CLIMATE COUNCIL

TENTS TO CASTLES: BUILDING ENERGY EFFICIENT, COST-SAVING AUSSIE HOMES

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Cover image: Rod Vargas.

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

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Key findings

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Low energy efficiency standards have left too many Australians living in poorly-made homes equated to "glorified tents", which are stifling during summer and freezing in winter.

- Australian homeowners face some of the most expensive energy bills in the world with as many as 85 per cent of Australians experiencing "bill shock" during 2020.
- Australia introduced home energy efficiency standards a generation later than our international peers - and at a lower standard - lumping people with homes that are uncomfortable and more expensive to run.
- Six per cent of deaths in Australia are contributed to by people living in households that are too cold - double the rate in Sweden, where winter temperatures reach minus 30°C.
- Australian homes are energy guzzlers compared to those built to higher minimum standards overseas, with a Tasmanian home built today using more than double the energy of a similar house built in Ireland.

2

Making new Australian buildings, including homes, more energy efficient will directly save homeowners hundreds of dollars every year in energy bills, and also cut network costs for all energy users.

- Climate Council analysis shows someone building a 7-Star, all-electric house in any capital city in Australia will save on average $450 per year on heating and cooling costs compared to a 6-Star home; with those in Adelaide, Canberra, Darwin and Hobart saving more.
- Improving energy efficiency in new homes means reduced demand for energy from networks (even when solar is excluded). Considering 1.1 million homes are expected to be built in Australia over the next five years, higher standards could result in reduced need for network expansion and lower capital costs.
- Building a 7-Star home over a standard 6-Star home can be marginally more expensive, but costs substantially less to run every year, from then on.

3

Making new Australian homes more energy efficient will help our country cut emissions and address climate change.

- Climate Council modelling shows a 7-Star all-electric home achieves a 25 per cent reduction in emissions compared to the current minimum standard of a 6-Star all-electric home.
- For every new home built to 7-Stars, the emissions saved each year are equivalent to taking a car off the road for an entire year.
- If we counted all the heating and cooling emissions saved from building 7-Star homes out to 2030 it would add up to total savings of 7.7 million tonnes; equivalent to a 12 per cent reduction on our 2019 national residential emissions.
- Economists calculate the economic benefits of avoiding these emissions over a ten-year period as being at least $90 million and up to $3.5 billion, depending on the cost of carbon factored in.
- Every new 7-Star home that is built in Australia uses a third of the energy needed to heat and cool a 1.5-Star home. These savings are significant given 80 per cent of Australian housing stock was built before the 6-Star standard came into effect.

4

Updating the National Construction Code so that 7-Star homes are the minimum standard is a huge opportunity to improve the quality, comfort and running cost of Australian homes. Any delay in doing so will lock in higher bills and emissions for many years.

- For the first time in 11 years, the laws that mandate minimum energy efficiency standards are being reviewed, with a proposed increase from 6-Star standard homes to 7-Stars under the National Construction Code (NCC). Such an update is long overdue.
- Developers are already building 7-Star homes, including some of the country's largest home builders, and standards at this level have been discussed since the NCC was first introduced in 2003.
- Any delay in introducing new standards will lock in higher bills and emissions. An independent analysis from Australian Sustainable Built Environment Council and ClimateWorks (2018) found that a delay in implementing new standards could mean 1.1 million homes (including townhouses and apartments) will be built to a poorer standard; adding $2 billion to residential energy bills and $720 million in additional network costs.
- The same analysis found a delay would also add 9 million tonnes of emissions this decade making it more difficult for states and territories to reach their climate targets. This would be the equivalent of forcing one of Australia's larger coal power stations to operate for an extra, unnecessary year.

Recommendations

1. States and territories should support lifting energy efficiency standards in the 2022 update to the National Construction Code and implement the update at a state and territory level by the end of 2022. If the national update is delayed or unsuccessful, states and territories should nonetheless commit to proceeding with a move to 7-Star homes in their jurisdiction by the end of 2022.

2. Push for additional updates to the National Construction Code to ensure homes are future-ready.

3. Implement mandatory energy efficiency disclosure at point-of-sale.

4. Implement minimum energy efficiency standards for rental properties by 2025.

5. Comprehensively upgrade existing social housing so they are energy efficient.

6. Increase incentives for home energy efficiency improvements including appliance replacement and thermal-performance upgrades.

7. Phase out gas from all new housing developments by 2025.

8. Investigate opportunities to incentivise the replacement of all residential gas appliances.

9. Ensure housing standards are prepared for worsening climate extremes.

1. Introduction

Having a home to call our own is the great Australian dream. It goes without saying that all of us expect our house to be comfortable, affordable to run and safe. Broadly, an important aspect of the liveability of any house can be defined by its *energy efficiency* - how much energy it uses to heat up, to cool down and to run essential appliances like refrigerators.

The energy efficiency of Australian homes is put to the test during our blistering summer heat, chilly winter nights and increasing extreme weather events. In the wake of the COVID-19 pandemic and changing work habits, more than ever we're spending increased time in our homes to notice and more people are questioning if their home's performance is adequate. Internet searches for space heaters increased by 44 per cent in June 2021 compared to the previous four winters (Miura 2021). With many Australians reliant on running heaters and air conditioners at home throughout the day using old and inefficient appliances, it's no surprise as many as 85 per cent of us experienced "bill shock" last year (Duffy 2021). Media reports during lockdowns featured people feeling cold air seeping in through window gaps, finding their children's frigid hands outside of their bed covers, or - at the other extreme - having to leave their house because the heat was unbearable (Petrovic 2021; Zagon 2021; Zhuang 2021). Shockingly, cold temperatures in our homes contribute to 6 per cent of deaths in Australia (Gasparrini et al. 2015). This is double the death-rate of much-colder Sweden and can be attributed in part to our comparatively poor housing stock (Barnett 2015).

Living in households that are too cold contributes to 6 per cent of deaths in Australia - double the rate in Sweden, where winter temperatures reach minus 30°C.

This comes as no surprise to home energy efficiency experts, who have long identified Australia's low housing standards as a risk to people's comfort, cost of living and health. A broad cross-sector of organisations and experts have long been calling for an increase in energy efficiency standards so that new homes are built to suit the local climate and are more affordable to run.

Figure 1: The Avoca 265 is a 7.1-star home by Gracious Living Constructions at the Ginninderry estate on the ACT and NSW border. All homes at Ginninderry are above 7-stars and built to run all-electric.

A major opportunity to improve standards for all new homes is now available with a proposed update to the National Construction Code (NCC). This uniform set of technical provisions sets minimum standards for Australian buildings in terms of safety, health, amenity, accessibility and sustainability of certain buildings. The Australian Building Codes Board produces and maintains the NCC on behalf of the federal, state and territory governments (ABCB 2022). Although the NCC is updated every three years, this revision is the first to propose an increase in the current 6-Star standard (to 7-Stars) for new homes since 2010. Currently, just over 16 per cent of new housing in Australia is built to this better, 7-Star standard (9.6 per cent of standalone houses) (CSIRO 2022). If implemented, a change to the code would improve the energy efficiency in an estimated 1.1 million homes, including townhouses and apartments, which at the time of analysis were expected to be built between 2022 and 2025 to this new minimum standard (ClimateWorks 2018). It is more likely however that this number of homes will be met in 2027 at the earliest based on ABS (2021) statistics.

Updating the National Construction Code can ensure more than a million homes expected to be built prior to 2027 are more comfortable, affordable to run and have lower emissions.

Our analysis shows significant savings for households. For example,a 7-Star house built in any capital city would deliver average heating and cooling cost savings of $450 every year (between $119 and $945). Over the life of a house, these savings would run into tens of thousands of dollars and pay back any potential upfront costs in building a more energy efficient home.

An update to the NCC would not only provide Australians with better quality housing, but would also help tackle climate change by cutting greenhouse gas emissions. The residential building sector accounts for 22.8 per cent of electricity use (DISER 2021) and is responsible for about 11 per cent of Australia's emissions (COAG Energy Council 2019). By building homes to a 7-Star minimum standard, emissions can be cut and residents can benefit.

2. Understanding home energy efficiency

Energy efficiency is a broad term that encompasses the various aspects of the generation and use of energy. When we achieve *higher* energy efficiency, it means we use less energy to perform the same task than someone/something with lower efficiency. The amount it costs us to fill up our car at the petrol pump comes down to energy efficiency - how much fuel (energy) it takes for the car to travel a certain distance. A more efficient car uses less fuel to travel the same distance as a less efficient car.

Notably, energy efficiency and energy conservation are not the same thing. Conservation means a change in behaviour; such as turning lights off when leaving a room or putting on a jumper rather than putting on a heater. Energy efficiency means we use less energy when we do things like heat our home or cool it; thus lowering demand. Both are important in lowering emissions from our homes, but improving household efficiency is something we can do to make homes perform better, regardless of how the occupants behave.

