



# Choosing a Heating System

## Before choosing a heater remember....

The best way to improve the comfort of your home in winter and spend less on heating is to reduce the heat losses from your home.

Before you buy a heating system, we recommend the following:

- **insulate ceilings (R3.5+), walls (R2+), and floors (R1.5+), where possible;**
- **seal off draughts;**
- **use insulating window coverings; and**
- **zone living and sleeping areas.**

For more information on the above, please see our 'Keeping Your Home Warm' and 'Cavity Wall Insulation' fact sheets.

When building or renovating these improvements even allow you to buy a smaller heating system.

## Buying a heater

The steps below give you a systematic approach to addressing the above questions.

### Step 1: Understanding (your own) human comfort

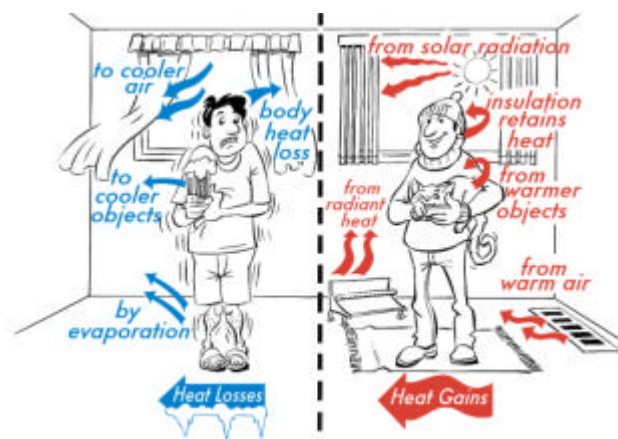
How comfortable your body feels is not only dependent on the temperature in your home. When choosing a heating system, it is worth considering the following

- Is it the appropriate size for the space to be heated?
- Does it have a range of heat settings?
- Is it thermostatically controlled?
- How much noise does it make?
- Can I zone it?
- Does it have a radiant heat component?
- How efficient is it?
- Cost?
- What are its greenhouse gas emissions?
- How quickly will it heat the area?
- How frequently am I going to use it?

factors that contribute to human comfort.

## What makes us feel warm?

**Radiant energy:** All materials, including people, give off radiant energy. The hotter something is, the more radiant energy it gives off. Examples of high emitters are the sun, fires, and hot radiators. Radiant energy is transferred by electromagnetic waves, which means it is not reliant on air movement. Radiant heat works best when the person to be heated is nearby. It is not as useful when people are moving about. About 50% of our experience of winter comfort depends on the amount of radiant energy reaching us.



Heat gains and losses from the body

**Convection/warm air:** Convection relies on the movement of heat through gas (including air) or liquid to transfer heat from a warm area to a colder area. Being surrounded by warm air makes us feel warm as our rate of heat loss by conduction and convection is reduced, but too much convection can make us feel uncomfortable.

**Clothing/bedding:** Surrounding the body with a layer of insulating clothing or bedding reduces the heat loss from a person, increasing the comfort level without changing the environment.

**Activity level:** The amount of heat generated by a person varies hugely depending on activity level. The amount of heating needed in an office is much greater than the heating required in a busy warehouse or gym.

## What makes us feel cold?

**Moving air:** Moving air increases the rate of evaporation a person experiences, which is the main mechanism the body has for losing heat. Even warm moving air, if close to the body, increases the heat loss from a person. For this reason, heaters that rely on moving air (fan heaters, central ducted systems) should be located to avoid excessive air movement where people are often sitting or standing.

**Cold surfaces:** Cold floors make for cold feet and cold walls, ceilings and windows make the rest of you feel cold as your body radiates more heat to them than they radiate to you. Insulation and insulating curtains increase the temperature of the surrounding surfaces and make you feel comfortable at a lower air temperature.

## Step 2: Should I heat the whole house?

### Central heating or zoning:

Heating unused areas in your home is a waste of heat and money. By closing off unused areas and ensuring your heater is only heating the used areas, you will save money and greenhouse gas emissions whilst still being comfortable. You can do this by closing doors as well as closing vents if you have a central heating system. In all but the most open plan houses, this should be achievable.



Central heating systems can be supplemented by high efficiency space heating when only small areas of the house are being used.

The table below gives an idea of whether you are likely to get better value from central or space heating. However, note that central heating systems can also be supplemented by installing a high efficiency space heater in the main living area, to be used when whole house heating is not required. If you are 'upgrading' from space to central heating, consider retaining the existing space heater for this purpose.

