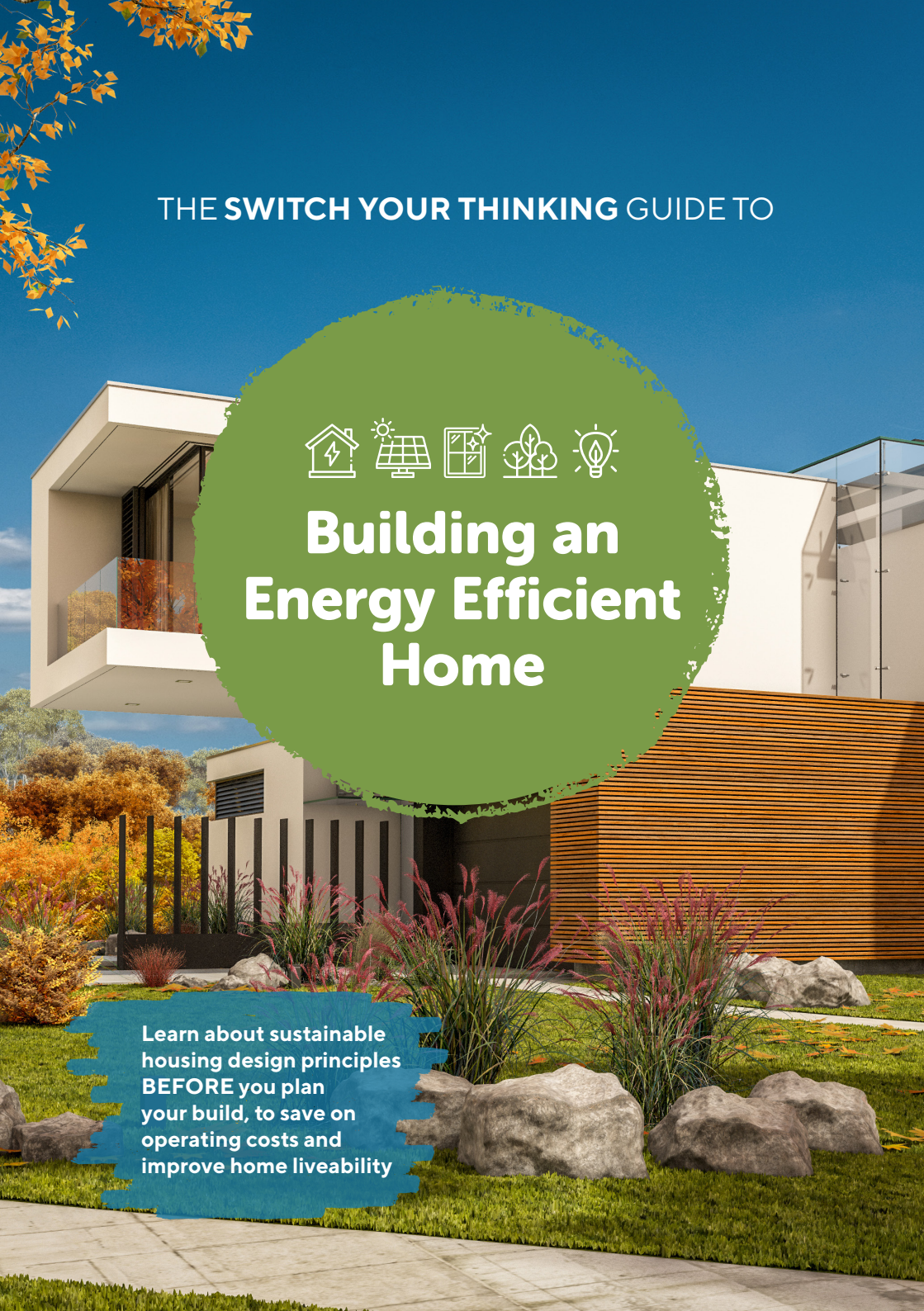
THE **SWITCH YOUR THINKING** GUIDE TO

Building an Energy Efficient Home



Learn about sustainable housing design principles BEFORE you plan your build, to save on operating costs and improve home liveability

What's in this guide?

The largest investment most of us will make is the purchase of a home. No matter whether you are building or buying, your ongoing operational costs will be largely determined by the building's initial design, fixtures and fittings. This guide will help fast-track your understanding of sustainable building design. These changes may cost more initially but could save you thousands of dollars in the long-run.