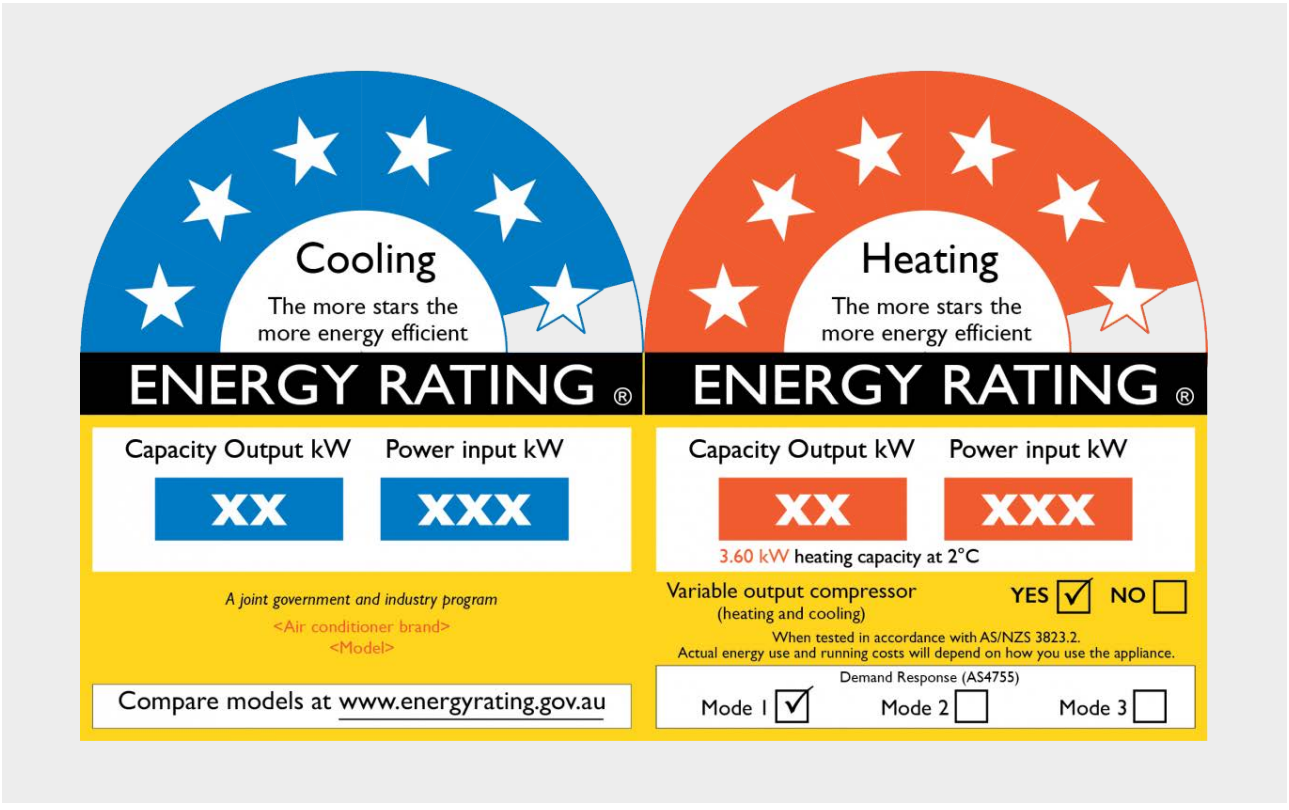


Figure 2: Star ratings on appliances show if an appliance is efficient to run, with more stars meaning higher efficiency.

Figure 3: Insulation in ceilings, walls and underfloor can substantially reduce the energy (and cost) needed to heat and cool a house.

Home energy efficiency applies this thinking to the homes we live in and the appliances we use. For example, a more efficient fridge will cool itself and its contents using less electricity, and also use less electricity to remain cool afterward. In Australia and New Zealand, a program rates appliances on their energy efficiency using Star ratings - the more Stars an appliance has the less energy it uses to complete a task and the more efficient it is (Energy Rating 2020).

Efficiency also extends to a house or apartment as a whole: with the building materials that are used, the direction that a house is facing, and the level of insulation among the contributing factors. These characteristics can have a huge impact on the amount of energy, either electricity or gas, that is needed to keep our home cool in summer and warm in winter. For example, many Australian homes are 'leaky' with cold and hot air seeping in through, and out of, holes or gaps around windows and doors. This leakage means more energy from heating and cooling appliances is needed to keep the indoor temperature comfortable. In most states and territories in Australia, the efficiency of a house is measured against a 'Star' rating from 1-10 with more Stars meaning less energy is needed to keep the house at a liveable temperature - a system known as the Nationwide House Energy Rating Scheme (NatHERS) (DISER 2021b).[1]

Examples of how home energy efficiency measures make a difference include:

- Installing roof and ceiling insulation can save up to 45 per cent on heating and cooling costs, while insulating walls can typically save around 15 per cent (Australian Government 2020).
- Electric heat-pump water heaters are around 3-4 times more efficient, meaning they use a third to a quarter of the energy than poorer alternatives (e.g. electric storage, instantaneous gas) to heat the same amount of water (Griffith 2022).
- Reverse cycle air-conditioners are the most energy-efficient heater and cooler of all types, irrespective of fuel source. The best of these are over 500 per cent efficient.
- The orientation of a home affects its efficiency because the sun heats up walls and enters through windows. An east- or west-facing house requires more than double the energy requirements for heating and cooling than a north-facing house. A south-facing house requires triple (Albatayneh et al. 2018).

1 In New South Wales, the online Building Sustainability Index system replaces the NCC energy efficiency requirements and adds other aspects of sustainable development. In the ACT, the ACT Home Energy Rating Scheme, out of 6-Stars, is used alongside the national scheme.

Figure 4: Efficient electric appliances (like an induction cooktop instead of gas) waste far less energy to perform the same function.

› Sealing gaps, including around windows and doors, can save between 5-15 per cent of summer gain and winter loss of heat.

Currently, many Australian homes use gas for cooking, heating and hot water despite the impact on our health and the availability of better electric alternatives (see, for example, Climate Council 2021a). Although it is not directly related to building homes to higher NatHERS ratings, removing gas appliances from the home is another way households can rapidly improve energy efficiency. For example:

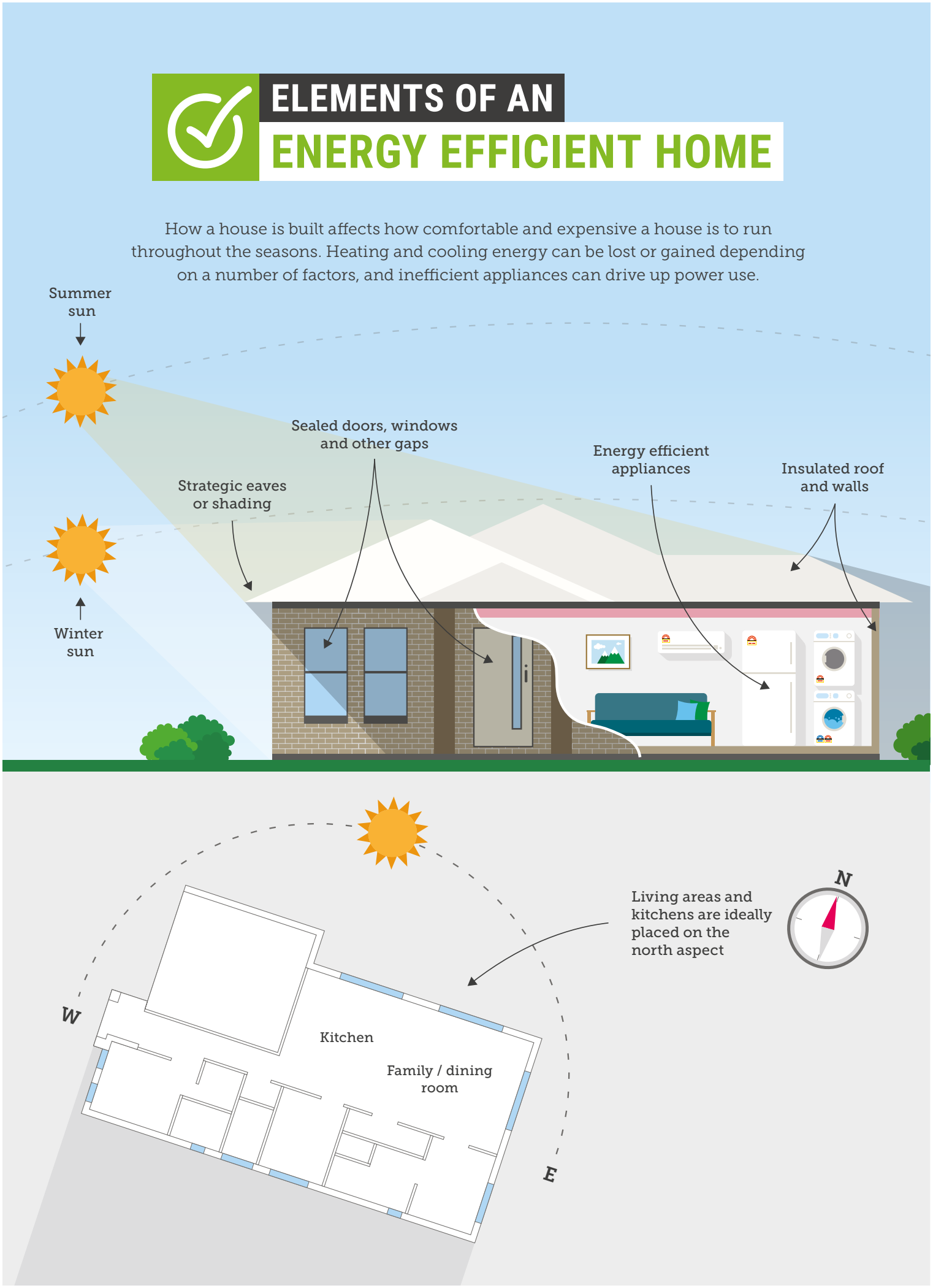
› As a result of rising gas prices, using electricity in a reverse cycle air-conditioner is more cost effective than gas heating. The reverse cycle delivers 4 units of heat for each unit of electricity you consume, whereas gas delivers only 0.9 units, or 90 per cent of the energy it contains (Domain 2019).