### Space vs Central Heating

Heating required	System recommended
Only heating living areas	Space heating
Living areas and minimal heat to bedrooms	Space heating
Heating several disconnected rooms	Central heating
Whole house	Central heating

The tendency in Canberra in recent years has been to install central heating because of perceived greater comfort. Additionally, large ducted systems (gas or reverse cycle) are perceived to have higher efficiencies than smaller space heaters because their efficiency rating ignores the very large losses through the walls of the ducts even before any heat reaches you in your rooms. Factors that are often ignored are the large initial cost of a central system and the increased energy consumed by heating much larger areas. A well-managed space heater can provide good human comfort often at much lower costs than a central system.

For this reason, the table below should be treated with some caution. While the 2 star gas appliance costs more per kWh to run, if you are only heating half the house, the actual running costs would be less than heating the whole house with a 5 star electric heat pump.

### Appliance emissions and running costs

Heater type	Greenhouse emissions per kWh	Cost per kWh heat produced <sup>1</sup>
Solar Air Heater	0-0.1 kg	0-1.5c
2 star Gas (65%)	0.28 kg	7.9cents
5 star Gas (88%)	0.20 kg	5.9c
Electric Heat Pump 5 star (COP2.0 <sup>2</sup> )	0.49	5.4c
Electric Heat Pump 2 Star (COP1.4)	0.70	7.8c
Electric Column, Convection, etc,	0.98 kg	10.9c
Off Peak Electric	0.98 kg	7.5c

## Step 3: Types of heating

Now that you have some ideas of cost and whether to use central or space heating, here is a breakdown of the more common types of heaters and heating systems:

### What to look for

- high star rating
- wall mounted thermostat
- timer/program option for large units

<sup>1</sup> Excluding duct losses, which are commonly around 15%.

<sup>2</sup> Coefficients of performance (COPs) are lower than commonly quoted by manufactures to account for Canberra's climate being colder than standard test conditions

**STOP PRESS:** *Solar air heaters to heat your home.* An increasing range of solar air heaters, modular, space, and integrated into existing duct work are now available. While generally not designed to be the only heater in the house these heaters provide very low cost, low emissions heat, particularly in the shoulder seasons.

## Space heaters:

**3.1 Flued gas heaters** have grown in size recently so that some of them almost qualify as central heating units, heating up to 150m<sup>2</sup> of a well insulated home. They give off a mixture of radiant and convective heat and their efficiencies and cost vary widely. Limited ducting is possible for some units.

*Pros:* Can be effective; low greenhouse gas emissions; medium cost; radiant heat; some have a visible flame.

*Cons:* Efficiency highly dependent on initial cost.

**3.2 Unflued gas heaters** are similar to flued units except that they tend to be smaller, cheaper, and highly efficient. However they have a number of issues that make them less attractive.

*Cons:* Internal air quality is reduced due to combustion products. This can exacerbate respiratory problems. Water vapour production also means that extra ventilation is necessary, reducing effective efficiency of the heater. Not recommended for Canberra conditions.

### **3.3 Electric fan forced heaters**

provide quick, even heating to small or moderate sized areas.

*Cons:* High running costs; high carbon dioxide (CO<sub>2</sub>) emissions; high air flows can cause cooling and rapid heat loss in older 'leaky' houses; often noisy; heat losses when mounted in an external wall.



### **3.4 Electric column/radiant heaters**

provide radiant heat to small areas.

When turned down very low they can provide adequate levels of comfort at low cost if the user is very close to the heater.

*Pros:* High radiant heat content; low initial cost; can be targeted to heat just the people.

*Cons:* High running costs and high greenhouse gas emissions if they are the primary source of heat in a room.

*What to look for*

- Built-in timer
- variable power thermostat



### **3.5 Off-peak electric storage heaters**

#### **Radiant/convective heaters**

store off-peak electricity as heat in storage bricks. **Storage fan heaters** are available to

heat up to 50m<sup>2</sup>. The fan helps distribute the heat and control the heat delivery and temperature. Storage radiators deliver 24 hour background heat for areas up to 30m<sup>2</sup>.

*Pros:* Off peak nature of electricity reduces cost; radiant heat component.

*Cons:* High emissions; relatively high cost; diminishing power as the evening wears on; lag time once stored heat is depleted.

*What to look for*

- remote thermostat
- charge controller
- fan control

#### **3.6 Electric thin film heating.**

Thin films are installed in the ceiling, in wall panels or under floor coverings to

give radiant heat. They operate on 'peak rate' electricity.