This guide is created for people living in sub-tropical Western Australia, and although many of the tips will apply to all homes, the location of your property may impact upon anticipated outcomes.

What is an energy efficiency rating scheme?

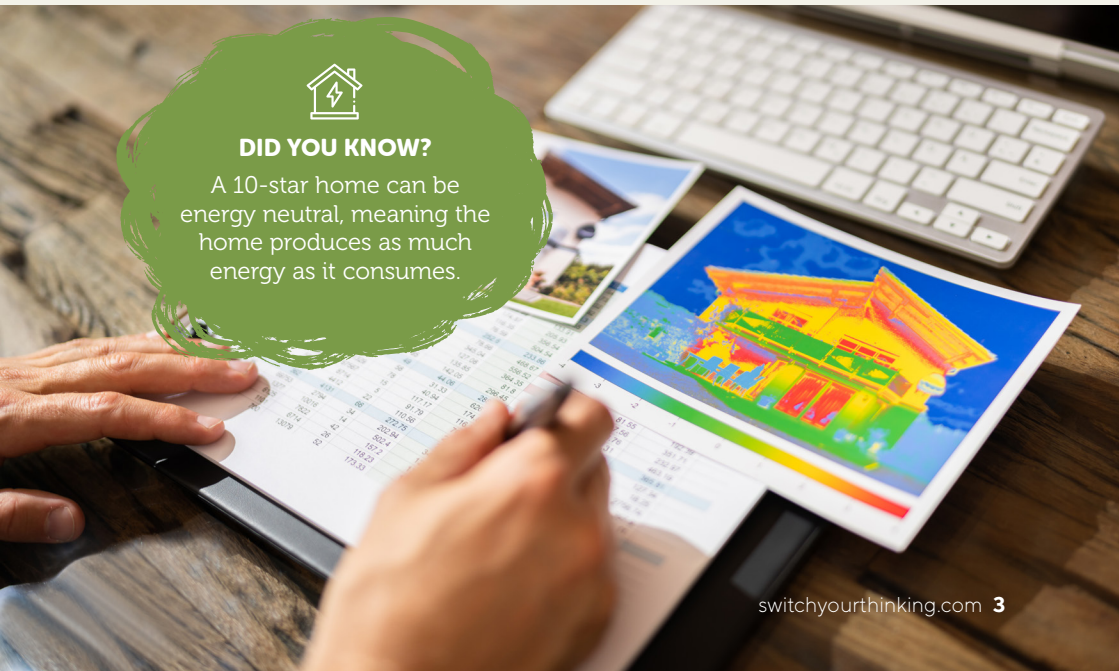
NatHERS (Nationwide Home Energy Rating Scheme) is a certified rating system (1-10 stars) and assessment tool that rates the energy efficiency of a home design. The higher the rating, the more energy efficient, resilient, and liveable a home becomes. Every effort you put at the design stage will pay off in the long run through reduced operating costs.

Building plans submitted for Local Government approval must include a report that demonstrates the energy efficiency of the building. From May 2025, all new homes must achieve at least a 7 star energy efficiency rating.

Discuss with your builder how you can achieve the highest rating possible for your home. Designing an energy efficient home during the building stage is far cheaper than retrofitting an existing home.

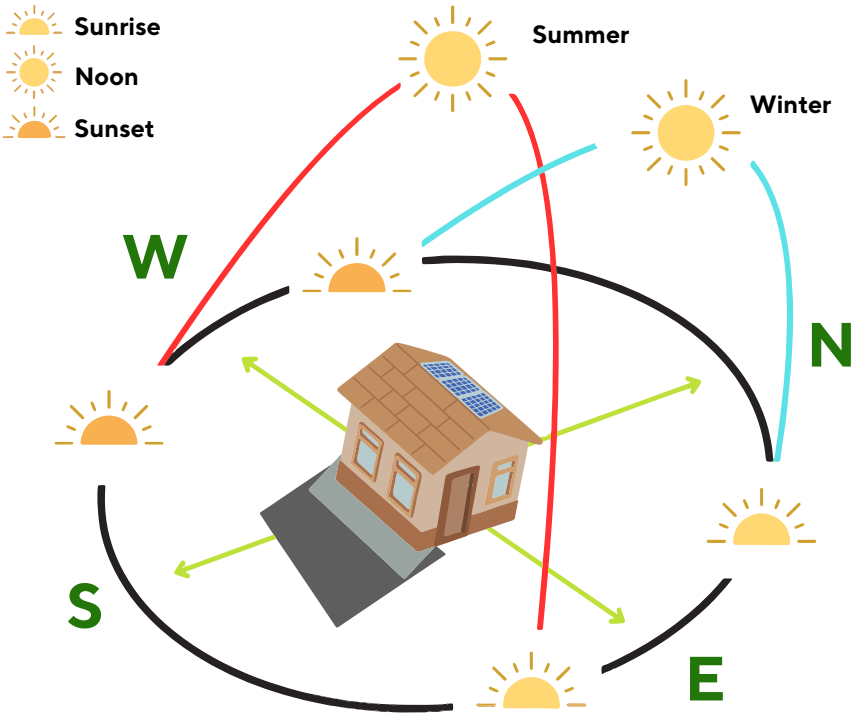
You can increase the energy rating of your home through some simple design changes or small additional investments. Research all available options before finalising your home building plan.

