

SMARTER ENERGY USE: HOW TO CUT ENERGY BILLS & CLIMATE HARM



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The Climate Council acknowledges the Traditional Owners of the lands on which we live, meet and work. We wish to pay our respects to Elders past and present, and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to Country.

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Key findings

1

Too many Aussie homes rate poorly on energy performance, which means they are more expensive to run, unhealthier for those living in them and unnecessarily add to our climate challenge.

- › Up to eight million homes were built in Australia before any minimum energy standards existed, and the vast majority of these still have poor energy ratings.
- › From October 2023, the minimum energy standard for new Aussie homes will be 7-Stars. However, it is possible that homes built before 2003 have a measly average rating of 1.5 Stars.
- › Renters, who make up one in three households, get a particularly bad deal when it comes to poorly-built homes - spending a higher percentage of their incomes on household bills. One Australian study found that less than half the rentals checked had insulation.
- › Poorly designed and built homes are dangerous to those who live in them. Research shows cooking with gas is responsible for 12 percent of the burden of childhood asthma in Australia; while poor thermal efficiency in a home exposes the occupants more often to extreme heat and cold.

2

Electrifying our homes and improving their energy efficiency is one of the best two-for-one deals Australians will ever experience, as it helps people with the rising costs of living while cutting our carbon pollution.

- › Our history of weak building standards and under investment in home energy efficiency means there are millions of Australians who can immediately benefit from improving the energy performance of their homes.
- › Climate Council analysis shows electrifying a home's cooking, heating and hot water can save a household between \$336 and \$1,311 a year; with households in Hobart, Melbourne, Canberra and Brisbane saving the most.
- › Climate Council analysis shows upgrading the thermal efficiency of your home (by putting in insulation and finding and fixing draughts) can save a household between \$354 and \$1,561 more each year. Households in Hobart, Canberra and Adelaide are calculated to benefit most from these measures, but all Australians would save cash.
- › By combining both electrification and practical efficiency upgrades, Climate Council analysis shows an average Australian household would save between \$1,119 and \$2,872 each year.
- › If one household took this combined action, they would also reduce their greenhouse gas emissions by an average of 37.5 tonnes over a decade. That's equivalent to the average yearly emissions of two Australian homes.

3

There are affordable and practical ways for everyone to improve the energy performance of their home whether they rent, own, are building, or live in social housing.

- › Finding and fixing draughts, insulation, reducing heat loss or gain through windows and keeping the outside of a home cool with a light-shaded roof and plants are the smartest ways to improve the thermal efficiency of your home.
- › Switching out gas appliances for electric alternatives that use less energy to do the same job can instantly save you money on running costs, and cuts down on pollution since gas is a fossil fuel.
- › No matter which measure you choose to start with, you'll experience cost-savings straight away, and these savings will only grow as you take more steps to improve the energy performance of your home.
- › Being smarter with how we use energy (through electrification and energy efficiency) can reduce demand on our grid at certain times, and the additional need for expensive upgrades. That means lower power bills for all energy users, with one Australian analysis finding the financial benefit to the community (\$2.3 billion) far outweighed the costs of the change itself (\$1.5 billion).

4

All levels of government - federal, state and local - need to step in and work together to make sure that all Australians can benefit from better energy performance in their homes, as the cost of living crisis continues to bite.

- › One of the biggest barriers for households that want to improve the energy performance of their homes is upfront purchase costs. Offering low- and zero-interest loan schemes is a practical way for governments to help households with the rising costs of living.
- › From 2025, all new residential properties should be fully-electric, and when a domestic gas appliance needs replacing it should be replaced with an efficient electric alternative so fewer households are locked into using expensive and polluting gas.
- › Australia needs clear energy efficiency targets that help reduce overall energy demand, which requires coordination among all levels of government. The European Union successfully cut its energy use by a quarter by doing this.
- › Anyone selling a home should have to disclose the property's energy efficiency rating so buyers know what they are getting, and there's a clear financial incentive to improve a home's energy performance prior to sale.
- › Minimum energy efficiency standards for rentals are needed across all states and territories so that everyone has access to a home which is liveable, safe and more affordable to run.

1. Introduction

Australia faces both an escalating climate crisis and rising costs of living. Importantly, we can tackle both challenges at the same time in the best two-for-one deal Australians will ever see.

Electrifying our homes and improving their efficiency will lower energy bills and emissions, while smoothing Australia's pathway to a grid powered by more renewable wind and solar energy.

To play our part in tackling the climate crisis and limiting future harms, Australia's emissions need to plummet this decade. This means moving beyond fossil fuels like coal and gas as soon as possible. We can do this by electrifying as many things as we can, and supplying as much energy as possible from renewable sources. Cutting our energy use at the same time by making our houses and the appliances within them more efficient in the way they use electricity is also an important part of the picture.

In Climate Council's 2022 report *Switch and Save*, we showed that households can save on energy bills, make their homes healthier and help cut emissions by switching from polluting gas appliances to modern electric alternatives. In this report we look closely at the important role that efficiency will play with electrification in Australia's energy transformation.

Historically, discussions on climate change and energy have focussed far more on changing the way we produce and source energy – that is, shifting away from fossil fuels to renewable energy – than on using energy more wisely by improving efficiency. In reality, both are essential. In fact, the International Energy Agency has described energy efficiency as "the first fuel" for the important role it will play in ensuring energy remains reliable, stable and affordable as we rapidly increase the uptake of renewables (International Energy Agency, 2019).

In short, we want the best possible energy performance: by using the cleanest and most affordable power source – renewable electricity – *in the most efficient way*.

By switching out gas heating and cooking for electric alternatives, and replacing petrol and diesel forms of transport for electric vehicles including trains and buses we will need to source higher amounts of electricity than we use today, and upgrade our transmission and distribution networks. If we adopt efficiency measures, and become smarter about how and when we use electricity, then we can reduce the amount of new electricity infrastructure required around the country – even as we move to electrify everything. Using the existing network infrastructure more efficiently can also lower costs for all homes and businesses.

The cost of building and maintaining transmission and distribution networks – often referred to as the ‘poles and wires’ – accounts for around half our electricity bills. By reducing new electricity infrastructure requirements through greater efficiency we can make our energy more affordable for everyone, as well as making Australia’s energy transformation more manageable and achievable.

This report explores a range of readily available measures for electrifying homes and improving efficiency together, and highlights how governments can support all Australians to benefit from the switch. Through these improvements, households will unlock bill savings, cut emissions and help secure a cleaner energy grid. That’s a good deal.

GLOSSARY

Electrification:

Increasing the use of electricity – whether from solar panels or the public grid – as the primary power source to the home. Australian homes are powered by a combination of electricity and other fuel sources like gas. Electrification would result in gas appliances like heaters, hot water systems and cooktops being replaced with electric alternatives.

Thermal efficiency:

The ability of a building to stay cool in summer or retain warmth in winter. Buildings with good thermal efficiency require less energy to heat or cool.

Energy performance:

Good energy performance uses the cleanest and most affordable power source – renewable electricity – in the most efficient way. This is achieved by a combination of electrification, thermal efficiency upgrades, and using energy wisely, like during off-peak periods.

Peak demand:

Energy networks are designed and built to meet peak demand – our highest total energy consumption. Typically in Australia, this is on hot summer days when use of air-conditioning is high. Most of the time, demand is lower and the distribution network is not being used to its full capacity. Reducing peak demand can mean we don’t have to invest in as much infrastructure, which puts downward pressure on power prices. Wholesale electricity prices are also highest when demand is high, so – again – reducing these peaks will help reduce prices.

2. Australian homes aren't built for good energy performance

Australian homes rate poorly on energy performance, and many older homes have never been improved or upgraded to improve efficiency. This has saddled many Australians with homes that are inefficient, expensive to run and uncomfortable: too hot in summer and too cold in winter with lots of outdated, energy hungry appliances.

The Building Code of Australia first established minimum energy performance standards for new homes in 2003, with this being set at a modest 4-Stars.¹ This means homes built before 2003 - an estimated 8 million Aussie homes - were constructed without any minimum standard (Hurlimann et al. 2018; Moore et al. 2019). The vast majority of these homes are likely to still have very low energy efficiency ratings.

The average rating of homes built prior to minimum standards is thought to be roughly 1.5 Stars although it is possible the average is even lower (CSIRO 2020).² Australian homes often lack even the most basic efficiency measures - such as insulation in roof cavities and draught sealing - which are two of the most cost effective ways to improve a home's energy performance (Sustainability Victoria 2015).

