

Energy

Climate change is arguably the greatest challenge faced by humanity. Global greenhouse gas emissions from fossil fuel use continue to grow each year, despite attempts to limit them through mitigation and energy efficiency measures. The effectiveness of these measures has been largely offset by population growth and increasing uptake of more affordable electrical appliances. To deal with this challenge, important goals for housing include:

- achieving the significant reductions in greenhouse gas emissions required to limit global warming and sea level rise
- using renewable energy while managing demand and maintaining security of supply
- reducing travel demand and finding viable (post-peak oil) sources of energy for transport.

More background on these challenges can be found in the section *Housing*.



Energy use in the Australian residential sector 1986–2020. Data are projected energy use for 2012

| Household energy use | % |
|--|----|
| Heating and cooling | 40 |
| Water heating | 21 |
| Appliances and equipment including refrigeration and cooking | 33 |
| Lighting | 6 |

Source: DEWHA, 2008

According to the Climate Change website, Australian households are directly responsible for about one-fifth of Australia’s greenhouse gas emissions. The average household’s energy use generates over 7 tonnes of greenhouse gas emissions from its premises, which could be significantly reduced by:

- reducing energy use through good design, the use of energy efficient technologies, and behaviour that focuses on energy conservation
- using renewable energy sources such as solar and wind, which produce very few greenhouse gas emissions. Non-renewable energy comes from diminishing fossil fuel reserves and can produce significant greenhouse gas emissions. Most electricity comes from coal-fired power stations that release high levels of carbon dioxide and other pollutants into the atmosphere. Losses in the transmission system from the power station to your home also create inefficiency. Using natural gas results in only about one-third of the greenhouse gas emissions of grid electricity.

The articles in this section focusing on energy use in the home are complemented by information on reducing car dependency and choosing fuel efficient and low emission vehicles in the *Transport* article.

The average Australian home is responsible for around 7 tonnes of greenhouse gas emissions each year. These emissions can be greatly reduced by following the advice in this section.

Heating and cooling

Heating and cooling accounts for 40% of household energy use, making it the largest energy user in the average Australian home. However, very little energy is required to make a well-designed house comfortable, and mechanical heating and cooling should never be used as a substitute for good design. Install space heating and/or cooling only in the rooms that require it, or if you use a centralised system ensure it is zoned. Centralised options include ducted air and hydronic systems. The latter are usually gas fired but can be heated by a solar system or heat pump.

For heating, gas heaters and efficient reverse cycle air conditioners produce a third (or less) of the greenhouse gas emissions of standard electric heaters. Heat shifters and solar air heaters can assist by reducing the amount

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of heating required. Fans are the lowest energy cooling option, followed by evaporative coolers, which work best in climates with low humidity. Each of the different heating and cooling options has pros and cons, and choices on type and size should be informed by energy labels.

Hot water service

Heating water accounts for 21% of the energy used in the average Australian home, and is the largest single source of greenhouse gas emissions (approximately 22%) from home energy use. Electric water heaters in particular contribute to these high emissions. Reducing hot water use and using renewable energy sources to heat water are effective ways to reduce your environmental impact. The most appropriate and efficient hot water service can be found for your household size, water use patterns and climate. The two basic types of water heater — storage systems and continuous flow (instantaneous) systems — each use a variety of energy sources including solar energy, gas and electricity.

Lighting

Lighting in homes consumes 8–15% of the average household electricity budget, although this can differ depending on the lighting technologies used, lighting design and user behaviour. Efficient and well-designed lighting can make for significant energy savings. The first step is to design your home to maximise the use of daylight so that electric lighting is not required during daylight hours. Then, create a lighting design strategy that meets your needs in the most efficient way, including daylight design. Lighting decisions need to take into account the characteristics of lamp technologies such as compact fluorescent and LED, lighting switches and controls, safety requirements, and the life cycle costs of different lighting options.

Appliances

On average, household appliances and equipment account for about one-third of household energy use and almost half of household greenhouse gas emissions. Of all appliances, the fridge/freezer and television are typically the highest individual electricity users.

Choices about purchases of whitegoods (refrigerators, freezers, washing machines, clothes dryers and dishwashers) and equipment for pools and spas (pumps and filters) should include operation and maintenance, not just the original price. Appliance choices can be informed by the Energy Rating Labelling Scheme and Water Efficiency Labelling Scheme, which allow comparison of different appliances by a star rating.

The more stars, the more water or energy efficient the appliance. However, size is also a factor: a large 5 star model may use more energy or water than a small 4 star model. The label includes total energy or water consumption figures, alongside the star rating.

