Climate Resilient New Homes

ISSUES PAPER

MAY 2019

renew.

Document information

DOCUMENT VERSION	DATE	PREPARED BY	REVIEWED BY	COMMENTS
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Promoting Renewable Energy, Energy Efficiency and Water Conservation since 1980

Contents

1. THE CHALLENGE

1.1. Our homes are not built for the future

The energy performance of buildings – how much electricity and gas they consume to deliver the services required by occupants – is a key driver of many of Australia's most urgent economic, social and environmental challenges.

As energy prices have risen sharply over the last decade, unnecessarily high energy consumption (due to poor building efficiency) has been a key driver of rising household living costs. Low-income households are particularly vulnerable to price increases, as they spend up to five times more (as a proportion of their disposable income) on electricity than higher income earners.[1]

Inefficient homes that are too cold in winter or uncomfortably hot in summer also pose significant health risks to occupants, which in turn place greater pressure on health services.[2] The heatwave in south-eastern Australia in 2009 is estimated to have contributed to 374 excess deaths,[3] while a recent international study concluded that more people die from the effects of chronic cold in Australia than in Sweden – largely due to the poor energy performance of our homes.[4]

Energy consumption by buildings contributes almost a quarter of national greenhouse gas emissions, while improving building energy efficiency offers low to negative cost opportunities for meeting Australia's international emission reduction commitments.[5] Buildings are also a key driver of peak electricity demand. Investment in transmission and distribution networks to ensure

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1 Australian Council for Social Service and Brotherhood of St Laurence 2018, *Energy Stressed in Australia*, Prepared by Associate Professor Ben Phillips, ANU, Centre for Social Research and Methods, https://www.acoss.org.au/wp-content/uploads/2018/10/Energy-Stressed-in-Australia.pdf

2 Department of Health, 2011, *Heatwave Plan for Victoria: Protecting health and reducing harm from heatwaves*, Government of Victoria

3 Department of Health and Human Services 2009, *January 2009 Heatwave in Victoria: an Assessment of Health Impacts*, Government of Victoria

4 A. Gasparrini et al., 2015, "Mortality risk attributable to high and low ambient temperature: a multi-country observational study", *Lancet*, vol. 386 p. 369

5 ClimateWorks Australia 2010, *Low Carbon Growth Plan for Australia*

reliability and security of supply during periods of peak demand has been a major contributor to increases in retail electricity prices over the last decade.[6]

Much of our worst-performing housing stock was constructed prior to the introduction of building efficiency standards. A recent Victorian study found the efficiency rating of houses constructed before 1990 averaged 1.6 stars while those constructed between 1990 and 2005 averaged 3.1 stars.[7] This is well below the 6-star rating that has been required for new homes and major renovations in all Australian jurisdictions since 2010.

However, while new homes may perform better than existing housing stock, building regulations must consider the needs of occupants in the decades to come. In 2050, approximately half of the housing stock standing will have been built after 2019.[8] Even if the Paris agreement to limit global temperature rise to below 2 degrees Celsius is met, major Australian cities are likely to experience 50 degree days by 2040[9] – well within the lifetime of homes built today. Australians will continue to be exposed to significant health and affordability risks if our housing is not capable of maintaining a safe indoor temperature without excessive energy use.

Improved design and construction of new buildings also offer many of the lowest cost, 'shovel-ready' opportunities for reducing emissions and accelerating the transition to net zero emissions. As the electricity grid transitions to renewable energy, reducing residential gas use by requiring new homes to be all-electric not only offers further emission reduction opportunities, but can also deliver significant household bill savings and reduced infrastructure costs.

Climate change and population growth also pose serious risks to already stressed water resources and river systems. Reducing urban water consumption and making more effective use of de-centralised water sources (such as rainwater and stormwater), offer significant opportunities for reducing pressure on water resources and avoiding financially and environmentally costly additional supply options (such as dams or desalination).

We are already dealing with the economic, environmental and health impacts of poorly performing existing housing. It is imperative we do not make this task even more challenging by continuing to expand the number of Australian homes that are poorly equipped to deal with the challenges of the future.

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6 Australian Competition and Consumer Commission (ACCC) 2017, *Retail Electricity Pricing Inquiry – Preliminary Report*

7 Sustainability Victoria 2014, *Household Energy Report*

8 Australian Sustainable Built Environment Council (ASBEC) and ClimateWorks Australia (CWA) 2018, *Built to Perform: An industry led pathway to a zero-carbon ready building code*.

9 http://nci.org.au/research/record-hot-year-may-new-normal-2025/

1.2. Drivers of poor energy performance in new homes

1.2.1. Australian building regulations are not consistent with best practice

Australian standards for energy performance in new residential buildings as articulated in the National Construction Code (NCC) are low by world best practice. In 2018 Australia ranked 18th out of 25 of the world's top energy-consuming countries – dropping two places from the previous Scorecard in 2016.[10]

The National Construction Code currently mandates a minimum 6-star performance standard for new buildings and renovations, does not stipulate a quantitative air-tightness standard, and does not articulate a goal (or date) for achieving net zero energy buildings. By the time the next update of the NCC is implemented in 2022, it will have been 12 years since the last increase in energy performance requirements.

