



# NEW HOME BUILDER'S AND RENOVATOR'S ENERGY CHECKLIST

(Extended Version)

The expected lifespan of a new residence in Australia is about 45 years, although many houses last longer. So building a new home, or renovating, is an investment in both the present and the future.

When designing your home or renovation, it is important to consider not only comfort and aesthetics, but also the dwelling's ongoing energy and water consumption through time. We use energy throughout our home. From heating and cooling, hot water heating, refrigeration, lighting to cooking and appliances. The way the home or renovation is designed and built will have a significant impact on the quantity of energy used and the associated cost of these services.

Careful design of your home or renovation with energy and water savings in mind from the start can provide you with benefits such as **greater comfort** and **lower energy and water bills**, so thank you for taking the time to learn a little about how to build a more comfortable energy and water efficient home.

### Design features that minimise heating and cooling

In a typical Canberra home, 60% or more of the energy consumed goes to heating and cooling. There are a number of design features that can reduce ongoing use of energy to heat/cool:

**House size and configuration:** The larger the dwelling, the more space there is to heat and cool, and the more the house will cost to build and run. To keep your mortgage and ongoing bills down, **build smaller**, more efficient houses.

- Designing a house large enough to suit your needs whilst using clever spatial design to keep it to a reasonable size, will reduce your mortgage and ongoing energy bills.

- Slab-on-ground construction with slab-edge insulation and northern orientation will add to thermal stability to your home.
- If you are installing central ducted heating or cooling, the system should suit the size of the house, be zoned and flexible so that you can choose to heat or cool only those areas of the house that you are using.
- Designing your house in compartments that can be sealed off for heating and cooling purposes, in combination with zoning, is far more efficient than a larger space that cannot be sealed off.
- Beware of high ceilings – they can increase heating/cooling costs.
- If you are building a two storey home, incorporate a closed stairwell so that downstairs heat is not lost as it flows upstairs.

**Passive solar design:** In winter the sun is low in the northern sky, to maximise passive (free) heating for your house, it is best to face living areas (where we spend most of our time) to the north. Install plenty of north-facing windows to let in the sun and passively heat the house.

- If possible, northern windows should shine onto areas of internal thermal mass, such as an exposed concrete slab floor or trombe wall. Thermal mass stores the sun's heat and releases it after dark, providing you with free warmth in the evening.
- Windows allow heat loss quickly in winter and heat gain quickly in summer. Prevent this with internal window coverings and shading.

**Wall design** - There are many different wall systems available, but ideally walls should consist of thermal mass (like brick or concrete) on the inside of the



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dwelling, with insulation and aesthetic cladding on the outside e.g. reverse brick-veneer.

- Thermal mass stores heat and moderates the interior temperature of a dwelling in all seasons.
- Insulation slows the rate of heat lost to the outside in winter and heat gained from the outside in summer.

**Insulation** - The effectiveness of bulk insulation (batts, loose fill, polystyrene board, etc.) is measured in R-values. The R rating simply refers to the insulation's *resistance to heat flow* - the higher the R-value, the better the insulation at stopping heat moving in and out of your home.

- Walls and ceilings should be insulated with as highest rated insulation as possible, ceilings with at least R5 and walls with R2.5.
- Underfloor insulation.
- Most new houses are also wrapped in reflective insulation, which acts as a mirror to radiated heat, it should be installed in the walls and under the roof trusses to reduce heat gain in summer.

**Windows** - Glazing allows heat to flow very easily (a typical aluminium-framed single-glazed window has a very low R-value of 0.17. This means heat will flow through it more than 10 times quicker than an R2 insulated wall!). To reduce heating/cooling bills and improve your comfort, think carefully about the placement of your windows.