*Pros:* can effectively heat an area using less electricity than other peak rate electric heaters, especially if targeted (e.g. under-desk leg and feet warmers); thermostatically controlled.

*Cons:* High initial installation cost; high running costs; massively inefficient if not mounted on the room side of high resistance insulation.

*What to look for*

- adequate insulation against heating film and in ceilings, walls and timber floors
- individual thermostat control for each room
- programmable timers

## Central Heating Systems

### **3.7 Hydronic heating.**

Water is heated in a boiler and then circulated around the home to radiator panels, skirting

board convectors or fan coil convectors that heat the room by convection and radiation. Natural gas, LPG or wood typically fuels hydronic heating, but it is also possible to use off-peak electricity, solar energy and air or ground sourced heat pumps. Each panel usually has its own control valve or thermostat to give individual room control.

*Pros:* Efficient; excellent zoning capability; silent; non-allergenic; high radiant heat component.

*Cons:* High initial cost

*What to look for*

- high star rating
- thermostat with programmable control

### 3.8 Ducted central heating

**a) Gas:** A gas furnace, usually located under the house or in the roof, heats air that is then circulated using a large fan and network of ducts. Zoning is possible but needs to be specified at the time of purchase.

*Pros:* Efficient; low initial cost compared to other central heating systems.

*Cons:* Large air movement; temperature fluctuations limited zoning potential; warmest air is near the ceiling; duct losses.

- What to look for**
- high star rating
  - well insulated
  - zoning option
  - 'positive close-off' floor registers
  - electronic ignition
  - thermostat with programmable timer

### b) Electric reverse cycle (heat pump)

A heat pump extracts heat from the outside air and delivers it into the home using a fan. It can be installed not only as

central ducting, but also in a wall or window, or as a split system with the compressor outside and the console unit mounted internally. Heat output of all units declines when outside temperatures drop – especially below 5 degrees Celcius where ice will start to form on the heat extraction coils. This should be considered when sizing units for Canberra.

*Pros:* Very high efficiency possible but decreases as temperature drops; low running costs; can use for cooling in summer.

*Cons:* High initial cost; higher CO<sub>2</sub> emissions than gas; generally noisier for you and your neighbours; some short blasts of cold air during the de-ice cycle; air movement; warmest air is near the ceiling;

- What to look for**
- high star rating (5 or 6 stars)
  - remote thermostat
  - adjustable directional louvres
  - programmable timer

### 3.9 In-slab heating

A concrete slab is heated by internal electric cables or hot water pipes. It is usually installed only in new homes or extensions before the concrete is poured. Typically it is fuelled by off-peak electricity (for cables) or

natural gas (for hot water pipes). Slow response time (6-8 hours) to changes in thermostat settings means systems should be set and left on for 24 hour heating.

*Pros:* High radiant heat component; warm feet; non-allergenic; silent.

*Cons:* Expensive to run; very high greenhouse gas emissions when using electricity; slow response time;

- What to look for**
- zoning for each bedroom
  - with thermostatic control
  - in each zone
  - slab insulation
  - hard floor coverings, e.g. tiles

requires large amounts of additional under-slab insulation.

### Wood fired heaters

Can be used for both central and space heating. Open fireplaces are no longer allowed to be installed. Only sealed, high efficiency wood heaters that meet Australian Standard 4013 can be installed in houses. In urban areas, particulate emissions arising from wood fires are a serious concern and the ACT Government encourages householders to switch to other forms of heating.

*Pros:* Can be very cheap to run; when used well can be efficient and low greenhouse gas emissions.

*Cons:* Some particulate emissions unavoidable; concerns about availability of sustainable firewood (e.g. plantation); very high greenhouse emissions and particulate emissions if burned poorly.

If you do have a wood heater, there are ways to reduce the smoke and pollutants.

For more information on how to burn fuel correctly and where to buy suitable firewood, go to: [http://www.environment.act.gov.au/\\_\\_data/assets/pdf\\_file/13616/woodpurchase.pdf](http://www.environment.act.gov.au/__data/assets/pdf_file/13616/woodpurchase.pdf)

### More information

This fact sheet is produced by the Home Energy Advice Team (HEAT) to provide you with basic information about heating systems. If you would like more free information about this or any other topic to do with saving energy in your home, please contact us. Also refer to the Victorian Government Sustainable Energy Website:

[http://www.seav.sustainability.vic.gov.au/index\\_seav.asp](http://www.seav.sustainability.vic.gov.au/index_seav.asp)

**A range of other fact sheets on saving energy and money in your home are available from HEAT**



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