In contrast, the EU's *Energy Performance of Buildings Directive* requires member states to implement measures to achieve nearly zero energy for all new buildings by 2020. Individual member states such as Denmark have set a pathway specifying incremental increases in the stringency of energy requirements towards the 2020 goal. In the US where states have responsibility for building codes, California has set a target for all new residential buildings to be net zero energy by 2020.[11]

1.2.2. Poor compliance with existing standards

As well as regulatory requirements being relatively low, there is increasing evidence that the actual performance of new homes once built, is not consistent with requirements. The National Energy Efficiency Building Project (NEEBP) for COAG Energy Council found that Code compliance was poor and that Australia's building energy performance "fell a long way short of best practice"."[12]

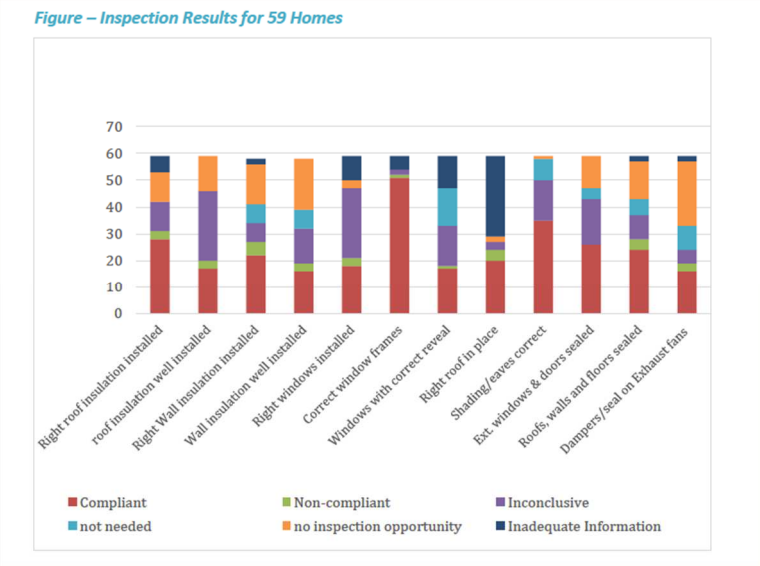

Figure 1. NEEBP report 2014

10 American Council for an Energy-Efficient Economy (ACEEE) 2016, *The 2016 International Energy Efficiency Scorecard;* American Council for an Energy-Efficient Economy 2018, *The 2018 International Energy Efficiency Scorecard*, https://aceee.org/portal/national-policy/international-scorecard

11 ASBEC and CWA 2017, *Building Code Energy Performance Trajectory Project: Issues Paper*

12 pitt&sherry and Swinburne University 2014, *National Energy Efficient Building Project Final Report*, prepared for the South Australian Department of Economic Development

A recent CSIRO study of air-tightness of 129 newly constructed houses in major cities around Australia found that almost half the houses tested were above 15 ACH@50Pa[13] which is considered the upper mark for a newly constructed house in Australia. Several houses recorded air change rates above 30 ACH@50Pa which is common amongst old poorly sealed houses, but was considered by the authors to be unacceptable for a newly constructed house.

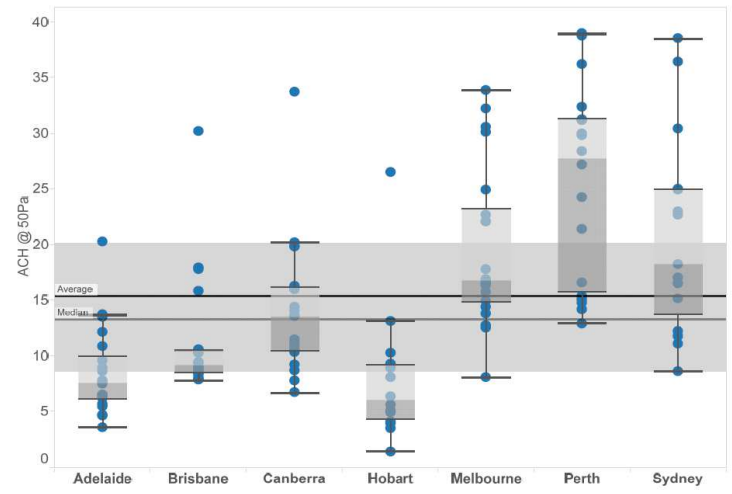

Figure 2. Air change rates by city[14]

However, while reducing draughts can significantly improve energy performance, improving air-tightness must be coupled with attention to adequate ventilation to avoid unintended consequences such as condensation and mould.

1.2.3. Low consumer awareness and complexity undermining incentives

Australians generally have a fairly low understanding of how efficiency improvements could deliver bill savings and other co-benefits. Purchasers of newly built homes face a complex decision-making process, while the choices offered by volume home builders are strongly driven by perceived customer demand.[15] Low consumer awareness of efficiency benefits and options translates into low consumer demand, thereby weakening the incentive for builders to offer higher performing homes. First home-buyers of newly built homes are particularly price-sensitive. But because efficiency features are less well understood and valued, they are likely to be traded off against other home features on the basis of cost.