› Gas stove tops have poor efficiency, delivering only 0.3 units or 30 per cent of the potential energy, while conventional electric stove tops are more than double that, and induction stoves even more efficient. You can feel the wasted energy of a gas stove top when you boil water: 90% or more of the energy in the gas gets converted into heat, but almost three quarters of that heat is lost to the air in the kitchen rather than heating the water (Griffith 2022).

› When producing hot water, an electric heat pump is 300-400% more efficient, meaning they use a third to a quarter of the energy that a gas system would use to heat the same amount of water (Griffith 2022).

The inefficiency of gas is exemplified by modelling performed by Sue et al. (2016), which found electrification of residential and industrial gas use would cut total gas use in Australia by 45 per cent whereas electricity consumption would only increase by 5 per cent.

Figure 5: Elements of an energy efficient home.



3. Why does home energy efficiency matter?

Greater energy efficiency means fewer greenhouse gas emissions, which is essential for tackling climate change. But that's not where the benefits of making homes more comfortable to live in stops: we can also improve people's health and wellbeing, reduce electricity bills, strengthen our energy grid and create jobs.

Australians can save money on energy bills by making their homes more energy efficient, and replacing gas with electricity.

CUTTING THE COST-OF-LIVING

Australian building efficiency standards lag behind other major economies, leaving many Australians to live in homes that are damp, draughty, too cold in winter and too hot in summer. This forces residents to rely on large amounts of artificial heating and cooling to stay comfortable.

Poor quality housing leads to increasingly unaffordable energy bills. Australian homes face some of the most expensive energy bills in the world (Alves, 2021) and as many as 85 per cent of us experienced "bill shock" in 2020 (compareclub 2021), in part because energy bills were even higher on account of people working from home due to COVID, a trend that is expected to continue as part of the "new normal". For low-income households in 2018, 6.4 per cent of their incomes were used for gas and electricity costs, despite using less energy than high-income households (with the top two quintiles paying 1.5% to 2.3% of incomes) (ACOSS 2018). Increasing home energy efficiency will save householders money and therefore reduce this strain on households.

The price of gas, which many homes use for heating, hot water and cooking, has risen sharply in recent years (ACCC 2022) - with wholesale prices increasing by around 2.5 to 3 times over the seven years to 2021-22 (AER, 2022a). This compares with an average increase of 2 times for electricity prices (AER, 2022b), although there is significant variation across the states and territories, unlike gas prices which are more uniform. Moving

from dual fuel (both electricity and gas) to all-electric homes will deliver major financial benefits to residents due to rising gas prices, avoiding fixed gas connection charges and falling wholesale electricity prices.

BETTER HEALTH AND REDUCING HEALTHCARE COSTS

The poor energy efficiency of our homes imposes significant health risks, particularly during cold or hot extremes. Heatwaves or cold snaps can cause an increase in respiratory and cardio-vascular diseases, such as pneumonia and high blood pressure, leaving the elderly, infants and people with pre-existing conditions particularly vulnerable (Gasparrini et al. 2015). In fact, heatwaves kill more Australians than bushfires, floods, storms and cyclones combined (Coates 2014), while homes that do not maintain warmth properly are a contributing factor in at least 6 per cent of deaths in Australia each year (Gasparrini et al. 2015). That is double the death-rate of much-colder Sweden, in large part attributable to our poor housing stock (Barnett 2015).

More efficient homes can also improve health outcomes during extreme heat. 'Passive survivability' of a home refers to how long internal temperature can be maintained at safe levels during an event that leads to a power outage (Building Green 2022). A more efficient home maintains this 'passive survivability' for longer than an inefficient one by making the internal temperature less influenced by the outside temperature. Given power outages often occur in extreme temperatures, such as heatwaves, when electricity demand is high, this temperature consistency is important. Between January 2006 and October 2017,

Figure 6: Of his 9-star home in the ACT, Harley Truong says "next time there is a blackout on a stinking hot day, I won't be worrying about overheating because the house keeps naturally cool. Such a simple way to achieve climate resilience."

36,765 Australians lost their lives due to extreme heat (Longden 2020). Improving energy efficiency will keep more people safe at home during future heatwaves, which are more frequent, intense and are lasting longer as a result of climate change.

Another health risk comes from using gas to cook, and heat our homes. An Australian study in 2018 found exposure to gas stove emissions is responsible for 12.3 per cent of the total asthma burden in children aged 14 years or under (Knibbs et al. 2018). The estimated cost of asthma in Australia in 2015 was $28 billion (Asthma Australia 2021). If we account for inflation, in 2021, this value was roughly $32 billion - 12.3 per cent of that figure, attributable to gas in homes, would result in a value of $4 billion each year.

Further still, there is the impact of carbon monoxide poisoning, which is the leading cause of accidental poisoning worldwide (Watt et al., 2018). This is often caused by faulty or poorly serviced heaters being used in areas that lack proper air flow. Short-term exposure to high concentrations of carbon monoxide from gas appliances, as well as long-term exposure to lower concentrations, can have lasting adverse effects, including trouble with memory and concentration, and other neurological problems (Watt et al., 2018). Acute carbon monoxide poisoning is a fatal risk of indoor gas use. While death from carbon monoxide poisoning is rare in Australia, it has led to the deaths of multiple Australians in recent times (Climate Council 2021a). In addition, because carbon monoxide is colourless, odourless and tasteless, and because the symptoms of poisoning are non-specific, deaths from carbon monoxide poisoning will often be mistakenly attributed to other causes (Kar-Purkayastha et al., 2012).

Figure 7: Household gas use, especially from gas stoves, contributes significantly to the burden of childhood asthma in Australia.

Recent research in the United States highlighted the issue of burning gas in homes showing that roughly 1 per cent of natural gas used is directly released into the home, three quarters of which occurred when the stove was turned off (Lebel et al. 2022). Gas appliances are however easily replaceable with more efficient and safer electric alternatives.

The burden of outdated appliances and poor quality housing on individual health and our healthcare system can be addressed through better energy efficiency. Higher quality homes result in people taking fewer days off work and school due to illness, and reduce visits to doctors and hospitals. For example, the *Warm Up New Zealand* program to improve home energy efficiency delivered a return of $3.88 to communities for every $1 spent, with 99 per cent of the total economic savings attributed to health benefits (Cumming 2020).

CHEAPER AND MORE RELIABLE ENERGY FOR ALL

Australian homes account for around 22.8 per cent of electricity demand – and even more in peak periods such as heatwaves (DISER 2021). Energy efficiency measures reduce demand, thus lowering prices and reducing the risk of blackouts at peak times for all Australians (Australian Sustainable Built Environment Council 2018).

The cost of delivering electricity through transmission and distribution networks to consumers (often referred to as 'the poles and wires') makes up a significant portion of electricity bills. By improving energy efficiency in homes, and reducing air-conditioning demand in particular, the need to invest in networks can be significantly decreased. Australian Sustainable Built Environment Council and ClimateWorks (2018) calculated that for every 1 kilowatt reduction in peak demand due to energy efficiency measures - equivalent to half the amount of power a kettle uses - results in just under $1,000 in saved network costs. While there are many factors affecting electricity prices, as new housing continues to increase to meet population growth, the report notes that implementing higher energy efficiency standards now has the potential to reduce future network costs through peak demand reduction.

