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Department of Climate Change, Energy, the Environment and Water

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Lodged Electronically

To whom it may concern,

Climateworks Centre submission on the National Energy Performance Strategy

Climateworks Centre welcomes the opportunity to respond to the Department of Climate Change, Energy, the Environment and Water's consultation on the National Energy Performance Strategy (NEPS). Climateworks develops expert, independent solutions to assist the transition to net zero emissions for Australia, Southeast Asia and the Pacific in line with a 1.5°C limit. A non-profit organisation, it was co-founded in 2009 by the Myer Foundation and Monash University and works within the Monash Sustainable Development Institute.

Climateworks supports the creation of the NEPS. Climateworks modelling shows the importance of energy performance improvements. Net zero emissions can be achieved most cost-effectively by unlocking the opportunities from the significant levels of energy savings available in the Australian economy – particularly in buildings and industry. There is a clear role for government to improve energy performance with its multiple benefits to unlock wider social benefit and address market failure. The market is currently not driving energy savings in line with Climateworks' modelled 1.5°C and 2°C scenarios. The market is also not yet unlocking potential levels of energy management – such as demand reduction and matching demand to the times of peak supply. This loses economic opportunities and creates greater cost for energy consumers.

The government has the opportunity to design the NEPS to support Australia's climate policy priorities, emissions reductions targets, and long-term goal of net zero emissions in line with the Paris Agreement. This is especially urgent given the window to keep global warming within 1.5 degrees is still open, but narrowing.

Climateworks submits the following key points and recommendations which are expanded on in the main body of this document.

Purpose and overall content

Climateworks recommends a NEPS that:

- sets achievement of Australia's legislated emissions reduction targets and the goals of the Paris Agreement as the overall objective
- is clearly linked to the actions needed for the wider energy system transformation

- sets whole-of-economy energy efficiency targets and a process and timeframe for relevant ministers to establish sectoral metrics and/or targets
- expects all federal departments and agencies to embed energy performance objectives and targets into their work
- sets a dynamic national framework to meet those targets and metrics with an accountability mechanism and processes to track, review and adjust progress
- sets out the policies for buildings and industry and the process and timeframe to develop a comprehensive policy suite
- sets out how this process will integrate with existing structures, initiatives and legislation and establish new ones as necessary – see further detail below
- sets out how energy performance improvement can fully contribute to the broader energy transformation.

Targets and governance

In line with international best practice, Climateworks recommends that the NEPS:

- sets 2050 and 2030 national energy efficiency targets (in absolute terms), with yearly savings of at least 1 per cent of Australia's overall energy consumption
- uses existing structures, such as the Energy and Climate Change Ministerial Council and Building Ministers Meetings to deliver the strategy across federal, state and territory governments
- creates a cross-government taskforce by and reporting to the Council to oversee implementation of the NEPS framework – or similar mechanism that provides focus on demand-side action with an explicit connection to governance for the wider energy system transformation
- includes consumer perspectives within the taskforce – for instance by including consumer representatives or having a dedicated stakeholder group that is consulted on actions to deliver the NEPS and reports on progress
- sets out a process for the urgent development of 2050 and 2030 sectoral performance metrics and/or targets for residential buildings, commercial buildings, industry and transport to ensure energy efficiency targets are met. These would link to existing initiatives and legislation and governance structures – for example building targets aligned to the Trajectory for Low Carbon Buildings, in agreement with Building Ministers and Energy Ministers, together with the ABCB.
- considers the use of performance measures on technology uptake as part of these measures
- sets out how the work connects with current plans to improve energy efficiency and energy performance in transport
- sets out how energy performance improvement can contribute fully to the broader energy transformation and provide benefits for consumers of energy and the affordability and reliability objectives of the NEO
- includes clear direction for the market and governments (including the energy agencies) on how to incorporate and incentivise demand-side changes into existing and emerging mechanisms and processes (such as the Powering the Regions Fund, Integrated System Plan and the Capacity Investment Mechanism).

