



# Energy Efficiency

Building design for a sustainable future

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- Heating and cooling systems
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**Where can I find out more?**

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This fact sheet explains how energy efficient design and specification principles can be incorporated into your next building project and the benefits that can be shared not only by you, but all Victorians.

## Why do our buildings need to change?

Around 40% of the world's energy resources are used in our buildings – both residential and commercial.

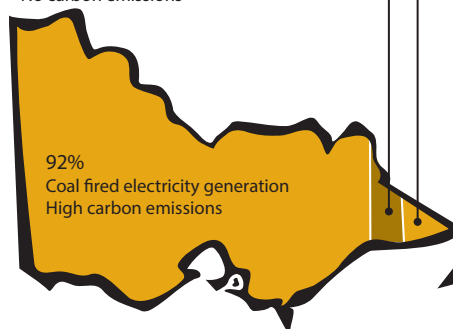
Estimates show that the use of electricity contributes approximately 70% of Victoria's total greenhouse gas emissions due to our reliance on brown coal.

Passive design principles including thermal mass, external shading, building orientation, cross ventilation and better insulation in buildings lead to less reliance on energy hungry mechanical

systems to maintain comfortable internal temperatures. Using renewable energy further reduces a building's environmental impact.

Good building design decreases power consumption, saves money and reduces the effects of climate change. On the other hand, poor building design is uneconomical and contributes to greenhouse gas emissions.

3% Gas fired electricity generation  
Medium carbon emissions  
5% Renewable electricity generation  
No carbon emissions



**Victoria's electricity sources and associated carbon emissions**

60% Heating and cooling  
20% Water heating  
10% Appliances incl. TV & computer  
3% Cooking appliances  
4% Fridge and freezer  
3% Lighting



**Typical energy consumption in homes**

## How will improved Energy Efficiency benefit me?

Whether you are an owner, occupier, builder or property developer, adopting Environmentally Sustainable Design (ESD) principles in the design and construction of buildings and renovations can result in marked benefits, both now and in the future.

As an owner/occupier you can expect:

- lower energy bills due to less reliance on active heating and cooling systems
- improved living comfort
- future proofing of your building asset.

Developers and builders can take advantage of:

- enhanced market appeal to prospective purchasers
- higher investment returns
- a development that meets best practice standards and more importantly, community expectations.



# What can I do to enhance Energy Efficiency?

## What can I do to enhance Energy Efficiency?

For both home owners planning a renovation to an existing dwelling and developers planning to construct multi-storey buildings, it is important to ensure that ESD is considered during the initial scoping stages of a project.

In fact, it is more costly to incorporate sustainability measures after the design process is complete.

The following information in this fact sheet will help you to identify and address the key areas of energy efficient building design.

## Building envelope

The exterior of a building is often referred to as the 'building envelope'. The building envelope ensures that occupants are protected from the elements such as heat, cold, wind and rain.

To maximise the building envelope's thermal protective capabilities:

- Insulate walls, floors and ceilings, exceeding current standards.
- Draft-proof any gaps around doors, windows and vents including any opening between the interior and exterior of the building.
- Consider the use of exposed 'thermal mass' of a building to balance a building's internal temperatures through heat storage and release.
- Specify high performance windows.

## Internal layout and orientation

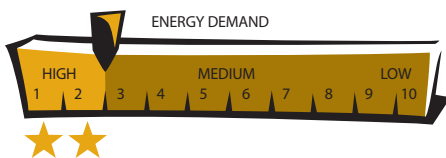
To minimise your reliance on mechanical heating and cooling systems, consider the following design principles:

- Orient living areas to a northerly aspect or as close to as possible, to take advantage of passive solar gains during colder months.
- The positioning and size of windows impacts on the amount of artificial lighting required during daylight hours. To maximize light ingress, it is preferable to use clear glazing. You can use highlight or roof windows to increase lighting levels in buildings with deep floor plans.
- Carefully study the location of your project. Is there the chance of overshadowing from neighbouring buildings? If so, consider how you might overcome any potential problems through clever window placement or reorienting your building.
- Try to cluster heated rooms together. Separate rooms with doors and apply internal insulation to walls adjacent to non-heated rooms. For example, adjoining garages and storage areas can be just as cold as the temperature outside.