The *Warm Up New Zealand* program improved home efficiency and delivered a return of nearly $4 for every $1 spent, with almost all savings due to health benefits.

REDUCING INEQUALITY AND THE RISK OF HOMELESSNESS

People on low incomes, renters and social housing tenants are more likely to live in poor quality housing and rely on inefficient appliances that are cheap to buy but expensive to run. High energy bills contribute to cost-of-living pressures and an increased risk of homelessness for people on low incomes, particularly for those who rent their homes and can be forced to choose between paying utility bills or rent (ACOSS 2019). Low income earners spend significantly more of their income on electricity and gas (on average, 6.4%) compared to the wealthiest households (on average, 1.5% of income) (ACOSS 2019). Many vulnerable households will go without heating or cooling, risking their health, because they fear disconnection if they can't pay energy bills. These problems have been known for many years, for example, analyses by PWC (2011) found that during heatwaves, the highest mortality rates exist for people on low incomes, among other vulnerable groups. Improving energy efficiency in these homes can reduce energy poverty and the burden it places on individuals and the social support systems they rely on.

HOW BETTER HOMES HELP ADDRESS CLIMATE CHANGE

Electricity is the biggest contributor to climate change in Australia, because the majority of our electricity still comes from the burning of fossil fuels like coal and gas (Climate Council 2018c). In 2019/20 homes consumed almost a quarter (22.8 per cent) of Australia's electricity (DISER 2022b). Improving the energy efficiency of Australian buildings, including homes, reduces their electricity use and the burning of fossil fuels; and therefore, our contribution to the climate crisis. For example, the average home built before 2003 (many as low as 1.5-Stars) versus a 7-Star home could add more than 15 tonnes of CO_2-e per year based on the national average NatHERS heating and cooling loads, depending on the type of heating used. Or, to put it another way, this means that the energy needed to heat and cool a single 1.5-Star home is the same amount used to heat and cool roughly three 7-Star homes.

Homes are responsible for 11 per cent of Australia's greenhouse gas emissions (DISER 2021c), and rising power bills are often used as a spurious justification for extending the life of fossil fuel power stations (see for example, The Guardian 2022). In fact,

Building better Australian homes is an effective way of reducing greenhouse gas emissions and tackling climate change.

Figure 8: The Strait House in Cape Patterson, Victoria is built to an impressive 8.4 stars. Resident Richard Keech reflects "like anyone with lived experience of high-performing homes, we would find it very hard to go back to a home that doesn't properly keep us comfortable. Everyone should expect more from their homes in this regard - it's so much more than saving a few dollars on your energy bill."

the opposite is true: extending the life of coal and gas power stations will drive up emissions as well as power bills, not lower them (see for example McConnell and Sandiford 2020). At the same time that we replace our energy source we can also reduce the energy demand of homes. This is widely recognised as one of the easiest, cheapest and fastest ways to reduce greenhouse gas emissions and household energy costs at the same time.

A further climate benefit comes from replacing gas appliances with better electric alternatives. Gas is a polluting fossil fuel. Roughly 11 per cent of Australia's gas consumption is used in homes (DISER 2022b). Although gas is often suggested to be a cleaner alternative than coal, the emissions released across the lifetime of its use mean that its contribution to climate change is much more significant than is generally reported (Climate Council 2020d). There are efficient, electric alternatives to all household gas appliances that allow us to easily and cheaply remove this source of emissions.

4. Behind the pack: How Australian homes compare to those in other countries

The numerous and varied benefits of energy efficient homes have prompted many countries to act swiftly to implement higher standards and upgrade older homes. Unfortunately, Australia introduced home energy efficiency standards much later than our international peers - and to a lower standard. Ever since, we've been slow to improve standards and upgrade existing homes in line with international best practice.

New homes being built in Australia today are 40 per cent worse when it comes to energy efficiency than those built in developed countries with similar climate zones.

The United Kingdom (UK) introduced housing energy standards as early as the 1960s (Moore et al. 2019). North America, New Zealand and other European countries followed suit the next decade, introducing minimum insulation or energy efficiency standards in response to the first oil crisis of the 1970s (Berry 2015; Ekins 2008; Lee 2004).

It wasn't until 2003 when the national minimum housing energy performance requirements in Australia were set at 4-Stars through the Building Code of Australia (Hurlimann et al. 2018; Moore et al. 2019). Compared to this new minimum Australian standard, homes in comparable climate zones overseas were already on average 55 per cent more efficient for heating and cooling energy use (Horne et al. 2008). In 2010, the Australian minimum Star rating increased to the current 6-Star rating with some states and territories slower than others in reaching this standard. Nevertheless, Australia's minimum energy efficiency standards for new homes are still at least 40 per cent worse than in compatible climate zones in other countries including the United States of America, Canada and the UK (Moore 2019). Australian homes built before 2010 are substantially lower quality than international standards, and homes built since still lag 40 per cent behind.

Energy demand from Australian homes has substantially increased over the last 20 years, while in the UK and France it has reduced by more than a third.

Poor building standards have directly led to Australia's residential energy demand substantially increasing by 21 per cent over the past 20 years (DISER 2022). In contrast, the UK and France have reduced their residential energy use by a third in the same period (IEA 2020). Going even further, the European Union has ruled that from 2021 all new buildings are required to be nearly net zero-energy (D'Agostino 2021) and that by 2030 all new structures need to be net zero (European Commission 2021). A net zero-energy building (or NZEB) is a building that has a very high energy performance in which the nearly-zero or very low energy requirements should be sourced from renewable energy produced on-site or nearby (Atanasiu 2011).

NZEB standards equate to a primary energy use for new residential buildings that is 67% lower compared to European national standards in 2006. This major improvement over a relatively short period has been made possible due to at least three incremental legislative steps (Economidou 2020). In the US, national model energy codes are updated every three years, with most states directly adopting the codes as proposed or only with minor amendments (Building Codes Assistant Project 2022). In contrast, the latest NCC minimum standards of 6-Stars in Australia has remained unchanged since it was first introduced more than a decade ago.

BOX 1: AUSTRALIAN STANDARDS VERSUS THE WORLD

The EU has set NZEB recommendations, and each member state is to determine its own definition and how it will be achieved. To put the standards into perspective, a Tasmanian home currently uses more than double the average annual end use energy consumption of a new Irish home built to NZEB standards in line with the EU's recommendations (The Fifth Estate 2020a).

Australia is now ranked 18 out of 25 of the world's top energy consuming nations for energy performance (ACEEE 2018). Spain, France, the UK, Germany, China, Poland and Mexico outperform Australia's energy efficiency building standards (ACEEE 2018).

Australia is now ranked 18 out of 25 of the world's top energy users when it comes to energy performance, sitting behind Spain, France, the UK, Germany, China, Poland and Mexico on energy efficiency building standards. That means a Tasmanian home built today will use more than double the energy of a similar home built in Ireland.

5. What do our low standards mean for the quality of Australian homes?

Our low energy efficiency standards and a lack of comprehensive investment in upgrading older homes has saddled Australians with homes that are draughty, too hot in summer and too cold in winter as well as having outdated, energy-hungry appliances.

One analysis of 60 homes built pre-2005 found they were on average, constructed to a measly 1.8-Stars (Sustainability Victoria 2015), with the possibility that this average is even lower in other areas (CSIRO 2020). Often these homes even lack basic energy efficiency measures such as insulation in wall and roof cavities and draught sealing, which have been shown to be two of the most cost effective energy efficiency measures (Sustainability Victoria 2015). When considering homes built after the 6-Star minimum was put in place, four out of five homes were found to be built *only* to the minimum standard (CSIRO 2020). In fact, research from CSIRO revealed only 1.5 per cent of homes being built were designed to perform at the ideal 7.5-Stars or beyond, despite this being what they assessed to be the economically optimal option (CSIRO 2020).

CSIRO researchers found 7.5-Star homes are the most economic option to build and run but only 1.5 per cent of Australian homes are being built to that standard.

Figure 9: Australian homes can and should be built to a higher standard. The Cullen is a 7.2-star home by McDonald Jones at the Ginninderry estate.