Switch Your Thinking recommend you consult a certified home energy assessor to check the proposed design.



The free online resource, www.yourhome.gov.au provides guidance on creating sustainable homes from the planning stage to completion.

The trajectory of the sun throughout the year has a big impact on the comfort of your home.



Passive solar design

A home designed with passive solar principles will reduce the need for external heating and cooling to make your home comfortable.

Site selection and orientation

In sub-tropical Western Australia, a block and building elongated in an east to west orientation will maximise a home's passive solar benefits. This will enable you to build an energy efficient home without making costly modifications after construction.

Positioning of rooms

Passive solar design is all about how you orient your home and your living spaces. To design a solar passive home in WA, you should have the most frequently used living areas, such as the kitchen and lounge room, to the north, and minimal windows on the east and west sides of your home.

You can find free examples of energy efficient home design on the Your Home website.

HOT TIP!

To use the thermal mass and thermal lag of concrete to your advantage, place concrete slabs where they are shaded during summer and exposed during winter.

Building materials

Try using energy efficient building materials such as concrete, re-purposed wood, reverse brick veneer, hempcrete, natural stone or mud bricks. When considering building materials, look for those which have a high thermal mass and long thermal lag.

Thermal mass and thermal lag

Thermal mass is defined as the ability of a material to absorb, retain and release heat. Thermal lag is a measure of how quickly the material absorbs and loses heat. Bricks and concrete have high thermal lag and can improve the thermal performance of your home.

Two options worthy of exploring are:

Reverse brick veneer - Bricks are placed on the inside of the frame instead of outside to increase the thermal mass of the building.

Hempcrete - A construction material made from a mix of hemp, lime binder and water. Hempcrete is breathable for improved indoor air quality while still having good insulation and heat retention properties. It can be purchased in block form.

Recycled materials

Consider using low carbon concrete that contains less cement and recycled concrete which is reprocessed from concrete waste.

The above options may cost a bit more but will make a massive difference to home comfort and long-term operational costs. Take some time to research what may work for your home build.

Roof and roof colour

No matter whether you choose clay, concrete or metal for your roof, opt for a lighter colour. A light coloured roof will make your home 5°C cooler on a 40°C day – providing better liveability and reduced reliance on artificial cooling.

Sarking

Sarking is a reflective film which is placed under tiles or roof sheets to provide insulation and to stop moisture entering the roof space. Sarking also provides thermal, fire, dust and noise protection.

DID YOU KNOW?

Reflective sarking installed in your roof can reduce energy used for cooling by up to 30%.

Home eaves

Heat can enter your home through unshaded windows. Hot brick walls can also stop your home from cooling down in summer months in the evening, requiring increased usage of air-conditioners.

Broad eaves shade windows and walls from direct sunlight. To block the hot summer sun, the width of the eaves should be 45% of the height measured from the bottom of the window to the top of the eave. In winter, extended eaves can shield windows from rainfall.

Insulation

Insulation is a building material which reduces the flow of heat and sound between two surfaces. Insulate your home to reduce the amount of internal heat during summer and minimise heat loss during winter. Properly insulating your home will therefore reduce your energy bills for heating and cooling.

The thermal resistance of an insulation material is represented by its R-value. The higher the value, the better its insulation potential will be.

Make sure insulation is properly installed without any gaps around structural beams and light fittings.

