SMART LIVING

At Home

A guide to sustainable building and renovating.

bright FUTURES

EAST GIPPSLAND SHIRE COUNCIL

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Foreword

Creating a Bright Future

This booklet results from major energy efficiency upgrades being undertaken by East Gippsland Shire Council. East Gippsland Shire is leading by example to reduce emissions and create a bright future for its residents and visitors.

East Gippsland Shire Council will save $500,000 and reduce emissions by over 1,500 tonnes every year, by undertaking the following energy efficiency projects:

- replacing old 80 watt mercury vapour residential street lights (close to 3,000) with new 18 watt LED fittings – to use a quarter of the energy for the same amount of light
- at the Bairnsdale Aquatic and Recreation Centre, cogeneration will create electricity from natural gas and will use leftover heat to warm the centre, and pool blankets and LED lighting will generate big savings also
- new air conditioning at the Corporate Centre (with an economy cycle and fresh-air intake) combined with LED office lighting
- installing air sourced heat pumps, pool blankets and LED lighting at the Lakes Entrance Aquadome

East Gippsland Shire Council has contributed $1.3 million towards this project and acknowledges the contribution of $1.8 million from the Australian Government.

As we continue to improve where we live, we encourage you to look for more ways to create energy efficient practices in your own home. Together we can create a bright future for East Gippsland.

Australian Government
Department of Industry and Science

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Introduction

Why build a sustainable home?

Your home and the way you live are two of the main ways in which you can influence your impact on the planet. This guide for residents has been designed as a resource to help you create an environmentally sustainable home and lifestyle.

Some of the benefits of making your house more sustainable are:

- a more comfortable environment to live in
- cheaper heating and cooling
- reduced exposure to harmful chemicals
- better connections to the external environment
- reduced reliance on mains water
- fewer new and non-renewable resources used in building and maintaining your home
- attraction of native birds and other wildlife
- improved biodiversity.

The main objective of building sustainably is to reduce the pressure of your home on natural resources and the surrounding environment, both during the building or renovation phase, and throughout its life. Household energy use accounts for about 26 per cent of Australia's total energy use, with the main sources being petrol, electricity and natural gas. If you think that your efforts alone don't matter, consider what the impact on our health and the environment would be if everyone across the Shire or even Victoria decided to make their homes more sustainable.

About This Guide

This guide aims to provide information on more sustainable choices for residents building new homes or renovating existing homes.

Climate change is bringing about new climatic challenges with an increase in the intensity and duration of summer heatwaves, milder winters, lower rainfall and more intense storm events. Heatwaves typically result in everyone trying to cool their homes at the same time by switching on mechanical cooling systems. This causes electricity demand to peak, requiring an expensive gold plated grid to be able to meet high demand periods.

Housing design is rapidly evolving to meet the challenge of climate change, and new products are being developed to enable greater energy efficiency in the home. If you are building or renovating it is important to do your research and to keep as up-to-date as possible on the latest developments, or to engage a designer or builder who meets your needs.

A hands-on management approach of actively opening or closing windows, blinds or doors will also greatly improve the movement of heat energy into and out of your home.

Rising energy costs have impacted on all households recently. It makes a lot of sense to have a home that doesn't require large amounts of energy to heat, cool and light, yet remains comfortable and pleasant to live in.

Re-using building and landscaping materials, minimising the use of harmful chemicals around the home and eating locally produced foods can all contribute to a healthy and satisfying life.

Household Energy Usage

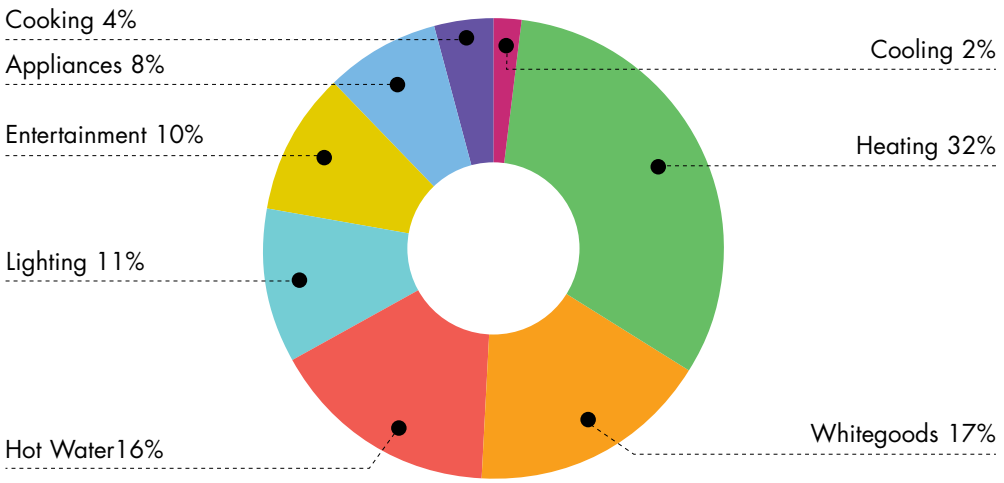
Every household situation is different. Factors that will contribute to your household energy usage include:

- the climate where you live
- the size and features of your home
- the energy standard of your heating, cooling, lighting and appliances
- the habits and lifestyle of people in your home
- the number of people in your home
- how much time you spend at home
- your choice of energy retailer

An important first step is to identify the big energy eaters in your home and consider what you can do to reduce usage.

Our greatest challenge in creating a comfortable home is to design and renovate to cope with heatwaves of increasing frequency, intensity and duration.

The following provides a general breakdown of Victorian household energy expenditure.



Source: Sustainability Victoria 2013

On the basis of the above, most households would benefit from especially targeting reducing energy usage for the big energy users such as heating and hot water, however, any reduction of usage in any area of the home will contribute to a lower energy bill.

Many energy retailers are now providing free online energy usage services for customers with smart meters. You simply log in to your own personal web portal to see graphs and statistics of your energy use over time. Contact your energy company for details.

If you have a smart meter you can also contact your retailer and request an interval report for several months energy use. This report will often be sent as an excel file, showing energy use in half hour intervals.

East Gippsland Shire Council libraries have Powermate energy meters to borrow free of charge. It is an energy meter that shows how much energy your household appliances use and cost.

Our Climate East Gippsland Climatic Zones

Main characteristics of Zones

Characteristic	Zone 6 Mild temperate	Zone 7 Cool temperate	Zone 8 Alpine
Day/night temperature range	Low near coast. High inland.	High	High
Winters	Mild to cool. Low humidity. Can exceed human comfort zone.	Cold to very cold. Low humidity. Majority rainfall. Exceed human comfort zone.	Cold to very cold. Low humidity. Majority rainfall. Some snowfall. Exceed human comfort zone.
Summers	Hot to very hot. Moderate humidity. Can exceed human comfort zone.	Hot. Low humidity. Exceed human comfort zone.	Warm to hot. Low humidity.
Autumn/ Spring	Ideal for human comfort.	Variable conditions.	Variable conditions.

For details on the recommended design response for your climate zone visit: www.yourhome.gov.au/passive-design/design-climate

Planning

- Check Council's planning controls. Each property sits within a planning zone, and each zone has specific requirements for building and earth works. The planning scheme can be accessed online at www.eastgippsland.vic.gov.au
- Planning scheme overlays cover many properties i.e., heritage, design & development and environmental overlays which may influence building material, design choices, location of building sites and vegetation removal/ retention.
- A Pre-application Meeting with a Planning Officer is a valuable way to determine the type of planning controls affecting your site.
- Consider the desired outcome of your new home or renovation. What would you like to achieve in terms of the aesthetics and functionality from your project?
- Consider the site orientation and access, views and how you can utilise building design to gain your ideal living arrangements.
- Consider which building materials would be most appropriate to deliver a completed home that meets your objectives.

Top 5 Renovation Regrets

- Inadequate insulation
- Air leakage
- Poor lighting
- No double glazed windows
- Poor design

Source: Sustainability Victoria 2014

This booklet addresses each of these issues, plus more.

NATIONWIDE HOUSE ENERGY RATING SCHEME ®

Resources

www.yourhome.gov.au/passive-design/design-climate

www.sanctuarymagazine.org.au

www.ata.org.au

Energy Ratings Explained

The energy rating is a calculation of how much energy would be required to heat and cool the house for a year given local climatic conditions and the construction of the house.

A one star house would require very large amounts of heating and cooling, whilst a ten star house at the other end of the scale, would require little or no mechanical heating or cooling. A six star rating is somewhere in the middle. Six stars are the minimum legal requirement, but there are many opportunities to achieve a better rating for little or no additional cost.

Some of the factors considered in an energy rating are:

- type of floor and floor coverings
- type of walls and roofing material
- colour of walls and roof
- type and R-value of insulation to roof, ceiling, walls and floor
- types of window glass and frames and the direction they face
- any permanent shading structures
- sealing of openings such as exhaust fans, down lights, doors and windows.

Some of the factors **not** considered in an energy rating are:

- the embodied energy of building materials
- type and efficiency of heating and cooling
- number and efficiency of household appliances
- water efficiency of tapware and appliances
- stormwater management
- type, quality and chemical composition of cabinetry, furnishings and paint
- any renewable energy system installed.

The tips included in this guide will help to achieve better energy ratings as well as addressing many other sustainability issues.

Energy ratings must be performed by an accredited Thermal Performance Assessor using approved software. You may engage your own assessor or ask your designer or draughtsperson to organise the report. You may also request that the assessor make recommendations to improve the energy rating.

Accredited Thermal Performance Assessors can be found at:

- Building Designers' Association of Victoria www.bdav.org.au
- Association of Building Sustainability Assessors www.absa.net.au

Further information about energy ratings can be found at www.nathers.gov.au.

Passive Building Design

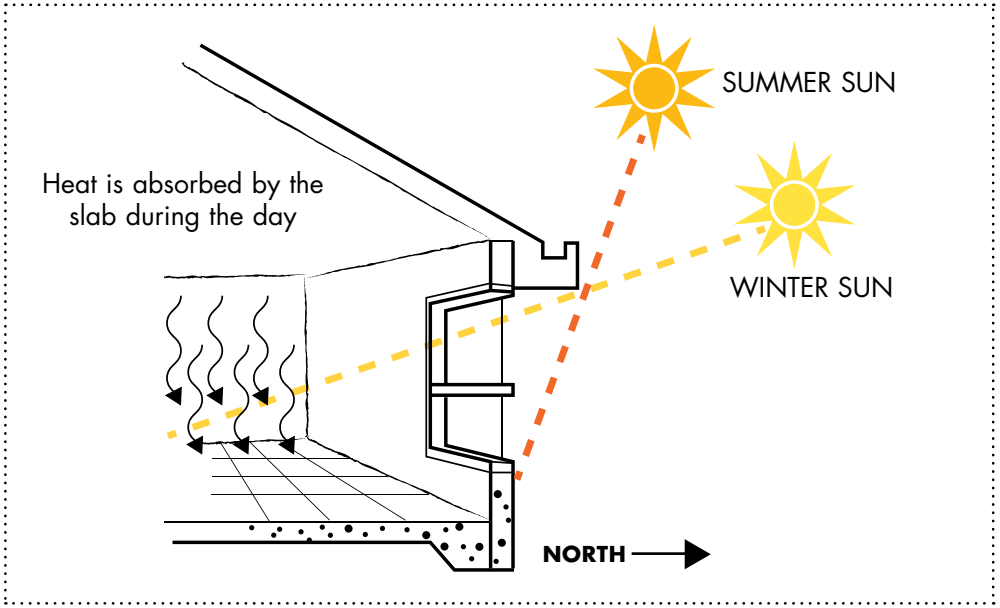
An energy efficient house is designed to work with your local climate to create a comfortable living space throughout the year.