Part of the resistance to improving energy efficiency standards comes from a perception that Australia has a mild climate, unlike some of the other countries to which we tend to be compared, and therefore have less to gain from greater energy efficiency. This has resulted in having homes that are not only less comfortable than they should be, but homes that are worse to live in than homes built in much colder climates. Temperatures inside a wooden Queensland home during winter are often below 18°C, whereas Scandinavian homes stay more comfortable at an internal temperature of 23°C regardless of the weather which can reach sub zero temperatures of minus 30° (Barnett 2015). Such poor living conditions have resulted in one public health expert branding Australian homes "glorified tents" (Barnett 2015). However, improving energy efficiency is not just about keeping homes warm in winter. The energy required to cool a 7-Star home in Darwin is greater than the energy required to heat a home in both Thredbo and Cabrumurra - two high mountain towns where it snows throughout the winter (DISER 2021d). This suggests that in warm and hot climates, energy efficiency is at least as important as cold climates because of the frequency that homes require cooling.

The poor standard of the typical Australian home means those living there are subjected to high bills and uncomfortable and unsafe temperatures, while unnecessarily adding to greenhouse gas emissions. While state and territory governments have taken some steps to improve energy efficiency standards and invest in replacing some outdated appliances, action on home energy efficiency is largely missing. The costs and poorer outcomes are predominantly being borne by individuals; who must independently work out ways to make their homes more comfortable and safe; and wear all the costs in trying to do so. Greater government action is needed on this issue considering the level of technical expertise and large-scale investment required to bring all of our housing stock up-to-scratch, as well the broad, societal benefits that can be achieved from doing so.

6. Bringing Australian housing up to scratch

With Australian homes lagging behind international standards and many of us experiencing the health and financial consequences of poor energy efficiency, there are a number of interventions required to improve our housing. All levels of governments and individuals have a role to play in not just upgrading existing housing, but ensuring that new houses built remain fit-for-purpose into the future.

A substantial opportunity exists in 2022 to ensure we improve the standard of homes built by raising standards through the National Construction Code.

THE 2022 UPDATE TO THE NATIONAL CONSTRUCTION CODE

In August 2021, the Australian Building Codes Board (ABCB) released a new draft of energy efficiency rules to be included in the 2022 update of the National Construction Code. In its first revision of minimum energy efficiency standards for homes since 2010, the draft proposes an increase for new homes under the Nationwide House Energy Rating Scheme (NatHERS) from the current 6-Stars to a minimum of 7-Stars. This update also proposes a new "whole of home" energy budget that sets requirements for appliances and encourages the uptake of rooftop solar (DISER 2021d). The budgets, labelled Options A and B in the draft update, will consider overall energy use and factor in thermal efficiency, appliances, and onsite solar, allowing for the efficiency of different appliances and solar generation to be traded off against one another to fall within a mandatory limit (Renew 2021a).

This represents a significant opportunity to improve the standard of new homes. Although the update covers a variety of changes, the remainder of this report focuses on the costs and benefits of increasing minimum new home build standards from 6 to 7-Stars.

Relevant state and territory ministers are currently considering whether to approve the update to the National Construction Code. They are also responsible for implementing the Code in their jurisdiction, including the speed and consistency of its application.

The premium to get from 6 to 7.5-Stars used to be $14,000 and is now just over $6,000

Figure 10: Matthew, Katherine and their two children live in this now finished home in NSW and reflect "in our energy efficient home, we use way less energy, meaning lower bills, and have a comfortable temperature year round."

According to the schedule, the new Code should come into effect on 1 September 2022, but previously some jurisdictions have delayed the implementation of new rules, and once again we find that some voices, including from the home building industry, are pushing for delay.

BUILDING BETTER HOMES

With the vast majority of homes built only to the minimum standard (6-Stars in most areas), the opportunity to increase this to 7-Stars would have a significant impact on the homes we build. The calculation tool that identifies the Star rating of a home takes into account many different variables including insulation, natural ventilation, air leakage, window size and material and external shading. There is no single design change that moves a house from being 6 to 7-Stars. Rather, such improvement is achieved through a range of different design and construction changes.

Designing a house to be a higher Star rating from the start is significantly easier and cheaper than retrofitting later, because work can be absorbed into the construction phase (such as installing sufficient insulation before walls are built) and build-features such as layout and orientation can also be taken into account.

The significant cost savings and relative ease of building for high energy efficiency initially, rather than retrofitting later, underscores the importance of raising standards for new homes. Homes built today will likely be around in 60 years' time (Property Registry 2022), so getting the performance standards right from the beginning saves money on needing to make changes later.

> *"Because buildings are long-lived assets, a delay in upgrading code requirements locks in higher energy use and emissions for decades."* - Built to Perform report, Australian Sustainable Built Environment Council and Climate Works 2018.

BOX 2: 7-STAR HOMES ARE ALREADY HERE

Developers around the country are already building 7-Star homes, both to meet consumer demand and as demonstration projects. This isn't just a niche interest: some of the country's largest developers are starting their own projects. For example, Stockland, one of the country's largest property groups, is building villages consisting of 7 and 8-Star homes in NSW (Stockland 2016), Victoria (Stockland 2020) and QLD (Stockland 2021).

There are an increasing number of examples where entire developments are being built to 7-Star or higher standards; such as The Cape in Victoria, Lochiel Park in South Australia and Ginninderry in the ACT.

At The Cape, on Victoria's Bass Coast, all homes have been designed to a minimum of 7.5 -Stars with many in the development achieving 8.0-Stars and above. Analysis performed by Renew and RMIT University found that homes in this development maintained a stable and comfortable year-round temperature within the 18-25°C band with residents needing their heating and cooling infrequently, and paying less for bills. In fact, the homes analysed recorded an 88 per cent reduction in energy consumption compared to a new 6-Star Victorian home of comparable size, and significant economic savings of $2,307/year. The analysis identified several benefits from this improved performance: reduction in energy consumption resulting in lower energy costs; a greater percentage of time spent by occupants in a healthy temperature range which could improve their health; maintaining thermal comfort for longer in the event of a blackout; reliance on smaller or no heating and cooling appliances reducing capital costs; and lower maintenance and replacement costs over the life of the home (Renew 2020c).

Figure 11: The Strait House at The Cape is an all-electric home built to a whopping 8.6 stars. The thick windows not only help keep the house at a comfortable temperature, but also help soundproof.

In recent years, some developers have built homes to 7 stars and higher to demonstrate the ease of doing this at the design phase, and the superior performance of those houses. According to many residential design and construction experts, it is neither more difficult nor costly to build a home that meets 7-Star standards, compared to a 6-Star one (Aliento 2021). For example, the difference in Stars might be achieved through rotating a house design 90 degrees, altering the eave length in accordance with sun position or including more careful building practices to prevent air entering or escaping through tiny gaps (known as 'air shift'). While all these changes are inexpensive at the construction phase, they do require a more flexible approach to home design, a level of technical design ability and a shift in building practices - minor complications that some industry voices are resisting.

Tony O'Connell of TS Constructions, Gippsland Victoria points to one simple example of how building more homes above 7.5-Stars has shifted their building practices:

> *"Good design is key, and with that sorted, we don't really need to sacrifice anything to get good ratings. There are a lot of things we used to price in as a bit of an unknown that we don't anymore. For example, it takes very little time to run a bead of silicone around under the frame as you put it down on the slab to stop any air shift. We used to price that in as a bit of a premium, but now we've built so many of these projects, we've developed better and quicker methods and just see this stuff as part of good building practice."*

One of the most common objections raising minimum standards has been that it will raise building costs that are passed on to homebuyers. However, for builders already completing 7-Star homes, this claim doesn't hold water.

BOX 3: IS BUILDING A 7-STAR HOME MORE EXPENSIVE?

Many home builders who are voluntarily working on 7-Star rated and higher homes have identified that, after an initial learning curve, building to a higher standard is not much more difficult or expensive. As Mark Thomas of GoodHouse in South Australia commented on his 42nd energy efficient project, "once the builders [we work with] have actually built one, they say it's not that tricky" (Renew 2022b).

Notably, most builders identify that any raised costs decline after they have experience building 7-Star homes. For example, Tony O'Connell of TS Constructions in Gippsland Victoria builds 25-30 houses a year which are routinely 8+ -Stars. He points out that the premium used to be about $14,000 to get from 6 to 7.5-Stars, and is now just over $6,000 (or 0.8 per cent of the median national house price (CoreLogic, 2022) to get from 6 to 8.2-Stars saying: "in 6 or 7 years we've increased the Star rating and cut the cost in half" (Renew 2022b). These very modest increases in up-front investments can be quickly offset by reduced energy bills.

Many home builders have reported the experience of costs and challenges declining substantially with a small amount of experience building higher standard homes. This underscores why an industry-wide adoption

BOX 3: CONTINUED

of 7-Stars via the National Construction Code update should continue to push costs down. As Jenny Edwards of Light House Architecture and Science in the ACT points out:

> *"If you talk to a project home builder about a 7-Star house or double-glazing or increasing insulation, the extra they want to charge is way out of proportion for what those items actually cost. What they're charging the client for is wanting to do something different. They have a massive stock of the same elements and it is inconvenient for them, so it wrongly gives the impression to the clients that it costs a lot more than it really does. The biggest hurdle is to get people to realise that a standard 6-Star project home costs as much upfront as mine does, but twice as much to run from then on"* (Renew 2022b).