Wall cavity insulation

Wall cavity insulation tends not to be included in double-brick wall construction. Insulating wall cavities will stabilise internal temperatures throughout the year.

Roof insulation

Choose insulation with a R value of 5.0 or more to provide greater insulation performance at minimal additional cost. There are different types of insulation products available on the market:

- Loose fill types (blow-in).
- Bulk insulation material (batts).
- Rigid materials (foam boards).
- Expanding spray foams for spaces such as ceilings, roofs, or walls.

The energy star rating of your home will increase with the installation of a solar energy system.

Solar panels and battery

Solar panels are now the cheapest form of energy for homes. A typical solar system (6.6 kW with a 5 kW inverter) will cost approximately $4000 and save around $1,000 a year. If you are yet to install solar, consider a larger system to accommodate for future electric vehicle use. Consider getting 3-phase power as a part of your build to support installation of a larger system.

To get the maximum benefit from your solar energy system:

- Choose the right number and capacity of panels to suit your needs.
- Use electricity when the sun is shining – washing machine, pool pumps etc.
- Install a battery to store extra energy generated while the sun is shining.

Electric vehicle charging at home

Electric vehicles are far cheaper to run than cars which use fossil fuels. If your home has a solar energy system, charging vehicles at home can cost even less. Electric vehicles also cut fuel related greenhouse gas emissions. Installing a home EV charging unit may require a switchboard upgrade. Discuss with your installer what the most appropriate size charger is for your needs.

Go fully electric!

Why you should give gas a miss:

- Gas is the least efficient method for cooking with 60% of the energy wasted through the open flame and leakage. Ceramic glass and induction cooktops are more efficient with only 26% and 16% energy wasted respectively.
- Gas heaters and stoves can emit harmful pollutants such as carbon monoxide inside the home.
- By switching to an all-electric home you can save money on the ever-increasing price of gas and on service charges.
- Rewiring Australia's website further explains why getting off gas makes sense. Visit: www.rewiringaustralia.org

Worried about cooking when there is a blackout?

For the rare occasions when your home loses power, fire up your barbecue, use a portable gas cooktop or a plug in electric stovetop with a battery pack. Even some electric vehicles can be used to power appliances!

The free getting off gas toolkit can help you make the most appropriate choices for your build or home renovation. Go to www.gettingoffgastoolkit.com.

Windows and window treatments

Glass windows and doors transmit significant amounts of heat in and out of the home. When designing your home, prioritise windows on the north side and minimise windows on the east and west sides. This will allow you to get maximum warmth in winter and prevent heat entering your home in summer.

If this aspect of home design is done right, you're also less likely to need to switch on artificial lights during daylight hours.

Things to consider when positioning windows:

- Size of the block
- Orientation of the block
- Position of various rooms
- Presence of trees or other buildings nearby

Window tinting

Window tinting is more economical than double glazing and e-glazing. It can be selectively applied to windows, even after the home is constructed. Products such as thermal films have a similar effect as window tinting in that they block heat transfer but allow natural light in.

Double glazing and E-glazing

Double glazed windows make it easier to maintain internal temperatures by reducing heat transfer. They are constructed with two panels of glass with air or gas such as argon in between them. This provides insulating and noise dampening benefits for your home. However, double glazed windows will add significantly to the cost of your build.

E-glazing can produce similar results to double glazing at a fraction of the cost. E-glazing is a special coating applied to one side of a window pane to prevent infrared and ultraviolet light entering into the home, whilst allowing plenty of visible light in. As a result, heat passage is reduced.

Window coverings and natural light

Indoor window coverings

Invest in quality window coverings, to prevent heat transfer. Block-out curtains, pelmets over curtains and window shutters provide the best protection, whereas unlined blinds and lace curtains provide little benefit.

Skylights

Ask your builder to install solar skylights in high use rooms such as the kitchen or bathrooms to provide free light during the day.

Blinds and shutters can be left open in winter during the day to allow warmth to enter through windows.

Honeycomb blinds feature air pockets between two layers of fabric which helps block heat and reduce external noise by 50%.