Passive design refers to a number of elements of a home that are designed to take advantage of the path of the sun and prevailing winds throughout the year. Passive solar heating keeps out the summer heat and lets in the winter sun. Passive cooling shades your house in summer and accesses cooling breezes. Good passive design can result in a significant improvement to the energy rating of a house, as well as lower your running costs by reducing the need for mechanical heating and cooling. Passive design includes a combination of elements such as building orientation, shading, sealing, insulation, thermal mass, glazing and skylights.

Orientation

The path of the sun varies seasonally. The position of your house on its site should be designed to take advantage of the sun and prevailing winds. A well-orientated house is usually north-facing with minimum east and west-facing walls and windows. In East Gippsland this means maximising north-facing external walls and minimising east and west-facing walls. This will allow access to the low winter sun and reduce exposure to the hot summer sun. By shading the northern walls and windows in summer with eaves, adjustable shutters or deciduous trees you can restrict the amount of solar heat entering from the north. In winter the lower position of the sun will enable solar heat to enter and warm your home.

West-facing walls receive the strongest sun at the hottest part of the day in summer. Keeping west and east-facing walls and windows to a minimum will reduce the amount of solar heat entering your house. Small, well-shaded windows that open will increase east-west cross-ventilation through your house. Consider the type and position of windows and doors to maximize opening up your house to cool evening breezes in summer.



Consider the type and position of windows and doors to maximize opening up your house to cool evening breezes in summer.

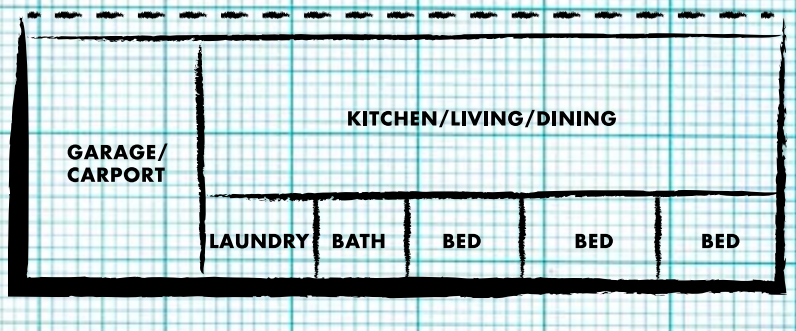
Windows should be predominantly north-facing and sized at a minimum of 12-15% of the floor area of the room (Zone 6), 15-20% (Zone 7) and 20-25% (Zone 8).

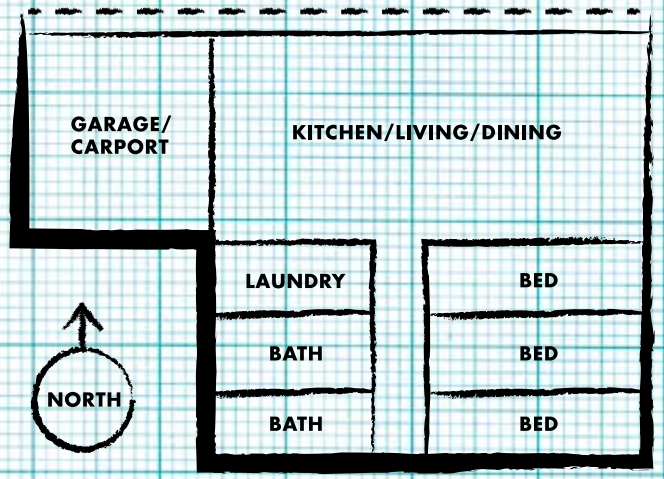
The floor plan of your home should also factor in the path of the sun and prevailing winds. In general, living areas should be located to the north, with utility areas (bathroom and laundry) on the west or south side. For a comfortable night's sleep avoid locating bedrooms on the west side of the house, the south side is much better. A garage or carport on the west side of the house helps to exclude the hottest summer sun from the house.

Avoid being overshadowed by trees or neighbouring buildings, especially on the north side. Solar access for solar electricity, solar hot water and clothes drying should be factored into siting your home on your property.

If you are building a two-storey house ensure your design is focused on the fact that hot air rises and cool air descends. Open stairwells and balconies should be avoided and ensure the upper levels can be closed off to control heat flow within your house.

Some suggested floor plans:





Consider also creating a space specifically for heatwave respite. A highly insulated, well-shaded cool room with small or no window area is highly effective. Heavy drapes (if you have windows), closeable doors and a small, energy-efficient mechanical cooling system can create a sanctuary in the worst of the heat.

RENO TIPS

1. Can you change how you use rooms in your home? If you have north-facing bedrooms, could you change them into living areas and move your bedrooms to the south side of the house?
2. Make your home flexible so that you can separate rooms that need to be heated or cooled. Consider where you could place a wall or door so that you don't need to heat or cool the whole house if you are only using part of it.

Shading

Eaves, adjustable shutters, window awnings, louvers, pergolas, shade cloth and deciduous trees or vines can block up to 90% of direct solar heat. Shading glass windows and doors is the most effective way of keeping heat energy out of your house. Shading your roof area through landscaping also helps.

Shading materials should be light coloured to reflect solar heat. This also includes roof materials.

When considering shading we are usually focused on reducing summer heat. We need to ensure that our shading does not block out the winter sun. Adjustable shading allows for seasonal variation.


Decidous vine in winter


Decidous vine in summer

Orientation	Shading
North	Horizontal adjustable or fixed shading e.g eaves, pergolas with louvers. Deciduous trees.
East & West	Vertical adjustable or fixed shading e.g. awnings. Deep veranda. Pergola with deciduous vine.
South	Deciduous trees.

Windows and glazing

Windows are windows, right? Not these days! There are two important aspects to your windows.

Windows let in light and cool air. They provide views to the outside world. They can also be responsible for the loss of up to 40% of home heating energy and 87% of heat gain in summer. The position of windows and the types of windows and their frames are an essential consideration for an energy efficient home.

Position

Larger windows traditionally have been located on the north side of the house with a fixed or adjustable shade. However, in an extended heatwave, even well-shaded windows will gain significant radiant heat from the surrounding air. An option is to limit the size of all windows including north-facing windows, or to cover them with insulating shutters.

East and west-facing windows should be small and placed to allow only winter sun access and provided with vertical adjustable shading to exclude the summer sun. South-facing windows should be small. All windows should be openable and positioned to allow for cross-ventilation, particularly summer evening breezes to help cool your house.

Double glazed window

Type

The types of windows and their frames should be considered. Windows are usually the weak link in the construction of a thermally efficient building. Standard single glazing offers little resistance to heat flow, so the windows in most homes are a windscreen at best. Double glazing, secondary glazing, coatings and some window films are effective at reducing the amount of heat lost or gained through windows.

There are two factors used to work out how well a particular product will work in different circumstances:

- U-value. This figure relates to the rate at which heat will travel through the window. Generally, the lower the U-value the better the resistance to heat flow.

- Solar Heat Gain Coefficient (SHGC). This figure relates to the amount of heat that will travel through the window. Generally windows on the south, east and west aspects of a house benefit from a window that has a low SHGC so that the heat entering from the summer sun is reduced. North-facing windows that receive good winter sun should have a higher SHGC to allow the heat into the house. External shading on these windows prevents the summer sun from entering the house. Low-e coating is a product applied during the manufacturing process that reduces the SHGC and also prevents heat loss during winter.

Frames

Simple aluminium frames should be avoided as they conduct large amounts of heat. Timber, u-PVC, thermally broken aluminium and composite frames work best because they don't conduct heat well. "Thermally broken" aluminium frames provide a gap filled with a non-conductive material between the interior and exterior layers of the frame to prevent heat being conducted. Timber generally has the lowest environmental impact of all framing materials. u-PVC frames are a petroleum product, and aluminium requires a very large amount of energy in the manufacturing process. These considerations also need to be balanced against any bushfire risk and cost.

RENO TIPS

1. Do you have north-facing windows? Moving windows is usually not as difficult as it seems. Consider whether you could add a north-facing window to your living area and reduce or remove east or west-facing windows.
2. Retrofit your timber window frames with new double glazed units. You can do this yourself or hire an expert. This is a much cheaper option than replacing the entire window.
3. Secondary glazing can be applied to some windows. Typically this consists of a sheet of clear acrylic placed inside the existing pane of glass, using a spacer to create an air gap and it is held in place by strip magnets.
4. Window films can be applied to existing glazing. These products are useful where access, height or heritage issues do not allow for double glazing or external shade devices. Ensure the film will perform correctly by checking the WERS website.

The position of windows and the types of windows and their frames are an essential consideration for an energy efficient home.

Skylights

Skylights, roof windows or tubes and shafts are all very effective ways of increasing the amount of light entering a home and reducing our need to switch on a light. It is estimated that a skylight can emit more than three times as much light as a vertical window. Solar heat gain can be greatly reduced through double glazing and insulated tubes and external shades. The Window Energy Rating Scheme (WERS) maintains a comprehensive, independent database of energy-rated skylight products called WERS for Skylights (WERSfs). For further information visit: www.wers.net/werscontent/skylight-products.

Sealing

Heat loss through air leakage can account for 15-25% of winter heat loss. Use weather sealing and caulking to seal cracks and gaps between the wall, floor and ceiling, around doors, windows, skirting boards, exhaust fans, fireplace, heating ducts and plumbing outlets. There are different sealing products available for different situations, so consult your retailer. Seal off door draughts with door 'sausages' or commercial door seals.

Make a Door Sausage

Cut a rectangular piece of fabric about 40cm wide and at least 4cm longer than the width of your door.

Fold in half and sew lengthways. Sew one end closed. Make sure the stitching is tight so your fill cannot leak through.

Turn inside out, so the raw edges are on the inside. Fill with kitty litter or sand.

Sew the open end shut and decorate.

Thermal Mass

Thermal mass is the term used to describe the capacity of building materials to absorb and store heat.

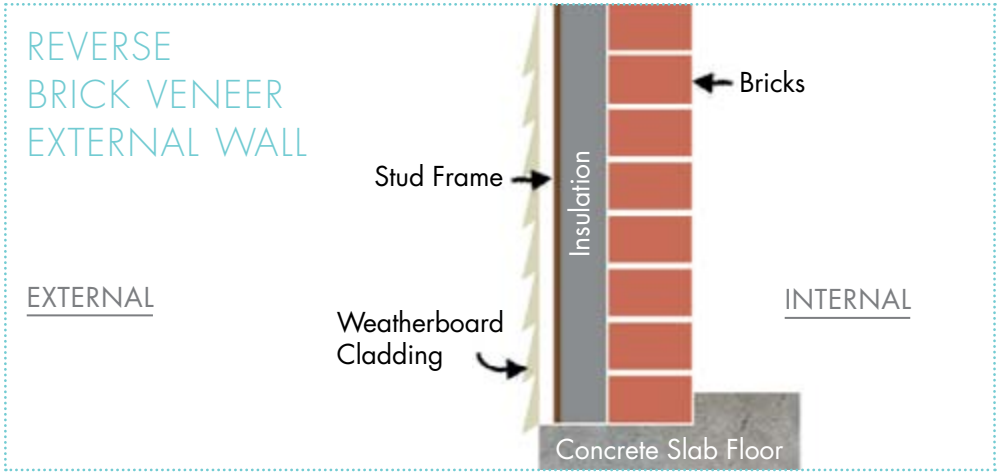
Typically brick, strawbale or concrete have a high thermal mass, while corrugated iron or weatherboards have a low thermal mass. Thermal mass works by absorbing heat during the day, storing it and releasing it at a later time, usually over 6 to 10 hours. The process helps to stabilise the internal temperature of a house and is usually incorporated into the floors and walls.

