

Reducing Your Energy Use:

Heating & Cooling - Insulation

The first step is draft proofing and ventilation. Keeping in the air you have made warm, and using cool night air and breezes to cool a hot house are the cheapest options.

✓ Sealing gaps around windows, in the joints of door frames, and at the bottom of doors with foam tubing, stick-on tapes, and simple stuffed tubing. ✓ Sealing up or installing self closers on vents and exhaust fans. ✓ Boarding up or hanging heavy curtains over unused fireplaces and wall air-conditioners vents. ✓ Covering floors with carpet or rugs.

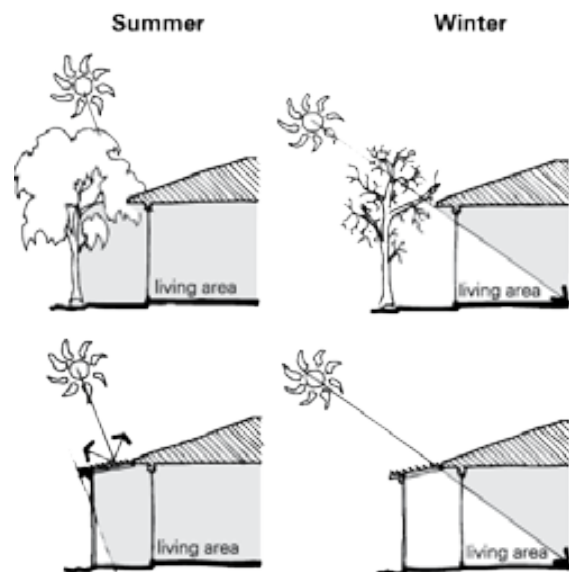
The next big step is ✓ Insulating the ceiling space to R4.1 standard ✓ Clean and replace loose fill cellulose, glass or mineral fibre batts, or wool batts that have degraded and collapsed losing their effect. ✓ Install polyester batts made of recycled materials, stay firm over time, and don't attract rodents. ✓ Ensures all the ceiling is covered, wiring is above the batts or protected in tubing, and light fittings are matched to suitable above ceiling guards and covers. ✓ Insulate external walls to R2.4 minimum, and under floor spaces to R2.25 in stiff non-sag batts.

Heating & Cooling - Ventilation & Shading

Orientation

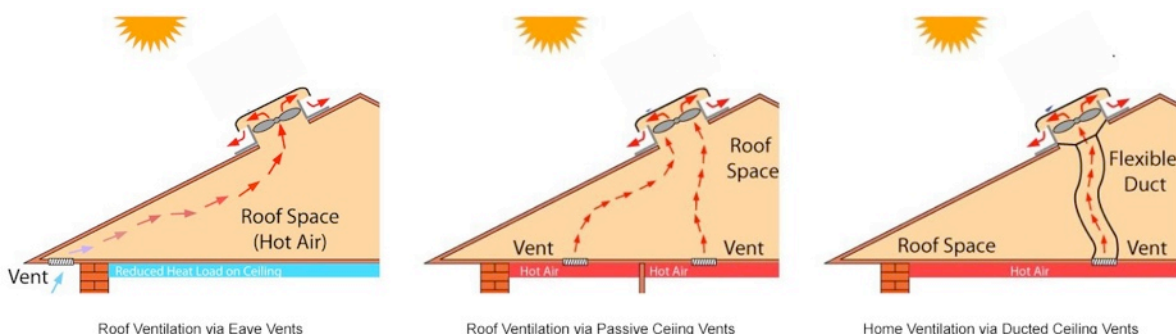
The angle the sun strikes the earth is high in Summer and low in Winter. ✓ Install shade trees, verandahs, and wide eaves to keep out the heat in Summer and let the sun heat the house in Winter. Works for North facing walls and windows. For East and West facing walls and windows the morning and evening sun is low in the sky and shines right in.

✓ Install pull down outside blinds, vertical shutters, or plant deciduous shade walls. ✓ Rearrange how you use rooms. It might be cheaper in the long run to convert the bedroom into the kitchen living space than to install a massive air conditioner.



Ventilation

✓ Fit opening vents up high in walls or window spaces, to allow for cross flow ventilation after hot days, and through cooler nights. ✓ Budget for more expensive options like solar powered roof space ventilation systems.