Draught proofing and ventilation

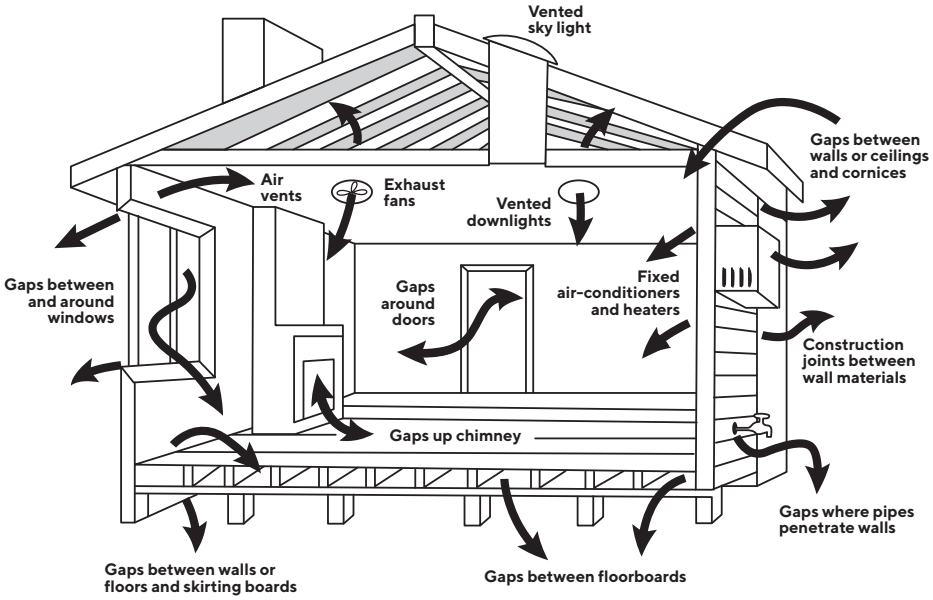
A draught is a current of air that moves through gaps in the structure of your home, while ventilation helps to bring fresh air flow in through open doors, windows and exhaust fans. To stop draughts, your home should be airtight. Install seals around windows and doors, and if installing floorboards, be sure to seal any gaps.

Strategically position doors and windows to allow air to travel from one side of a space to the other. Install bi-directional ceiling fans to encourage air movement. Reduce heat build up by plumbing rangehood and bathroom exhaust fans to the exterior of the home rather than into the roof space.

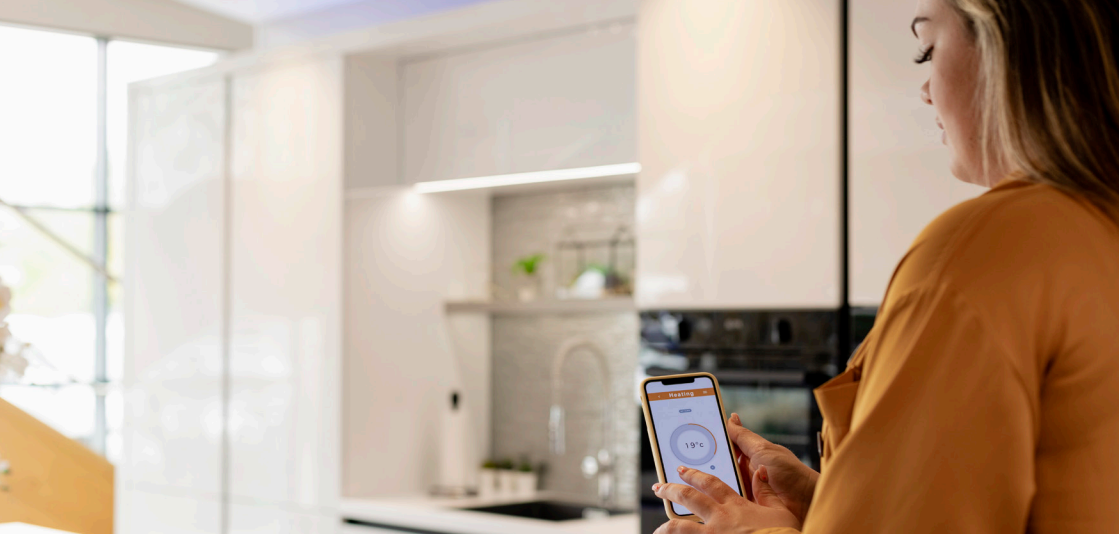
HOT TIP!

Draught proofing won't cost much but can reduce heat loss in winter by 25% and result in huge savings in heating costs.