During winter, this process helps to reduce heating costs by absorbing direct sunlight during the day and releasing the heat into the house overnight. Insulation is obviously important, including under the concrete slab to prevent heat loss to the ground. In summer, thermal mass absorbs heat during the hottest parts of the day, drawing heat out of the surrounding air. The heat is then released overnight as outside temperatures drop.

However, as our climate is changing to prolonged heatwaves, we need to carefully consider how best to use thermal mass in a house, if it all.

In fact it is now suggested that we got the classic brick veneer house wrong! The bricks should be on the inside as they are more effective at regulating internal temperature, while the outside cladding (e.g. corrugated iron) is more responsive to temperature change, resulting in a cooler house in summer provided good insulation is used between the internal and external layers.

It would seem our focus needs to be more on careful design to keep the summer sun screened out through glazing treatments and adjustable shading than thermal mass.



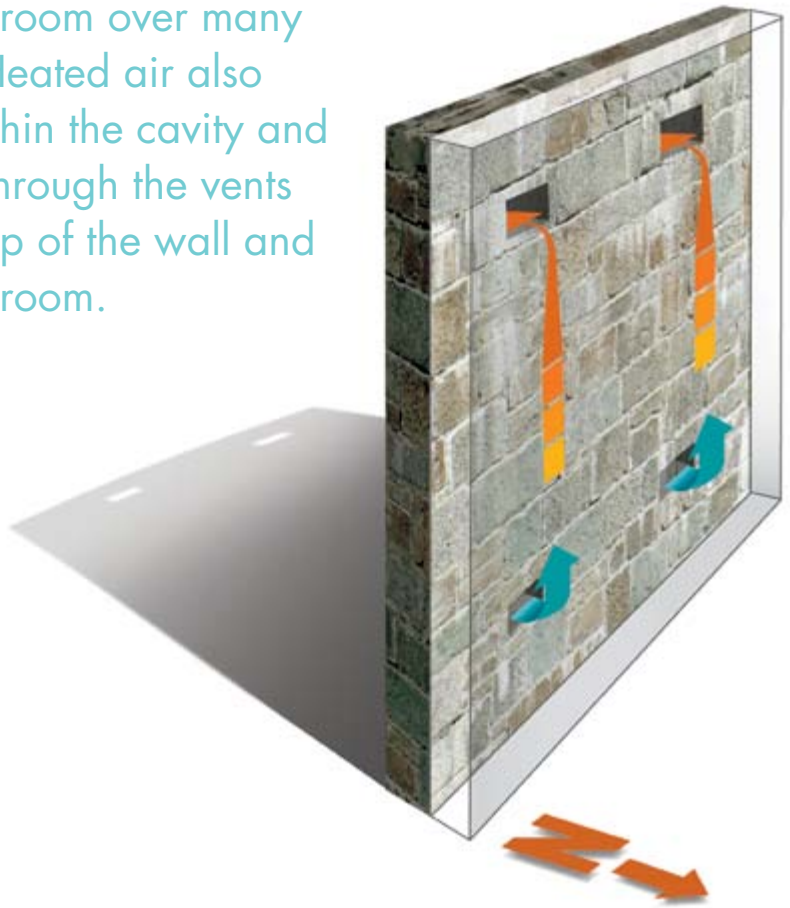
Trombe Walls

A Trombe wall is a thick masonry wall that sits inside a sealed north-facing pane of glass. There are vents located in the top and bottom of the wall.

The sun warms the wall through the glass during the day. Some of the heat then moves through the wall and is released into the room over many hours. Heated air also rises within the cavity and moves through the vents in the top of the wall and into the room.

Cooler air from inside is drawn through the vents at the bottom of the wall to be heated. One-way flaps installed over the vents prevent heat moving in the opposite direction at night.

A suitably sized eave should be designed to stop summer sun hitting the glass and allowing unwanted heat into the house.



Phase Change Materials

Phase change materials are substances that melt and solidify at certain temperatures. These substances store heat and release it at desired times to stabilise the internal temperature of a home. They work in a similar way to thermal mass but are generally much lighter weight products.

Insulation

Insulation comes in many different forms, but its primary purpose is to keep the heat in during winter and keep the heat out during summer. Insulation works best in conjunction with passive design. For example if a house is not adequately shaded in summer, built-up heat can be kept in by insulation to produce an 'oven' effect. Insulation is most economically installed during construction, but it can be added during renovation. Some construction materials such as strawbales and aerated concrete blocks, have good natural insulating properties, while others such as timber and iron are ineffective at restricting heat flow.

Insulation should be incorporated into the roof, ceiling, walls, floor and, in the case of Zone 7 & 8, underneath and around the vertical edge.

Avoid downlights and recessed lights in the ceiling as safety requirements stipulate that insulation must be removed from around the lights and transformers to prevent fires. This creates a Swiss cheese effect in your insulation reducing its effectiveness.

R-value

The resistance to heat flow is labelled as the R-value. East Gippsland has large temperature fluctuations, requiring a higher R-value than somehwhere with a lower temperature range, such as Brisbane. There are optimal levels of insulation, so avoid over-installing for only minor performance improvements at extra cost.

Location	**Minimum required** (with a light coloured roof)[1]
Ceiling	R4.1
Walls	R2.4
Under Floor	R2.25

Note these R values include building materials used in the construction of the roof, ceiling, walls and floor to give a total R value.

[1] National Construction Code 2013, Australian Building Codes Board.

Insulation

Bulk insulation. As the name suggests this type of insulation is bulky and can be used in ceilings, walls and under floors. Generally, the thicker the product the better it performs, but some materials perform better than others. All bulk insulation products should be treated with fire - resistant chemicals and tested to Australian Standards. Bulk insulation comes in various forms:

a. **Glasswool,** made from spun glass or silica. This type of material should not be used without eye, skin and respiratory protection as it contains small glass particles that can cause itching, as well as eye and lung damage. Some products contain some recycled material.

b. **Rockwool,** made from spun volcanic rock. Good for sound insulation. This type of material should not be used without eye, skin and respiratory protection as it contains small glass particles that can cause itching, as well as eye and lung damage.

c. **Earthwool,** is a mineral wool made from recycled products and renewable organic materials. It contains a proprietary binder to reduce health issues associated with glass fibres. Earthwool is non-combustible and reduces sound.

d. **Polyester,** a petroleum-based product. No known health issues. Some products contain some recycled material.

e. **Wool,** straight off the sheep's back and treated with anti-vermin and fire-retardant products. A renewable resource.

f. **Expanded polystyrene board,** a petroleum-based product. Rigid board, resistant to moisture. Can be used in small ceiling cavities, on external walls which can then be rendered, or on internal walls attached to plasterboard. These boards can also come with foil attached for use in the ceiling.

g. **Extruded polystyrene board,** a petroleum-based product. Semi-rigid board. Can be used in small ceiling cavities and on external walls which can then be rendered.

Bulk insulation works by trapping heat in the small air pockets throughout the product. If bulk insulation is compressed it will not work effectively, so a batt should fit snugly into the allocated space, but not be squashed in.

Reflective insulation. This type of insulation helps to reflect heat. In East Gippsland we use most of our energy for heating, so it is installed with the shiny side facing into the house to reflect heat back inside. However, this type of product installed in the roof cavity also helps to reflect heat away from the roof in summer. Reflective foil insulation comes in various forms:

a. **Foil Laminate,** using glasswool reinforcement on one side. This is a thin layer, usually with only one shiny side (known as anti-glare foil).

b. **Multi-cell Foil Batts,** two or three layers of foil with layers of plastic containing air bubbles in between them. Slightly more effective than foil laminate.

Combination insulation. This is also known as builder's blanket or anti-con (anti-condensation) blanket. It is generally used under a tin roof to prevent the formation of condensation on the underside of the tin. Without the blanket, condensation can drip on roof timbers and ceiling insulation causing long term structural problems. It can also be used to line tiled roofs which can reduce the amount of breeze that travels through the roof cavity.

RENO TIPS

Renovations often involve removing internal plasterboard and ripping up flooring. This is an ideal time to add insulation to your walls and floor.

Rigid board insulation suitable for use in tight spaces

INSULATION PRODUCT GUIDE

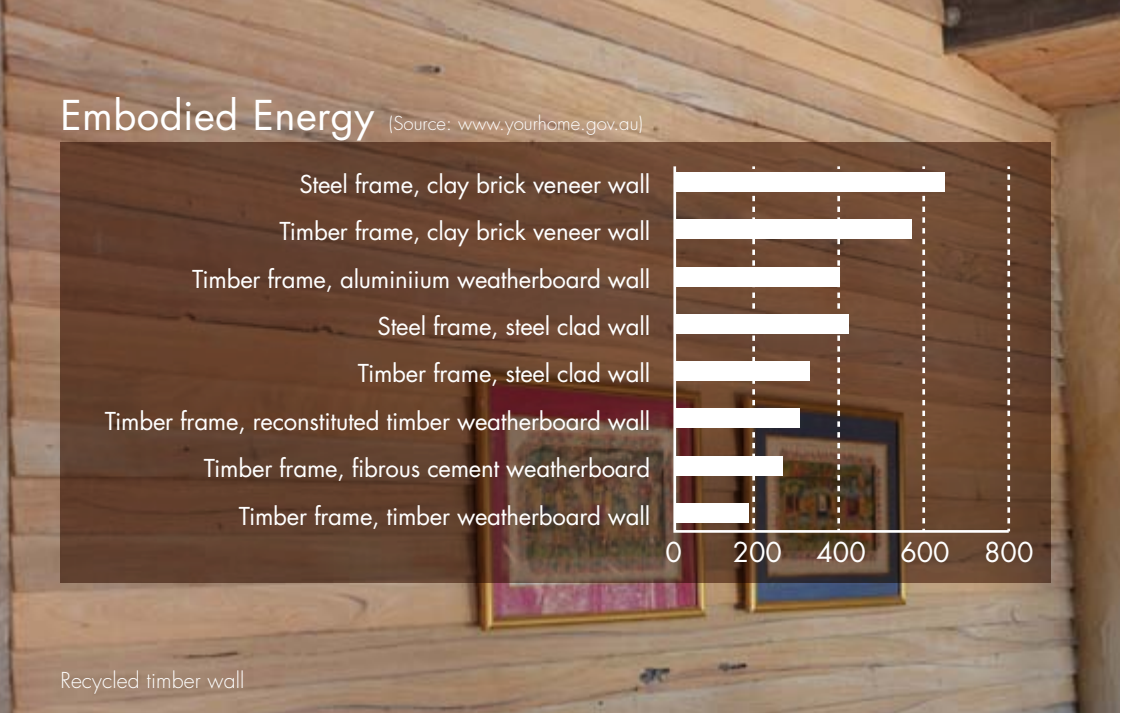
APPLICATION	PRODUCT	SUSTAINABLE FEATURES
INSULATION – REFLECTIVE	Air Cell	A range of products for different applications and ideal for limited spaces. Suitable for roofs, walls and under floors. Manufactured without toxic adhesives. Durable.
INSULATION – BULK	Wool and wool blend batts	Natural renewable fibre, treated with fire retardant.
	Polyester batts	Made from 80% recycled PET bottles, non-toxic and 100% recyclable.
	Kooltherm K8 Boards	Suitable for flat or raked ceilings and walls.
INSULATION – RETROFITTING WALLS	Rockwool	Molten rock can be blown in from inside through holes in plasterboard or from outside by removing weatherboards. Can be blown down into brick cavity walls by removing roof tiles.