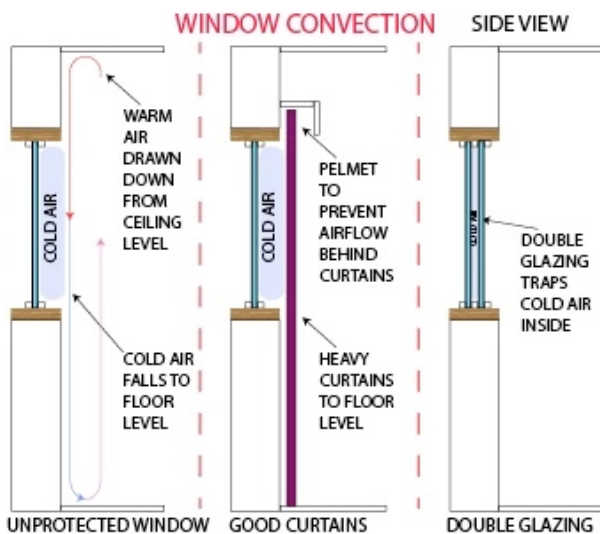


Roof Ventilation via Eave Vents

Roof Ventilation via Passive Ceiling Vents

Home Ventilation via Ducted Ceiling Vents

Heating & Cooling - Windows and Glass



Ordinary single pane glass lets a lot of heat flow both in and out. In summer, one square meter of glass, in direct sun, can transfer as much heat as a 1,000 watt bar radiator.

Be careful with external shading or blinds that are close to the window, a problem with roller shutters and security shutters. Without some ventilation across or out from the top, the air behind the blind can become very hot and transfer heat through the window glass.

✓ **Curtains** that reach to the floor and have sealed pelmets - boxes that hide the curtain rail and seal off the top of the curtain.

✓ **Double Glazing** - using glass or clear plastic to make a second internal window that works using the trapped air layer as a form of insulation. Does not stop sunlight heating up the inside so shading is still needed.

Double Glazing Options

- ✓ Easiest is to cut out to fit, and temporarily install on the inside, a perforated foil-coated paper sheet. These reflect back around 80% of the light and heat. You can still see out, and one more skillful option is to make them into roller blinds.
- ✓ Low cost option is to install a DIY clear plastic film making an air gap on the inside. This comes in kits with thick profile, double sided, tape (makes the gap) and the film heat shrinks to a firm clear finish using a heat gun or hair dryer.
- ✓ Expensive option is to use fly screen kits to make window inserts and then glue and shrink the film to this frame. These are easier to remove for window cleaning and at times when the weather is mild.

Finally, there are commercial, custom made, internal fitted frames with glass or acrylic panes, and full replacement double glazed windows (frames, glass, and mechanisms). These can provide some sound-proofing as well, but are expensive solutions to heating and cooling problems alone.

Heating & Cooling - Appliances

- ✗ Portable electric heaters are cheap to buy, but expensive to run for more than brief periods.
- ✓ Tackling drafts, ventilation, and insulation, and closing off areas that don't need heating are good strategies, as is warm clothes, personal rugs, and hot water bottles.
- ✓ Personal fans work by creating evaporation on your skin which cools you physically. Evaporative Central Cooling and Split System Air Conditioner systems cool the air first, and then blow it around the house.
- ✓ Creating smaller personal comfort zones and not trying to heat or cool the whole house, will be the cheapest and most energy efficient. Mini-zone air-con units are available.

Lighting

Lighting can use between 6-8% of your energy bill. Your audit maybe highlighted legacy bulbs and outdated systems with nests of low-voltage halogen downlights.

Things to consider when making a change:

- * **watt** relates to electricity used to run, and is an indicator of the heat when running
- * **beam angle** is the spread or width of focus of the pool of light. A tight beam is good for task activities like cooking, reading, and crafts etc.
- * **temperature** like 2,700 (warm light) or 4,000 (cool light) to 6,000 (day light) indicates how harsh or sterile the light makes the space look. Warm suits living spaces, but a bathroom, laundry, or dedicated kitchen might be better with cool or daylight.
- * **colour rendering index** - not common data, but 100 means true colour, while 70 or less makes everything look washed out and dull.
- * **dimable** - handy to change the total brightness and the colour in a room, but many fluorescent and LED bulbs can not be dimmed - check first.

✖ **Halogen** - generally used as down-lights with a narrow beam angle, cheap to buy but expensive to run - 4 x 60W = 240W - to light a space that one exposed compact fluorescent bulb (23W), or single LED bulb (7W) could match. ✖ Recessed, or set into the ceiling, run hot and a 100mm minimum space must be left free of insulation in the roof space, often doubling your heat load in summer.