Common air leakage points



Source: Sustainable Energy Authority Victoria



Energy efficient appliances and fixtures

Energy efficient appliances may cost a little extra upfront but they can reduce your energy bills over the life of the appliance by up to 15%.

Choose energy efficient appliances and fixtures that have in-built timers so they can be programmed to run during the day when your solar panels are generating electricity.

Go to www.energyrating.gov.au to find out how much you can save by using energy efficient appliances.

Hot water

Water heating accounts for about 21% of average household energy use. The most energy efficient option is a heat pump hot water system paired with a renewable energy source.

Hot water heat pumps are 2-3 times more energy efficient than gas or electric hot water systems since they transfer heat rather than generating heat using electricity. Program the unit to heat water during the day for free with your solar. This will minimise water heating costs over a 24 hour period.

Solar hot water systems also are extremely energy efficient but they usually require gas or electric boosting in the winter.

Both hot water heat pumps and solar hot water systems are eligible for Government rebates at the time of purchase.

Heating and cooling indoor spaces

Ceiling fans

Ask for the inclusion of ceiling fans as part of the builder's package. Ceiling fans cost only 2 cents per hour to operate. Use ceiling fans as your first cooling option, and air-conditioners only when absolutely required on hot days.

Reverse cycle air-conditioners

Installing reverse cycle air-conditioners in separate rooms is a far more energy efficient option than ducted refrigerated or evaporative systems. Rooms can be cooled or heated as required rather than wasting energy in unoccupied rooms.

Avoid evaporative air-conditioning systems as they require a lot of water to run and are not effective in humid weather.

Cooking with electricity

There are many great alternatives to gas cooking. These include ceramic glass and induction cooktops, electric ovens and portable electric woks. Rest assured, there is a gas free option for your kitchen!

Induction cooking works through the creation of a magnetic field, where the cooktop surface and the cookware act as the heating element itself. This allows for faster cooking, using less energy and minimal heat wasted.

Many chefs are moving to induction cooktops because they have superior temperature control, rapid heat response, reduced need for extraction fans and they are safer to use.

Induction cooktops require stainless steel or cast iron cookware to work. If a magnet sticks to the bottom of a pan, it will work on an induction cooktop.

Lighting

LED lights

Choose good quality LED lights for your indoor and outdoor spaces. Ask your builder to include LED lighting as part of your building package.

Solar powered LED skylights

Solar powered LED skylights look like a normal light but are powered by a small solar panel for daytime use.

Unlike a traditional skylight, these lights do not require any structural changes to the building.

Benefits of LED lighting:

- They operate on very low voltage and produce almost no heat.
- There is close to no UV radiation unlike halogen and fluorescent globes.
- They are less likely to cause fires.
- They are ecologically friendly i.e. no mercury.
- They have a long lifespan.

Smart technology

Many appliances now come with additional programming capabilities that allow you to further improve energy efficiency in your home. From delayed start functions on your washing machines and dishwashers, to automatically switching off devices that aren't in use to reduce stand-by power.

Using smart tech for lighting is another way you can reduce your energy bills by:

- Controlling lights individually and in groups.
- Remotely dimming lights.
- Programming lights to come on and off as required.
- Having lights turn on as your phone comes within range of the home.

LED lights use at least 75% less energy and last up to 25 times longer than incandescent lighting, An LED light can last up to 25,000 hours compared to a fluorescent light that lasts approximately 8,000 hours.

Outside the home

External shading and vegetation

The shade created by trees, verandahs, shutters and adjustable awnings is very effective in reducing heat in summer and protecting windows from cold winds in winter.

Having trees and shrubs will reduce the urban heat island effect, provide habitat for wildlife and increase the amenity value of your home.