“Thermal mass (e.g. exposed concrete floor) can store and release heat in winter when exposed to direct sun. In summer, thermal mass can assist with passive cooling by releasing the stored heat at night through effective means of ventilation (night purging).”

## Reducing your energy demand through an energy efficient building envelope

Victoria's existing building stock (average)



NCC Energy efficiency requirement for single dwellings



Council's best practice standard



## Building compliance for residential and commercial buildings

How can you be certain that your building envelope meets best practice energy efficiency standards?

Before commencing a major renovation or new construction, a building permit will be required, confirming compliance with the National Construction Code of Australia (NCC).

Residential buildings receive an energy efficiency rating which is calculated through tools such as:

- FirstRate
- Building Energy Rating Scheme (BERS) Pro
- Accurate

The rating reflects a dwelling's energy efficiency and is measured on a scale of 1 to 10 Stars. A 1 Star rating means that the dwelling is extremely inefficient and 'energy hungry'. While a 10 Star rated building is extremely energy efficient and requires very little or no energy for heating and cooling due to the passive design principles incorporated during the

building's early design stages.

Similarly, non-residential buildings must also meet the NCCs energy efficiency standards. However, this is determined using different modelling tools that rate the relative energy efficiencies of a building.

It's important to be aware that the NCC only describes minimum standards that must be met and not what is considered best practice. To ensure you future proof your asset, it is strongly recommended that you exceed today's minimum standards.

Energy efficient office buildings are generally rated above 4 Stars under the National Australian Built Environment Rating System (NABERS). This also makes sure your property will remain a 'good performer' as the standards will be raised over time and that you are ready for the recently introduced mandatory disclosure scheme.



# What can I do to enhance Energy Efficiency?

## Heating and cooling systems

Choosing the correct heating and / or cooling system for your project can have a big impact on your energy consumption and greenhouse gas emissions.

Smart buildings and renovations, will incorporate passive solar design in their construction. This may include above standard insulation, external shading that can be adjusted to changing climate conditions, good cross ventilation and the best possible building orientation.

When all of these are combined, buildings will have significantly lower heating requirements in winter and you may be able to avoid the need for active cooling systems in summer.

When choosing an active heating and cooling system (reliant on energy to power), be aware that each has its pros and its cons. Some general rules apply:

- Gas fuelled systems create considerably less carbon emissions than electricity fuelled systems.
- The efficiency of a heating and cooling system is rated in stars. The higher the star rating, the more efficient the unit.
- Hydronic heating systems (run by hot water) can utilise the sun's renewable energy in the form of a 'solar-boosted' heating system, that works just like the solar hot water system on your roof.
- Central systems in larger commercial developments are generally more energy efficient. However, individual systems are more flexible and can be easily modified to suit a building's changing occupancy.
- Some systems are inherently more efficient than others. A ceiling fan, for example, will always consume less energy than an efficient air-conditioner.

### Building Service's Energy Efficiency

Building Services	Low Efficiency	High Efficiency
Space Heating	Electric Heating Panels	Gas Boosted Solar Hydronic Heating
Space Cooling	Electric Air Conditioning	Ceiling Fan
Water Heating	Electric Storage Heater	Gas Boosted Solar Hot Water (Solar contribution > 80%)
Artificial Lighting	Halogen Light Bulb	Light-Emitting Diode (LED), Compact Fluorescent

## Lighting

When considering artificial lighting design, weigh up these design options:

- Ensure living areas, including kitchen and bedrooms, do not require any artificial lighting throughout the day.
- Familiarise yourself with appropriate lighting requirements (how bright is bright enough?) for different living and working spaces.
- Choose energy efficient lights and lamps.
- Install efficient lighting controls such as motion, sound and daylight sensors and time switches, or a 'master switch' that controls several lights, and possibly appliances, at once.

## Renewable energy generation

In addition to good "green" design and performance, many buildings are now being designed to generate their own energy to supplement or meet everyday's energy consumption. Council supports these initiatives and recommends exploring onsite renewable energy production. Renewable energy options include photovoltaic solar panels and small wind turbines for electricity production, solar hot-water heating systems, and geothermal systems for space heating and cooling.

Solar hot water systems are the most common systems that work with renewable energy - free energy from the sun.