1.2.4. Industry skill gaps

Recent industry research has identified knowledge and skills gaps as a factor influencing the capacity of the building industry to deliver higher performing homes. Specific knowledge and skills gaps include building sealing and detailing, as well as an understanding of the fundamentals of passive solar design. Contributing factors include the absence of mandatory continuous professional development requirements in most jurisdictions, as well as weaknesses in training curricula and information products.[16]

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13 Air Changes per Hour – a measure of 'leakiness' or 'draughtiness'
14 Ambrose and Syme, 2015, *CSIRO House Energy Efficiency Inspections Project*
15 Presync 2018, *Net Zero Energy Homes: Volume Builder Appetites and Insights*
16 pitt&sherry and Swinburne University 2014

2. THE OPPORTUNITY

2.1. Raise energy standards in the National Construction Code

2.1.1. Current NCC requirements

Minimum energy performance standards for all homes built in Australia are set through the National Construction Code (NCC). Current NCC provisions for Class 1 residential buildings (detached housing) require all new homes and major renovations to achieve a minimum 6-star NatHERS[17] energy rating. Administration of the NCC is the responsibility of the States and Territories under their various building and plumbing Acts and Regulations.

NCC provisions act as a 'floor' and do not prevent States and Territories from setting higher standards within their jurisdiction. The NatHERS tool only covers the heating and cooling performance of the building fabric, excluding consideration of other significant energy users such as lighting and fixed appliances (eg. water heating). Additional requirements for fixed equipment such as lighting are set out in the Code separate to NatHERS requirements, while appliance efficiency is regulated by the federal Greenhouse and Energy Minimum Standards (GEMS) program.[18] The BASIX tool adopted in NSW considers both energy and water efficiency, and takes into consideration thermal comfort and ventilation as well as lighting and fixed appliances.

The most recent version of the NCC came into effect on 1 May 2019. While there is no increase in energy performance requirements, the 2019 update does include some useful improvements – most notably new heating and cooling load limits.[19] This change is in response to evidence that while the current 6-star regulations were doing a reasonable job of reducing winter energy use, they could also be making summer performance worse.[20] Recent RMIT research analysing CSIRO data found that 5 and 6 Star-rated homes were hotter than 4 Star ones on average and had higher summer energy use.[21] Homes with large areas of exposed windows and ineffective shading were behaving like 'solar ovens', cooking their occupants and exposing them to serious health risks – risks that will only get worse if major population centres like Melbourne and Sydney start experiencing 50-degree days as is now being predicted.

However, while the new split load limits should knock out the very worst examples of poor summer and winter performance, without an increase in overall stringency they will do little to lift the performance of the 'massive middle' of new homes built over the next 3 years. NSW has for many years applied separate heating and cooling load limits via its BASIX scheme, which is a NSW variation.

2.1.2. Trajectory for Low Energy Homes

As part of the National Energy Productivity Plan (NEPP), the Department of Environment and Energy has been managing the *Trajectory for Low Energy Homes* project to consider opportunities to increase minimum energy efficiency requirements in the NCC. A critical input to the process was the report by the Australian Sustainable Built Environment Council (ASBEC) and ClimateWorks *Built to*

17 National House Energy Rating Scheme
18 http://www.energyrating.gov.au/document/gems-compliance-monitoring-program-20182019
19 Specifically, separate limits on the heating and cooling loads or energy consumption/m2 required to maintain a certain indoor temperature.
20 Australian Building Codes Board (ABCB) 2018, *Inclusion of Heating and Cooling Energy Load Limits in NatHERS assessments: Final Regulation Impact Statement for Decision*
21 https://www.thefifthestate.com.au/columns/spinifex/alan-pears-summertime-and-the-living-aint-easy/

Perform report which showed that stronger energy standards could reduce energy bills and network costs, and deliver significant emissions savings.[22]

Analysis conducted for the *Trajectory* project, based on (by its own admission) highly conservative assumptions, showed it is cost effective from 2022 for new Class 1 dwellings to be built to at least:

- Between 6.5 and 7.0 NatHERS stars equivalent in NCC climates 6, 7 and 8;
- 6.5 stars equivalent in NCC climates 1 and 5; and
- 6 stars equivalent in NCC Climates 2, 3 and 4
  (noting many homes in these climates currently have credits available to build below 6 stars); and
- Total combined energy usage budget for the building and services of 115MJ/m^2 equivalent in most climates.
- "Technology neutral" allowing for continued use of gas in residential buildings.

The potential energy savings and costs of this scenario in each capital city based on 2018 energy prices and capital costs are summarised below.

	NCC Climate	Annual Energy Bill Saving (2018)	Additional Capital Cost (2018)
Darwin	1	$896	$5,564
Brisbane	2	$510	$8,641
Sydney	5	$202	$3,636
Adelaide	5	$178	$3,863
Perth	5	$294	$3,940
Melbourne	6	$140	$3,741
Canberra	7	$769	$949
Hobart	7	$348	$6,796

Table 1. 2018 potential household energy bill savings and capital cost in each capital city for Class 1

In February 2019, COAG Energy Council supported the *Trajectory* recommendations and requested the Australian Building Codes Board (ABCB) to provide further advice on a holistic review of the energy efficiency provisions in the NCC.