Millions of Aussie homes rate poorly for energy performance because they were built prior to mandatory standards, and have never been upgraded.

¹ Energy ratings for new homes in Australia are provided through the Nationwide House Energy Rating Scheme (NatHERS): <https://www.nathers.gov.au/>. There are however other systems in use including Home Scorecard: <https://www.homescorecard.gov.au/>, which uses a whole of home analysis including appliances.

² Unfortunately, it is impossible to build a complete picture of the energy efficiency of Australian homes, as the most recently collected data is from 2016. See for example the 'Geoscience Australia - NEXIS - Residential Building Exposure (LGA) 2016.'

Renters are more likely to live in poorly performing homes and be on lower incomes, so it's no surprise they spend a higher proportion of their income on household bills.

Renters, who make up one in three Australian households, get a particularly bad deal when it comes to poorly-built houses. They are often unable to make changes to homes because they do not own them, and are more likely to be on lower incomes. This is why they spend a higher percentage of their income on energy bills than owner-occupiers (Healthy Homes for Renters 2022). Research by Choice (2021) found that less than half of rental properties are even insulated. Further, research has shown that areas with lower average incomes and those dominated by rental properties were less likely to take advantage of energy efficiency upgrade incentives (Willand et al 2020). This highlights the need for mandatory minimum standards for rentals³ and targeted assistance with efficiency upgrades to ensure that all homeowners and renters can benefit.

Our history of weak building standards and under-investment in efficiency measures means there are a large number of Australian homes that need upgrading to improve energy performance. On the plus side, this means there are millions of Australians who could quickly reap huge benefits in the form of lower energy bills from better housing energy performance.



Image 1. Smarter lighting: Installing LED globes or replacing halogen downlights with LEDs can save up to 80 percent of lighting electricity costs.

³ Minimum standards are gradually being adopted in some Australian states and territories although they are inconsistent. For example, the ACT Government is implementing minimum ceiling insulation requirements, whereas the Victorian Government requires a standing heater.

Rowena - Brisbane, Queensland

I live in an old Queenslander in Brisbane from the 1950s. The house is not fitted with air conditioning and we struggle during the warmer months. Our inefficient and unhealthy home makes my disabilities worse.

Among other disabilities, I suffer from myalgic encephalomyelitis and chronic migraines with aura, and both conditions in particular get worse when it's hot and humid, which has a cascading effect on my capacity to manage my other disabilities. I am on preventative medication for my migraines, and this stops working effectively when the indoor temperature and humidity are high.

I live on a small disability support pension and used it to purchase a portable air conditioner. However, my inefficient home makes it super expensive to run as all the cold air is immediately replaced by hot air coming from outside.

Even though my landlord is awesome and fixes things when they stop working I'm too scared to ask for upgrades like draught proofing, insulation or split system air conditioning. At any time our landlord could ask me to leave if they think I'm being difficult and I'd struggle to find affordable housing. Despite how bad my situation is, I know it could be worse, which is really saying something because the pain and exhaustion I experience from the heat and humidity are awful.

If the state government implemented minimum energy efficiency standards for rentals I'd have money to engage disability support workers who would help me manage my disability, be healthier and experience more things life has to offer.



Image 2. Unhealthy home: Rowena's home in Brisbane, Queensland has poor energy efficiency, and no built-in air conditioning, which worsens her disabilities.

2.1

Electrification with improved efficiency benefits our health and household budget

Across the country a little over half of all residential energy is met by electricity, with a little less than 40 percent coming from piped gas (Energy Consult 2022).⁴ However, there are big differences between states and territories in the combination of fuel sources.

In Victoria and the Australian Capital Territory (ACT) more than half of all energy used in homes comes from piped gas. By contrast, in Tasmania and Queensland overall residential gas use is very low.

Figure 1 shows what Australian homes are currently using energy for - whether it's electricity or gas.

In some states, grid electricity still has a higher emissions intensity than gas on per unit of energy basis. This means that in some places, even when the higher efficiencies of modern electric appliances are considered, gas is a lower emissions option. Accelerating the transition to renewables will mean that across Australia, electricity will become less emissions intensive than gas.

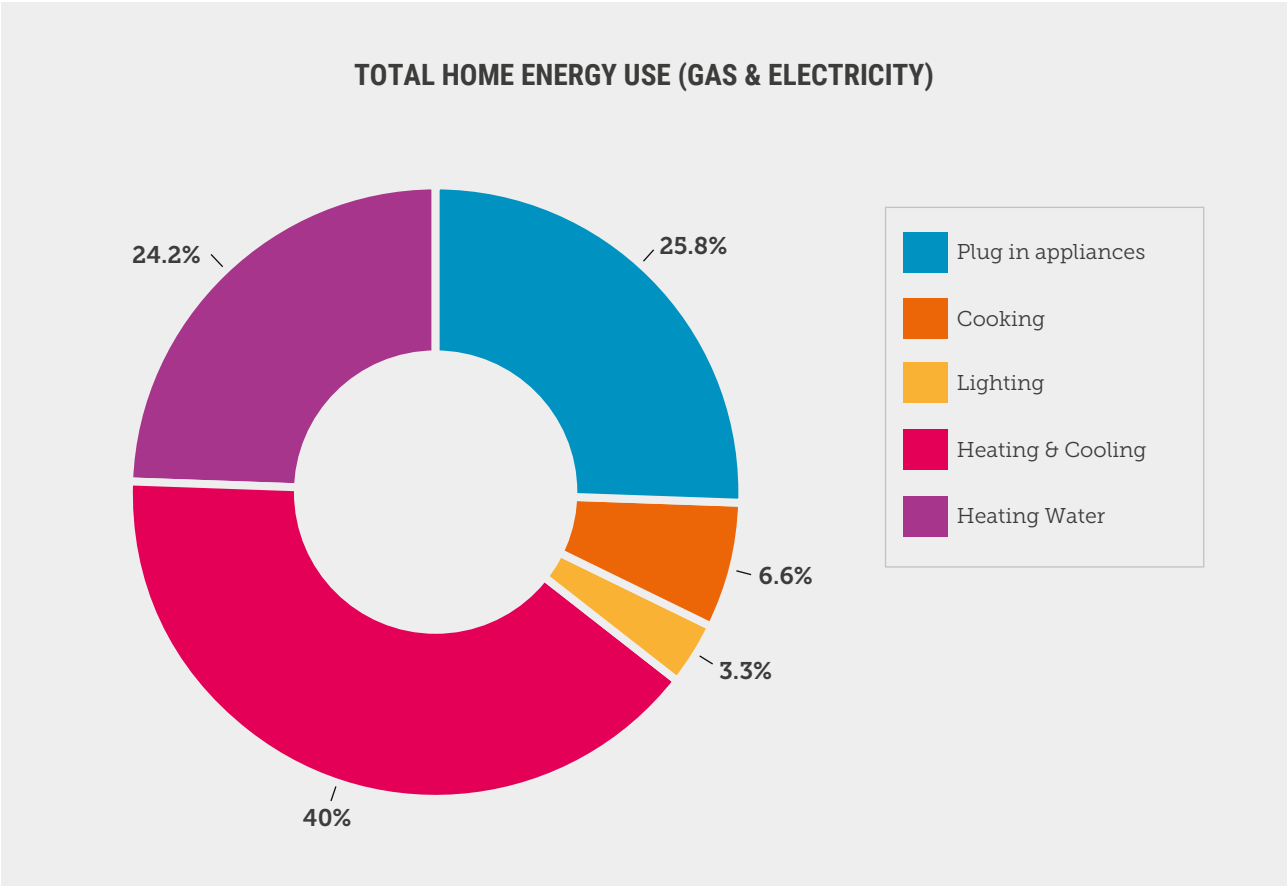


Figure 1: Total home energy use (gas and electricity) divided into what it is used for in Australian homes (Source: Energy Consult 2022).

4 The remaining share of household energy needs are met from bottled gas and wood (Energy Consult 2022).

As explored in our report *Switch and Save* (Climate Council 2022), switching from gas to efficient electric appliances benefits our health in many ways, with many recent studies revealing the alarming health impact that burning gas in our homes for cooking and heating can have. Cooking with gas is estimated to be responsible for up to 12 percent of the burden of childhood asthma in Australia (Knibbs et al. 2018). In fact, a child who lives in a home with gas cooking faces a comparable risk of asthma to a child living with household cigarette smoke (Climate Council 2020).