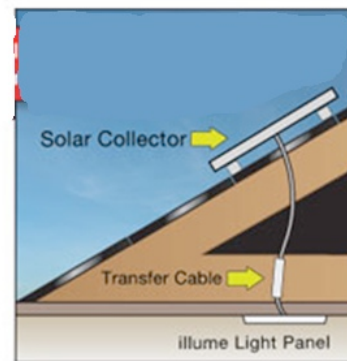
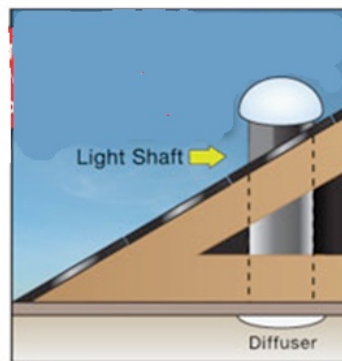
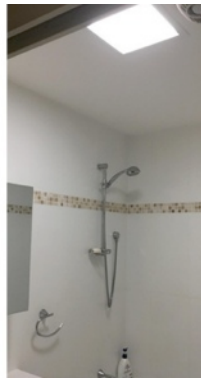
✓ **Fluorescent Tubes** and bulb like **Compact Fluorescents** - use less electricity than old incandescent bulbs or halogens, run with less heat, and typically produce cool to daylight temperature light. They rarely dim, and have a wide beam angle. They can be recycled if not broken - ✓ many councils have tube collection points. But if broken, they must be treated as mildly toxic and any internal dust collected using sticky tape, and a dust pan or stiff cardboard collector, then wrapped and sealed and delivered to a transfer station.
✖ Never vacuum up a broken tube or bulb as the dust contains mercury.

✓ **LED** - Light Emitting Diodes - are made up of small light spots, wired together, so they can be built into ordinary bulbs, or standard tubes, or as strips of lighting and special fittings. They can be designed as narrow or wide beam angle, to cover a range of temperature settings, be dimable, and while needing transfer station end of use recycling, wear out but rarely break. They can last 15 times as long as a halogen and 5 times as long as a fluorescent.

Lighting - Taking Steps.

- ✓ Buy LED bulbs and tubes to replace your halogen and fluorescent lights. Some halogens need the bulb only replaced, some the entire bulb and reflector unit, and some need their 12v power supply in the roof space changed - ask for expert advice first. It might be better to remove them altogether.
- ✓ Look at lighting patterns. Do you have to turn on all the lights to have a meal? Would a set of single lamps, or an under bench LED strip, provide enough light instead? Can some light switches be replaced with timer switches, or motion detector switches, or controlled by opening cupboard doors?
- ✓ **Solar Light Shafts** with a collector, mirrored tubing, and ceiling diffuser can be installed through the roof, as can larger domed roof skylights.

✓ Combination of dedicated solar panel, wiring, and LED light panels mounted on the ceiling. These can mimic real sunlight and are easier to install, even in multi-storey apartments and rental dwellings



The basic single panel kits are very low voltage and can be DIY installed. There are also electrical trade kits that allow multiple connections, replacement down-lights as well as flat and round panels, mains powered evening lighting, timers, and controller options. Technically, with a battery, you could install a full off-grid lighting package.

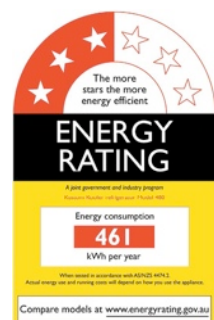
Cooking & Appliances

Cooking, Appliances, Games and Entertainment can be a third or more of your domestic energy needs. And a third of that third can be from leaving things on stand-by - not running, but still powered and waiting for a quick start next time.

✓ **Step One** - turn things off completely, install remotely controlled power boards for hard to reach setups. Install power plugs timers to shut off power for long cycle appliances like washing machines, slow cookers, and other self timed processes when they finish.

✓ **Step Two** - choose the most energy and water efficient appliances that suit your needs. Don't buy anything larger, or generally more, than you need. Refrigerators and freezers have a 10 star rating system - everything else 6 star range.

✓ **Step Three** - plan ways to cook and use appliances effectively. **Fridges** and freezers work best in cool places with good rear ventilation. Some with hidden coils need side ventilation too. Check the fridge is running at 3-5 C and freezers at -15 to -18 C, and that both are only 80% full and not close packed with items.



Front load **washing machines** are generally more water and energy efficient, and spin clothes a little dryer, but some models heat the water internally and are very energy hungry despite the star rating. ✓ Wash full loads, or use the half load button. ✓ Use cold water cycles with liquid soap as powder needs warm water to dissolve properly.



✓ Small fan forced bench top **ovens** or convection microwaves can use less energy than a large oven. Multi basket steamers are efficient stove top options. ✓ Plan meals ahead and think about extras for next day leftovers or lunches.