Home entertainment and home office equipment

An increasing portion of household energy use and greenhouse gas emissions comes from home entertainment and home office equipment. Almost all home entertainment and office products draw stand-by power, which can contribute up to 10% of household electricity use, when not in use. Turn equipment off when not in use, preferably at the power outlet (or use a stand-by power controller). Multi-function devices (e.g. scanner, copier and printer in one) can save on electricity and on the materials and manufacture of multiple devices.

Energy Star is an international voluntary labelling scheme that indicates a product is the best in its class and meets stringent energy standards for operational and standby modes. The Energy Rating Labelling Scheme also applies to televisions, which can use a significant amount of electricity. To compare products of different screen size and technologies, use the total energy consumption figure on the label, alongside the star rating.

Choosing efficient home entertainment equipment (e.g. TVs, DVDs, stereos, games consoles, set-top boxes) and home office equipment (e.g. computers, phones, printers and networking devices) can be complemented by operating them in the most efficient way.

Home automation

Appliances and equipment in the home can now be automated or remotely controlled to turn on or off or adjust operating settings. Homes using automation, often with integration of broadband communications, are called 'smart homes'. Home automation systems can improve the energy efficiency of your home if they are designed for this purpose and save more energy than they use. However, energy efficient house design, appliances and lighting must still be the priority. The various home automation systems available can contribute to management of different energy uses around the home, and provide important feedback to householders by displaying real-time electricity use.

Renewable energy

Electricity generation systems based on the conversion of solar and wind resources are becoming increasingly accessible to the average homeowner. Renewable energy can also be used for home heating and cooling, hot water and even cooking. On-site production of renewable electricity by photovoltaic systems and wind generators requires design and installation by specialists with the knowledge and accreditation. Renewable energy systems, both grid connected and stand alone, usually operate with low running costs. They can be expensive to install but rebates and other financial incentives may be available to offset the initial cost. Maintenance can also be a cost issue for systems reliant on batteries. To get the most out of your renewable energy system, minimising energy demand in the home first is crucial.

Photovoltaic systems

Photovoltaic systems are increasingly used to supply price-competitive, zero greenhouse gas emission energy to homes and businesses across the country. The average cost of producing electricity from solar modules over their lifetime is now broadly equivalent to the average cost of purchasing electricity from the grid. Module types fall into two categories, crystalline silicon and thin film, and can be mounted on frames or building integrated. Siting, orientation and tilt of modules are all critical to gain maximum efficiency at the home location, or to match energy production to peak loads. The size of a system is also governed by the household. Design and installation of photovoltaic systems must be undertaken by an accredited specialist.

Wind systems

The amount of renewable electricity harnessed from the wind is growing rapidly. Australia has an abundant wind resource, which, if used to generate electricity, can save significant greenhouse gas emissions. Only turbines in open sites and on sufficiently tall towers produce energy efficiently. Wind systems installed on roofs typically do not produce much electricity, have short life spans, and are thus never economically sound. Be wary of turbine installers or manufacturers claiming products are suitable for urban or turbulent locations, and always prioritise solar photovoltaics if investigating residential renewable electricity options in urban areas.

Site assessment, determining appropriate tower heights, and choosing a system size, design and manufacturer are best done by an experienced contractor.

Batteries and inverters

Batteries store energy for use when demand exceeds output, for example at night when a photovoltaic system is no longer generating electricity. Inverters turn energy from DC to AC mains power. Any renewable system also includes switches, circuit breakers and fuses to ensure safety and allow equipment to be isolated for maintenance. Grid connected systems usually consist of the energy source, inverter and meter. Stand-alone systems usually comprise the energy source, a battery bank, inverter, battery charger and often a fuel generator for back-up power. Each system also includes a charge controller that can be part of the inverter or other equipment.

Smart meters, in-home displays and smart appliances

'Smart' meters offer a range of capabilities that traditional meters do not, including the transmission of energy use data to your utility, fault monitoring, and communication between the utility and home appliances. In-home displays provide information on real-time energy use and costs, which is useful in guiding energy-saving behaviour and avoiding energy peaks. Data can be transmitted to computers and mobile devices. Smart appliances can take advantage of lower electricity price periods via signals from the utility and automation. This convergence of technological capabilities is part of the 'smartening' of the grid, with closer integration of the supply and demand sides of the electricity system through better communications and controls. This emerging technology is changing energy use patterns.

Transport

Some of your most important energy decisions relate to transport. Where will you live? Is there good public transport? Will you have to buy a second car? An energy efficient home can still be a high energy household if you rely heavily on your car. Car dependency can be reduced by public transport use, walking and cycling, or using car share schemes. Fuel efficient and low emission cars, driven efficiently and well maintained, also reduce energy use. As the range and availability of electric cars are increasing, new homes could provide charging points in garages or carports.

Author

Caitlin McGee, 2013