Improving the thermal efficiency of homes can also deliver enormous health benefits. Poor thermal efficiency in homes increases health risks, particularly during very cold or extremely hot weather. This is because it leaves people more exposed to extreme heat or cold. Heatwaves or cold snaps can cause an increase in respiratory and cardiovascular diseases, such as pneumonia and high blood pressure. The elderly, infants and people with pre-existing conditions are particularly vulnerable (Gasparini et al. 2015). Heatwaves kill more Australians than bushfires, floods, storms and cyclones combined (Coates 2014). Cold temperatures are a contributing factor in at least six percent of deaths in Australia each year (Gasparrini et al. 2015). That is double the rate in much-colder Sweden; in large part attributable to our poor housing stock (Barnett 2015).

Getting gas out of homes is good for our health, good for our planet and good for our wallet.

Climate Council's *Switch and Save* report also concluded that Australians can save up to \$1,899 a year on energy bills by getting off gas and going all electric. The estimated savings are greatest in places like the ACT and Victoria where households use a lot of gas. But homeowners right around the country can benefit. In this report, we build on that work by analysing the possible savings of electrification and home energy efficiency combined.

A recent report from Sustainability Victoria (2022) has further helped quantify the health benefits that can be achieved through improved thermal efficiency. It found that for an average upgrade cost of \$2,809 per home, savings over a three-month winter period would equate to \$887 in healthcare savings and \$85 in energy savings. The same study suggests the cost of these modest upgrades could be recouped within three years, with ongoing annual savings.

2.2 Improving energy performance will help cut harmful carbon pollution

Gas is a fossil fuel that is worsening climate change, with major impacts like killer heatwaves and megafires occurring more frequently, or becoming more severe. When gas fields were discovered and developed in Australia, a lot of houses were automatically connected to gas pipelines. These days renewable energy sources like wind and solar, backed up by storage such as batteries, renewable hydrogen and pumped hydro, can supply all the energy we need cleanly, cheaply and reliably.

Even before it is burned, gas causes climate harm. The main component of gas, methane, is a greenhouse gas that's 80 times more potent than carbon dioxide over a period of roughly 20 years. Along the entire gas supply chain - from extraction to processing and use - large quantities of methane are wasted. Burning gas for heating and cooking in our homes also produces large quantities of carbon dioxide as well as oxides of nitrogen. If you consider the millions of homes around the country still using expensive, inefficient and polluting gas, household energy (including electricity sourced from fossil fuel reliant grids) makes a significant contribution to total greenhouse gas emissions - 12 percent of Australia's total yearly emissions (DCCEEW 2023a).

In some states, when a house gets off gas by going all-electric there's an immediate reduction in harmful emissions because electric appliances are much more efficient to run (see below). However, this depends on the amount of fossil fuel generation in that place. As we rapidly transform all of Australia's electricity grids to be powered by more renewables, the benefits of getting off gas in avoided emissions will continue to increase.

Going fully-electric while improving the efficiency of our homes is the best option of all because this significantly cuts total energy use for individual households and, therefore, the emissions associated with meeting such energy needs.

2.3 Smarter energy use will reduce the need for new infrastructure

Australian homes account for around 24 percent of electricity consumption – and even more in peak periods such as heatwaves (DCCEEW 2023a). Modern electric appliances are more efficient than gas alternatives. This means that Australian households can save on their energy bills and immediately start helping to reduce emissions by making the switch. Gas will always be a polluting fossil fuel. In comparison, the emissions savings from switching to electricity will continue to grow as we keep decarbonising the grid itself and shifting to a 100 percent renewable energy system.

While electrical appliances are more efficient than gas appliances, shifting from gas to electrical appliances without also investing in energy efficiency measures could result in a drastic increase in overall electricity demand. As an illustrative example, we estimate the overall increase in residential electricity demand created through the electrification of existing residential gas use would be around 15 terawatt hours⁵ – about 8 percent of yearly consumption in the National Electricity Market (AER 2022). Owing to the greater efficiency of modern electric heating, hot water and cooking appliances compared to gas appliances, this is roughly a third of the energy content of the gas required by domestic appliances. By applying the efficiency measures explored in the report, we can reduce additional residential electricity demand.

The renewable energy system and clean industries of the future will require a substantive investment in new electricity generation capacity and our electricity grid. If we reduce additional electricity demand by improving home energy performance – particularly heating and cooling requirements through greater thermal efficiency – this transformation will become easier. This is because it will reduce the amount of new investment needed in generation, transmission and distribution. Since the cost of delivering electricity through our transmission and distribution networks makes up a significant proportion (around half) of electricity bills, reducing the demand for further grid investments will also help keep household energy costs down.

The benefits of improving energy performance are real, and will be experienced by Australians in better health, lower bills and reduced emissions. So what will it take to deliver them? The following section outlines the practical steps Aussie households can take to improve the energy performance of their homes, and how governments can support them.

⁵ A direct conversion of the current Australian residential gas use of 166 petajoules to electricity is just over 46 terawatt hours. By assuming a Coefficient of Performance of 3 across modern electric appliances we get just over 15 terawatt hours.



Image 3. Major savings: Installing readily available and affordable seals to windows is one method of reducing draughts, which can mean major savings on bills.

Using energy in smart ways (that reduce waste and peak demand) at the same time as we electrify our households will mean we reduce the overall need for new energy infrastructure.

3. The solutions

3.1 Improving efficiency

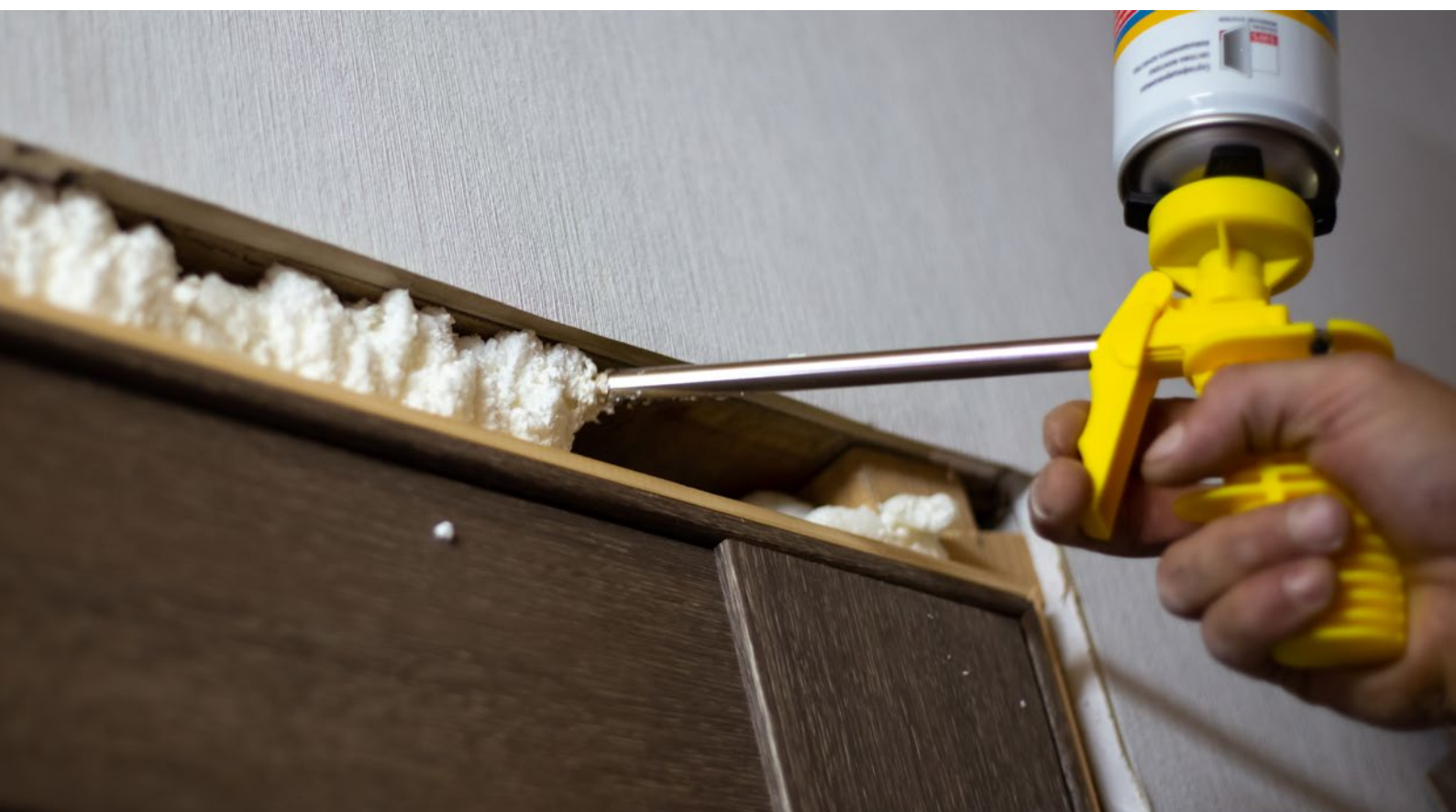
With power bills climbing, it makes sense to make some simple and practical changes so we have a home that's healthier, more energy efficient and doesn't cost the earth to heat or cool.