- As a general rule, ample window space should be provided on the northern face of the house to aid in passive heating but ensure windows are adequately shaded in summer, and insulated internally with insulating window coverings to reduce heat loss in winter.
- Glazing should be minimised on the eastern, western and southern faces of your house to reduce heat loss in winter and heat gain in summer.
- Double glazing will reduce the rate of conducted heat loss/gain from windows, but may be expensive and if you can only afford to double glaze some windows it is best to prioritise the living areas.

**Internal window coverings** - As windows lose heat so quickly, it is advisable to install insulating internal

window coverings such as blackout drapes, heavy Roman blinds, or honeycomb blinds.

- Internal window coverings should be designed to reduce the rate of heat conducted through the window coverings themselves - this means blackout backing and as many layers of fabric as possible. Two layers is good, but adding a third layer (such as felt) between the aesthetic fabric and backing is even better. This will provide two air pockets and more insulating effect.
- Internal window coverings should also seal the air in the window reveal to prevent convection currents forming. This means curtains floor to ceiling or some form of pelmet on top, some way to seal the window coverings to the wall or reveal frame (such as velcro or wraparound curtain tracks) and coverings of an appropriate length.

**Shading** - Once the sun has passed through the windows it is absorbed by the things it hits and re-emitted as heat. Internal window coverings will reflect a little of this light back out the window before it is turned into heat. A far more effective way to keep your home cool is to externally shade any windows that allow in the sun.

- In summer the sun is high in the sky, which means it mostly falls on the eastern and western faces of your home, so those windows should definitely be shaded.
- Northern or southern windows may need shading depending on the situation (e.g. be aware of bright, reflective surfaces like concrete paths or paving next to windows).
- Eaves are built-in shading and should be at least 500mm but will not always be sufficient. Further shading can take the form of awnings, shade sails, verandas, pergolas or vegetation. Make sure vegetation to the north of the house is deciduous so that you still benefit from the sun in winter.
- Blockout fabrics like canvas stop the most heat from entering a house, while other fabrics like shade cloth partly reduce the heat build-up whilst still allowing some light in.

**Heating and cooling appliances** - There are five main factors that can determine your heating and cooling bills, three of which should be considered in the design of your home:



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- Consider the efficiency of the heater. Investing in an efficient heating and/or cooling unit will save considerable energy and money over time when compared with a less efficient unit. Solar passive, geothermal, gas hydronic (radiators), and gas ducted are some of the most efficient kinds of central heating systems. Fans/evaporative coolers are far more energy efficient than air-conditioning (up to 100W for fans, ~150W for evaporative, 5000-15000W for a/c!).
- Consider volume of air to be heated. It is inefficient to heat rooms that you are not using. Look at purchasing a central heating system with a variable speed fan/heat output which can be zoned – that is programmed to send heat to specific room/areas. This is far more efficient than heating the whole house every time you turn on your system. Also, vents/radiators should be situated away from windows, and for heating floor vents are generally more effective than ceiling vents.
- Consider the fuel used in the heater. Using gas for heating costs significantly less per unit of heat produced than electricity and produces between a quarter and one third of the greenhouse gas emissions depending on the relative efficiencies of the heaters in question.
- If you invest in solar, be sure to install a manual booster switch so that you can turn the booster off during the warm months when it is not needed.
- Group wet areas together to reduce dead water losses from long pipe runs to the hot water heater. If necessary, install a secondary gas instant hot water heater to service a distant ensuite.
- Electric heat pumps are far less efficient in cold climates - if possible, install solar or gas instant, but if you must install a heat pump make sure to invest in a model that operates under 0°C.

**Ventilation** - On most summer nights Canberra receives an east to west breeze, so designing your home with this in mind can help to purge heat build-up in the house overnight, making the house more comfortable and reducing or eliminating the need to use cooling.

- If you are building a two storey home, incorporate a closed stairwell so that downstairs heat is not lost as a result of air flow to the upstairs.
- Make sure that any fans/Tastics (bathroom, laundry, kitchen) are installed with draft stopping devices so that they don't act as chimneys and suck heat from your house.