[22] ASBEC and CWA 2018

2.2. Arguments for ambition

2.2.1. Higher standards are affordable for home-buyers

The average Australian family now spends more than $2,000 on household energy (electricity and gas) bills every year.[23] This adds up to almost $20 billion across the whole economy. Low energy homes can reduce living costs, enabling households to spend money that would otherwise have been spent on energy bills towards other essential services. More than $16 billion in savings for households could have been achieved between 2016 and 2030 by improving residential energy performance.[24]

Renew has conducted several case studies of Class 1A (detached) homes built up to 2.2 Stars above the mandatory minimum of 6 Stars with solar PV.[25] This work has found that:

- this level of performance can often be achieved at no additional cost through improved design (particularly house orientation);
- where design changes aren't possible, the buildings have a 'cost premium' in the order of $3K to $10K;
- the homes ongoing energy bills that hover between zero and $500 per year (typically saving in the order of $2.5K per year), without relying on high feed-in tariffs or energy storage; and
- the buildings achieve high comfort levels as reported by occupants.

Consistently, these case studies find that an economically optimal level of thermal performance for new homes is between 7 and 8 Stars.[26] As the vast majority of new home-buyers in Australia mortgage their purchase over 25 or 30 years, a minor shift in upfront price is unnoticeable over the average 25-year mortgage. It is the ongoing costs in terms of energy bills and their impact on mortgage repayments that has a much bigger impact on overall affordability.

There is growing evidence that it is not only people living in very poor quality 1 or 2 star existing homes who are struggling with energy bills, but that 6-star homes are also failing to protect households from energy hardship risks.

2.2.2. Current standards are not shielding people from energy hardship

Recent analysis of AGL's energy hardship program customers (representing around a quarter of all NEM customers) found that a large and growing cohort of customers experiencing financial difficulties were families on low to middle incomes with higher than average energy use. When geographic hotspots of energy hardship were mapped for the major urban centres, the areas seeing the largest growth of this 'Family Formation' cohort tended to be in outer suburban areas (see Figure 3 for Melbourne below).[27] It could be assumed that a significant proportion of the homes in these areas would have been constructed since 2005, and also that these households' financial stress was due to a complex interaction between high mortgage, transport and well as energy costs.

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23 Australian Bureau of Statistics 2017, *6530.0 – Household Expenditure Survey, Australia: Summary of Results, 2015-16*

24 ASBEC 2016 *Low Carbon, High Performance*, p. 65

25 Analysis and findings relevant to Victoria, although some extrapolation to other climate zones may be possible.

26 Renew 2018, *unpublished*

27 Simshauser, P and Nelson, T. *The Energy Market Death Spiral - Rethinking Customer Hardship*, AGL Applied Economic and Policy Research, Working Paper No. 31

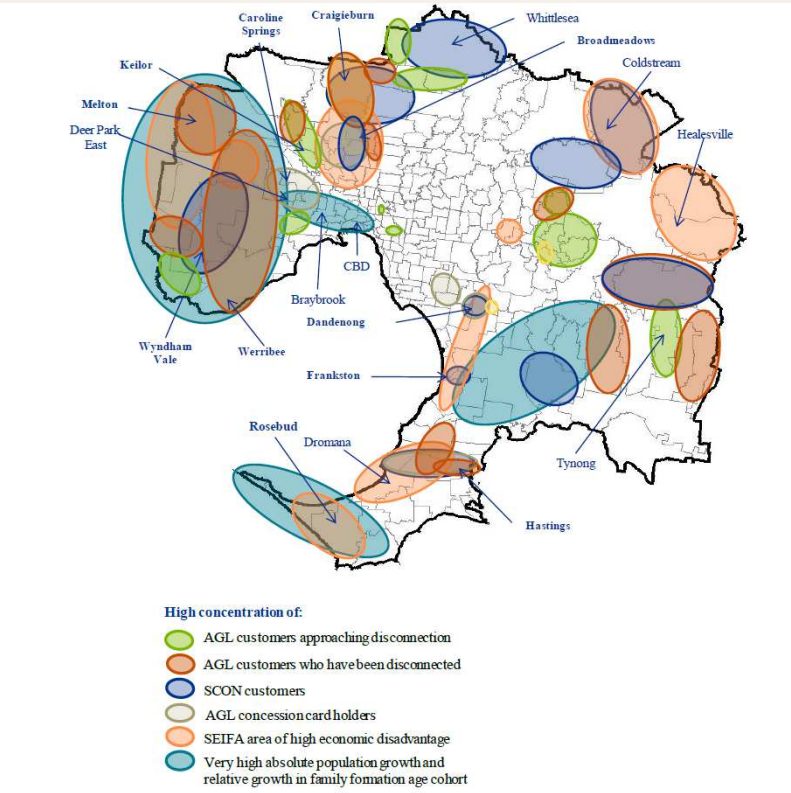

Figure 3. Geographical Map of Potential Hardship: Melbourne

Another factor that could be contributing to energy hardship, is the continued growth in the average floor size of Australian new homes. Over the past 60 years Australian homes have more than doubled in size – from an average of around 100 square metres in 1950 to about 240 square metres today – making them the largest in the world, ahead of Canada and the United States. Recent University of Melbourne research concluded that not only did larger houses larger houses require more heating and cooling leading to higher energy bills, but they also needed significantly more energy to manufacture and replace construction and maintenance materials.