From switching the light bulbs we use, to installing insulation in the roof, there are many opportunities to improve the energy efficiency of our homes. In this section we focus on ways to maintain a comfortable temperature inside the home, and avoid using excessive heating or cooling; known as thermal efficiency.

Heating a home in winter and cooling it in summer can account for up to half of our home energy use depending on where we live (DCCEEW 2023c). So the better our home's thermal efficiency, the more we can reduce our energy bills and emissions at the same time.

The good news is that some of the smartest ways to do this are also some of the simpler options for households. This section of the report briefly explains what these are, ahead of highlighting the associated bill and emissions savings.

Image 4. Readily-available: Filling large gaps is important for draught proofing and can be done using expanding foams that are readily available at hardware stores.



FINDING AND FIXING DRAUGHTS

Reducing the amount of hot or cold air that moves in and out of your home as well as reducing the circulation between spaces in walls, floors, and your roof can make a big difference in how much energy is needed to keep it at a comfortable temperature. However, proper ventilation is important for indoor air quality, particularly after draught sealing. Opening windows is a free and easy way to reduce condensation and to regulate indoor temperature when the weather permits.

- › **Draught sealing:** This decreases the amount of air that gets in or out of our home's living spaces, and is one of the simplest and most cost effective measures available (see Figure 2).
- › **Sealing the wall cavity:** This can be applied to houses with a "suspended timber floor" (where there is a crawl space underneath your ground floor), where the cavity within a wall connects this sub-floor space to an attic or roof space; creating a pathway for air to flow. Sealing the wall cavity using expanding foam for example, will result in higher energy savings when the sub-floor space is not well enclosed and when there's a bare timber floor.
- › **Reducing sub-floor ventilation:** This applies to houses with a suspended timber floor where a lack of access means underfloor insulation is not an option. Heat losses through a suspended floor are greatest when there are high levels of ventilation under the floor. This might be due to large gaps in the walls enclosing (or surrounding) the sub-floor space, or no sub-floor walls at all.

INSULATION

In cold conditions, a lot of heat within a home can be lost through walls, the roof and floor. Insulation works like a blanket to keep households at a more comfortable temperature. It is also useful in hot conditions to keep warmth from coming into the house. Insulation is measured by an R value - a measure of the insulation batt's resistance to heat flow, known as 'thermal resistance'. Higher R values mean higher resistance to heat transfer and therefore better insulating effect and subsequent energy savings.

- › **Ceiling insulation:** Putting an effective thermal barrier in to limit heat loss and/or gain through the ceiling. Data from CSIRO shows that more than 83 percent of homes have ceiling insulation that doesn't work as well as it could, even for warm climates, while one in five homes don't have any ceiling insulation whatsoever (CSIRO 2022). Milder climates require insulation with an R value between 3-4, whereas in more extreme climates, an R value of 5 is recommended.
- › **Underfloor insulation:** Putting insulation in the floor cavity. Underfloor insulation can provide both energy savings and greater comfort in winter. However, it can reduce thermal efficiency and lower comfort during the summer, when the underfloor space would help cool the house at night. It is important to consider how underfloor insulation might work alongside other measures and the climate you live in.
- › **Wall insulation:** Adding insulating material to wall cavities - particularly for external-facing walls. Wall insulation is easily installed during construction of a new home. Adding it to a house already built often involves pumping in loose fill insulation or removing internal or external cladding, which can increase the cost.



WINDOWS

Northern sun can help warm a house, and reduce electricity needs during the day, in winter. However windows can also bring in unwanted heat or cold if they are not properly covered.

- › **Window dressings:** installing curtains or blinds that can be closed to limit heat loss or gain. Pelmet (which sit above a window and its curtain) can reduce air circulation between the space behind the curtains and the room.
- › **Double glazing windows:** installing a manufactured double-layered window, typically with a new frame. This reduces heat loss or gain that occurs through the glass.
- › **Secondary glazing windows:** installing a secondary layer of glazing on an existing window, or within an existing window frame. This can have a similar impact to double glazing at a significantly reduced price.
- › **Window films:** applying a film (which can come in a variety of materials) to existing windows to reduce heat gain or loss. This can be a temporary but effective measure for people who rent and may not be able to make permanent changes.
- › **'Low e' glass:** low emissivity glass has a special coating on one surface that reduces the amount of heat or cold which can pass through it. Replacing single glazed windows with this kind of glass can greatly reduce heat loss or gain, and is another more cost effective option than double glazing.



SHADING AND ROOF COLOUR

It's not just what you do inside your home that can make a difference. Outdoor shading around the home and design choices like the colour of a roof can also improve thermal efficiency.

- › **External shading:** installing shades or planting plants to reduce the sunlight that hits windows; particularly those that face east and west.
- › **Roof colour:** darker roofs reflect less heat than lighter-coloured ones, which can have a major impact on how hot or cool a house feels. Lighter roofs can also help reduce the urban heat island effect - whereby heat gets trapped in the built environment and raises average, local temperatures. This improves the liveability of our communities for everyone.