RENO TIPS

1. New types of insulation in rigid board form can have a higher R-value for the depth than traditional batts. As boards range in depth from 10mm upwards, there are boards available that will fit into flat or raked rooflines.
2. Insulation can be blown into the wall cavities of some existing homes. Wool or recycled polystyrene materials are usually used for retrofitting, although batts can also be used if weatherboards or plaster are able to be removed.
3. Elevated houses with timber floors achieve significant gains in comfort levels by insulating under floor areas. Installation can be done in sections to reduce the cost burden.

Construction Materials

Most people build a house from all new materials, so it is not surprising that the construction industry accounts for around 40 per cent of raw materials used worldwide. A large number of these materials are either not sustainably produced or are a finite resource. In addition, many new building materials incorporate harmful chemicals that can impact human health and/or air quality.



Recycled timber wall

There are a number of ways you can reduce the impact of your new house or renovation:

- use fully recycled materials, such as used timber, bricks, windows and decorative items, especially if you are demolishing an existing house
- use materials that have a long lifespan so they won't need to be replaced frequently
- choose a style that is classic so it won't need updating when the fashion changes
- use sustainably produced materials, such as FSC-certified plantation timber frames or insulation made from wool
- use materials that are locally produced to reduce transport emissions
- use materials containing some recycled content, such as insulation batts made from old PET or glass bottles, a concrete slab with fly ash, slag or silica fume and recycled aggregate
- consider the environmental and social impacts of the manufacturing process of any materials you choose
- consider whether your new house or parts of it can be pre-fabricated off-site to reduce waste and travel miles
- consider a building technique that uses natural, local, renewable and/or re-used materials, such as mudbrick, rammed earth, straw bale, or timber.

Mudbrick

Mudbricks are made by mixing earth with water, placing the mixture into moulds and drying the bricks in the air.

Straw or other fibres that are strong in tension are often added to the bricks to help add strength and improve the thermal performance.

Mudbricks have a high thermal mass, so they are a good way to stabilise the internal temperature of a home.

Mudbrick houses provide:

- very low environmental impact construction materials
- non-toxic materials
- good fire resistance
- high thermal mass
- long lifespan.

Earth Brick

Earth bricks are manufactured by compressing a mixture of water, earth and fine aggregate into a large block shape by machine. The blocks are uniform in size, shape and thermal properties. If local materials are used, the bricks are very low in embodied energy. Earth bricks are joined with a mud mortar, are quick to manufacture and erect and can be used in a large variety of applications. Earth bricks can be rendered or left in their natural state.

Earth brick houses provide:

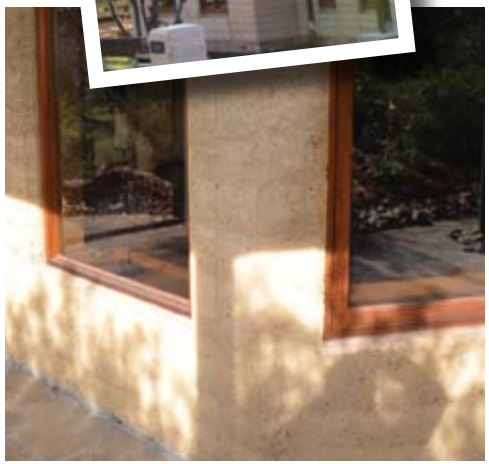
- low environmental impact construction materials
- non-toxic materials
- good fire resistance
- high thermal mass
- long lifespan.

Rammed Earth

Rammed earth walls are made by mixing a combination of clay, sand, aggregate and water and compressing the material into formwork on site. In Australia, a small amount of cement is often added to the mix as a stabiliser then coated with a permeable sealer, ensuring the walls are protected from the weather. Formwork can be re-used many times, although it is sometimes cut to the individual specifications of the building.

Rammed earth houses provide:

- low environmental impact construction materials if un-stabilised
- non-toxic materials
- good fire resistance
- high thermal mass
- long lifespan.



Straw Bale

Straw has been used as a building material for centuries. Straw is derived from the stalk of grasses like wheat and rice, which are high in tensile strength and have the grain head removed. Straw bales are a renewable building material with low toxicity.

Straw bales themselves have very low thermal mass, however, the walls are usually built on a concrete slab floor and with the use of earthen renders, a thick render skin of up to 75mm can be achieved, providing significant thermal mass.

A main feature of straw bales is their excellent insulation – both thermal and sound, which is the most cost-effective available.

Straw bale houses provide:

- renewable resource
- high thermal and sound insulation
- vermin resistance
- non-toxic materials
- a relatively easy medium to work with.

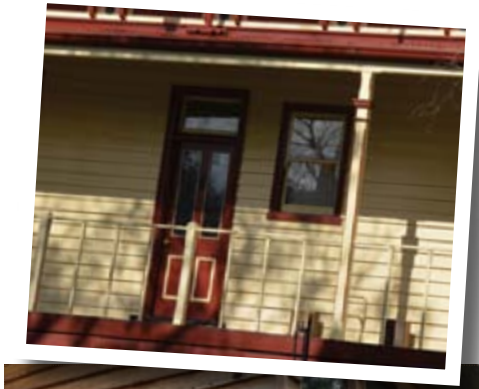
Weatherboard

The timber should be sourced from a FSC-certified plantation.

Weatherboard houses should contain large amounts of insulation to roof, walls and ceilings and contain some internal thermal mass to improve the thermal properties of the building.

Weatherboard houses provide:

- a medium level of embodied energy
- relatively low environmental impact as they use a renewable resource
- non-toxic materials
- low thermal mass.



Autoclaved Aerated Concrete (AAC)

AAC is a lightweight concrete product that provides an innovative alternative to concrete blocks and clay bricks. AAC is produced by adding a foaming agent to concrete in a mould before cutting it into blocks or panels and then autoclaving.

AAC has moderate embodied energy content and contains good thermal and sound insulation properties, due to the number of air pockets within the blocks. AAC also has moderate thermal mass properties.

AAC blocks have a long life and do not produce VOCs after installation. AAC has a high fire-resistance rating as it does not burn.

AAC houses provide:

- good thermal and sound insulation
- good fire resistance
- vermin resistance
- a relatively easy and fast medium to work with.

Corrugated Steel

Sheets of high-tensile steel are passed through rolling presses to create corrugated steel. Recycled content varies from 20-40%. Although the embodied energy of the product is high, corrugated steel is 100% recyclable and the product has a long life.

Corrugated steel has a low thermal mass making it responsive to temperature changes. Light colours can be selected and cladding can contain a solar reflective property. It can be an effective external wall cladding when used in combination with passive design and good insulation.

Corrugated steel is lightweight, making it more efficient and cost effective to transport. It has a high strength-to-weight ratio meaning you can have long, column-free spans and lighter structures that use minimal framing material. Less material is required to construct the building, minimizing waste and resource use.

Corrugated houses provide:

- low thermal mass
- good fire resistance
- low maintenance
- termite resistant
- easy and fast to work with.

Concrete

Concrete slabs or walls provide great thermal mass. However, the manufacturing process uses large quantities of energy and raw materials. To reduce the environmental impact of concrete substances known as supplementary cementitious materials and recycled aggregate can be added to the mix.

Concrete products can be factory made and delivered (precast) or poured on site (tilt-up). Choice is determined by site access, availability of local precasting facilities, the standard of finishes and design requirements relocated or recycled after use.

Concrete slabs or walls provide:

- high thermal mass
- can be insulated
- fire resistant
- termite proof.

CONSTRUCTION MATERIAL PRODUCT GUIDE

APPLICATION	PRODUCT	SUSTAINABLE FEATURES
Concrete slab, footings and drive-way – blended cement	Blended cement Ecoblend (GECA) Envirocrete E-crete	Supplementary cementitious materials are waste products from other manufacturing processes added to cement to reduce the use of new resources and embodied energy. They can also improve the strength and durability of the concrete. Most sites also use recycled water for washdowns.
Aggregate – recycled crushed con-crete	Ecobase Recycled common aggregates	Reduces raw material use by recycling old concrete. Comes in various sizes. This product can have varying strength.
Reinforcement – recycled mesh and bar	Reinforcing bar and mesh	Australian product with 90% recycled content.
	Ecoreo	Australian product with 66-89% recycled content.
	Mesh and bar	New Zealand product with 100% recycled content.
Formwork	Formply	Lower impact on biodiversity by using local plantation timbers.
Concrete slab – insulated slab system	Waffle Pod	Air pockets created by polystyrene blocks create an insulating layer between the concrete and the ground to reduce heat loss. Less concrete required for slab pour. Recycling of waste material from building sites.
	Unipod	
	Cupolex	Air pockets created by recyclable polypropylene structure create an insulating layer between the concrete and the ground to reduce heat loss. Less concrete required for slab pour.
Stumps	Concrete and steel	Concrete or steel stumps are lighter and stronger than timber and are resistant to termites. Fully recyclable.

CONSTRUCTION MATERIAL PRODUCT GUIDE

APPLICATION	PRODUCT	SUSTAINABLE FEATURES
Floor joists and bearers	Composite beam	I-shaped beam reduces resource use.
	Prefabricated beam	Plantation timber eliminates the use of old growth timber. Reduces waste.
	Flooring System	Lightweight steel joists and composite flooring system
	Recycled timber	Eliminates use of new resources.
Underfloor lining	EcoCore Multiply Plyfloor	Plantation timber, low VOC glue.
	R-flor	Laminated with foil on the underside of the board to improve the R-value of suspended timber floors. Made from plantation pine.
Steel frames	Zincalume	High embodied energy but durable and termite-resistant. Includes 20% recycled content and is 100% recyclable.
Thermal spacers for steel frames	Deckmate	Reduces the thermal conductivity of steel frames, but made from Styrofoam
	Polyair spacers	Polyethylene foam.
Timber frames	Studs, noggins, plates, LVL beams and roof trusses	Lower impact on biodiversity by using FSC-certified plantation timbers.
	Hybeam LVL beam	Reduced use of resources as this beam is I-shaped and engineered using recycled or reconstituted wood.
	Roof trusses	Recycled.
Bracing	Plywood	Uses FSC-certified plantation timber.

APPLICATION	PRODUCT	SUSTAINABLE FEATURES
Walls – brick or concrete block	AAC or Hebel	Autoclaved Aerated Concrete (AAC) contains lower embodied energy than bricks and concrete is lightweight and easy to use. It has relatively good thermal and acoustic insulation and is non-combustible.
Walls – concrete alternatives	Timbercrete	The main ingredient is recycled timber waste (cellulose), and it contains low embodied energy as it is air-dried. Timbercrete provides very good thermal insulation, is non-combustible and is very durable.
Walls – recycled brick	Blues and reds, creams, greys and bluestone	100% recycled.
Walls - weatherboard	Radially sawn timber	Efficient use of whole log.
Walls – weatherboard alternatives	Shadowclad ply cladding	Lower impact on biodiversity by using FSC-certified plantation timbers.
Walls – alternatives	Kooltherm K5 insulated board	Insulation attached with R-values up to 4.0. Requires rendering
	Mudbrick	A natural resource with very low embodied energy. Can be made on site.
	Compressed Earth Brick	A natural resource with low embodied energy. Can be made from on-site materials.
	Rammed Earth	A natural resource with low embodied energy. Can be made from on-site materials.
Internal walls	Durra Panel	Durra Panel has excellent acoustic and thermal insulating properties, proven durability, high impact and fire resistance. Made from wheat and/or rice straw fibres, contains no formaldehyde or additional chemical binders.
	LaFarge Plasterboard	The lining uses 100% post-consumer recycled paper and the production process has low water use. 100% recyclable. Low VOCs.
	Kooltherm K17 Plasterboard	The plasterboard is insulated to reduce heat movement through walls and ceilings. R-values range from 2.1 to 4.0.