Figure 4. The relationship between house size and resource use[28]

2.2.3. Previous predictions of cost increases have not eventuated

Experience from previous increases in energy standards has demonstrated that actual cost impacts have been lower than predicted. Recent work examining the increase to 6 stars found that 70 percent of industry stakeholders reported a cost impact of less than $5,000, with half of those reporting impacts below $2,000.[29]

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28 Stephan, A. and Crawford, R.H. 2016, *The relationship between house size and life cycle energy demand: Implications for energy efficiency regulations for buildings*. Energy 116, Part 1: 1158-1171

29 Moreland Energy Foundation Ltd (MEFL) 2017, *Changes associated with efficient dwellings project: Final Report*, Prepared for the Department of Environment and Energy in association with Strategic, Policy and Research, WTP partnership and Building Environmental Assessment Company

A key factor influencing lower than expected cost impacts is learning rates across the industry. Once the higher standard becomes the new industry norm the purchasing power of volume builders and the spread of new skills and least-cost approaches across the industry combine to reduce costs to virtually zero.[30] More stringent provisions can drive the market transformation of certain products or fixtures, leading to lower unit prices for key elements over time (such as high performance windows), further reducing the cost premium associated with building to higher standards.

2.2.4. Consumers do value healthy and affordable homes

Recent research concluded that builders perceive current customer demand for net zero emission homes as non-existent for entry-level home-buyers, and low for customer segments with more discretionary budget. Builders also observe that there is very low customer awareness and understanding of energy efficiency and thermal performance potential of a new home in technical or conceptual terms.[31] This is backed up by CSIRO research that consumers are generally ignorant of (or do not value) the benefits of environmentally sustainable housing features (eco-features).32 This low level of awareness tends to limit customer demand and hence market incentives for builders to deliver a higher performing product.

However, there is ample evidence that while consumers may not be highly technically literate or use the language of energy efficiency, they do value the co-benefits that high performing homes and developments deliver – comfort, health, affordability and community.[33]

Raising baseline performance through an increase in minimum energy performance requirements and the setting of a forward trajectory will make higher performance the 'new normal'. This will drive market transformation for key inputs, drive skills development and the spread of improved practices across the industry, driving the cost of building to higher standards down. This will ensure all new home-buyers – not just the most informed or those on higher budgets – can afford the low bill and comfort benefits of high performing homes.

2.2.5. Inaction will increase cost of meeting emission reduction targets

Buildings contribute to almost a quarter of Australia's greenhouse gas emissions and consume over half of the country's electricity, through their operation.[34] Cost-effective efficiency improvements modelled in the *Built to Perform* project could deliver 10.8 million tonnes of cumulative emissions reductions to 2050 – more than the annual emissions of Victoria's Loy Yang B coal-fired power station. This assumes that the electricity system transitions to net zero emissions by 2050, in line with Australia's Paris Climate Change Agreement commitments. If this transition occurs more slowly, the benefits of reducing energy use in buildings are greater.

Building efficiency improvements offer many of the least-cost (zero to negative cost) emission reduction opportunities across the Australian economy, because efficiency investments generate cost-savings by reducing waste.[35] Missing improvements in building efficiency will mean additional

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30 MEFL 2017

31 Presync 2018

32 "Eco-features" are physical objects or qualities of a home, that can be identified and discussed by industry professionals and consumers as characterising the environmental credentials of a home. These are typically the features that a home owner would buy, in order to upgrade a home to something more environmentally sustainable.

33 Hulse, K. et al, 2015, "I'd just Google it: media and home renovation practices in Australia", CRC for Low Carbon Living, https://researchbank.swinburne.edu.au/items/efb930d9-70c3-450a-9499-94a5af843e79/1/

34 Harrington, P. and Toller, V. 2017, *Best Practice Policy and Regulation for Low Carbon Outcomes in the Built Environment*, p. 19

35 ClimateWorks Australia 2010, *Low Carbon Growth Plan for Australia*

emission reductions will be required from sectors of Australia's economy that may not be as cost-effective or immediately achievable.

2.2.6. Health risks will increase in a warming climate

Even if the Paris agreement to limit global temperature rise to below 2 degrees Celsius is met, major Australian cities are likely to experience 50-degree days by 2040[36] – well within the lifetime of homes built today. Consequently, Australians will continue to be exposed to significant health and affordability risks if our housing is not capable of maintaining a safe indoor temperature without excessive energy use.

The *National Energy Efficient Building Project* found considerable stakeholder concern with what is known as "hot box syndrome".[37] This refers to homes that perform well in winter conditions (minimising energy demand for heating) but poorly in summer (with concerns about over-heating). Such homes may require large quantities of cooling energy to bring comfort to acceptable levels. A further study in regional Victoria found that a cohort of 6 star rated homes performed badly in summer heat, with homes recording indoor temperatures of 33.8 degrees on a 40-degree day.[38] The inclusion of separate heating and cooling load limits in NCC 2019 is a response to these concerns. But in the absence of greater overall stringency in requirements, this change alone is unlikely to be sufficient to ensure homes will be capable of providing safe and affordable shelter in a much hotter future.

2.2.7. Bill savings can support jobs and local economies

Energy efficiency is already a major jobs creator in Australia. Recent analysis found that implementing a series of basic energy efficiency improvements to Australian homes and businesses would create an extra 120,411 job years of work – or 120,411 full-time jobs for one year if all of those upgrades are completed within 12 months.[39]

This figure relates to job creation opportunities in retrofitting existing homes rather than those flowing from building new homes to higher standards. However, the energy bill savings from higher performing homes that would be freed up for spending elsewhere in the economy, could be expected to contribute to local economic activity and job creation. Where new housing is concentrated in greenfields developments, the local economic impacts of keeping more household expenditure in the community rather than being spent on bills, could be significant.