Establishing zero carbon new buildings by 2030 at the latest

To ensure a zero carbon standard for new buildings relevant to all climate zones is implemented by 2030 at the latest, and to support industry in this transition, Climateworks recommends that the NEPS:

- sets the process to agree on the definition for zero carbon buildings by end of 2023. We recommend considering the definition developed by Climateworks Centre in conjunction with key stakeholders to establish this standard[1].
- establishes the process that would set up a phased adoption of this standard by 2030. Phasing would involve ramping up from the existing 7 star NatHERS standard towards a zero carbon building standard in 2030, using the 2025 and 2028 updates of the National Construction Code. Climateworks recommends that NCC 2025 introduces the zero carbon standard definition as a voluntary standard and plans for it to become mandatory with NCC 2028 (at the latest), with a maximum of 2 years for implementation. This will allow early-moving building developers to refer to a national standard as early as 2025 for zero carbon buildings.
- affirms the government's commitment to working with the Building Ministers Meeting, Energy and Climate Change Ministerial Council and Australian Building Codes Board for action in the building sector in line with cost-effective action to meet Australia's targets
- sets out how NatHERS will be updated to include calculations and a star rating aligned to zero carbon, in addition to the methods applied to calculate star ratings used at present
- sets out near-term financial incentives to support early movers to build or renovate to the zero carbon and resilient building standard, prior to the standard being made mandatory. Examples could include new homes being built under the National Housing Accord, specifically the 10,0000 new affordable homes. Support for early movers will help build market and supply chains.
- sets out a process to develop mid- to long-term financial incentives for zero carbon compliant buildings in collaboration with federal, state and territory governments and the investment community.

Designing Australia's national renovation pathway

Climateworks recommends that the NEPS sets a process with timeframes to establish a comprehensive policy package for improving energy performance in buildings. In addition, Climateworks recommends the NEPS includes options for mandatory and persuasive mechanisms to promote mass adoption of energy-efficient and zero carbon renovation of existing buildings. This includes committing to a long-term effort and establishing short, medium and long-term goals. Climateworks views that an effective policy package would include the following timeframes and goals.

Short-term focus on:

- setting up appropriate energy efficiency targets and governance (see section on targets and governance)
- designing national legislation aiming to normalise zero carbon and resilient buildings by 2030. This includes updating the NCC as per recommendations for new buildings and major renovations, and introducing new regulations for existing buildings including minimum rental standards by 2025.

[1] Definition developed as part of Renovation Pathway Project, for further details see https://www.climateworkscentre.org/project/renovation-pathways/

- update minimum energy performance standards for appliances through the Greenhouse and Energy Minimum Standards Act and set in place a plan for ongoing updates by end 2023
- prioritising direct government investment and funding towards upgrading social housing and supporting low income households and using this as an opportunity to stimulate and improve supply chains, skills and materials; also investing in upgrading government assets to stimulate the market and lead by example
- incentivising upgrades through financial incentives (targeted tax rebates, subsidies, loans) and working with banks on normalising energy upgrade requirements for mortgages (and consider establishing an opt out approach, rather than opt in). Financial incentives should be designed in conjunction with a ratcheting up standard, to incentivise early movers to build above standard.
- improving data collection and consumer information on energy performance. This includes rolling out a national mechanism to record and monitor energy use in buildings by 2025 and providing prospective buyers and tenants with information about the relative performance of a property at point of sale or lease. It also includes information and awareness-raising campaigns to support households.

Medium-term focus on working with states and territories to:

- expand effective policies that have been implemented in some states (e.g. ACT rental standards, etc.)
- ratchet up standards in combination with adapting financial subsidies to focus on most vulnerable households and incentivise to build above standard
- review performance against set targets and take corrective action where needed.

Targeting improvements for low-income and First Nations households

- Design and fund grant programs specifically targeted towards low-income households, taking into account their motivators and barriers, to improve access to energy efficiency upgrades and audits, and/or solar PV.
- Invest in upgrading and building highly efficient social housing and improving low-income housing, using this to kickstart supply chains and the market. Improving the readiness of the market will enable a renovation wave across existing building stock.
- consider the particular circumstances and vulnerabilities of First Nations Australians, including through responding to and consulting with communities, recognising that investment in renovating homes of First Nations Australians in vulnerable communities will have multiple benefits for these communities in terms of health and social well-being.