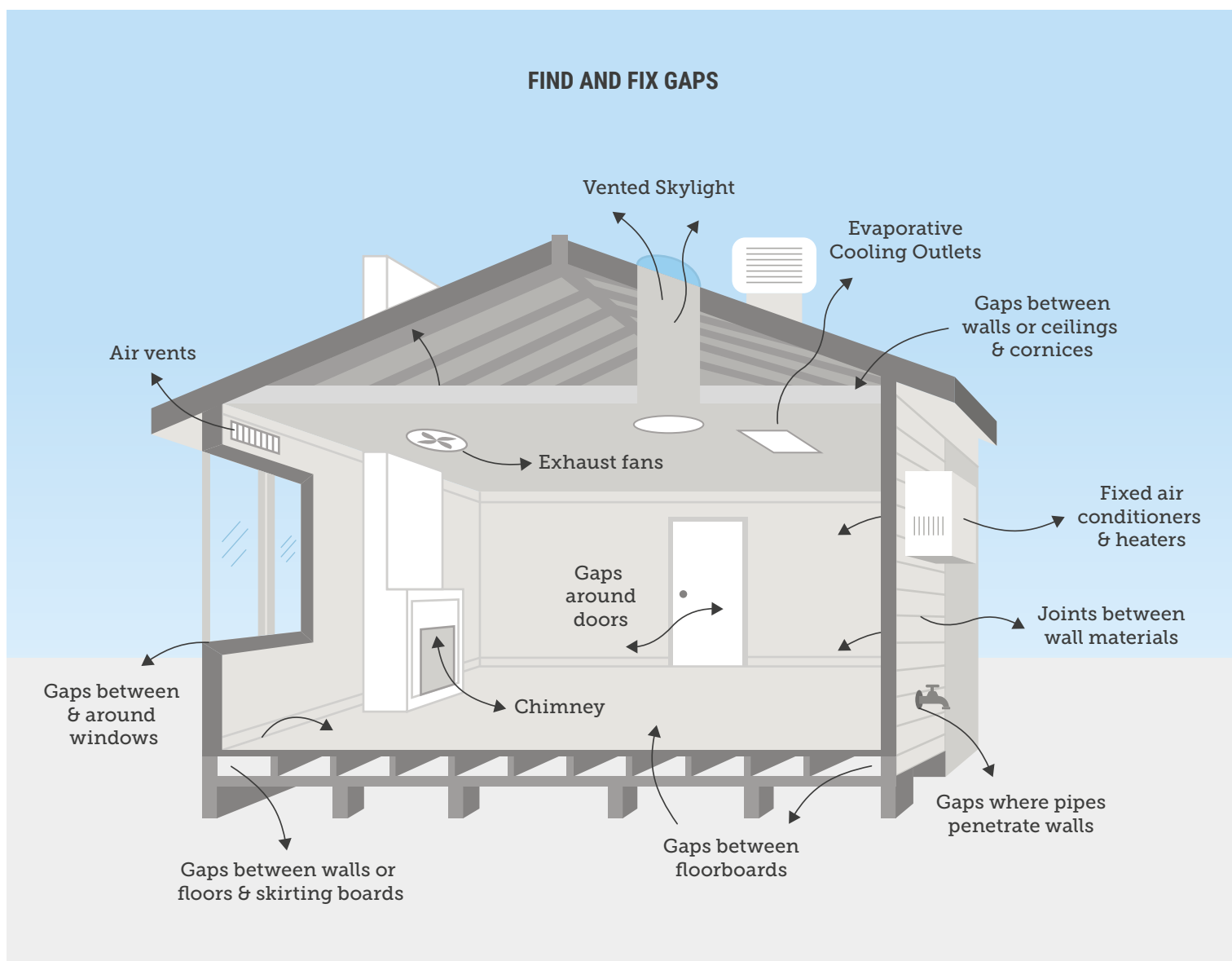


Figure 2: Draught proofing homes can lead to major reductions in heating and cooling and is affordable to do.

In addition to thermal efficiency measures, there are many other simple options for improving home energy efficiency. For example, a low-flow shower head reduces water use; and thereby the need and expense of heating water. Studies have shown that you can recoup the amount of money you spent on buying a low-flow shower head via energy bill savings in less than a year (Sustainability Victoria, 2015). Similarly, lighting your home can make up roughly

10 percent of your total electricity bill. This energy use can be slashed by up to 80 percent by switching halogens for LEDs (light-emitting diodes) (DCCEEW 2023b). While important, some of these measures have not been included in the analysis for this report due to a lack of available, detailed data on total home electricity use whereas heating and cooling loads are readily available.

3.2 Going all electric

As explored in detail in our report *Switch and Save* (Climate Council 2022), switching from gas to modern electrical appliances can significantly boost efficiency and reduce energy consumption.

This is because electrical appliances typically use less energy than gas alternatives to do the same job. This is particularly true for room heaters and water heating. Heat pumps - which are used in water heaters, reverse-cycle air conditioners and refrigerators - use energy from their surroundings to get the job done and have efficiencies, or

Coefficients of Performance (CoP) of up to 4. This means that less energy is consumed than is produced. By contrast, gas appliances generally have CoPs of 1 or less.

There are three main types of upgrades that households can make to switch to more efficient electric appliances. As an added benefit, once all appliances have been switched over to efficient electric options, households can also end their gas connections for good, saving even more by avoiding the daily gas supply charges that gas retailers slug us.

Image 5. Low-cost options: Draught sealing can be as simple as blocking gaps under doors using low-cost products that are widely available and moveable.





HEATING AND COOLING

Heating and cooling uses the greatest amount of energy in Australian homes, accounting for around 40 percent of total use (DCCEE 2023c). In cool climates like Victoria, the Australian Capital Territory and Tasmania, gas heaters are very common for getting through the chilly winters.

Reverse-cycle air conditioners based on efficient heat pump technology are significantly cheaper to run and produce fewer emissions in cold weather, because they are much more efficient. On average, reverse-cycle air conditioners cost about half as much to run as standing gas or ducted gas heaters.



WATER HEATING

Heating water for hot showers and cleaning clothes accounts for around a quarter of the energy used in our homes. Gas hot water systems are a common fixture in existing Australian homes because these used to be the cheapest available technology. However, electric heat pumps are now a cleaner and more affordable technology for water heating. These hot water systems draw in heat from the air and collect it in a water storage tank. They are more efficient than both traditional electric and gas hot water systems, with annual running costs around 50 percent lower than an instantaneous gas system.



COOKTOPS

Replacing gas cooktops and ovens with induction appliances is another great way to save energy, and doesn't have to come at the expense of a delicious meal. For example, induction cooktops can be used with woks made from a ferromagnetic material such as stainless steel, carbon steel, or cast iron – delivering the same great flash cooking as gas, much more efficiently.

The price of induction cooktops has also come down considerably in recent years compared with when they were introduced as a new technology. Today, induction cooking appliances are available in a wide range of models and price points to suit every household.

The combined benefits of electrification and thermal performance upgrades can deliver big savings for households and hefty cuts to emissions to help tackle harmful climate change. The next section of this report looks at the specific savings - in dollars and emissions - for each type of upgrade, and how these savings can add up for households around Australia.

Heating and cooling our homes uses a lot of energy, so the better our home's thermal efficiency, the more we can reduce our energy bills and emissions at the same time.

Hamish - Melbourne, Victoria

"I live in the eastern suburbs of Melbourne with my partner and two young kids. We feel really lucky to live in a mudbrick home that was built with sustainable materials. While it's cool in the summer, it's freezing in winter (like most Melbourne homes) and our energy bills go through the roof.

"Along with draught proofing, I'd really like to get rid of the gas cooktop and hot water system to save on bills and protect my kids from the harmful chemicals coming from the stove.

"Unfortunately, the demands of a young family have prevented us from upgrading this far. If we had access to an interest-free loan from the state government I'd be able to upgrade much sooner. I'd focus on changing the gas hot water to a heat pump, the gas stove to induction, and seal up the cracks to keep our home warm in the winter.

"We'd save loads on energy bills and reduce our carbon footprint. It's a win-win."



Image 6. Keeping cosy: Hamish's home in the eastern suburbs of Melbourne, Victoria stays cool in summer, but he'd love to make upgrades that keep it cosy in winter.

4. Savings for Australian households

4.1 Bill savings

Electrifying your household, and using energy efficiently can save a household thousands of dollars in energy bills each year.⁶

Climate Council's analysis (Table 1) reveals that once a home's cooking, heating and hot water are electrified, and practical changes such as insulation and draught sealing have been made to improve thermal efficiency, families can save **between \$1,119 and \$2,872 a year**, compared to those stuck using gas appliances and living in poor energy performing homes.

Importantly, households in poor performing homes will experience cost-saving benefits no matter which measures they choose to start with, and these savings will only grow as more measures are taken to improve home energy performance. We've used averages across all variables, so the savings could be higher for some households in different situations.⁷

Find out your potential savings from different measures by using our [Bill Savings Simulator](#).



Australian households can save thousands of dollars a year on average by electrifying their cooking, heating and hot water and taking some practical steps to improve their home's thermal efficiency.

⁶ Darwin was not included in our analysis as average gas prices were not available.

⁷ This is particularly the case when it comes to ceiling insulation given an R value of 3.5 used in the analysis is below the standard in some areas.

Table 1: Calculated annual savings on energy bills for 1.5-Star homes that are upgraded.