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36 http://nci.org.au/research/record-hot-year-may-new-normal-2025/

37 pitt&sherry and Swinburne University 2014

38 Dr T Moore, Dr Y Strengers, Dr C Maller, Dr I Ridley, Dr L Nicholls, Prof R Home, 2015, *Final Report: Horsham Catalyst Research and Evaluation*, commissioned by the Department of Health and Human Services, Victorian State Government. Centre

39 Green Energy Markets 2019, *Energy Efficiency Employment in Australia*, commissioned by Energy Efficiency Council (EEC) and Energy Savings Industry Association (ESIA)

2.2.8. Industry can deliver

A proportion of the building and construction industry is already building above minimum standards, demonstrating that building to higher standards is possible and cost-effective now. (see Table 2).

NCC Class	7+ stars	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Class 1: House	In	42.33 %	9.62 %	30.50 %	23.73 %	5.62 %	17.53 %	3.05 %	12.44 %
Class 1: House	Out	57.67 %	90.38 %	69.50 %	76.27 %	94.38 %	82.47 %	96.95 %	87.56 %
Class 2: Apart.	In	65.78 %	27.70 %	98.33 %	25.67 %	25.56 %	53.77 %	41.07 %	40.38 %
Class 2: Apart.	Out	34.22 %	72.30 %	1.67 %	74.33 %	74.44 %	46.23 %	58.93 %	59.62 %

Table 2. Summary of NatHERS compliant certificates issued in 2018[40]

Renew works closely with a number of small builders and developers who have demonstrated that much higher performance can be achieved at minimal additional cost, largely through better orientation and design, and better construction practices and techniques.

However, 40 percent of new detached homes are constructed by volume builders, the majority of which are not building beyond mandated minimum requirements. In this sector, decisions about sustainable technologies are often taken at the level of the building company rather than individual home. Discounts for volume purchasing act to lock in supply chains and reduce the incentive for innovation. Recent industry research has found that builders are strongly driven by perceived customer demand and price sensitivity and will change their products accordingly. But they will resist changes that do not stimulate customer demand or deliver short to mid-term commercial benefit. Builders resist change due to cultural attitudes, supply chain inertia and build-cycle inertia, and perceived risks to build time and cost that could impact margin.[41]

Setting a forward trajectory articulating increasing stringency in requirements over time well in advance of each Code upgrade cycle, can help to address these barriers by providing certainty for planning and investment, enabling innovation and supporting improved performance over time. In Denmark where a pathway was set in 2010 specifying a series of incremental increases for 2015 and 2020, 15 to 20 per cent of Danish building investors elected to build to “class 2015” or “class 2020” requirements while “class 2010” minimum requirements were still in force.[42]

40 CSIRO analysis of NatHERS certificates, 2018. https://ahd.csiro.au/
41 Presync 2018
42 Energy Efficiency Watch 2014, *Energy efficiency policies in Europe: Case study – Danish Building Code*

The Cape, Cape Paterson

The Cape is a sustainable residential project offering 230 home sites on Victoria's Bunurong Coast near Cape Paterson, with sales of Stage 3 launched in early 2019. Land purchasers have the choice of building using one of The Cape's 10 house designs, or customising their own home based on design guidelines.[43]

Household scale

- Victoria's first zero emissions neighbourhood of scale (230 lot development)
- 7.5 star minimum rating (achieving average 8-star energy efficiency across the estate)
- Good insulation, ventilation, thermal mass, shading, double-glazing
- All-electric with efficient appliances (heat pumps and induction cook-tops) replacing gas
- 200 m^2 limit on house size
- 4-5 kW solar arrays
- 10,000 litre rainwater storage plumbed into toilets and gardens
- Water-efficient tap-ware and shower-heads
- Electric vehicle-enabled
- Super-efficient wicking bed food gardens

Precinct scale - Water

- 3 million litres per annum harvested to community farm
- Swales and rain-gardens retain and filter water and recharge vegetation
- Wetlands engage in larger rainfall events

Energy and financial savings targets compared with conventional estate

- $500k per annum stationery energy by 2025
- $500k avoided petrol spend by 2030
- $1 million per annum combined by 2030

Purchase cost

- Smaller houses – 2 bedroom ensuite, study starting at $330,000
- Larger houses – 4 bedroom and study starting at $420,000
- $150k townhouse lots, premium lots >$300k;
- Sustainable house and land starting at $450k

Achieving

- Homes comfortable with minimum heating and cooling, maintaining indoor temperatures of 18-25 degrees year-round
- Average energy bills $500 per annum or less
- Many homes starting to achieve zero energy bills
- Estate generating 4-5 times as much energy as consuming

43 https://www.liveatthecape.com.au/


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2.2.9. Energy market benefits

Reducing demand by improving efficiency can avoid or delay costly investment in electricity system infrastructure – a key driver of rising wholesale electricity prices in the National Electricity Market over the last decade. Recent analysis estimates that a single building cutting its peak demand by one kilowatt (kW) – equivalent to the power used to run a small oil heater – would save almost $1,000 in required investment in electricity system infrastructure, reducing electricity prices for everyone. Reducing demand also makes the transition to a 100% renewable energy grid cheaper and faster, by reducing the amount of new infrastructure investment required to meet the increase in demand for electricity from future electrification of transport and industry.[44]

There is already evidence that previous efficiency increases in building standards have had a positive impact on lowering demand. Further increases would therefore likely deliver greater benefits.