Supporting improvements to rental properties

- Adopt the forthcoming National Framework for Minimum Energy Efficiency Rental Requirements aligned with the Community Sector Blueprint for rental standards by Healthy Homes for Renters.
- Collaborate to develop and implement a national program for mandatory energy assessments for rental homes, including training of assessors, with data published and accessible for research purposes, and a national roll-out of mandatory energy efficiency disclosure for rental properties.

- Identify minimum standards for rental homes, with collaboration led by Federal government to implement these nationally to maximise the impact of the national framework. The Federal government could work with state and territory governments to commit to implementing standards in their jurisdiction.
- Target and tailor financial support to have the greatest impact, for example target:
    - social housing providers
    - private landlords in areas of known low-socio economic status, after an energy efficiency assessment returns a low rating by an accredited assessor
    - homes with no prior energy assessment
    - apartment and unit complexes (class 2) with strata bodies, as both landlords and renters have the least agency to upgrade these homes.

Action to improve energy performance in commercial buildings

- Create a process to extend and amend the NABERS energy rating disclosure scheme to be in line with the net zero carbon standard.

Improving energy performance in the industry sector

- Create a coordinated approach to energy efficiency and management building on existing innovation support institutions and initiatives. These include ARENA, CEFC, the National Reconstruction Fund, the Powering the Regions fund, and state and territory programs. Greater coordination would further accelerate the transition and help integrate the range of support for research and development and commercialisation of technologies that increase energy performance.
- Potential options for industry policy are discussed in more detail below. These include:
    - support of pilots and demonstrations for the range of energy efficiency, energy management and electrification technologies that can improve energy performance in industry
    - attracting private sector investment by leveraging government funds
    - various mechanisms of support for early market development
    - certification schemes for green products
    - development of regional roadmaps to understand the opportunities and barriers for technology take-up at a local level
    - government facilitation to improve collaboration between multiple industry partners
    - governments and industries working together to identify skill capacity gaps and solutions.
- Strengthen energy market system planning to anticipate and enable electrification of heavy industry.
- Track the effectiveness of market incentives for distributed energy storage and industrial demand management services.

Thank you for taking the time to consider our submission. We would welcome an opportunity to brief your team if you would like to explore our responses in further detail.

Yours sincerely,

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Detailed submission

Energy performance

Improving energy performance has multiple benefits and is a key pillar of least-cost pathways to net zero emissions.

As discussed in the National Energy Performance Strategy (NEPS) consultation paper, improving energy performance has a range of substantial benefits. Climateworks' research is focused on how Australia can reach net zero emissions in line with the 1.5°C temperature goal of the Paris Agreement. Our research, including scenario analysis that models least-cost pathways to net zero (Climateworks 2020), finds that actions to improve energy performance are often the most cost-effective way to reduce emissions.

The Aus-TIMES model we use for our scenario analysis, developed with CSIRO, incorporates actions that improve the energy efficiency of existing fuel use, and actions that switch fuel use which have additional energy efficiency benefits. Electrification is the main type of fuel switching taken up in least-cost pathways in our model due to both lower costs and emissions. Electrification opportunities taken up in the model result in the adoption of more efficient appliances, reducing operational costs as well as emissions.

Recent work has demonstrated some of the health and comfort benefits arising from residential improvements.[2] The Victorian Healthy Homes program showed that households that had energy efficiency upgrades installed had a significant correlation to lower medical needs/costs than the control group, without those upgrades. The research measured medical needs during the 2018 to 2020 winter seasons, looking at Medicare Benefits Schedule benefits and charges and out-of-pocket medical costs[3] These health and economic benefits are likely to be more pronounced in lower-income households, addressing the interrelated issues of energy poverty and inequitable health outcomes.[4] There are also health benefits from fuel switching. Recent research has highlighted the negative impacts associated with gas-fired residential cooking. For example, a recent study found that 12.7 per cent of current cases of childhood asthma in the US are due to exposure to pollutants such as nitrogen dioxide from stoves.[5]

Further action would unlock the significant economic potential of investments in energy performance.