	Adelaide	Brisbane	Canberra	Hobart	Melbourne	Perth	Sydney	National average
Yearly gas bill for heating, cooking and hot water <i>before</i> any upgrades	\$3,159	\$1,794	\$3,406	\$3,546	\$2,349	\$2,054	\$1,866	\$2,596
Savings made shifting from gas appliances to electrical								
✓ Switching from instant gas hot water heating to a high efficiency electric heat pump saves you...	\$448	\$689	\$359	\$465	\$431	\$202	\$464	\$437
✓ Switching from standing gas heating to electric reverse cycle air conditioning saves you...	\$271	\$183	\$604	\$587	\$493	\$36	\$191	\$338
✓ Switching from a gas cooker to an induction stovetop and electric oven saves you...	\$15	\$107	\$20	\$43	\$51	- ⁸	\$14	\$31
✓ Removing daily gas supply fees saves you...	\$215	\$254	\$252	\$215	\$326	\$98	\$229	\$227
Total bill savings from electrifying	\$948	\$1,233	\$1,236	\$1,311	\$1,301	\$336	\$898	\$1,033
Savings from thermal efficiency upgrades⁹								
✓ Ceiling insulation saves you...	\$352	\$107	\$423	\$420	\$250	\$236	\$163	\$279
✓ Wall insulation saves you...	\$310	\$94	\$372	\$370	\$220	\$208	\$143	\$245
✓ Draught sealing saves you...	\$270	\$82	\$324	\$322	\$192	\$181	\$125	\$214
✓ Ceiling insulation top-up saves you...	\$147	\$45	\$176	\$175	\$104	\$99	\$68	\$116
✓ Secondary glazing saves you...	\$142	\$25	\$171	\$269	\$101	\$56	\$39	\$115
✓ Reducing sub-floor ventilation saves you...	\$83	\$25	\$99	\$98	\$59	\$55	\$38	\$65
✓ Sealing wall cavities saves you...	\$69	\$21	\$83	\$82	\$49	\$46	\$32	\$55
Total bill savings from thermal efficiency	\$1,226	\$354	\$1,471	\$1,561	\$869	\$783	\$539	\$972
Combined savings	\$2,174	\$1,588	\$2,707	\$2,872	\$2,170	\$1,119	\$1,436	\$2,005

⁸ Due to lower prices for gas in Perth there is no saving between gas and electric stoves and ovens. However, if gas cooking is switched, the home will no longer pay gas supply fees, which would increase the savings.

⁹ Bill savings for thermal upgrades have been calculated assuming the installation of R 3.5 insulation rather than insulation top-up, which increases insulation from R2 to R 3.5.

To arrive at these bill savings, we looked at the average electric heating and cooling bill for an average-sized household in each capital city,¹⁰ which has a 1.5-Star energy rating. We then applied average energy savings for each type of upgrade, developed from real-world upgrade projects (Sustainability Victoria 2015) (see [Methods](#) for details). The list of thermal efficiency upgrades is not exhaustive, but has been prioritised based on cost effectiveness and the availability of national data.

Why did we start with a 1.5-Star rated home?



The average Australian home has very low energy efficiency. As highlighted on p.3, the average home built before the introduction of minimum energy standards in 2003 is believed to have a woeful energy rating of just 1.5 Stars. Some of these properties may have been improved over the years, but many haven't - leaving too many Australians living in draughty, uncomfortable homes that cost a fortune to heat and cool. Climate Council's analysis highlights the significant benefits that home electrification and energy efficiency upgrades would deliver to the large number of Australians living in homes with a very poor energy rating.

Bill savings for switching from gas appliances to electrical appliances are based on the [methods](#) used in Climate Council's report *Switch and Save*. They were calculated by combining heating, cooking, and hot water bills for an example household using gas appliances per year, including daily connection fees for gas. Then comparing this amount to the combined bills for a household with electric appliances at the same level of use, including the removal of daily gas supply fees. Gas disconnection can however attract costs, which the Climate Council is advocating to be removed or minimised across Australia.

Everyone's home is different!



If you're considering making energy efficiency upgrades, it's smart to get an assessment done by a professional energy efficiency provider to determine which ones will make the biggest difference in your home. Some of the upgrades described here come with a significant upfront cost, and benefits within individual homes will vary depending on the mix of efficiency measures you already have in place. It's good to start with the upgrades that will deliver the most benefit for the upgrade budget you have available - whatever that may be.

In the ACT and Tasmania, households can access zero-interest loans to help with the cost of doing such upgrades. Climate Council is calling for these programs to be rolled out nationally to ensure the upfront costs of switching aren't a barrier and everyone can share in the benefits. See our Recommendations on p.26 of this report.

¹⁰ Base average bill \$2,596. Average house size 186m² (Architecture&design 2022).

Simon - Cairns, Queensland

Living in Queensland's sunny tropics, Cairns homeowner Simon Thompson was shocked by his first electricity bill at his new family home - which amounted to a whopping \$800 per quarter. This was \$1,100 more per year than at his previous home which was an energy efficient house.

He was determined to do something about it.

To reduce his exposure to the grid, Simon took a two-pronged approach - embracing rooftop solar and a battery system, as well as reducing his overall electricity use by putting in place a range of home energy efficiency measures.

"We swapped out all our inefficient light bulbs, fans and appliances and put in security screens so we could leave windows open in summer. We switched to a more efficient stove and washing machine, and installed solar hot water.

"We even modified our roof - going from rusty silver to white, which brought the inside temperature under the roof down by 10 to 15 degrees."

While there was a large upfront cost for making such changes to his house, Simon is now getting free power and the capital value of his home has increased by at least the value of his improvements.

Today, he looks forward to receiving his quarterly bills which are now negative as he sells power back to the grid during peak times. When power prices soar, Simon's bills go down.

"Having independence from the grid gives me huge peace of mind, especially with the volatile energy prices we're seeing at the moment. And with our region facing more frequent heatwaves, it's a comfort knowing [we have solar and a battery so] we'll be able to run our air con and not worry about the cost or power outages."



Image 7. Taking action: Simon installed solar on his roof with a Tesla battery at his home in Cairns, Queensland. Then, he made his home more energy efficient, and now looks forward to getting his much lower power bills.

4.2 Emissions savings

In addition to substantially lowering household energy bills, getting off gas - a polluting fossil fuel - and improving energy efficiency will also reduce greenhouse gas emissions. In Figure 3 we show the total emissions that can be saved per household over 10 years. This takes into account the planned switch over to renewable energy in Australia's energy networks during this time.¹¹

This shows that together, energy efficiency and electrification can help reduce household emissions by an average of 37.5 tonnes of harmful carbon pollution over a decade - while cutting annual energy bills at the same time. That's equivalent to the average yearly emissions of two Australian homes.

Since Canberra already has 100 percent renewable electricity, the emissions savings shown are those gained by avoiding gas use. We have also included the emissions that would otherwise have been released if the ACT Government's policy was not in place, highlighting the emissions that are already being saved by the ACT's policies, which have encouraged renewable energy uptake. In Tasmania, which relies mainly on hydroelectricity, which is close to zero emissions, emissions reductions for energy efficiency once full electrification has been done are small.

Image 8. Affordable option: Portable induction stoves are easy to find and a great option for renters or homeowners with gas stove tops who may not be able to replace appliances.



¹¹ Emissions savings were calculated over a 10-year period assuming decarbonisation of electricity at a rate in line with the AEMO's 'Independent System Plan' and Western Australia's 'Whole of System Plan'. Gas emissions were calculated using the 'National Greenhouse Accounts Factors'.

Every household that gets off gas, a polluting fossil fuel, and improves its energy efficiency will help cut carbon pollution. The more households that do so, the more harmful carbon pollution we can collectively avoid.