### Hot water heating

In most cases, the most efficient hot water heating is (in order): gas-boosted solar, electric-boosted solar, gas instant, electric heat pump.

- Electric/gas storage hot water heaters are basically large kettles which keep water at 60°C, 24 hours a day, 365 days a year. As such, they are highly inefficient and should be avoided.

### Lighting

Technology around Energy efficient lighting is fast-moving and ever changing. The quality of compact fluorescent globes (CFLs) and LEDs is constantly improving while reducing in price.

- Using downlights and halogens should be avoided if at all possible. In general, they use a lot of energy, can be a fire hazard, reduce the effectiveness of your ceiling insulation, and are often not suitable for the lighting purpose to which they are put. Consider other fittings or lamps instead.
- CFLs last 7-10 times longer than classic incandescent bulbs and generally use a quarter or less of the energy.
- LEDs last up to 50 times longer than incandescent bulbs and use a fifth or less of the energy. However they do cost a lot more but over the life time of the bulb...
- If possible, external lighting should be sensor activated so that it cannot be accidentally left on. The same can be done with internal lighting, although be sure to invest in sensors with low standby power.

### Wiring and plumbing

Planning the electrical and plumbing systems in your house carefully in the design phase prevents systems ineffective being installed. You might consider the following:

- A time-of-use electricity meter in an easily accessible part of the home (such as kitchen or living room) so that you can monitor your energy



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consumption in real time, and change your behaviour accordingly.

- Two circuits within the house. The primary circuit, which is connected to lighting and most of the powerpoints, should have a master switch – this allows you to kill the power to most of the house easily at any time (such as when you are out or overnight). The secondary circuit, which might encapsulate the refrigerator powerpoint, a powerpoint in each bedroom for a clock radio and bedside lamp, and a powerpoint in the living room for a recording device (video, hard-drive recorder), is left on even when the master-switch is off. This configuration allows for minimisation of standby power and other energy wastage with minimum effort.
- You might also investigate the benefits of a home automation system.
- Wet areas should be located as close together as possible to minimise pipe runs and thus dead water losses. Distant wet areas can be fitted with dead water diversion systems so that water that would otherwise be wasted is instead diverted to a tank or garden dripper system.
- A low-volume dual-flush toilet with hand basin on top of the cistern (so that water used for hand washing is then used for flushing the toilet) is optimal.
- Investigating reuse of grey water and planning your plumbing accordingly is also a good idea.

If you would like more detailed information on any of these issues an excellent, easy-to-read place to start is the Your Home Technical Manual and the Your Home Renovator's Guide at:

<http://www.yourhome.gov.au/technical/index.html> and  
<http://www.yourhome.gov.au/renovatorsguide/index.html>

Finally, here are some **DEFINITE DON'TS**:

- DON'T install an electric storage hot water heater, as it is the least efficient way to generate hot water.
- DON'T install electric in-slab heating, which is extremely inflexible and inefficient and has the highest energy cost and CO<sub>2</sub> emissions of any heating system.
- DON'T over-glaze your home.
- DON'T put reflective surfaces in front of windows, or if you must, shade the reflective

surface or the window it will reflect into adequately in the summer.

- DON'T put holes in your ceiling insulation by installing downlights of any kind, or uninsulated skylights. If you are installing a skylight, make sure to double glaze at the roof and layer the diffuser at the bottom of the light well with 25cm+ of bubblewrap (which will mimic the insulation in your ceiling), then seal the diffuser with No More Gaps.
- DON'T neglect the issues explained in the body of this fact sheet! Addressing these issues during the design phase of your house will result in a more comfortable, more sustainable house which is cheaper to run.

### More Information

This fact sheet has been produced by the Home Energy Advice Team (HEAT) to provide you with some basic information on building and renovating.

If you would like to find out more information about this or any other topic to do with saving energy in your home, please contact us for a FREE technical consultation.