The private and public economic benefits of improving energy performance are well accepted. The current increase in energy prices has increased the economic benefits of energy efficiency and demand management, at least in the short-term. Market analysts expect high energy prices to persist

[2] "It's changed my life not to have the continual worry of being warm" – health and wellbeing impacts of a local fuel poverty programme: a mixed-methods evaluation | BMC Public Health
[3] The Victorian Healthy Homes Program – Research findings
[4] Empirical evidence on the dynamics of energy poverty and poor health in Australia | SpringerLink
[5] Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States

until around 2026[6]. In the longer term an opposite trend may become more dominant, as renewable generation increases, leading to lower energy unit costs from renewables' lower marginal cost of production. Although this may reduce private economic returns from energy efficiency, energy efficiency will remain an important core part of emissions reductions, in addition to its role in reducing the size of the electricity system required to serve demand.

Electricity demand management that encourage demand to follow supply can reduce the likelihood of situations where demand exceeds supply and hence supports the stability of the electricity system. Energy efficiency and demand management can reduce requirements for generation and storage, as well as transmission and distribution infrastructure.

Efficiency upgrades in buildings can help to ease load at peak times of the day or season and so can reduce a mismatch between demand and supply. Thermal shell and general building efficiency upgrades pair well with appliance upgrades in reducing peak demand pressure in the grid, reducing both energy prices and energy system instability risks[7]. Investment in energy efficiency upgrades serves as an economical method to minimise grid instability risk, deferring the need for expensive grid investments. Such energy efficiency is currently often undervalued at a private and society level – which leads to under-investment in these measures and over-investment in generation and network infrastructure. These higher infrastructure costs are ultimately borne by consumers[8].

The story for demand management is similar. Demand management can be implemented either through reducing actual energy demand at peak times or by storing energy use (either through the grid or behind the meter) at off-peak periods for use during peaks. The energy market and governments have tended to focus on large-scale supply and transmission – there has been less focus on large-scale demand management, and even less on small-scale distributed responses. Yet projections by AEMO indicate that the future capacity of small-scale storage, including home batteries and electric vehicles, is likely to exceed conventional large-scale storage. Integrating customer-owned small-scale storage into current market systems – for instance through 'virtual power plants' – is yet to be harnessed effectively within the market. New technologies for controls and data provision, changes to behaviour of energy market operators, and price signals for following forecast schedules can all support small-scale storage to be a forecastable and dispatchable resource.

Experience in Australia and elsewhere has long shown that despite financial and economic benefits, investment in energy efficiency and other energy performance measures is not taken up at the rate consistent with a well-functioning market, let alone the level required to support rapid decarbonisation. This creates an important role for governments to drive further energy performance improvements. This will support the Australian economy to decarbonise in line with the Paris Agreement and at the same time benefit from the global transition to a net zero economy.

Our research suggests that a substantial benefit of increased energy efficiency is a significant reduction in energy system costs.

Climateworks has estimated potential energy and transmission cost savings using outputs from our in-house modelling in *Decarbonisation Futures*. The modelling provided the scale of technical opportunity to reduce energy use from energy efficiency improvements and from this we estimated potential cost savings. Our analysis illustrates the significant economic potential of energy efficiency investment in displacing carbon-intensive fossil fuel electricity demand, stabilising the grid, and lowering transmission and overall energy costs.

Climateworks' 1.5°C-aligned scenario from *Decarbonisation Futures* included around 280 PJ of electricity and gas savings from energy efficiency upgrades in commercial and residential buildings in 2030 (see Figure 1, below), and around 130 PJ in industry. By comparison, energy savings in the modelled 2°C-aligned scenarios reached comparable levels of around 180 to 250 PJ in buildings and 120 to 140 PJ in industry in 2030. The similarity reflects that energy efficiency measures are cost effective even without tight emissions constraints. As shown in Figure 1, the energy efficiency savings

[6] Energy prices across Australia to remain high until 2026 – Cornwall Insight
[7] (Clark, 2019); (Jackson, Zhou and Reyna, 2021)
[8] Cost of supplying electricity to households at an eight-year low | ACCC

from our 1.5°C pathway represents a 39 per cent decrease in national buildings energy consumption by 2030.

