends on a number of other factors besides the area of room to be cooled, make sure you consult an air-conditioning specialist before purchasing your system. Your specialist will be able to give you a precise calculation of size based on your own specifications.

When sizing your system it is important not to confuse the output capacity with the input capacity or coefficient of performance (COP). The COP of an air-conditioner indicates how many units of heat are removed by the air conditioner per unit of electricity consumed. For example, an air-conditioner with a COP of 2.5 will pump 2.5 kWh of heat outside for every unit (kWh) of electricity used. Typically, COPs vary from a low of about 1.7 to a high of about 3.3 for domestic air-conditioners. For air-conditioners capable of heating, different COPs apply for the heating mode and are usually between 2.0 and 3.2. Air-conditioners with a high COP for cooling do not necessarily have a high COP for heating, although this is often the case.



Portable units

Small, portable units cool one room at a time and can be wheeled from room to room. A connection to the outside is required to remove the hot air. Some units can be placed in an open window so the hot coil is outside while other types have an internal hot coil and a flexible air hose which can be placed out a window or door.

Fixed or fascia units

Fixed units can cool larger areas and come in two main types - single units and split systems.

Single units are mounted through a wall or window with the hot coil on the outside and can only really cool the room in which they are situated. As the pumps and fans are all in one location, they can be quite noisy. Most can be adjusted to either fully recirculate air or to incorporate a portion of fresh air from outside.

Split systems have the cool coil inside a room and all the other equipment located outdoors up to 15 metres away. This makes them much quieter indoors than single units. Some split systems can cool more than one area but these are more expensive. Split systems generally do not enable fresh air to be incorporated in the air flow, instead relying on 100% recirculated air.

Ducted systems

These systems can cool a whole house by supplying cool air to multiple outlets. A good system will have a zone arrangement so that cool air can be supplied to only those areas required (for example, living areas during the day and bedrooms at night). This can significantly reduce the amount of energy consumed.

Ducted systems can be roof or ground-mounted and are usually split type systems with the hot coil and fluid pumps outdoors and a cold coil situated inside the ducting. Typically air is drawn from inside the house and then cooled and recirculated. Some systems allow fresh air to be mixed with the recirculated air.

Take care to plan the layout of ducts, thermostats, sensors, timers and other devices to get the best performance and efficiency from your system.

Operating tips

When operating a refrigerative air-conditioner, always ensure windows and doors are closed so the cool air does not escape.

Ensure that the outside coils, pumps and other equipment are in a cool place and well ventilated. This helps improve the unit's performance as it does not have to pump heat up such a high "temperature hill".

Refrigerative air-conditioners should also be kept clean and protected from the weather, as dirt will decrease their effectiveness and efficiency.

If not used for extended periods, covers should be placed over the compressors, air intakes, cooling coils etc. to keep dirt and bugs out. With cooling only systems, ducts should be closed during winter to prevent warm air from leaking out of the house.

Creating air movement through the house can make temperatures of 25-27ºC quite comfortable, so set the thermostat to ensure that no active cooling occurs below this level and circulate air with the air-conditioner's fans or other fans.

Noise levels

The external elements in an air-conditioning system can be noisy and if not located appropriately on your property can cause annoyance to neighbours. There are regulations that govern the noise level allowed at your neighbours property and these regulations can be used to stop the air-conditioner being used. Most air-conditioners sold in Australia have a noise rating label (dB). To minimise noise annoyance to your neighbours:

- Contact your local council for guidance on acceptable noise levels and relevant details of the regulations
- Buy the quietest unit to suit your needs
- Ensure the installer is aware of the noise regulation requirements
- Discuss the location of equipment with your installer
- Locate equipment as far as possible from neighbours or in a well screened location.

Look for the energy rating label

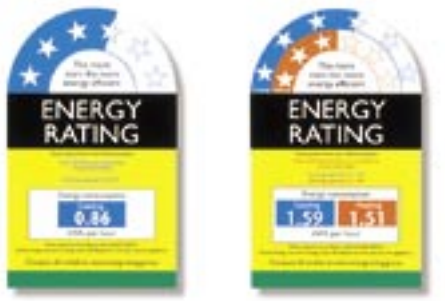
Most room-sized refrigerative systems are given an energy star rating which enables their performance to be compared. They show a cooling rating in blue, and if they can be operated to provide heating, they will also show a heating rating in red. While less efficient units may be cheaper to buy, they will cost more to run. On the other hand, the additional cost of a more efficient system is usually offset by reduced running costs. Larger and multiple outlet split systems are not required to have star ratings, however suppliers should be able to provide information on the performance of these larger systems.

Compare energy ratings

To compare the energy ratings of various refrigerative systems, visit the Government's 'Energy Rating' web site at www.energyrating.com.au or ask the Energy Smart Line for a *'Reach for the Stars'* brochure.

If the system has a low star rating for heating in winter then heating with natural gas may cost less to run. However, compared to other types of electric heating, a reverse cycle system can give the same amount of heat for about one-half to one-third the electricity cost.

Although evaporative air-conditioners don't currently carry a star rating, their energy consumption is much less than similar sized refrigerative systems.



Comparative running costs of cooling systems

Room cooling	Floor area	Approximate hourly running cost
Refrigerative Split-System	40 m^2	23 to 30 cents per hour
Evaporative Fixed Wall System*	30 to 50 m^2	4 cents per hour
Whole of home cooling		
Ducted Refrigerative System	150 m^2	80 c to $1 per hour
Ducted Evaporative System*	150 m^2	10 to 15 cents per hour

* Water consumption costs not included.

The figures are indicative costs for systems running on maximum setting for one hour. Actual costs will be lower if the air-conditioner cycles on or off due to the thermostat or if a low power setting is used.

More Information

If you want to know more about choosing energy efficient appliances, keeping your house cool in summer and warm in winter or any other matters relating to home energy use, simply phone the **Sustainable Energy Development Office's Energy Smart Line on 1300 658 158** or visit the Sustainable Energy Development Office's web site at **www.sedo.energy.wa.gov.au**

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