CONSTRUCTION MATERIAL PRODUCT GUIDE

APPLICATION	PRODUCT	SUSTAINABLE FEATURES
Roofing	Recycled tiles	100% recycled product.
	Concrete tiles	Lower embodied energy than baked tiles, but can contain toxic sealants. Contains 80% slag.
	Steel	Lower embodied energy and fewer raw materials required than baked tile. Victorian manufactured, 20% recycled content, 100% recyclable.
Complete roofing systems	Ritek Custom and Ecotek Roof Panels	Combined Colorbond with polystyrene insulation layer up to R6.1. Reduced requirements for roof structure materials.
Roof ventilation	Draft Stoppa	Covers exhaust fan motors inside the ceiling to reduce hot air from flowing into the roof or outside.
	TopHat	Sealed exhaust fan unit to reduce hot air from flowing into the roof or outside.
Plumbing	Greenpipe -drainage & stormwater pipes	100% recycled HDPE from post-consumer waste.
	Roof garden drainage, pipes, natural textiles for weed and erosion control	Recycled HDPE, innovative garden ideas.
	Neta, Pope or Garden Mate drip hose	60% recycled rubber.
	Bio-hose	Recycled plant material content.
Termite protection	Termimesh	Mesh barrier that must be installed around a concrete slab and penetrations during construction. Chemical-free.
	Blockaid	Brush-on or gun-in physical termite barrier. It is made from rubber-modified bitumen and is water-based and non- toxic. Good for awkward joints, step downs, narrow cavities and retaining walls.
	Homeguard	Polymer material impregnated with a chemical that will repel and kill termites. Chemical will not leach from product.

Managing Construction Waste

As much as 40 per cent of Australia's landfill is generated from demolition and construction waste. By reducing landfill waste during your project you can reduce the cost of remediating landfill at the end of its life, protect the environment against contamination from waste products, reduce the need to use new resources and possibly make some money from selling unused or recovered items. Steel, aluminium, concrete, timber, glass, bricks, plasterboard, roof tiles and plastics can all be either recycled or reclaimed. At least 70 per cent of site waste should be able to be diverted from landfill.

Reclaimed bricks

If minimising waste is an important issue for you, let your designer and builder know as early as possible so they can be involved in helping to develop a waste plan and make decisions about re-using or recycling materials up front.

A contract clause incorporating minimum recycling levels can help. Other ways to make the process easier are:

- ensure space is available for placing skips to hold different materials for recycling
- ensure all contractors on site are aware of the waste management requirements
- ensure loose rubbish is picked up off the ground regularly so it is not washed into drains and waterways, or blown off-site
- consider using your own labour to clean any materials you will be re-using in your new home
- approach a salvage company or hold a demolition sale if you are demolishing an old house
- visit the Bairnsdale Tipshop
- many items are free of charge to dispose of at landfills and transfer stations such as cardboard, steel and household appliances. By separating waste from recyclables you will reduce your disposal costs.

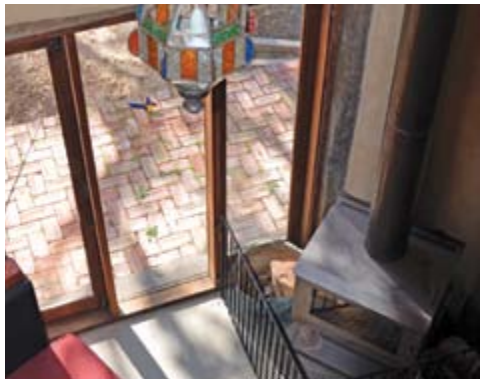
For further information obtain a copy of the East Gippsland Shire Council **Rethink Waste** booklet.

Comfort Indoors

Recent research strongly suggests that the quality of our indoor environment has a direct effect on our health and wellbeing. Indoor environment quality is influenced by access to natural light, ventilation and external views, thermal comfort, exposure to harmful chemicals and noise levels.

Natural Light

Good access to natural light assists with regulating the body's clock as well as reducing the need to turn lights on. In combination with external views, natural light gives us a sense of connection to the outside and a perspective of time and place.



Thermal Comfort

Thermal comfort relates to the temperature and humidity levels at which the body is comfortable. This is slightly different for everyone, but it is important that individuals are able to control the building to suit them. A sustainably built home will rely less on mechanical heating and cooling to remain comfortable.

In recent years there has been a considerable focus on sealing up homes to improve energy efficiency and thermal comfort. However, when this is done without considering ventilation it can lead to some problems with indoor air quality, including mould growth and increased exposure to harmful chemicals. For people with weakened immune systems this can lead to poor health, including respiratory and skin conditions.

Ventilation

Ventilation solutions should allow fresh air into a building without compromising thermal comfort. In our relatively mild climate, this is often about having opening windows in the right position to allow cross breezes to cool the house. In cooler months, opening a window to get some fresh air simply allows all the heat to escape the house, which then costs more to re-heat.

A relatively simple solution is a heat recovery and ventilation (HRV) system. Common in Europe and North America where the climate is harsher than Victoria, these systems use a heat exchanger to transfer fresh air from outside to inside and stale air from inside to outside, retaining up to 90 per cent of the heat inside the house. They are cheap to run and help to retain heat inside during winter and outside during summer. These units also assist in removing moisture and odours from the house, keeping condensation from forming, mould from growing and reducing exposure to harmful chemicals.

Heat recovery ventilation system

Material Selection

Material selection also forms an important role in improving indoor environmental quality. Certain chemicals known as volatile organic compounds (VOCs) are contained in many modern building materials and decorating products. Items such as paint, fabrics, furniture, cabinetry and insulation products can all contain VOCs at harmful levels. The more natural form a product is in, the less likely it is to contain VOCs. There are also many new alternative finishes available that contain few or no VOCs.

Noise Levels

Minimise the impact of external noise by placing windows on walls away from the road or noisy neighbourhood activities and/or using double glazing or landscaping elements to stop noise penetration. Using sound-insulating batts in internal walls will minimise noise moving between rooms.

RENO TIPS

1. Most homes with a roof cavity can have a HRV system fitted. The heat exchanger, fan unit and ducting all sit inside the roof space.
2. Create your own pleasant view. If you only have a small space that looks at the fence, use mirrors, plants and sculptural forms to enhance the area that you can see through a window.
3. Insulate external walls and/or apply secondary glazing to existing windows close to the road to reduce noise infiltration.
4. Next time you redecorate, choose paints, fabrics and other items that are low in VOCs.
5. Clean out your cupboards and dispose of harsh chemicals through the 'Detox Your Home' drop-off point at Bairnsdale Landfill.

General Lighting

In recent years there have been significant advances in lighting technology. Most of us have replaced our old incandescent lights with compact fluorescent lamps. Some are now venturing into the latest technology of Light Emitting Diodes (LEDs).

LEDs have several advantages over other types of lamps:

- a lower wattage is required to generate the same amount of light
- a lifespan 10 to 30 times greater than that of other technologies
- they contain no mercury
- full colour range
- very small compared to other types of lamps.

LEDs also run at much lower temperatures than other types of lamps, so in combination with their small size, this makes them extremely flexible in their application. We are starting to see new purpose-built LED light fittings emerge for residential and commercial applications which will become more common as time goes on.

Recessed Down Lights

With changes to the building requirements, it is almost impossible to use halogen down lights in a new home or renovation. Halogen down lights are a problem for numerous reasons. Usually they are installed with a 50 Watt lamp. If there are four or more in a room, this can add up to significant energy consumption. Halogen lamps also generate a lot of heat. In combination with insulation or cramped spaces, this is a fire risk.

Down lights of any type present another larger problem in a house. To reduce the risk of fire, insulation is required to be laid with a gap of 100mm around each light fitting. This provides a clear area of approximately 452cm2 for each light fitting. If you have 30 down lights in your home, this adds up to a staggering 13.6m2 that is not covered by insulation, an area equivalent to a bedroom. These cleared areas provide an easy way for heat to leave or enter the room and have a significant effect on heating and cooling costs.

If you already have recessed down lights installed, consider the cost benefit of removing them or replacing the halogen lamps with LED lamps and installing a down light cover over each light inside the roof.

Test your LEDs – sometimes compatibility issues occur between the LED lamp and transformer, so purchase one lamp first and test it before buying replacements for all lights.

A cost comparison of a single halogen and LED down light is shown below:

Type of lamp	Lifespan (hrs)	Purchasing cost	Lifetime running cost	Total lifetime cost	Lifetime saving
Halogen	5000	$10	$1,800	$1,810	
Led	30000	$45	$600	$645	$1,165

Note that the same electricity cost per kWh was used for both types of lamp. As electricity prices increase and the cost of LED lamps comes down, the saving per light will increase.

Taps and Showerheads

From late 2011 specified water products have been required to be registered under the Water Efficiency Labelling and Standards Scheme (WELS).

These include taps, showerheads, flow restrictors, toilets, washing machines and dishwashers. For a product to be sold in Australia it must be registered and meet minimum standards. New homes must now have efficient taps, showerheads and toilets installed.

A WELS label showing the star rating and water use should be attached to any product in the scheme: for taps and showerheads the label will show the number of litres used per minute. When buying new products always compare the water use rather than just the number of stars. More information is available at www.waterrating.gov.au

RENO TIPS

1. If your taps are still in good condition, fit aerators to the faucet to slow the water flow rate. These are available from hardware stores for only a few dollars.
2. Change your showerhead over to a low flow version.
3. Change over any remaining incandescent globes for LEDs. Even though they cost more to buy, they will save you a lot in running costs and replacement costs over their lifespan.

APPLICATION	PRODUCT	SUSTAINABLE FEATURES
Doors	Blokdor/ Coritech	Uses laminated plantation pine in construction. Insulated with polystyrene.
	Recycled doors	Some doors use FSC-certified timbers. 100% recycled.
Windows	Timber-framed	Double glazed, sealed and BAL rated, various styles suitable for the best ventilation outcomes.
	uPVC-framed	Double glazed, sealed and BAL rated, various styles suitable for the best ventilation outcomes. Imported from Europe.
	DIY for timber frames	Double glazed, sealed and made in Melbourne.
	Windows Energy Rating Scheme	
Lighting	LED lighting	Lower wattage means lower energy consumption and LED's do not contain mercury.
	Light Fittings	Recycled and reclaimed light fittings
Flooring	Recycled timber	100% recycled product.
	New timber	Plantation timbers, FSC certified reducing the impact on biodiversity. Plantation timbers, FSC certified reducing the impact on biodiversity.
	Bamboo	Fast growing, plantation bamboo that is hard wearing. Imported from Asia.
	Cork and cork/rubber	100% recycled cork combined with rubber. Renewable resource, good thermal properties, low VOC, low flammability. Take back policy at end of life.
	Rubber	100% recycled tyre product. Long lasting. 100% Australian made and owned. Natural, renewable resource with some recycled content. Resilient and long lasting.
	Natural fibre carpets (jute, coir, seagrass and sisal)	Renewable resources, not dyed.
	Cavalier Bremworth wool carpet	Renewable resource, low VOC with a recycled backing. Flashbac recycling program at end of useful life.