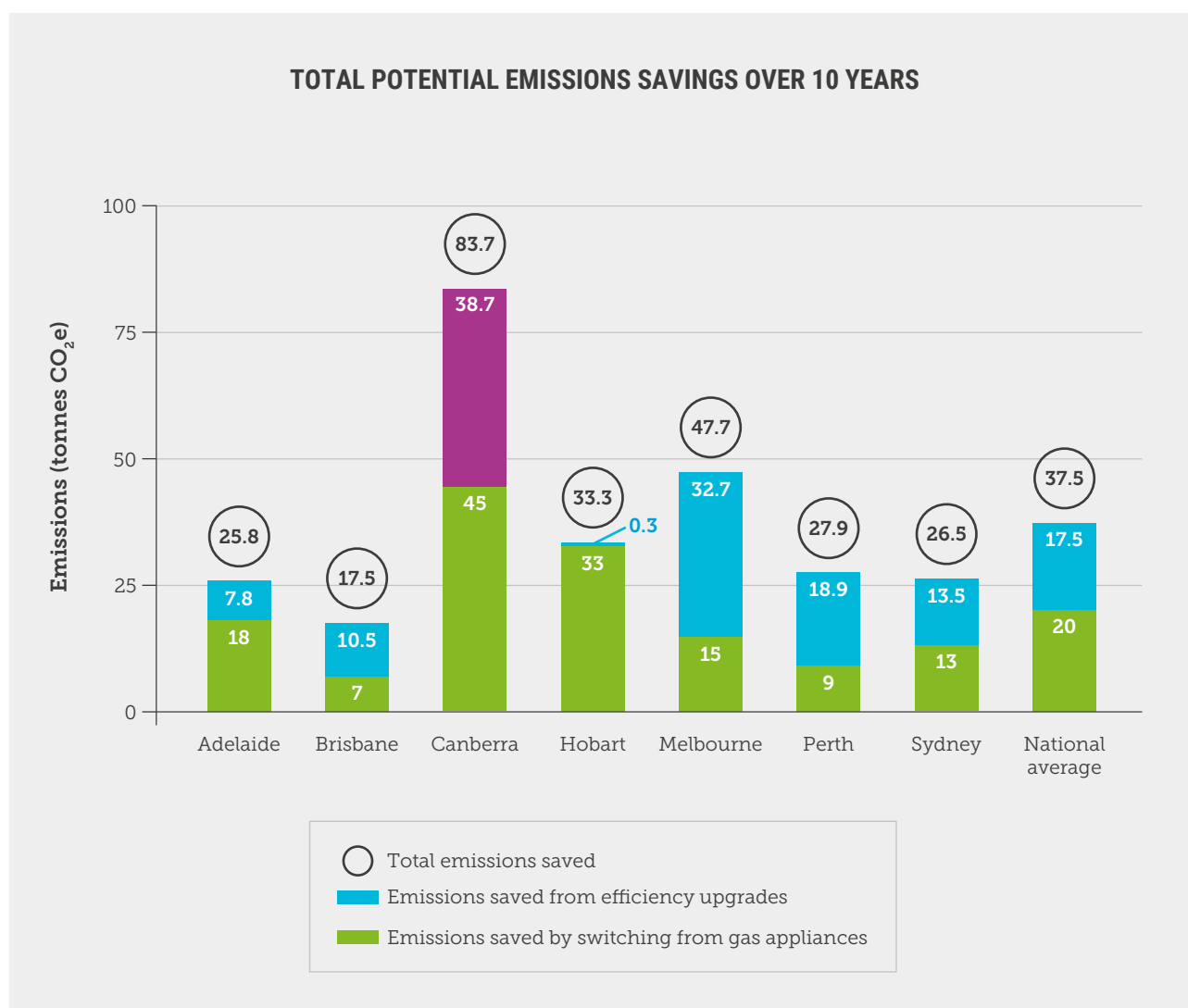


Figure 3: Total potential emissions savings over 10 years from switching from gas appliances and installing various thermal efficiency upgrades. Total includes all measures excluding top-up of insulation.

4.3 Network upgrade and demand savings

The findings above highlight the bill savings and emissions reductions from getting off gas and making individual homes more energy efficient. It is also important to consider how electrification - even when accompanied by efficiency measures - will increase demand for electricity and the need for network upgrades. Network infrastructure costs make up a significant share of the final bill that households pay, so finding ways to reduce the need for infrastructure is another important factor in keeping bills as low as possible.

Studies both from overseas and within Australia have demonstrated the potential of energy efficiency measures and demand management to reduce network pressures and costs.¹²

For example, a recent study from Brazil showed that energy efficiency measures would lead to a reduction in the amount of new electricity generating capacity required. In turn, this would decrease overall system costs by between 1.9 and 7.7 percent (Dranka et al 2020). If energy efficiency is coupled with demand side measures, then the need for newly installed capacity is reduced even further, resulting in a 15.8 percent reduction in total system costs compared to a business-as-usual scenario. Usefully, this could also reduce harmful carbon pollution by up to 11.8 percent (Dranka et al 2022).

Closer to home, the Australian Sustainable Built Environment Council and ClimateWorks (2018) have looked at how much can be saved in new network build costs simply by improving energy efficiency. Our electricity network is built to cope with times of peak demand, when energy use by homes and businesses is highest. They found that for every one kilowatt reduction in peak demand due to energy efficiency measures - equivalent to half the amount of power a kettle uses - there are just under \$1,000 in saved network costs. This means there are massive savings to be made in relation to the future development of our power grid by improving energy efficiency to reduce peak demand. By reducing energy demand at peak times, efficiency measures also reduce the risk of blackouts, and keep our grid stable and reliable (Australian Sustainable Built Environment Council 2018).

Lots of studies, both in Australia and overseas, show being smarter with our energy use can reduce network pressures and costs - and that's good for all energy users.

¹² Demand side management refers to various strategies to encourage consumers to optimise their energy use, in particular to use less energy during peak demand hours.

Two recent analyses in Australia - undertaken by the Consumer Energy Transition Reference Group (2023) and the ACT Government (2022) - have confirmed Climate Council's findings that homes that electrify and become more energy efficient will cost less to run. They have also demonstrated that electricity prices are likely to fall over the long term, in spite of increased electrification. These findings directly contradict claims, most frequently made by gas network operators, that grids won't be able to handle increased electrification of homes, and that price rises attached to required network upgrades will somehow outweigh the many benefits.

For example, the Consumer Energy Transition Reference Group (2023) found that electrifying homes and improving energy efficiency would lead to annual savings of roughly \$2,000 per home by the end of this decade.¹³ Interestingly, although electricity consumption and grid investment increase under these projections, the distribution network prices - which can make up between 35-40 percent of a household's energy bill - actually decrease. This is because increased consumption of electricity means network costs are spread across more consumption and users (Consumer Transition Coalition 2023).

Analysis of electrification by the ACT Government has drawn similar conclusions. As compared to a base case (involving lower rates of electrification and energy efficiency and higher use of gas) electrification and energy efficiency measures were estimated to collectively deliver community benefits worth \$2.3 billion - far outweighing the costs attached to the change itself at \$1.5 billion (GHD and ACIL Allen 2022). Their electrification scenario actually saw a decline in the total grid energy requirement of 8 percent (from 2,722 GWh in 2022 to 2,533 GWh in 2045), compared to an increase of 21 percent in the base case. This was driven primarily by a higher level of energy efficiency, along with higher uptake of rooftop solar.

In short, electrification and energy efficiency can collectively deliver cost savings for Australians, benefits for our environment, and the efficient delivery of our future energy system. In the final section of this report, Climate Council provides some practical recommendations for Australia's federal, state and local governments to put in place that will help accelerate this trend.

¹³ The CETRG assumes an improvement in residential energy efficiency of 0.5 percent per year, which matches the Australian Energy Market Operator's "Step Change" scenario. However, some countries in Europe have managed to improve energy efficiency to the point where energy consumption has dropped by up to 4 percent per square metre per year (IEA 2022).

5. Recommendations

All Australians should be able to benefit from cheaper bills and healthier, more comfortable homes through improved energy performance. Climate Council is calling on all levels of government - federal, state and local - to work together to deliver the policies and investments that can make this a reality as the cost of living crisis continues to bite.

All Australians deserve to live in a home that is safe, healthy and affordable to run. There are lots of tangible ways that all levels of government - federal, state and local - can help them do so.

Recommendation:

1. Support Australians to upgrade the energy performance of their homes with zero-interest loans

Low and zero-interest loan schemes are a great way to help households start saving today from better energy performance because they address the upfront purchase and installation costs of new electric appliances and thermal efficiency measures, like insulation or double glazing. Upfront costs can be a significant barrier for many households, which do not have enough savings or are unable to access affordable financing elsewhere.

Importantly, this type of household support is also more affordable for governments than direct grants or incentive payments, and can therefore be provided at a significantly greater scale which means more help for more people. Climate Council (2022) has prepared a dedicated guide for governments on the design of such schemes - [How concessional financing can help reduce emissions](#). The ACT's [Sustainable Household Scheme](#) is also a useful case study of this approach in practice, and has proven extremely popular with [extra funding being added](#) to allow more residents to take up loans.

Recommendation:

2. Prioritise energy performance when building and upgrading homes

At the moment, hundreds of thousands of new homes are being built each year with gas appliances and take a “bare minimum” approach to energy efficiency. Making sure that best practice applies to new homes when they are built, rather than trying to upgrade homes later, is the smartest approach.

To improve the energy performance of new homes and deliver cheaper bills for households from the first day they connect to the grid, **the National Construction Code should be updated to require new residential properties to be all-electric.** The next significant update to the Code will take place in 2025, so now is the time to prepare.

At the same time, Australians shouldn’t be locked into using expensive gas appliances just because their homes already have them.

Governments should require existing domestic gas appliances to be replaced with efficient electric alternatives from 2025.

When household appliances like heaters, cooktops and hot water heaters reach the end of their life and need replacing, they should be replaced by cheaper-to-run and cleaner electric options. This is particularly important to ensure that renters and people who rely on social housing are not left behind and bear higher living costs than other Australians because their landlords want to stick with inefficient and expensive appliances.