✘ Clothes Dryers use as much electricity as a 3 bar radiator ✓ install a clothes horse or drying rack inside or under cover outside and ✓ use a fresh air clothes line when you can.

✘ Dishwashers use electricity to heat water for the cycle - use only for full loads.

Hot Water

✘ **Electric Storage Hot Water** systems are the most energy hungry. All States except Tasmania are banning them in new buildings. NT & QLD still have some exemptions. These use a large element like an electric kettle, and in older installations were only powered at night or other off-peak times. Most now heat anytime the stored water cools.

✘ **Gas & LPG Storage Hot Water** systems are also inefficient and high energy uses. They are only partly insulated to allow for burnt gas exhausts, and heat anytime the water cools.

✘ **Gas & LPG Instantaneous Hot Water** systems heat water as it is used. Non-renewable and carbon intensive, this is fairly efficient when used in blocks - 3 min shower, filling a kitchen sink or washing machine, but poor for short rinses or hand washing with gas wasted firing up the boiler, and with heat loss in the pipes.

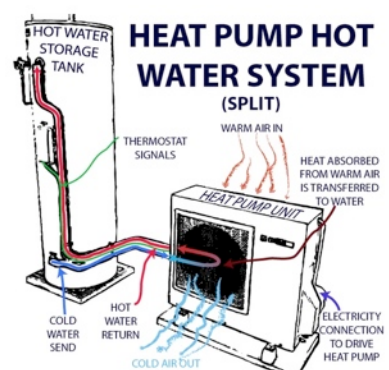
✓ **Solar Hot Water** systems come in many forms. Water requires as much as 4 times the energy to rise 1 degree as most materials and solids, so using renewable sunlight is the most efficient method possible.

Two main types - **flat solar panels** - pipes in an insulated box with a glass front. Simple and cheap, the sun heats the pipes and they heat the water flowing through them. The water passes to an attached storage tank. Some have a split system with a thermostat controlled pump managing the water flow. - **evacuated tube** - these have double wall glass tubes like a thermos. The sunlight passes through but once it hits the inside wall it turns to heat and cannot escape, making this very efficient, especially in cold air conditions. These also come in split and syphon type storage systems.

✘ Both systems need gas or electric booster elements in the storage tanks for cloudy days, the low angle winter sun, and high demand situations.

✓ **Heat Pump Hot Water** systems use the same technology as a fridge or air-conditioner to draw in outside air, compress it to extract the heat, use the heat to warm water which is cycled through a storage tank, ready to use, and pump out the cold air. The heat exchange part can be a separate unit or built onto the storage tank case.

The heat pump technology is very energy efficient as the electricity only drives the compression pump and not heat the water. 1 kW produces 4 kW equivalent hot water. A good system runs in the middle of the day for 1.5-3 hours (can use your solar power) and stores up to 3 days of hot water with no extra booster element.



Solar Power & Renewables

✓ **Green Power** (www.greenpower.gov.au) is an option you can pick with your electricity supplier, that requires them to buy renewable power to match your usage. It costs slightly more but means your house or business has a 100% renewable energy source.

✓ **Domestic Solar Power** - roof top solar panels (PV panels) are connected to the main grid supply through an inverter. This take the DC electricity from the panels and converts it to AC electricity of the same frequency as the mains grid. This pool of power is then used in the house. The smart meter measures what power flows out through the day, and back in during the night and low light periods. Your electricity supplier bills you the nett power inwards, with a rebate for nett flows out (feed-in-tariff)

There are often incentives schemes running in each State to encourage renewables - check your State, and talk to registered solar installers about your options

✓ **Domestic Wind Power** - is limited because the wind turbines need unbroken, constant, wind, and they do generate some noise. They do suits rural homes and operate 24 hours

✓ **Solar Power Schemes** - some councils are supporting schemes where landlords get incentives (loans, rebates) to install roof top solar in rental properties. Another option is to buy shares in commercial solar farms and get a rebate on your bill based on the farm's feed-in-tariff, and in some regions, be part of a community solar or wind farm project. A very recent option is to use block-chain technology to buy and sell electricity on a virtual grid and have that added to your normal supplier's bill.

✓ **Domestic Batteries** - roof top solar and wind generation can include a battery storage option. These are mostly large Lithium-Ion batteries with a built in controller. They are charged from your solar or wind system, and resupply the house when needed. They don't feed back out to the grid. They can be designed to supply a few days without recharging.

There are complex installation regulations and fire safety rules - it is essential you get a complete assessment and quote from registered installers, including a power used to battery capacity assessment. Battery size and amount of available power is not the same.