FIXTURES & FITTINGS PRODUCT GUIDE

APPLICATION	PRODUCT	SUSTAINABLE FEATURES
Flooring	Villa Natralis Carpet	Undyed wool carpet, woven fibres
	Sunburnt Country Carpet	Woven fibres are long lasting with lower embodied energy and low VOC.
	Carpet underlay	Airstep - 85% recycled fibre and plastic. Dunlop Springtred – low chemical use, 100% recyclable. Tontine Fibres Wunderfelt – Goats hair and jute are renewable resources. No chemicals used in manufacture. Return to manufacturer at end of useful life. Tontine Fibres Superfelt – 100% recycled textiles.
Cabinetry	X-Board Ply	Low toxicity varnishes and oils, low emissions with sustainably sourced additives. Low embodied energy.
	PYNEboard	No-VOC products, natural tints, plant-based ingredients grown without pesticides.
	Manufactured cabinets	Low VOC moisture resistant MDF. Renewable resource from plantation pine. Low VOC.
Bench tops	Recycled or reclaimed timber	Recycled or renewable resource.
	Bamboo	Fast-growing renewable resource with natural antiseptic properties. Can also be used for cupboards.
	Laminex Greenfirst	Using FSC-certified timbers, this product is also low VOC.
	CO by Cosentino stone	75% recycled materials (glass, ceramics and vitrified ash), polyester resin.
	Reconstituted stone	42% reclaimed quartz, long lasting.

Furniture and Finishes

Paints, sealers, polishes, fabric, furniture stuffing and ornamental items often contain chemicals which can be harmful to our health. The term 'off-gassing' is commonly used to describe the process in which chemicals are released from the product into the surrounding air.

These chemicals are often known as volatile organic compounds, or VOCs. Some familiar VOCs cause the 'new car' smell and the odours associated with new carpet and fresh paintwork. VOCs have potential adverse health effects and should be avoided, especially indoors.

Choose low or no-VOC products from the guide. Ensure adequate ventilation and buy recycled furniture to avoid introducing VOCs into your home.

To recycle unwanted or buy pre-loved furniture visit the Bairnsdale Tipshop, Op Shops or online. For further details on recycling obtain a copy of the East Gippsland Shire Council **Rethink Waste** booklet.

New Car Dashboard

VOCs

(volatile organic compounds)

PAINT AND FURNITURE PRODUCT GUIDE

APPLICATION	PRODUCT	SUSTAINABLE FEATURES
Paints, Stains and Renders	Grimes paints, stains and renders – interior and exterior	Low toxicity paints, low emissions with sustainably sourced additives, low embodied energy.
	Porters Paints – interior limewash, acrylic, milk, mineral and silicate paints	Low toxicity paints, no- and low- VOCs using plant, milk and mineral bases.
	Ecolour Paints – interior and exterior	No-VOC paints, certified carbon neutral.
	Livos Paints – interior and exterior, oils, waxes, paint stripper and tile adhesive	No-VOC products, natural tints, plant based ingredients grown without pesticides.
	BIO Paint – interior and exterior paints, oils, varnish and waxes	Low-VOC products, natural tints, plant and mineral based ingredients.
	Rockcote Ecostyle	No-VOC clay paint.
	Oikos Paints – interior and exterior	Low toxicity, low VOC, biodegradable and non-allergenic paints.
	Berger BreatheEasy Haymes Interior Expressions Bristol Easy Living	Commonly available low-VOC interior paints
Floor and Timber Polishes	Grimes floor and timber products	Low toxicity varnishes and oils, low emissions with sustainably sourced additives. Low embodied energy.
	Livos Paints – oils and waxes	No-VOC products, natural tints, plant-based ingredients grown without pesticides.
Furniture	Furniture made from recycled and reclaimed materials	Recycled and reclaimed timber and metal items made locally.

Heating and Cooling

The best way to improve comfort levels and reduce ongoing heating and cooling costs is to implement the passive design elements discussed in the earlier *Design* section of this Guide.

Tips for Winter:

- allow for winter sun to warm living areas
- have heavy curtains or blinds with pelmets and close them in the evenings
- insulate roof, ceiling, walls and under floor or slab edge as required
- include thermal mass to smooth diurnal temperature fluctuations
- seal gaps around doors, windows, skirting, exhaust fans, chimneys/flues and down lights.

Tips for Summer:

- apply external shade to windows that receive direct sun
- include screened, opening windows on opposite sides of the house and open on cooler evenings
- insulate roof, ceiling and walls as required
- include thermal mass to smooth diurnal temperature fluctuations
- seal gaps around doors, windows, skirting, exhaust fans, chimneys/flues and down lights
- design upper storey or clerestory windows that can act as a thermal chimney.

There are many different options for heating and cooling a home, although choices for most areas in the Shire are limited by not having a reticulated natural gas supply. Heating and cooling accounts for around 38 per cent of household energy use throughout Australia[2]. In Victoria this figure is thought to be higher due to the large variation in summer and winter temperatures that require heating for six months of the year yet only a few days of cooling over four months over summer.

The trend is now towards space heating rather than central heating, as most households don't need to heat the whole house all the time. Some high efficiency central heating options can now be zoned. This means that heating can be switched on and off independently in different areas of the house.

[2] Your Home Technical Manual, 4th Edition, Department of the Environment, Water, Heritage and the Arts, 2011.

Heating Options:

Wood and Pellets

Wood is a renewable resource, so provided the supply of firewood is sustainably managed it is a reasonable alternative. Firewood is generally also very expensive compared with gas and electricity. Wood pellets are usually made from waste created from timber milling and cost around the same amount as wood.

The way you burn wood also affects its efficiency. Open fires are the most inefficient way to heat a home. Around 80-90 per cent of the heat disappears up the chimney, with any remaining hot air being sucked up the chimney as fire dies down. When the fireplace is not being used, cold air comes down the chimney creating large draughts in the room. A high efficiency wood or pellet heater with a fan produces more heat and pushes the warm air around the room instead of straight up. There is some heat loss up the flue, but these flues are usually sealed.

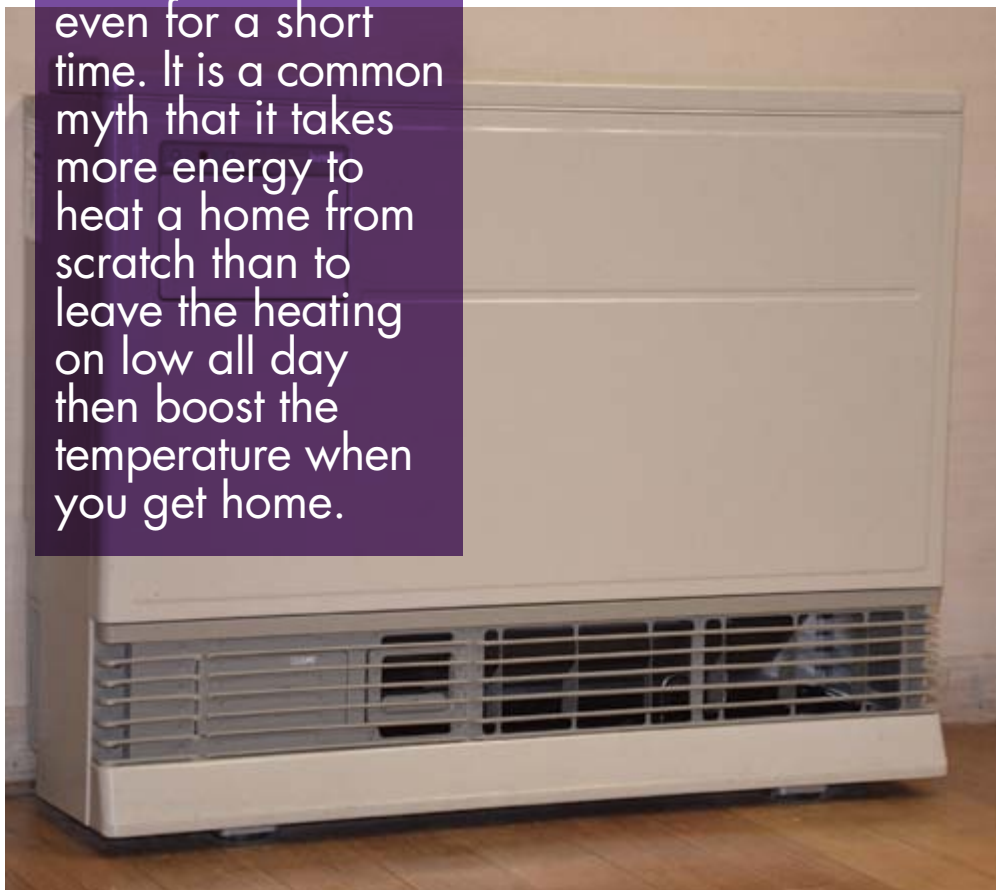
Gas

Natural gas is a much 'cleaner' fuel, contributing far less to greenhouse gas emissions than electricity or oil. Traditionally gas has been the cheapest option for heating and cooking. However, changes to the gas market in eastern Australia are leading to rapidly rising prices. The role of gas as a continuing cheap alternative to electricity is in doubt and needs to be factored into your decision making.

Electricity

Electricity in Victoria is generated primarily from burning brown coal. Brown coal creates a large amount of greenhouse gas. In fact, Hazelwood Power Station in the Latrobe Valley is the least efficient electricity generator in all developed (OECD) countries. If you decide to use electricity for heating consider whether you could install a solar power system to generate all the energy you need to run the system. If solar on your own roof is not an option, purchasing GreenPower from your energy retailer is a way of buying renewable energy from the grid and ensuring that we move away from burning coal to generate electricity in the future.

Always turn heating off if you leave the house, even for a short time. It is a common myth that it takes more energy to heat a home from scratch than to leave the heating on low all day then boost the temperature when you get home.



Some common heating options:

Fuel	Heater Type	Details	Best Use	Relative Running Costs
WOOD	**Open Fire**	Poor efficiency as most heat rises up chimney rather than into room.	None	High - Low#
	Wood Heater	Suitable for whole of small house or small to large living areas. Sustainable supply of firewood should be used.	Living areas, regions with no access to gas.	High - Low
	Pellet Heater	Suitable for whole of small house or small to large living areas. Waste wood shavings should be used to form pellets.	Living areas, regions with no access to gas.	Med - Low
GAS	**Space Heater**	Includes a fan to push heated air through room, suits small to large rooms.	Living areas.	Low*
	Ducted Heating	5-star efficient units are available with zoning options to allow flexible heating patterns.	Whole of house (zoned for heating different areas at different times).	Med*
	Hydronic (in combination with solar pre-heat and boosted with gas or gas only)	Gas/solar heats water that runs through in-room panels or under the floor.	Whole of house (zoned for heating different areas at different times).	Med - Low*

Try not to place space heaters opposite windows as they can create draughts which make those sitting in the room feel cold.

* Based on 2012 gas prices

Depending upon whether or not you pay for your wood supply.