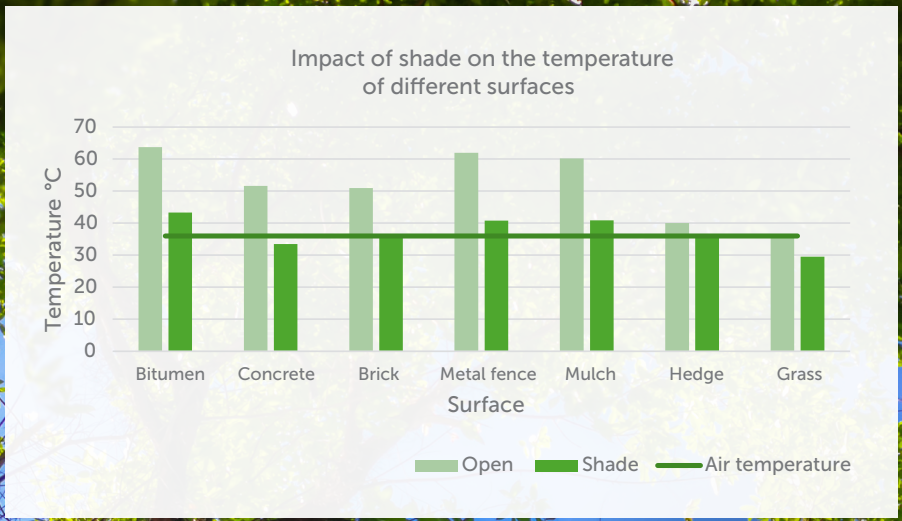
Whenever possible, retain existing trees on the property and use plants native to your local area to support the local ecosystem.

How to green your home

Plant deciduous trees or shrubs to shade the east, west and north facing windows from summer sun.

Install frames on your outside walls to allow for deciduous vines and cover fences with creepers to stop heat from radiating into your home. For added benefit, you can also plant hedges around the border of your home.

Use natural turf over fake lawn and reduce the amount of hard artificial surfaces close to your home. Adding potted plants is another great way to increase green spaces both inside and outside your home.



Other tips to reduce energy use

Once you have done everything possible to design and build your home to maximise energy efficiency, there are still other things you can do to reduce your reliance on artificial heating and cooling while you're living there.

To make sure that you aren't wasting energy when using your air-conditioner, remember to regularly clean the filters and close any open doors and windows.

Tips to keep cool in summer:

- Switch off non-essential electrical appliances when not in use.
- Use ceiling fans and only use air-conditioning when necessary, setting it at 24 °C or warmer.
- Wear clothes made from natural fibres (cotton, hemp, wool) and avoid cooking indoors on hot days.

Tips to keep warm in winter:

- Run ceiling fans in the opposite direction in winter to push warm air downwards.
- If using a heater, set it between 18-20 °C and only heat the rooms you are in.
- Rug up with warm clothes, blankets, and heat packs.
- Consume warm drinks and hot food.

Checklist for an energy efficient home

Block selection and home positioning

- [ ] Choose a reputable builder who can design homes above a minimum 7 star energy rating.
- [ ] Select an east-west elongated block. Most used rooms (kitchen, lounge room etc) in the north.

Home design and structure

- [ ] More windows on the north side of your home, less on east and west. Invest in tinting or double/e-glazing.
- [ ] Insulation of R-value 5.0 or higher.
- [ ] Install exhaust fans and roof ventilation.
- [ ] Position doors and windows to enable a cross breeze.
- [ ] Seal gaps around doors and windows.
- [ ] Include wide eaves (45% of the height from the bottom of the window to the outer edge of the eave).
- [ ] Light/pale roof colour.
- [ ] Install awnings or external blinds.
- [ ] Install natural or LED skylights.
- [ ] Place your washing line on the north for more sun.

Home energy and appliances

- [ ] Install a solar energy system that suits your current and future needs. Ensure your switchboard has sufficient capacity to allow for electric vehicle charging.
- [ ] Install induction or ceramic glass cooktops and an electric oven.
- [ ] Install LED lighting throughout. Consider smart tech for added benefits.
- [ ] Select appliances with a high energy efficiency rating (dishwasher, fridge, ovens etc). Opt for a hot water heat pump.
- [ ] Install ceiling fans and reverse cycle air-conditioning.

Landscaping

- [ ] Plant deciduous vines/trees on the east, west and north sides of the home.
- [ ] Cover fences with hedges, climbers or large potted plants.
- [ ] Avoid artificial turf.

Verification and improvement

- [ ] Get your design assessed by an independent energy auditor to find out if it meets the star rating you agreed to and any more improvements you can make.

SWITCH
YOUR THINKING

switchyourthinking.com

Switch Your Thinking is a joint initiative of the City of Armadale, City of Gosnells and Shire of Serpentine Jarrahdale working together as the South East Regional Energy Group.

SwitchYour Thinking are proud to have considered the environment in the printing of this handbook. It has been produced on carbon neutral paper that is manufactured using post consumer waste recycled and FSC certification mix paper.