The assessment that building costs for improved standard delivery will fall as builders adjust to the change is supported by analysis of previous upgrades to standards. Despite earlier assertions from the building industry that costs would rise substantially and people would be locked out of the housing market because of standard upgrades, a review of the implementation of 5-Star standards reveals that compliance costs not only fell below original government estimates, but also progressively diminished over time as industry learning improved. No negative impacts on housing affordability were substantiated and there was no evidence of negative impacts on the housing market (The Fifth Estate 2016b).

Figure 12: Jenny's house by Light House Architecture and Science rates 8.2-stars, keeping it comfortable during the ACT's cold winters.

As the examples above demonstrate, not only are homes already being built to 7-Star standards, some are being built to even greater efficiency. There are numerous examples of 10-Star homes (Dwell 2022; Suho 2022) and the first zero carbon home was built in South Australia back in 2013 (Renewal SA 2022). These achievements show that 7-Stars is not only possible as a baseline for industry, but another step towards even more sustainable and comfortable homes in the future.

THE BENEFITS OF ACTING QUICKLY

The 2022 update to the National Construction Code is a substantial opportunity to improve the quality of homes built today and into the future, while also acknowledging there is still work to be done. A diverse cross-sector of voices have thrown their support behind the update including efficiency experts like the Energy Efficiency Council, Green Building Council of Australia and Australian Energy Foundation; social service organisations like Brotherhood of Saint Lawrence, Australian Council of Social Services and St Vincent de Paul; consumer groups like CHOICE and tenants unions; and climate focused organisations like Beyond Zero Emissions, ClimateWorks and Australian Youth Climate Coalition (Climate

Figure 13: Ambitious developers are even seeking to exceed minimum standards in apartment buildings. Apartments in Nightingale 1 in Brunswick, Victoria achieve an average of 8.2-stars and operate on 100% renewable energy with no gas in the building.

Figure 14: Even homes in remote locations can be built to higher energy efficiency standards. This 7-star home in Jindabyne, NSW is entirely off-grid and works to keep residents comfortable even in extreme summer and winter temperatures.

Council 2021e; The Fifth Estate 2021c). Industry voices, like the Property Council of Australia and a range of developers have also expressed their support for the proposed update (Wheeler 2022; The Urban Developer 2022).

Raising minimum standards for new homes provides all of the benefits already identified in this report, making homes better for residents as well as the environment. In assessing any policy change, it is essential that all benefits are looked at collectively to paint a full picture of what the change would mean for states, builders and individuals. Beyond costs and emissions, this includes everything from health benefits to energy resilience.

The Climate Council has calculated some of these benefits, by comparing the potential price increase a 7-Star build makes to each house with the heating and cooling reductions, which are presented as a reduction in electricity bills.

Climate Council notes there is merit in taking a whole-of-home approach to energy efficiency, such as the energy budgets approach used in the Consultation Regulation Impact Statement (CRIS) on the current proposal (ACIL Allen 2021). However, we have opted to only model heating and cooling costs, and have not offset electricity consumption with roof-top solar as we do not believe that a Star rating should be able to be offset by solar, as this could

Figure 15: The all-electric kitchen at The Cullen, Ginninderry estate features an efficient induction cooktop. All homes at Ginninderry are above 7-stars and not connected to mains gas, saving residents money.

mean that the thermal efficiency and peak demand benefits of energy efficiency are not realised. However, adding rooftop solar at the time of construction can be a positive step for homeowners, although it is not our intention here to assess this individual decision. From the 7-Star base we have analysed, the appliances added - including for water heating and cooking - will reduce electricity bills and emissions further, as long as they are efficient electric options. This is particularly true because as the entire Australian energy grid decarbonises, so too will the electricity use of all homes.

Cost savings for residents

Below we present our analysis for a move from 6 to 7 NatHERS Stars and compare a 6-Star and 7-Star all-electric home. The comparison uses the average house sizes built in capital cities (CommSec 2022) and the increase in cost for 7-Stars based on analysis performed for the CRIS (Tony Isaacs Consulting 2021). Notably, these cost increase numbers may be much higher than what would be seen in practice, particularly as industry adjusts to the change. We have not modelled the savings in comparison to gas use, however previous analysis has highlighted major savings, which occur even before moving into a home, given gas connection itself can cost around $1,500 per home (Renew 2021a).

Our calculations show that for all-electric houses in all state or territory capital cities built to a 7-Star rating, there are immediate savings; an average of $450 per annum on heating and cooling costs alone. Table 1 below shows bill savings for the typical home in each capital city and the national average, as well as the amount of time it takes for these savings to offset the current cost required to bring a house up from 6 to 7-Stars (known as 'the payback period'). Darwin and Canberra experience substantial energy bill savings of $945 and $713 per year respectively, with Hobart and Adelaide also experiencing savings above the national average. Sydney and Brisbane have the lowest savings in bills, because the temperature ranges here are milder requiring less energy to heat and cool homes (NatHERS 2021). It is worth noting the ratings for Sydney are based in Mascot where temperature fluctuations are less extreme. If we were to use Western Sydney temperatures, which are far hotter in summer, then the bill savings increase to just under $400 each year. As discussed in the previous section, it may not cost anything extra at all to build a 7-Star home rather than a 6-Star home, in which case these bill savings would mean additional money in the pocket of homeowners from day one.

Figure 16: Howard and Libby love their 8.4-star all-electric home in Ringwood East, Victoria; "raising the minimum standard from 6 to 7 stars reduces the amount residents have to pay for electricity (and gas) to live comfortably. Investing in the improvements required to achieve a higher star rating pays a dividend with reduced heating and cooling energy costs over the life of the house."

Table 1: Heating and cooling bill savings for an all-electric 7-Star home as opposed to a 6-Star home including payback period based on additional cost of build.

	Ave. new home size (m^2)	Increased cost $/$m^2$	Total additional cost of ave house ($)	Heating and cooling savings in first year	Payback period (years)
Adelaide	201.8	10.47	2113	$460.41	4.6
Canberra	259.3	14.42	3739	$713.08	5.2
Brisbane	231.5	3.94	912	$119.05	7.7
Darwin	199.5	8.84	1764	$945.29	1.9
Hobart	176.5	13.46	2376	$453.02	5.2
Melbourne	238.8	11.18	2670	$407.15	6.6
Perth	230	6.92	1592	$337.30	4.7
Sydney	222.5	11.19	2490	$225.47	11.0
Average	**229.3**	**10.05**	**2306**	**$450.55**	**5.9**

Using even the most conservative build cost data, our analysis shows homes built to 7-Star, all-electric standard save the homeowner hundreds of dollars in energy costs each year, no matter where they're built in Australia.