Fuel	Heater type	Details	Best use	Relative running costs
ELECTRICITY	**Radiator**	Radiates heat at a person, does not heat air space.	None.	High
	Column/ panel	'Efficient' units have thermostats but still use a lot of energy.	None.	High
	Fan	Pushes heated air around room. Not suitable for bathrooms or large rooms.	Small rooms for short periods of time.	High
	Underfloor	Coils located in slab. Can be zoned and used at low temperatures.	None.	Very High
	Inverter (air to air heat pump)	Highly efficient units are now available. They come as air heaters or water heaters for hydronic heating and can be used for hot water as well.	Whole of house.	Med - Low
	Geothermal (ground to air heat pump)	Highly efficient units are now available. They use heat from in the ground to heat air or water. High up front cost.	Whole of house.	Med - Low

Whichever method of heating you choose, the ideal temperature range is 18–20°C in winter. For every degree higher you set the thermostat, it will cost around 10% more to heat. It is often air movement that makes you feel cooler, so draught proofing is a great way to control this.

Patio heaters have become increasingly popular in recent years. They are one of the most expensive ways to provide heating and are not efficient because they are used in the open air. If we're all busy trying to reduce our energy use inside our homes, does it make sense to use large amounts of energy to warm us outside our homes? If it's cold enough for a heater, it's probably too cold to sit outside.

For every degree higher you set the thermostat, it will cost around 10 per cent more to heat.


Clerestory windows


Ceiling fan

Cooling Options:

Gippsland has a good diurnal temperature range where, generally, our nights are much cooler than our days. If you invest $12-15 in an inside/outside thermometer to show when the temperature outside is lower than inside, you can open windows to allow cool breezes through the house.

In two-storey homes or those with clerestory windows, high windows can be opened to create a thermal chimney. Heat will rise, move out through the window and draw cooler air throughout the house. This will work even on very hot days, but you might need to experiment with which windows work best in your home.

External blinds and awnings on the outside of windows can reduce heat gain through windows in summer by up to 85%, particularly if the material is a light colour to reflect the heat. They are more efficient than internal curtains or blinds.

If you need some additional cooling, the cheapest method that consumes the least amount of energy is a **pedestal or ceiling fan**. A fan works by helping to evaporate sweat from the skin, so we feel cooler rather than reducing the temperature of the room. A little spray bottle with water can be used to create a mist that will enhance the effect.

Most ceiling fans have a winter/summer switch. In winter they should be set to low speed to avoid creating a draught as they push the warm air trapped at the ceiling back to floor level. In summer the ceiling fan blades can be adjusted to draw up cool air.


Evaporative cooling


Air conditioning

Compare the costs:

Type of cooling	Power	Hourly running cost*	Cost over summer*
Pedestal or ceiling fan	30-75 Watts	1-2 cents	$0.68-$1.70
Evaporative cooler	800 Watts	23 cents	$18.17
Air conditioner**	1500-3000 Watts*	43-85 cents	$34.08-$68.16

* Based upon a cost of 28.4 cents/kWh and running 80 hours over summer.
** Air conditioners vary in size and this is a relatively small unit.

Evaporative cooling is the next most cost-effective way to cool. The main cost is to run the fan motor. This type of cooler also uses some water, so if it runs for many hours each day you will see a slight increase in the water bill.

Air conditioning is the most expensive way to cool a home. New air conditioners must have an energy rating, so choose a model that has a high star rating and it will save on running costs over its entire life. Make sure the unit is the right size for the space you want to cool. Ideally the thermostat should be set to 25-27°C. Each degree cooler will increase the running cost by around 10 per cent.

Reverse-cycle air conditioners

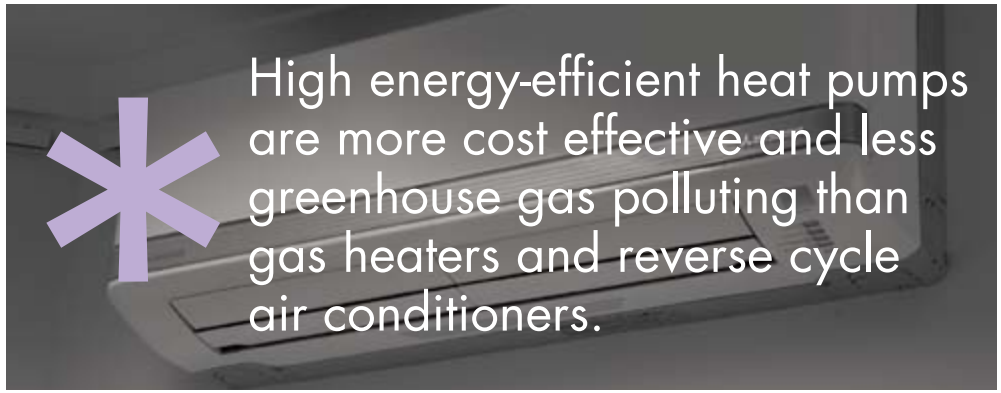
Air conditioners sold in Australia must comply with Minimum Energy Performance Standards (MEPS) and be labelled with an energy star rating as well as information about how much energy is consumed by the appliance and how much energy it emits.

1. Determine the required output. You will need information about the type of materials and insulation used in the ceiling, walls and floor of the area you want to condition, as well as the size of the area. You will also need to know the size and U-value of all windows in the area to be conditioned. Your appliance sales person or electrician should be able to help you determine the correct size required. Be conservative with sizing as a larger unit will use more energy to build and run.

2. Check for brands that are reliable. You don't want to have to replace the unit after a short time or buy one that needs frequent repairs. Online or Choice reviews are often helpful.

3. Choose the most efficient model possible. Divide the Output Energy by the Input Energy. This figure is known as the Coefficient of Performance (CoP). An efficient model should have a CoP of five or higher. This means that the unit puts out five times as much energy as it uses. As new models emerge, this figure should improve. A full list of models available in Australia can be found at www.energyrating.gov.au.

4. To ensure your appliance is running at maximum efficiency, ensure the filters are cleaned regularly (at least every six months) and the unit is serviced periodically.



Hot Water Systems

Water heating accounts for around 25 per cent of a household's energy use. There is a range of energy efficient options that will suit different household circumstances.

Solar hot water evacuated tubes

Solar with gas booster

This type of system comprises either solar panels or evacuated glass tubes and a storage tank. The addition of an instantaneous gas unit means that on cold and cloudy days when there may not be enough sun, there will still be hot water available. This is generally the cheapest type of system to run, although the purchasing cost is quite high, however water heating costs can be reduced by as much as 85 per cent. It is best suited to a household of three or more people.

Solar with electric booster

This type of system comprises either solar panels or evacuated glass tubes and a storage tank that contains a heating element. The element means that on cold and cloudy days when there may not be enough sun, there will still be hot water available. This type of system generally saves about 65 per cent of costs compared to an off-peak electric storage hot water system, although the purchasing cost is quite high and it requires moderate levels of boosting over winter. It is best suited to a household of three or more people.

Heat pump

A heat pump is an electric system comprising a storage tank and a heat exchanger. A pump draws air into the heat exchanger and removes the heat, transferring it into the water. Heat pumps can be linked to a solar panel or evacuated glass tubes to give even greater efficiency, although this makes it an expensive solution. This type of system is suited to any sized household, especially where there is no access to reticulated gas.

Gas instantaneous

A small box located on the wall outside the home is all this system needs to generate continuous hot water. It achieves savings because it only heats the water that is required. There is no storage tank to re-heat. The system can be configured to run on natural gas or LPG.

Electric instantaneous

This type of system consists of a small wall-mounted box that heats water as it runs through the unit. As it heats water on the peak daytime tariff it can be expensive to run for a large amount of water. If you have a small household of one or two people, with irregular water use patterns, it may be the best option if you do not have access to reticulated natural gas.

Heat Recovery System

This type of product is suited to installation during building, usually in a two storey home. It is installed in addition to a hot water heater. It works by transferring any remaining heat in waste shower water through the walls of the pipe and into cold water in a separate pipe that's on its way to be heated. Further information is available at www.recohvert.com.au.

Heat pump

Gas instanteaneous

All new hot water systems should be installed with lagging (insulation) covering all the hot water pipes. This helps to prevent heat loss as the water sits in the pipes either as the water travels to its destination or when the tap is turned off and on.

If you are designing a new home, try to group rooms that will use hot water close together and place the hot water system as close to these rooms as possible. This will reduce the amount of water wasted waiting for the hot water to arrive at the tap and reduce the amount of heat lost when hot water is sitting in the pipes.

Hot water systems are required to have an energy rating displayed on the unit. Make sure you compare the energy use of different types of heaters, not just the number of stars.

RENO TIPS

1. Change showerheads over to low flow models. These can save between 24 and 52 litres of water per shower. For a four person household this could add up to 76,000 litres per year. Not only does it save water, it also means you have to heat less water which reduces the cost in two ways.
2. If you are not ready to replace your current hot water system, install lagging on all hot pipes that you can access. Lagging is inexpensive and can be purchased at hardware stores.
3. Install a Valve Cosy over the relief valve on the storage tank. It is claimed that a Valve Cosy reduces heat loss from the tank by 7 per cent and it is very cheap to purchase.
4. If your hot water system is highly exposed to the elements, consider enclosing it inside screens to help reduce heat loss from the walls of the tank. Make sure you can still access the tank.

Household Appliances

Choosing appliances to finish your new home or renovation is one of the exciting parts. Most of us think about form and function when we select our appliances and put very little thought into how these might affect our energy and water bills. Whenever possible choose appliances with the highest possible number of stars as indicated on an Energy Rating or Water Rating label.

A few brief tips:

- Standby power refers to electricity many appliances continue to draw when not switched off at the power point. Any appliance that is turned on and off with a remove control or have a digital display or memory setting will use standby power. Switch off appliances at the power point and save money.
- Set your fridge thermostat between 3°C and 5°C. The freezer should be between -15°C and -18°C.
- If you have a thermostat on your heating and cooling devices, adjust the settings as the seasons change. Generally 25-27°C in summer, 18-20°C in winter.
- If you have a second fridge for entertaining, switch it off when it's not needed.
- Check the seals on your oven, fridge and freezer. It should hold a piece of paper firmly in place when closed. If not, buy a new seal and replace.
- Avoid buying appliances that you don't really need. Why buy a clothes dryer when you could use a clothesline or clothes rack?
- Switch off your heater or air conditioner an hour or so before you go to bed. The living area will generally stay warm/cool until you retire.
- Buy the right sized appliance to suit your needs. Why buy a large freezer if a small one will suffice?
- Select the right sized model dishwasher for your needs. Two drawer models are available that allow for smaller loads. Look for a good range of programs including economy options.
- Front loader washing machines tend to be more energy efficient than top loaders. They usually have a higher spin speed so clothes come out drier. Many have a cold water connection.
- Usually, the larger the TV or computer monitor, the more energy it uses.
- Follow the manufacturer's instructions when positioning, operating and maintaining your appliances.
- Visit:www.switchon.vic.gov.au/more-ways-to-save/appliance-calculator to check how much your individual appliances cost to run
- www.choice.com.au to compare brands and models before purchasing.

Why buy a clothes dryer when you could use a clothesline or clothes rack?

Renewable Energy

There are generally three options for PV connection:

1) Grid-connected - the system is connected to the national electricity grid. Energy generated in excess of the needs of the household is fed into the grid for use elsewhere.

2) Hybrid connection - the system is also connected to the grid, but excess energy is stored in batteries onsite to be used to offset your peak load, at night or during a power failure of the grid.

3) Off-grid connection - this is a 'stand alone' system for those who live in remote areas, or do not want to connect with the grid. Energy generated is stored in a bank of batteries and managed on site.