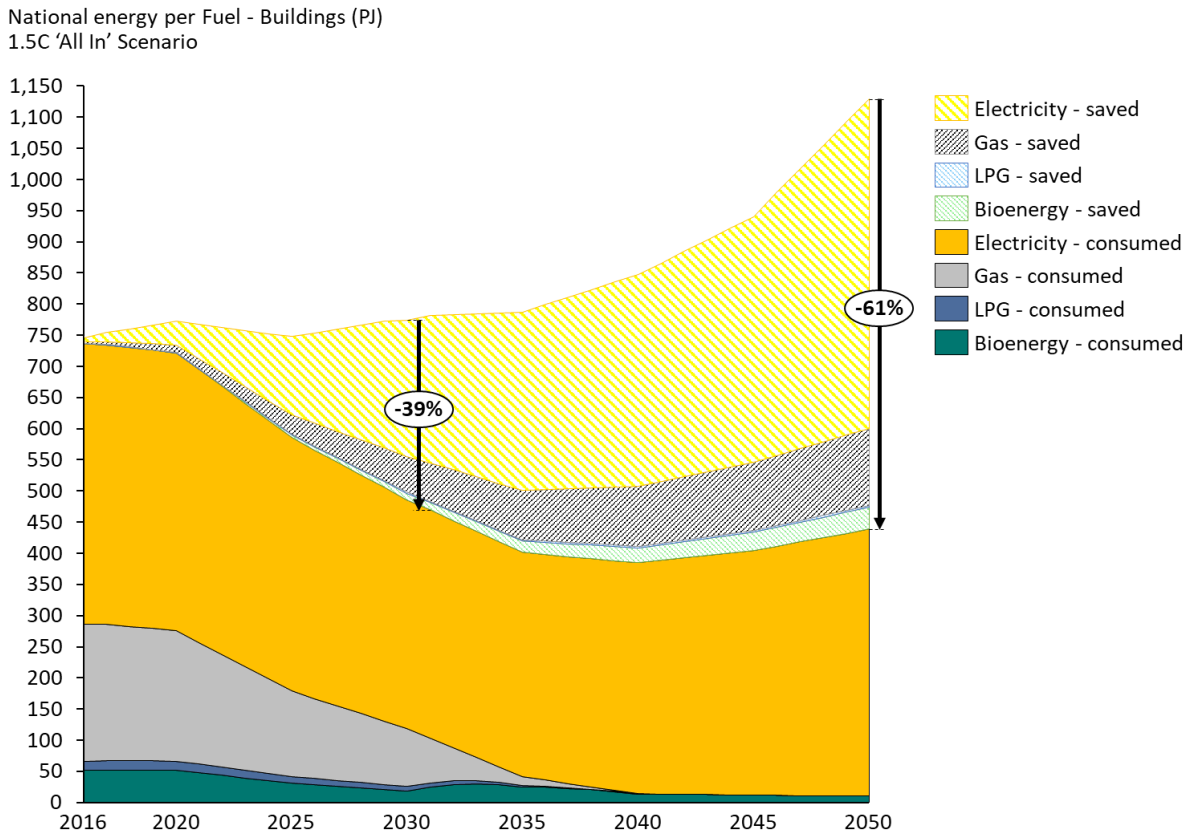

FIGURE 1: NATIONAL ENERGY CONSUMPTION AND SAVINGS FROM ENERGY EFFICIENCY IMPROVEMENTS IN BUILDINGS, 2016-2050, BROKEN DOWN BY FUEL. DATA SOURCE: DECARBONISATION FUTURES 'ALL-IN' 1.5°C-ALIGNED SCENARIO[9].

Assuming an average wholesale electricity price of $100/MWh and wholesale gas price of $5/GJ (roughly in line with historical trends), energy efficiency improvements result in approximately $5.5 to $8 billion of electricity and gas bill savings across buildings and industry in 2030[10], depending on the scenario.

Although current efforts to quantify the benefits of energy efficiency for lowering grid investment requirements are limited, some utilities and planning authorities have assigned values to factors that account for reliability-related benefits of energy efficiency. These values range from just over $1/MWh to $20/MWh[11]. Climateworks' calculations based on outputs from our *Decarbonisation Futures* modelling suggest energy efficiency could prevent approximately 19 GW to 28 GW of peak electricity demand on the grid in 2030, amounting to roughly $8 to $13 billion of savings from deferred investment in the grid[12]. This is equivalent to around half of the planned investment through Rewiring the Nation. Note these estimates are high-level calculations, not more precise modelling of the savings themselves, and only give a rough indication of the scale of potential savings. Figure 2

[9] We expect energy consumption to increase over time (beyond 2040) due to GDP and population growth expectations assumed in the modelling. Until around 2040, energy consumption (without energy efficiency improvements) is relatively constant, reflecting energy performance gains from electrification and fuel-switching.