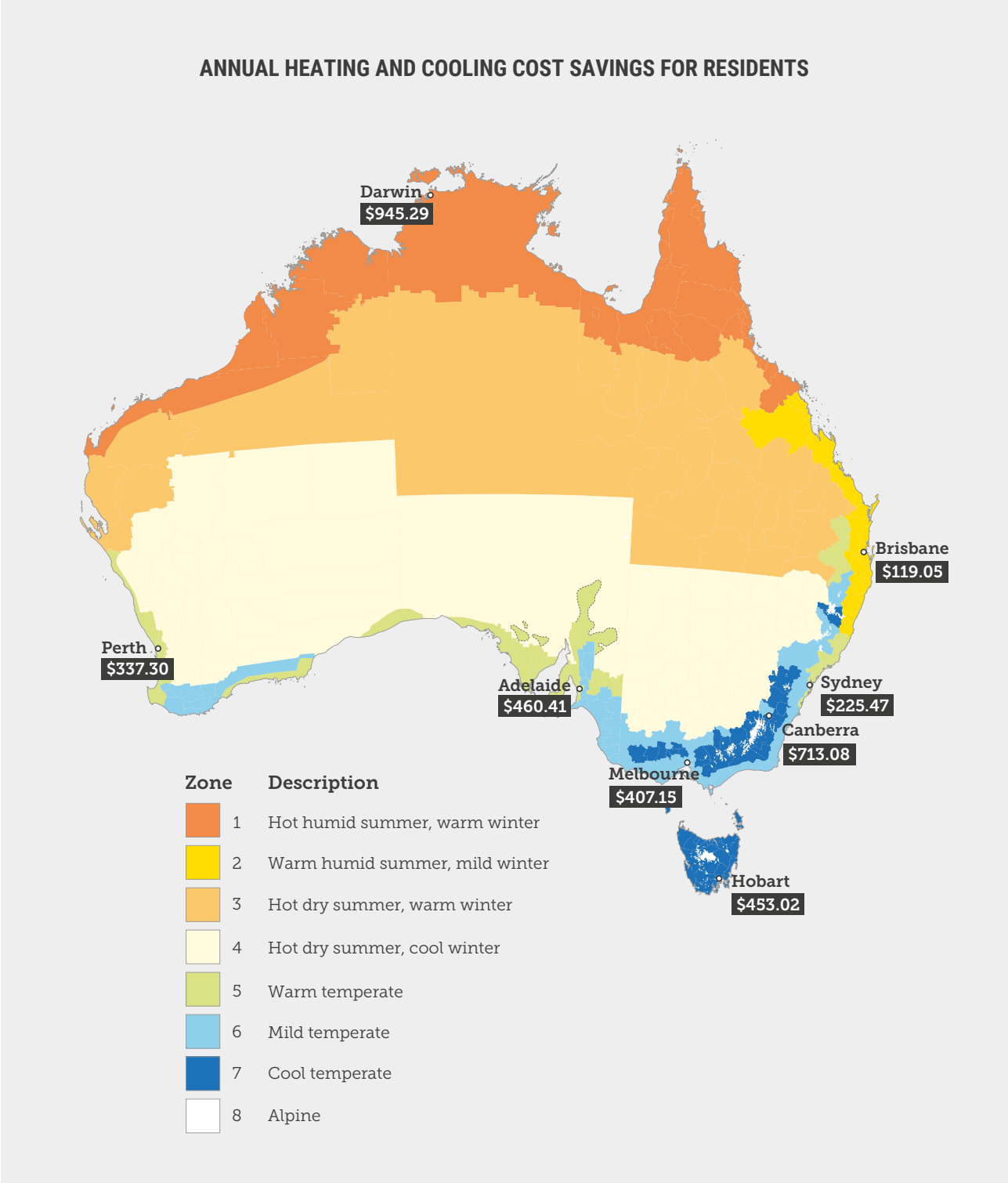


Figure 17: Annual heating and cooling energy bill savings in capital cities overlaid on the NatHERS climate zones. Bill savings are higher in areas with more extreme climates, but homes in every part of Australia are better off. Adapted from CSIRO 2022, *NCC Climates*, [Online] Available at: https://ahd.csiro.au/dashboards/energy-rating/ncc-climates/ [Accessed 04 2022].

Emissions reductions

In addition to cost savings, Climate Council's modelling also shows major savings in emissions each year if we move to a 7-Star minimum. On average, a 7-Star all-electric home achieves a 25 per cent reduction in emissions compared to a 6-Star all-electric home for heating and cooling every year.[2] Overall greenhouse gas emissions savings were calculated using the state-wide average reduction in NatHERS energy (kWh) for heating and cooling, the emissions factor of each state or territory's grid supplied energy, and multiplied by the 10-year average of stand alone homes built in each state - roughly 110,000 houses per year nationally (ABS 2022). The total emissions savings across the country in this scenario are just under 198,000 tonnes each year. If we calculate cumulative emissions to 2030 using electricity decarbonisation projections of 8 per cent per year (DISER 2021e), the total emissions saved are 7.7 million tonnes between 2023 and 2030. This would equate to a 12 per cent reduction of Australia's residential sector emissions by 2030 (DISER 2022b). Of course, this impressive figure will be even higher if multi-unit dwellings are included.

In Table 2 we present the emissions reductions per state and territory per year based on raising the minimum standard from 6-Stars to 7 for stand-alone houses only, calculated using the price of Australia Carbon Credit Units (ACCUs) as at 11 April 2022. As Australia does not have a formal carbon price, this is a useful proxy, although likely underestimates the true cost of carbon emissions, which are better captured by a Social Cost of Carbon (SCC) (Hutley 2021). The SCC is a more comprehensive measure of the economic, social and environmental damages avoided for every tonne of carbon emissions reductions.[3]

The value of emissions reduction for each jurisdiction using the conservative ACCU value ranges from $38,931 in the Northern Territory to more than $2.1 million in Victoria each year due to the different emissions intensities between the states and territories. If these numbers were extended out to 2030, the total value of avoided emissions is close to $80 million.

Emissions savings per house, per year would be equivalent to a car being taken off the road for an entire year.

2 A 25 per cent reduction is in line with the 24 per cent decrease suggested by Dr Trivess Moore, senior lecturer at RMIT University's Sustainable Building Innovation Lab (Climate Control News 2021, New energy efficiency standards for Australian homes viewed online at https://www.climatecontrolnews.com.au/news/latest/new-energy-efficiency-standards-for-australian-homes [18 Mar 2022].

3 There are also estimates for the Social Costs of other GHGs.

Table 2: State emissions savings per year based on building 7-Star homes rather than 6-Star homes and the value of avoided emissions calculated using ACCU carbon price of $30.

State	Tonnes CO^2 saved per year	Value of avoided emissions per year
NSW	46,341	$1,390,238
VIC	72,681	$2,180,415
QLD	31,077	$932,298
SA	12,761	$382,836
WA	26,874	$806,217
TAS	4,122	$123,667
NT	1,298	$38,931
ACT	3,146	$94,367
Total	**198,299**	**$5,948,969**

However, if we were to use the more comprehensive SCC, this figure rises significantly. There are various estimates for the SCC, which will depend on a complex range of assumptions. These estimates range from a low of US$38 per tonne of CO_2-e in 2020 to a high of $776. By 2050, these rise to US$62 and US$885 respectively (Hutley 2021). A recent study, which has expanded upon previous modelling of Social Cost of Carbon, determined a value of $US307 per tonne of carbon (Kikstra et al 2021). Accounting for inflation and exchange rates, this would equate to just under A$457 per tonne of carbon and would result in more than $90 million in avoided losses in the first year (2023), and close over $3.5 billion extending out to 2030.

Even using very conservative data for both emissions and cost savings calculations, it is clear that the move from a 6 to 7-Star minimum in the 2022 update to the National Construction Code delivers significant benefits to both residents, and the country as a whole. New homes in every single state of Australia would enjoy lower energy bills and reduce their contribution to national greenhouse gas emissions.

More details on the methods used for calculations can be found at: www.climatecouncil.org.au/resources/tents-castles-building-energy-efficient-cost-saving-aussie-homes/

Figure 18: Many owners of high efficiency homes report being motivated by sustainability concerns, such as at this efficient Djildjit home in Western Australia.

Updating the minimum standards for new homes would result in a 12 per cent reduction in Australia's residential emissions by 2030.

7. Why states and territories should urgently adopt the update to the National Construction Code

Despite broad support and diverse benefits from increasing minimum standards in the National Construction Code, past experiences tell us there is a risk that the update is at risk of being delayed or shelved entirely. The urgency of the climate crisis, along with the clear benefits to Australians of greater energy efficiency, mean that higher standards are both necessary and urgent.

The first risk to the comprehensive implementation of new standards is inconsistent or slow action by individual states and territories. Traditionally, some jurisdictions have been slower than others at bringing in standards or applying them consistently. Part of this has been driven by a belief that warmer locations don't need the standards as much as colder ones, despite evidence that the benefits (including cost savings) occur in all states and territories. It is important to note that while the responsibility to implement the National Construction Code is held by states and territories, a consistent application and timeframe is helpful for industry. Ideally, state and territory ministers should collaborate so there is a nationally consistent approach.

A second risk stems from a few conservative industry players reluctant to improve standards. Their unfounded objections range from increased building costs to improved thermal shell performance resulting in condensation (Australian Financial Review 2022; Heaton 2021; The Fifth Estate 2021d; Source Table 2021). Given the technical nature of the code and the consultation process, it is of course much easier for industry voices to be heard than the residents who stand to benefit.

When modest 4-Star standards were first implemented around the country, construction peak bodies claimed it would add a significant cost to housing with little benefit (The Fifth Estate 2021e). Similar protests followed the introduction of minimum standards into the National Construction Code with one senior Minister claiming it would be the death of the Queenslander (Arnell 2021). No such things occurred. When influential voices are viewing standards that protect and improve the lives of everyday Australians as regulatory burdens to be fought regardless of the benefits, this must be called out and challenged.

BOX 3: HOW EVEN A SHORT DELAY IN RAISING STANDARDS LOCKS IN HIGHER BILLS AND EMISSIONS

Some conservative industry voices have been pushing for a three-year delay in the implementation of an updated National Construction Code. This suggestion is unacceptable because Australians have already waited more than a decade for minimum standards to be updated in the National Construction Code. A shift to 7-Stars is a modest increase on current standards that sees residents around the country benefit, and industry has been given ample opportunity to prepare.