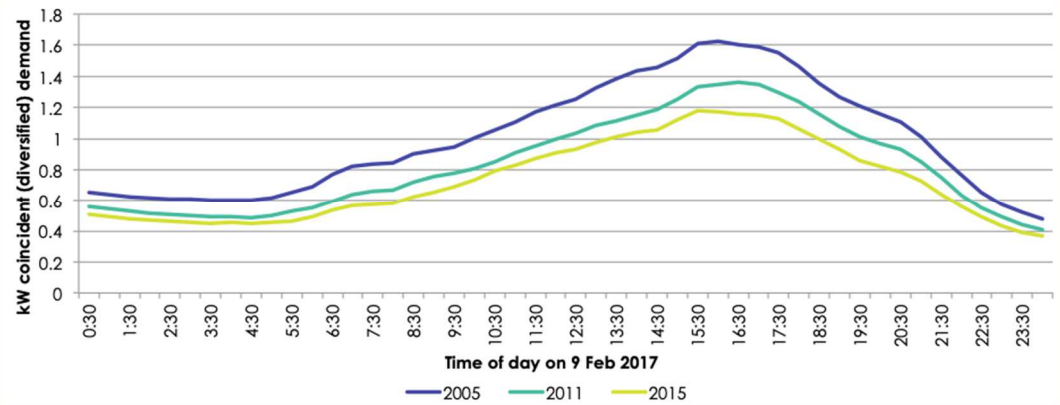

Figure 5. Demand profiles on a hot day by year connected[45]

2.2.10. Gas no longer makes economic or environmental sense

Many Australian homes particularly in Victoria, are dual fuel, relying on natural gas primarily for space heating, hot water and cooking. While traditionally considered cheaper and 'cleaner' than electricity (produced by burning coal), this is no longer the case. The ongoing transition of the electricity grid to 100% renewable energy means that substituting electricity for gas consumption offers significant emission reduction opportunities, that will increase over time as the emissions intensity of electricity supply decreases.

In the context of rising retail gas prices, recent Renew (ATA) research found that for all National Energy Market states and territories, it was not cost-effective to connect a new home to mains gas when efficient electric appliances were an option. When the avoided costs of investment in gas reticulation infrastructure are taken into account, the cost-effectiveness of an all-electric home improved further.[46]

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44 ASBEC 2018

45 Renew analysis of AusNet data, Dean Lombard *pers. comm*.

46 ATA 2015, *Are we still cooking with gas?*, Prepared for the Consumer Advocacy Panel

2.3. Address gaps between design and as-built performance

Compliance and enforcement of the National Construction Code is the responsibility of state and territory jurisdictions through their respective building and planning regulations. Local government has responsibility for administration of the planning and building approvals process, with some jurisdictions such as Victoria relying on private operators for key roles such as building surveyors.

Current concerns around fire safety particularly for multi-storey residential buildings have prompted a serious examination of compliance issues across the building industry, most notably through the Weir-Shergold report commissioned by the Building Ministers Forum.[47] The current focus on compliance risks may provide an opportunity for highlighting the complementary impacts of poor compliance regimes for efficiency performance.

Renew is currently investigating the extent and nature of the factors affecting as-built compliance with 6-star rated building designs, and to develop recommendations for redress. While this work is not yet complete, a number of issues at various stages of the process have emerged.

- The NCC offers three main pathways for satisfying the thermal performance requirements –obtaining an energy rating of at least 6 stars using a software tool accredited under the Nationwide House Energy Rating Scheme (NatHERS) and two alternative pathways (Deemed to Satisfy or Performance Solution). However, there is a lack of evidence that the alternative pathways are delivering similar performance outcomes to NatHERS.
- The existing audit system of two inspections – one at frame stage and a second at handover of complete building – are not suited to checking efficiency measures. Efficiency measures such as insulation are typically not in place at frame stage but are covered/invisible by handover.
- There are no specific requirements for efficiency testing (blower door testing, thermal imaging) at building completion, to ensure that as-built performance complies with both minimum performance requirements and energy ratings on-plan.
- Industry perception that there's little risk cutting corners on energy performance will be discovered (by regulator or consumer), and if it is, consequences will not be serious.
- Lack of consumer awareness of the benefits of higher energy performance and relative invisibility of efficiency measures undermines consumer enforcement/engagement.
- Inadequate documentation in design makes it unclear on what basis NCC compliance was determined in the first place, ie. roof colour, lighting, air-conditioning not specified in documentation.
- Inadequate documentation during construction makes subsequent assessment difficult (i.e. lack of receipts for purchase of specific items, photographic evidence of key features such as wall insulation prior to being covered).
- Potential for conflicts of interest faced by private building surveyors.
- Gaps in industry training, accreditation and professional development.