[10] Note that this dollar figure is not discounted and hence is a representation of expected cost savings in 2030 Australian dollars. The indicative split between sectors is approximately $4-6.5 billion bill savings in buildings depending on the scenario, and approximately $1.5 billion in industry across all scenarios.

[11] ACCEE Keeping the Lights On: Energy Efficiency and Electric System Reliability

[12] Estimated based on simplified conservation load factors for residential buildings, commercial buildings and industry of 0.2, 0.4 and 1.0 respectively, and grid deferral investment benefit of $500/kW as used by Jacobs in the VEU energy market modelling report. Note that this dollar figure is not discounted and hence is a representation of expected cost savings in 2030 Australian dollars.

illustrates peak load savings due to energy efficiency for the 1.5°C modelled scenario, and ongoing potential for bill savings and deferred grid investment costs across all scenarios.

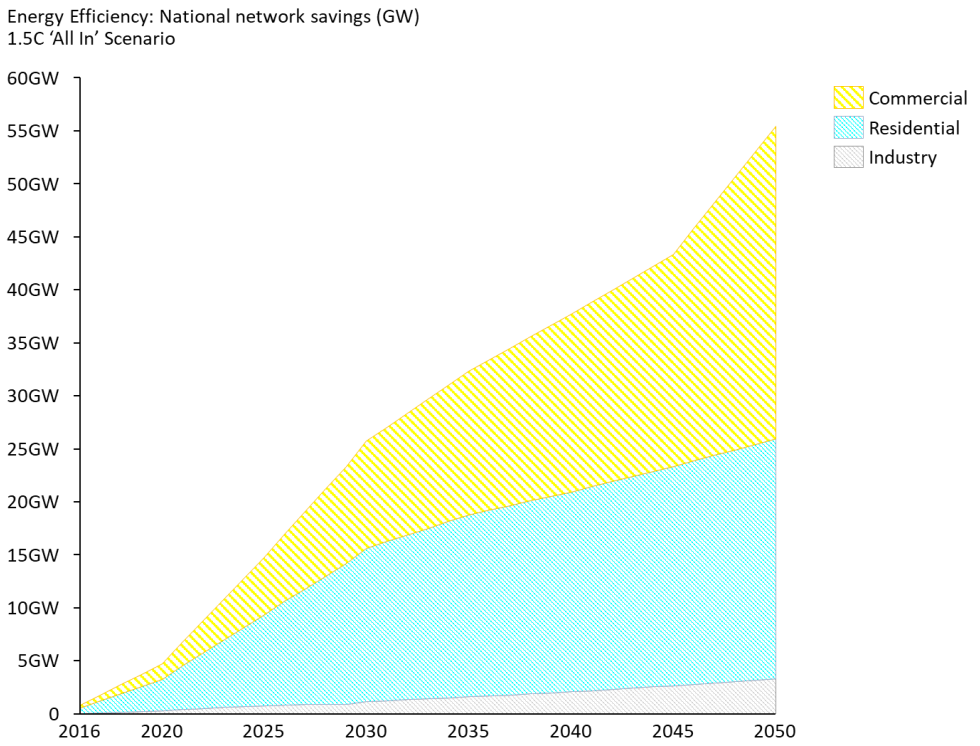

FIGURE 2: NATIONAL PEAK LOAD SAVINGS FROM ENERGY EFFICIENCY IMPROVEMENTS IN BUILDINGS, 2016-2050, BROKEN DOWN BY DEMAND SOURCE. DATA SOURCE: DECARBONISATION FUTURES 'ALL-IN' 1.5°C-ALIGNED SCENARIO.

Improving energy governance

Adopting appropriate frameworks, governance and targets will help guide the rapid energy transformation and unlock opportunities from improving energy performance.

The government has set the overall framework for governance of climate action in Australia through the Climate Change Act 2022, with emissions reduction goals and annual progress reporting. And Australian energy governance is evolving rapidly to match the speed and necessary scale of transition and the transformation of the energy system. The importance of this evolution been rightly recognised by the Energy Ministers with the formation of the National Energy Transformation Partnership and the greater coordination offered by the new Energy and Climate Change Ministerial Council. As part of these changes, Climateworks welcomes the proposal to introduce an emissions reductions objective into the National Energy Laws as this clarifies and signals the task for the transition. The changes to emphasise a whole-of-energy system approach and consumer focus within the energy laws are likely to help the energy agencies to understand the complexity of the task they face.