ASBEC and Climate Work's (2018) *Built to Perform* report analysed what the consequences of a three year delay in implementing the update would mean. Looking at both residential and non-residential buildings impacted by the Code, they found that 1.1 million homes and 42 million square metres of non-residential floor space are expected to be built between 2022 and 2025 although the Climate Council considers it is more likely to be by 2027 at the earliest based on updated ABS (2021) statistics.

Because buildings are long-lived assets, these spaces will either require subsequent more expensive retrofits or will use more energy than they should. Either way, these additional costs are borne by homeowners. A three-year delay in implementation is estimated to collectively lock in $2 billion extra in residential energy bills, $620 million extra in nonresidential energy bills and $720 million of additional network investments up until 2030. From a climate change perspective the consequences of a three-year delay would be an additional 9 million tonnes of greenhouse gas emissions out to 2030 (ASBEC 2018). This is similar to extending the life of one of Australia's larger coal power plants for a year.

Any further delay in implementing improved standards is bad for residents, the environment and the economy, and should not be considered by state and territory governments.

A third risk to the timely approval and implementation of this update comes as a result of a widely criticised cost-benefit analysis of the proposed update included in the Consultation Regulatory Impact Statement (CRIS). RegulationImpact Statements are required for all major regulatory proposals that are expected to result in significant changes to industry. In stark contrast to multiple other lines of evidence, this analysis found there to be a net cost to society of the changes.

A diverse collection of organisations and individuals have criticised the CRIS and its reliance on inappropriate assumptions and inputs. As Rob Murray-Leach, Head of Policy at Energy Efficiency Council, summed up:

> *"The Regulatory Impact Statement systematically underestimates the benefits that better energy efficiency standards will deliver to new homeowners, and overestimates how much it will cost to deliver them"* (Fifth Estate 2021c).

One of the most comprehensive responses came from a review jointly commissioned by the Australian Sustainable Built Environment Council, Green Building Council of Australia, Energy Efficiency Council, and the Property Council of Australia. Amongst other things, this review of the CRIS found:

- In several instances, key social benefits do not appear to have been included, while in other instances, key social benefits are heavily discounted – by up to 80 per cent – without appropriate justification.
- The quantity of energy savings modelled appears low, and this may reflect methodological choices and assumptions that require justification.
- Many incremental costs appear relatively high, and yet are not well-justified.
- The approach taken to valuing energy savings, based on wholesale electricity prices and network augmentation costs alone, substantially undervalues the social benefits.
- Costs associated with limiting thermal bridging are included in the analysis, but no benefits are (Strategy Policy Research 2021).

Concern over the CRIS has even been shared by some decision-makers, including Victorian Minister for Energy, Environment and Climate Change, Lily D'Ambrosio. In releasing a statement on Victoria's commitment to moving from 6 to 7-Stars regardless of the outcomes of the National Construction Code update, the Minister said the statement

> *"focuses more on costs while understating the emissions reduction, energy bill savings and health and wellbeing benefits of efficient homes"* (One Step Off the Grid 2021).

Notably, despite all of the undervaluing of benefits in the CRIS, it still concluded that virtually all households benefit under the update, because energy bill savings are greater than the additional build cost. As Paul Bowers, Chief Executive of Renew, said

> *"there's one thing we agree with the [C]RIS on, and that is its finding that households with higher efficiency levels will be better off. Households will have more money in their pockets from day one..."*

The Consultation Regulatory Impact Statement undervalues the benefits of raising minimum standards and over-emphasises the costs; but even this widely criticised assessment concluded that households will be better off.

Figure 19: Passive solar 7 star design principles, offsite modular construction and sustainable materials integrated with operational efficiencies such as hot water and rainwater harvesting, minimise the overall environmental impact of the 'Northcote House'.

8. Conclusion and recommendations

AN URGENT AND NATIONALLY CONSISTENT APPROACH

The central recommendation of this report is that state decision-makers support the move from 6 to 7-Star homes and implement this change urgently. This update is long overdue and any further delay places a burden on individuals living in inadequate housing, and reduces the ability of states and territories to meet their own greenhouse gas emissions targets. If the National Construction Code update is rejected or delayed, all states and territories should follow Victoria's example and voluntarily commit to implementing the change anyway, by the end of 2022.

1. States and territories should support lifting energy efficiency standards in the 2022 update to the National Construction Code and implement the update at a state and territory level by the end of 2022.

If the national update is delayed or unsuccessful, states and territories should nonetheless commit to proceeding with a move to 7-Star homes in their jurisdiction by the end of 2022.

OTHER OPPORTUNITIES TO IMPROVE THE EFFICIENCY OF AUSTRALIAN HOMES

The update to the National Construction Code is an essential step in improving the energy efficiency of Australian homes, but state and territory governments can't stop there. Even with such an update, Australia is still behind in both housing standards and performance, and much more can be done to improve both new and existing homes. More than 9.5 million homes around the country were built before modern standards even existed (Beyond Zero Emissions 2020) and on average these rank well below the current 6-Star minimum (CSIRO 2020). Both policy change and government investment is needed to ensure all Australians are safe and comfortable inside their homes.

There are opportunities to improve energy efficiency through action by all levels of government, but this report, and the following recommendations, are focussed primarily on states and territories.

2. Push for additional updates to the National Construction Code to ensure homes are future-ready.

These updates to the National Construction Code are just the beginning of what is required. There needs to be a move away from ad-hoc, periodic updates where the scale of standards are re-debated every few years. Instead, we need a clear timeline with regular targets and planned improvements that provide regulatory certainty. This timeline should include a move to zero carbon homes by 2030 as has been implemented in the European Union.

3. Implement mandatory energy efficiency disclosure at point-of-sale.

Mandatory energy efficiency disclosure makes it clear to people buying properties what they are purchasing. Making that information more visible empowers customers to make better decisions, and avoids saddling people with higher running costs. In turn, this incentivises investing in upgrades for both the buyer and seller - the seller to increase the house's value and the buyer because they are aware of any defects and have the chance to act when renovating (COAG Energy Council 2019). Such disclosure is already in effect in the ACT, and it is the only jurisdiction where the average Star performance of homes has risen between 2016 and 2018, from 6.5 to 6.9-Stars (CSIRO 2020). Notably the former Council of Australian Governments (COAG) agreed to this change in 2009 and implemented it for office buildings in 2010, so there is no reason to continue delaying for residential properties (PMTGEE 2010).

4. Implement minimum energy efficiency standards for rental properties by 2025.

Rental homes often have outdated appliances and low energy efficiency - in fact, less than half of rental properties are even insulated (Choice 2021). There is a fundamental challenge in relying on voluntary improvements to rental stock because of the 'split incentive': landlords are less inclined to pay for upgrades that reduce energy costs that they don't personally pay. This situation also exacerbates inequality with those who can't afford to pay higher rents, often saddled with rentals that are expensive to heat and cool. Minimum energy efficiency standards for rentals are needed for all states and territories so that everyone has a home that's liveable, less polluting and affordable to run.

5. Comprehensively upgrade existing social housing so they are energy efficient.

Residents of existing social housing need additional support to access the benefits of improved energy efficiency and home solar. State and territory governments need to comprehensively roll out these upgrades, improving liveability for some of our most vulnerable residents and creating new jobs in the process.

6. Increase incentives for home energy efficiency improvements including appliance replacement and thermal-performance upgrades.

All states and territories must introduce a comprehensive suite of policies that incentivises home improvements such as insulation, draught-proofing and replacing outdated appliances with more efficient alternatives. This can include rebates, no-interest loans and a community education campaign to spur uptake. Incentives should be particularly targeted toward low-income households.

7. Phase out gas from all new housing developments by 2025.

Homes being built today don't need and shouldn't have a gas connection. Planning rules that require new residential developments to be connected to the gas network should immediately be removed and a plan put in place to phase out all gas connections in new residential developments by 2025.

8. Investigate opportunities to incentivise the replacement of all residential gas appliances.

Residents should be encouraged to replace all water heating, space heating and cooktop appliances reliant on gas with efficient electric alternatives through community education, no- or low-interest loans and rebates. All gas appliances supported on government rebate lists must immediately be removed.

FIT FOR THE FUTURE

Ensuring the comfort, affordability and safety of Australian homes demands not only a focus on energy efficiency but ensuring that all homes are built to withstand the impacts of climate change that, due to past inaction, can no longer be avoided.

9. Ensure housing standards are prepared for worsening climate extremes.

Beyond energy efficiency standards, homes built in Australia today need to be ready for accelerated climate change and worsening extremes such as heatwaves, floods and bushfires. State and territory governments must review planning and development regulations to ensure they take into account climate projections so that new homes are not built in a way that endangers future residents.

The homes we build today need to be ready for increasing extreme weather events as a result of climate change including heatwaves, bushfires and floods.

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