Renewable energy comes from an energy source that can be replenished within a human lifetime. Sometimes the sources of energy are not so clean, such as methane gas from landfill. However, other sources, such as solar, hydro and wind power are considered clean sources of renewable energy, as they produce no greenhouse gas emissions. The two types of renewable energy most suitable for domestic use are solar and wind power.

Solar pv on ground

Solar Panels

Solar electricity systems use photovoltaic (PV) cells to convert sunlight into electricity.

Most systems are connected to both the house and the national electricity grid and these are known as 'grid-connected' systems. This enables any energy generated in excess of the needs of the household to be fed into the grid for use elsewhere. Some homes, mostly located in rural areas, have what is known as a 'stand alone' system. This type of system feeds excess energy into a bank of batteries instead of the grid so it can be used at a later time, either at night or during a very cloudy day. Some systems are known as 'hybrids' where they are both connected to the grid and have a battery bank. Hybrid systems are useful for times when the mains power goes down and for controlling the ongoing cost of electricity use.

Solar panels have an approximate lifespan of 25 years. Minimal maintenance is required over this timeframe, consisting mainly of regular washing with water. The panels work more efficiently when free of dust, leaves and bird droppings.

Solar panels come in different types and sizes. Most domestic systems installed to date use monocrystalline panels and range in size from 1.5 to 5 kilowatts. As a general rule 1 kilowatt of panels would provide you with roughly 4.5 kilowatts of power each day, provided the panels are not shaded.

Before deciding on how large a system to install, it is wise to reduce your daily electricity use as much as possible. This means a smaller system can be installed at a lower cost.

Inverters

The other major component of a solar electricity system is the inverter. This is a box located on a wall which converts the power generated by the system (DC electricity) into a useable current (AC electricity), to be used in the home and fed into the electricity grid. The inverter must be sized appropriately for the system or slightly larger than the power output of the panels to allow for future expansion.

New technologies emerging include:

- micro-inverters that attach to individual panels to improve system efficiency in shady situations
- Building Integrated Photovoltaics (BIPV) that are designed to form part of the building structure, such as windows and wall cladding.

The inverter must be sized appropriately for the system or slightly larger than the power output of the panels to allow for future expansion.

Siting a Solar System

When siting a solar system there are several factors to consider to achieve the best results:

- Panels work most effectively when facing north. They will work when facing in other directions, but the efficiency will decrease significantly.
- Obstructions on your roof may shade the panels. Common examples of this are television antennae, chimneys, air conditioner/cooling motors and uneven rooflines.
- Trees to the north, east and west of your roof could shade the panels. Can you move the panels to a less shady position? Can you trim the top of the trees? If the trees are on the nature strip or in your neighbour's garden, it may be wise to have a conversation with Council or your neighbour to find out if pruning will be a problem.
- Is there a possibility of a future higher storey extension to the north of your house? If so, consider placing the panels in a position where they would not be affected.
- Consider the view from the street and your neighbours' yards. If you need frames to tilt the panels what would they look like from a distance? Will they create any problems for other households?
- If your home is heritage-listed, consult with Council's Heritage Advisor prior to committing to a purchase.

More detailed information about installing a solar electricity system is available through the Clean Energy Council's Consumer Guide to Solar PV, available at www.cleanenergycouncil.org.au .

Wind Generators

Wind generators use wind to rotate blades or turbines. This movement is turned into electricity using an alternator. Like a solar system, a wind generator can be grid-connected, stand alone or a hybrid.

It is also possible to have both solar and wind systems installed to produce a more consistent supply of electricity. Maintenance of a wind generator is greater than for solar as there are constantly moving parts. A six-monthly check should be done on oil levels and greased parts. Seals, blades and other parts should be checked every 12 months and oil changed every two years.

Wind generators do produce some noise. Most of the time this is not a problem and there are designs available now that virtually eliminate noise all together. However, certain types of blade arrangements produce noise when turning out of the wind, so this should be considered.

Siting a Wind Generator

When siting a wind generator there are several factors to consider to obtain the best results:

- An anemometer should be used to monitor the wind speed at your intended installation site for 12 months. This will give an accurate average wind speed so the size of the turbine and electricity output can be calculated.
- The tower should stand at least ten metres higher than any surrounding objects. Remember that trees grow, so consider if you will need more height in the future.
- Never attach a tower to the house.
- Consider the view from the street and your neighbours' yards. Also think about noise levels and whether there could be damage to neighbouring property if the tower falls or needs repairs.
- Consider whether there would be any impact on local fauna and flora.

More detailed information about installing a wind generator is available through the Alternative Technology Associations' Wind Power Plan, your own wind power system, available at www.ata.org.au.

Green Power

Green Power is the only voluntary government accredited program that enables your energy provider to purchase renewable energy on your behalf. If you are not able to place a solar or wind system on your property, there are other options that allow households to purchase renewable energy:

A joint initiative of the Australian Capital Territory, New South Wales, South Australian, Queensland, and Victorian governments, GreenPower guarantees that the renewable electricity you buy from energy suppliers meets stringent environmental standards. This means that all the renewable energy purchased for GreenPower must come from generators built since 1997. Payments made under this system assist the renewable energy industry to grow.

GreenPower only costs a few cents per kilowatt hour on top of your regular tariff. Accredited products can be identified by the GreenPower logo.

Community Solar or Wind Projects

Creating a solar or wind system large enough to distribute energy to the local community is an emerging concept. Various models exist but are yet to come to fruition. If you are unable to have renewable energy at home but are keen to invest in renewable energy contact Council's Sustainability Officers to register your interest.

Water Capture and Use

A well-designed home can reduce water (and energy) use, take advantage of water captured on site and improve the quality of water flowing back into waterways. Whether there are official water restrictions in place or not, a good target to aim for is no more than 155 litres of water per person per day. This should include mains water and any water used from a tank.

Placing kitchen, bathrooms, laundry and the hot water system close together will reduce the amount of pipework required and reduce the amount of energy required to heat water. Taps, showerheads and toilets are all required to meet minimum water efficiency standards under the Water Efficiency Labelling and Standards Scheme. When comparing different models ensure you check the number of litres per minute rather than just the number of stars.

Capturing and Using Rainwater

Rainwater tanks have become a common sight throughout Victoria in recent years. They now come in numerous shapes, sizes, colours and applications, including those designed specifically for very small spaces, mobile versions and tanks that can also be used as retaining walls and garden beds.

When planning a new home, provision should be made for tank location and connection to toilets and laundry to reduce the demand for mains water. Typically, a tank of at least 4,000 litres would be required for toilet flushing, laundry and a small amount of garden watering in most homes. If you plan to grow fruit and vegetables, the amount of water required will be far greater. For a home not connected to mains water, a supply of at least 50,000 litres is recommended.

Maintaining the quality of your rainwater supply is essential, especially if it is your only source of water. You can ensure a good quality water supply by:

- regularly cleaning gutters of leaves, twigs and dust
- installing a first-flush device to prevent the initial flow of water entering the tank
- ensuring there is a fine mesh over the inlet and overflow outlet to prevent insects entering the tank
- ensuring no light enters the tank to prevent algal growth
- ensuring the tank is drained and the sediment removed every few years.

Gardens should be watered using tank water where possible. Early morning is the best time of day to water as evaporation rates are low. Consider installing a drip watering system rather than sprinklers so that water is directed to the roots of the plants and evaporation is minimised. Attaching a trigger nozzle to the hose means that control is totally in your hands.

Raingardens

Raingardens are garden beds specifically designed to capture and slow stormwater from hard surfaces such as roofs, driveways and paths. Overflow water from rainwater tanks can also be filtered through a raingarden. Layers of sandy soil are placed at the bottom of the raingarden to slow the passage of water and filter pollutants from the water before it goes into waterways.

Raingardens can be constructed in a number of different ways:

- **planter box:** an above ground garden that collects water from a diverted downpipe and is connected back into the stormwater drain
- **inground raingarden:** water is collected from hard surfaces or a diverted downpipe and is connected back into the stormwater drain
- **infiltration raingarden:** a garden bed at ground level that collects water from hard surfaces or a diverted downpipe and allows the water to infiltrate into surrounding soil
- **swale:** a depression or ditch containing plants that collects water from surrounding hard surfaces and allows the water to seep into soil below or connects to a stormwater drain

Swale

Further information about raingardens and how to contsruct them is available at www.raingardens.melbournewater.com.au

Grey Water Re-use

Grey water is wastewater from non-toilet fixtures such as showers, basins, washing machines and taps.

Treated grey water (using an EPA-approved system) can be used for toilet flushing and clothes washing, and untreated grey water can be used to irrigate the garden on a short term basis. Blackwater (toilet wastewater) and water from the kitchen sink are not suitable for re-use.

When using grey water in the garden, keep in mind the following for environmental and health reasons:

- do not store untreated grey water for longer than 24 hours
- apply grey water using drip irrigation and only when the soil is dry
- prevent over-watering to avoid site runoff; so as not to inhibit plant growth or clog soils with organic matter
- do not use grey water on leafy vegetables, herbs or fruit
- use biodegradable detergents, cleaners and shampoos that are low in salt and phosphorus.

Wastewater Treatment

Low-impact toilets and alternative treatment systems may be worth considering, although, it is always worth first checking with Council's Environmental Health Team about the appropriateness of your planned wastewater treatment system.

Composting Toilets

Composting toilets have a single container in which waste is deposited to decompose as it slowly moves through the container. It is then removed as compost from the end-product chamber. Single containers are fitted under a bathroom and can easily replicate a flush toilet.

The container is permanently fitted under the toilet seat and never has to be fully emptied, as the compost can be gradually removed when it reaches the end-product chamber. A composting toilet looks much the same as a conventional toilet.

One disadvantage of continuous composting systems is that they can allow fresh material and pathogens deposited on the top of the pile to contaminate the successfully decomposed end-product at the bottom of the pile.

When a composting system is approved it will also require an approved system to treat grey water.

FSC Certification

The Forest Stewardship Council (FSC) is an international, independent, not-for-profit, membership-based organisation.

The FSC was founded in 1993 in response to the Rio Earth Summit to promote environmentally appropriate, socially beneficial and economically viable management of the world's forests.

The FSC has developed standards based upon the "10 Principles of Forest Stewardship" to ensure:

- waterways are protected
- wildlife habitat and species are protected
- high conservation value forests are preserved
- forest management practices are monitored annually
- pesticide use is reduced
- worker safety and wellbeing is enhanced
- the rights of Indigenous Peoples are respected
- communities are respected and valued.

The organisation has a governance structure that includes all stakeholders to ensure that it is independent of any single group. Certification bodies are audited annually and a chain of custody system ensures that products are tracked from the forest to the end consumer.

Further information, including a list of certified timbers, paper and printers can be found at www.au.fsc.org.

GECA Certification

Good Environmental Choice Australia (GECA) is an independent, not-for-profit organisation whose mission is to transform the actions of business and consumers to drive a substantial increase in the sustainability of consumption.

GECA was founded in 2000 as an eco-labelling system and in 2002 created its first standards and commenced an accreditation program. The standards development and review process is transparent, consistent, and includes consultation with stakeholders, industry, experts and the general public.

The GECA Program follows the ISO 14024 standard and offers global best practice in product certification and eco-labelling to the Australian market.

GECA certification is trusted, rigorous and relevant. Verifying a product's environmental performance claims will help consumers avoid 'greenwash'.

Further information, including a list of certified products can be found at www.geca.org.au.

Smart Living

Building and Renovation Guide

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