While we weren't able to provide renewable energy for all 150 apartments, we at least covered all common area electricity demand (lighting and ventilation for entrance lobby, corridors and basement) through onsite electricity generation with photovoltaic panels. That way we not only reduce the development's environmental footprint but also reduce the body corporate fees.



## What can I do to enhance Energy Efficiency?

### Water heaters

On average, hot water heating contributes 20 per cent of a household's energy bill. Choosing a highly efficient system reduces energy costs and a building's environmental footprint.

Water heaters follow similar guidelines to heating and cooling devices:

- Gas fuelled systems are commonly more efficient than electricity fuelled systems.
- The efficiency of a hot water system is rated in stars. The more the better.
- A solar hot water system provides a large proportion of the energy required to heat water by directly using the sun's energy. Where possible, supplement outstanding energy requirements using a gas booster, known as a gas boosted solar hot water system.
- Instantaneous systems are generally more efficient than storage systems as there is no water being stored and constantly reheated. However, this can vary, depending on the fuel source, be it renewable energy, electricity or gas.

### Reducing peak demand

Peak energy demand refers to the use of electricity, caused by extreme weather events such as heat waves and cold snaps. For example, on a hot summers day, the Victorian electricity grid carries an additional load of up to 20% due to the additional use of air conditioners. Extreme conditions occur on a relatively few number of days per year however this peak demand is enough to increase demand for the construction of new power stations.

The impact on consumers is additional costs for the entire year as Victoria's energy grid is 20% larger than it would need to be without peak demand.

However, we can all take steps to help reduce peak demand on our electricity supplies by:

- installing efficient shading
- providing good insulation
- only using high efficiency heating and cooling systems, which means that specified systems should be within 1 Star of the highest rating available
- installing photovoltaic panels that produce energy when it is needed most - on a hot summers day.

### Clothes drying facility

A well designed residential dwelling should incorporate natural clothes drying facilities. External drying spaces give the occupant the opportunity to use sun and wind to dry clothes rather than electrical appliances. Apartment buildings could provide retractable drying racks on individual balconies or a common clothes line on the building's roof terrace.

### Where can I find out more?

#### 6 Star Energy Efficiency Requirements

Victorian Building Authority  
[www.vba.vic.gov.au](http://www.vba.vic.gov.au)

#### Find an accredited Thermal Performance Assessor

Association of Building Sustainability Assessors  
[www.absa.net.au](http://www.absa.net.au)

Building Designers Association Victoria  
[www.bdav.org.au](http://www.bdav.org.au)

#### National Australian Built Environment Rating System (NABERS)

[www.nabers.gov.au](http://www.nabers.gov.au)

#### Choose an Energy Efficient Appliance

Department of Climate Change and Energy Efficiency  
[www.energyrating.gov.au](http://www.energyrating.gov.au)

Sustainability Victoria  
[www.sustainability.vic.gov.au/](http://www.sustainability.vic.gov.au/)

#### Energy Use Technical Manual

Your Home  
[www.yourhome.gov.au](http://www.yourhome.gov.au)

**Other Fact Sheets in this series are also available to provide guidance on the 10 Key Sustainable Building Categories. For further information on Energy Efficiency, see the Fact Sheets entitled:**

- Indoor Environment Quality
- Urban Ecology
- Building Materials.
- Sun Shading
- Melbourne's Climate

### Mandatory Requirements and Council's Best Practice Standards

#### Mandatory Requirements

You must meet:

The National Construction Code (NCC) requirements for energy efficiency, and;

The objectives and standards of the local planning scheme.

#### Council's Best Practice Standards

- Achieve an energy efficiency standard at least 10% above minimum NCC compliance.
- Install energy efficient lighting to achieve an improvement of at least 10% above NCC compliance for lighting power density.
- Provide daylight and occupancy sensors for external lighting.

- Provide on-site renewable energy generation.
- Provide external natural clothes drying facilities.
- Install energy efficient hot water, heating and cooling systems within one energy star rating of the best available.
- Ensure basement carparks are either fully naturally ventilated, or use Carbon Monoxide monitoring to control the speed and operation of ventilation fans.

Developments, which seek to vary from these best practice standards, must demonstrate how energy efficiency can be satisfactorily achieved.