A coordinated national approach is needed to require the replacement of gas appliances with efficient electric ones. Getting this in place as soon as possible is important because household appliances can have a lifespan of more than a decade, so every gas heater or hot water service that’s sold today could still be in service well into the 2030s.

Recommendation:

3. Set clear targets for energy efficiency to drive demand reduction

Climate Council recommends all levels of Australian government collaborate to develop a well-designed and coordinated system of energy efficiency targets that result in demand reduction. This will provide a clear signal to energy providers and Australian households about the importance of improving the way we use electricity as we move to electrify everything. Energy efficiency and/or demand reduction targets can also play an important role in helping maintain grid stability and reliability of supply, as we keep increasing the amount of renewables in our electricity grid. This is one lever to be used alongside others, such as the rapid expansion of appropriate storage like grid-scale batteries and pumped hydro. Energy efficiency targets have worked well in a number of places around the world. For example, in 2007 the European Union set a 2020 target to improve energy efficiency by 20 percent. While COVID restrictions influenced the final result, they roughly achieved a 25 percent reduction in primary energy consumption (European Commission 2023).

Recommendation:**4. Disclose energy efficiency ratings when selling properties**

Disclosing the energy performance of a home means that buyers know what they are purchasing at the time of sale. Making that information more visible empowers Australians to make better decisions, and avoids saddling people with higher running costs for a home with poor energy performance. It rewards households that have already invested in improving their home's energy performance and incentivises such investments for both the buyer and seller - the seller to increase the property value and the buyer because they are aware of any issues and have the chance to act when renovating. Mandatory disclosure of energy efficiency is already in place in the ACT. This is the only jurisdiction where the average Star performance of homes rose between 2016 and 2018, from 6.5 to 6.9-Stars (CSIRO 2020). A coordinated, national approach that requires disclosure of energy efficiency ratings during property sales would help kickstart a wave of further investment in energy performance upgrades and retrofits for existing homes around Australia.

Recommendation:**5. Implement and coordinate minimum energy efficiency standards for rental properties**

As discussed in this report, renters face particular disadvantages when it comes to energy performance - even though they are often among those who can least afford high energy bills. This is because landlords can be less willing to pay for upgrades that reduce energy costs when they will not personally benefit. Minimum energy efficiency standards for rentals are needed for all states and territories so that everyone has a home which is liveable, safe and more affordable to run.

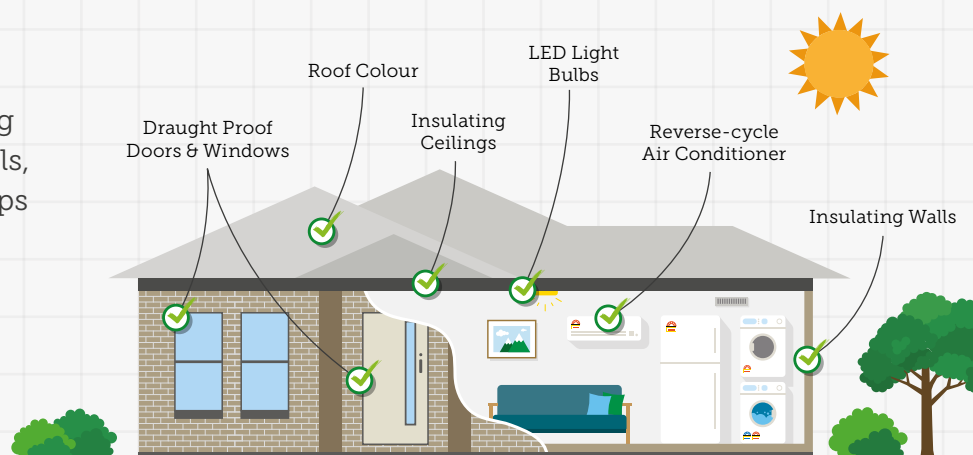
Several jurisdictions around Australia already have some form of minimum standards, which set out the requirements a home must meet to be listed as a rental property. In 2023, the ACT is incorporating a new requirement for all rental properties to have ceiling insulation that meets a minimum standard of thermal efficiency. These kinds of requirements should be standardised and made mandatory for rental properties across Australia so everyone can share in the benefits of better energy performance.

HANDY CHECKLIST:



CHANGES YOU CAN MAKE TO IMPROVE THE ENERGY EFFICIENCY OF YOUR HOME

If you're ready to start making big savings on your energy bills, here's a handy checklist of steps you can take for a cheaper, cleaner and healthier home.



ELECTRIFICATION

Owner	Renter	
✓		Replace gas heaters, particularly central ducted systems, with reverse-cycle air conditioning (RCAC) to save hundreds of dollars per year on heating and cooling. Many homes already have RCACs installed for cooling, alongside gas heating. If switching isn't an option, using existing RCACs to replace or supplement gas heating during winter will also save you money for upfront cost.
✓		Swap instant or gas storage water heaters with an efficient heat pump or solar hot water heater to save hundreds of dollars per year.
✓		Switch from gas cooking to induction to secure major benefits for you and your family's health, as well as your wallet. As an added bonus if this is the last appliance you change, you will no longer have to pay gas supply fees, which can cost hundreds of dollars a year. Gas supply removal can mean extra costs charged by your gas retailer.
✓	✓	Renters can purchase portable induction cooktops very affordably.



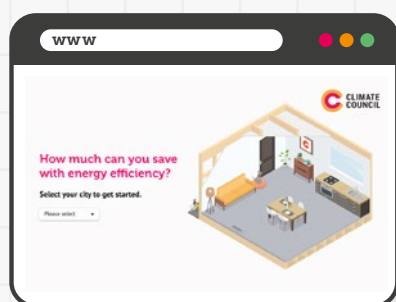
This isn't a DIY job! Before you get your toolbox out, always seek professional help. It isn't just dangerous, it is illegal in Australia to conduct electrical and gas system repairs, modifications, and upgrades without an appropriate qualification.

Some energy efficiency upgrades can be done by homeowners with affordable products that are widely available - particularly those related to draught sealing, which is one of the most cost-effective options available for reducing the heating and cooling needs within your home.

Note: As rental laws differ from state to state some of the following upgrades can be done without approval in some states, and will require approval in others. Check with your real estate agent if you're unsure.

ENERGY EFFICIENCY

Owner	Renter	
✓		Install or upgrade ceiling insulation to reduce heating and cooling costs and make your home more comfortable in the most cost-effective way. The majority of Australian homes already have some ceiling insulation, however it is often inadequate for particular climates.
✓	✓	Draught proofing , or reducing the amount of air that enters and leaves your home, is the second most cost-effective efficiency upgrade. Many options, such as door seals, are low cost and easy to buy.
✓		Wall insulation is another effective measure to reduce bills. However, it can also be expensive to add to an already built home depending on your home's structure.
✓		Secondary glazing , either installing a second window or glazing within existing frames or windows, can achieve the same good outcomes as double glazing at a much lower cost.
✓		For homes with wall cavities that connect the underfloor space and the roof space, reducing sub-floor ventilation and sealing wall cavities can reduce heating and cooling bills; though to a lesser extent than insulation.
✓	✓	Replacing inefficient bulbs or halogen downlights with LEDs can save up to 80 percent of lighting electricity costs.
✓		Window dressings : install curtains or blinds and pelmets to limit heat loss and/or gain when they are closed. Pelmets also reduce air circulation further when installed above curtains or blinds. This places an additional barrier to air flow via permeable glass.
✓	✓	Window films : apply films of a variety of materials to existing windows to reduce heat gain and/or loss. This can be a temporary but effective measure for people living in rental accommodation, where other changes aren't possible.
✓		External shading : install shades, or plants, to reduce the sunlight that hits windows.
✓		Roof colour : darker roofs reflect less heat than lighter-coloured ones, which can have a major impact on heating and cooling depending on the climate. Choosing a lighter-coloured roof, or painting a roof a lighter colour, can also help reduce the urban heat island effect - whereby heat gets trapped in the built environment and raises average, local temperatures. This improves the liveability of your community for everyone.



For more help on improving your home's energy performance, check out the Climate Council's Bill Savings Simulator at:

www.climatecouncil.org.au/resources/bill-savings-simulator



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The Climate Council acknowledges the Traditional Owners of the lands on which we live, meet and work. We wish to pay our respects to Elders past and present, and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to Country.

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