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47 Shergold, P. and B. Weir 2018, *Building Confidence: Improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia*, https://www.industry.gov.au/data-and-publications/building-confidence-building-ministers-forum-expert-assessment

2.4. Increase consumer demand for higher performance

While regulatory change is a necessary tool to drive improvement, it is unlikely to be sufficient to drive change at the speed we need to address urgent energy affordability and climate risks. Industry has a greater capacity to respond quickly to changes in consumer demand, creating the potential for the overall quality of homes to increase more quickly beyond minimum requirements if industry can see a clear demand and market advantage.

The building sector is currently experiencing a slow-down in the wake of the banking Royal Commission and subsequent tightening in lending standards. There are signs some developers are seeing sustainability as a marketing opportunity to differentiate their product from competitors and attract price-sensitive home-buyers.

In this market environment, there is significant scope for encouraging and assisting home-buyers to choose higher performing homes through improved point-of-sale information, and better targeting of incentives. For example, linking eligibility requirements for government first-homebuyer grants to efficiency performance or footprint size could have a significant and rapid impact on consumer demand – and industry response.

Government can also play a significant role in influencing community attitudes that lead to behaviour change. Every significant shift in community attitudes to key public health challenges has been driven by a major investment by government in community education that has led to a normalisation of new behaviours (see Figure 6 below).

A similar investment over the next decade in helping Australians better understand the benefits of higher performing homes could deliver significant dividends beyond what is likely to be achieved through regulatory change alone over the same time period.

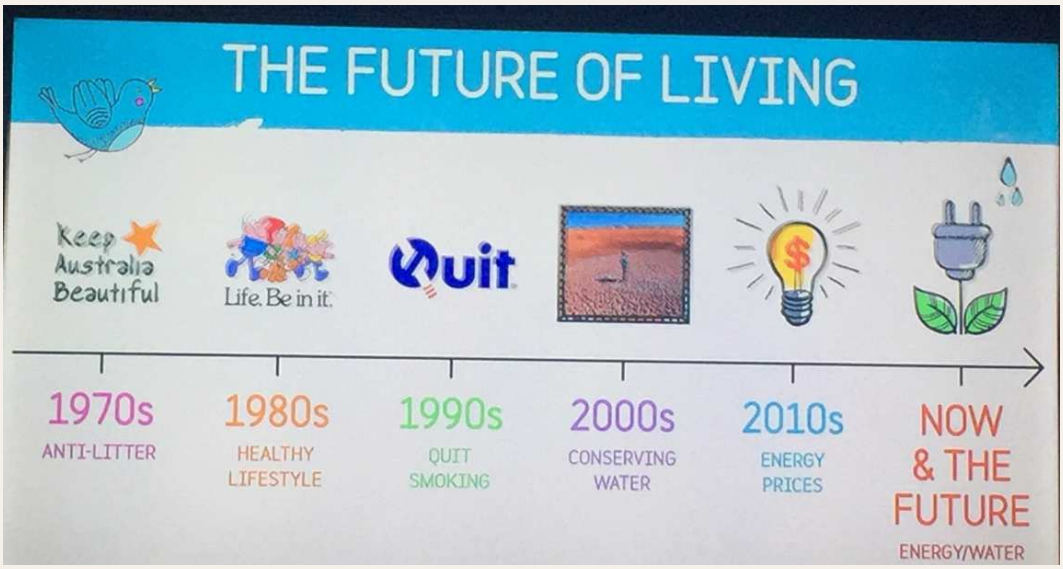

Figure 6. Australian community education campaigns

3. RECOMMENDATIONS

3.1. A Climate Resilient Building Code

Building Ministers Forum commits to:

- A trajectory towards a Climate Resilient Building Code by the end of 2019
- Deliver a step change in energy and water performance requirements in the National Construction Code 2022, at minimum:
    - Raise star rating to at least 7.0 stars NatHERS equivalent;
    - Update NatHERS framework to support rating of whole-of-house energy performance and water consumption;
    - Ensure that alternative pathways to NatHERS deliver outcomes that meet mandated energy performance requirements;
    - Commit to introducing mandatory quantitative air-tightness standards, whilst addressing potential building condensation issues;
    - Phase out gas use by prioritising all-electric designs over dual-fuel for new dwellings;
    - Implementing water efficiency measures in relevant building and plumbing regulations.

State governments and building authorities commit to:

- A planning process that prioritises house orientation for higher energy performance and water-sensitive urban design in sub-division design;

3.2. Tighten compliance and enforcement regimes

Building Ministers Forum and respective state building and planning authorities commit to:

- A comprehensive documentation system for building design, construction and commissioning that captures and communicates all relevant design details and ongoing changes during construction, including re-rating where necessary
- Mandatory accreditation of all energy assessors in all State and Territories;
- An improved audit and inspection regime, with mandated assessments during and post-construction to ensure compliance with design and product specifications. A further 12-month post-construction inspection to ensure actual energy use complies with rating;
- Minimal product substitution during construction, and minimum quality requirements for products available in the market;
- Establishing a longitudinal evidence base of compliance with energy performance requirements and improvements across the building sector over time.
- Working with the building industry to increase understanding and skills to deliver high performance design and construction

3.3. Consumer education and incentives

The Council of Australian Governments commits to:

- National consumer education campaign (mass and targeted at point-of-sale)
- Government first home-buyer incentives linked to housing performance

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