Climateworks supports the creation of the National Energy Performance Strategy (NEPS) as we see the value of a clear framework to catalyse improved energy performance. We see the NEPS with its focus on the demand side as a key part of the suite of actions that will transform Australia's energy system. As noted in the consultation paper there are already efforts underway to place increased focus on the demand side – for instance, in energy system planning and investment. The NEPS can add clarity and direction to this existing work. Climateworks proposes several additional governance and framework actions for energy performance as outlined below.

Climateworks has long argued for the value of setting out the end goal, and the pathways to reach that goal. Setting an end goal, along with energy savings targets, will provide a clear signal to guide implementation and investment priorities for energy market participants, investors and the energy market agencies.

Recommendations for overall content, purpose and framework

Climateworks recommends a NEPS that:

- has an overall objective to improve energy performance in line with achievement of Australia's legislated emissions reduction targets and the goals of the Paris Agreement
- is clearly linked to the actions needed for the wider energy system transformation that will underpin the transition of energy use across the economy
- sets energy efficiency targets – see further detail below – to ensure the opportunities in energy performance can be unlocked in order to meet the overall objective
- expects all federal departments and agencies to embed energy performance objectives and targets into their work
- sets out a process and timeframe for relevant ministers to establish sectoral metrics and/or targets – see further detail below
- sets a dynamic national framework to meet those targets and an accountability mechanism and processes to track, review and adjust progress
- sets out the policies for buildings and industry, and the process and timeframe to develop a comprehensive policy suite to improve Australia's energy performance
- sets out how this process will integrate with existing structures, initiatives and legislation and establish new ones as necessary – see further detail below
- sets out how energy performance improvement can fully contribute to the broader energy transformation and provide benefits for consumers of energy and the affordability and reliability objectives of the National Energy Objectives (NEO).

Integrating demand considerations into Australian energy governance

Through explicitly connecting NEPS to existing energy governance through the National Energy Transformation Partnership, governments have the opportunity to integrate improved demand management and energy efficiency with efforts to deliver a major scale-up of clean energy generation.

The current proposals for changes to the National Energy Objectives (NEO) will be an important step in decarbonisation of the energy system. However, they are unlikely to be sufficient to unlock the full potential for demand management and energy efficiency, thereby missing out cost-effective options. Changes to the Integrated System Plan (ISP) can assist in creating a visible signal of what is required as it outlines least-cost pathways for the transition of the energy system. The 2024 ISP is expected to be a more comprehensive approach to integrated planning, but there are as yet to clear plans to fully integrate demand management. The WA's WOSP Whole of System Plan (WOSP) also offers guidance on the pathway to decarbonising the energy system.

Further guidance for the decisions of the Energy and Climate Change Ministerial Council on the opportunities from the demand management and energy efficiency would support achievement of the objectives of the National Energy Transformation Partnership. coordinate the transition of increasing renewable energy and fuel shifting across the energy system and the sectors where fuel use will change most (industry, transport and buildings) will assist and include demand management, energy efficiency and distributed generation and storage as part of this transition planning

As part of changes suggested under the NEPS, or directly through the Energy and Climate Change Ministerial Council, energy governance can be improved by:

- providing clear direction for governments and the market (including the energy agencies) on how to incorporate and incentivise demand-side changes into existing and emerging

mechanisms and processes guiding planning and investment. At the national level, examples include Rewiring the Nation, Powering the Regions Fund, and the Capacity Investment Mechanism.

- requiring the Integrated System Plan better integrates demand-side opportunities, and resourcing is provided for an annual Energy Performance Statement of Opportunities – with comparable changes for WA's Whole of System Plan.
- governments ensuring expertise in energy management, demand-side issues and consumer issues to be embedded deeply within energy market bodies, including at board level.
- ensure market reforms give equal weight to energy efficiency, demand management and customer-owned storage (as well as the potential hydrogen production as a load balancing mechanism) as has previously been given to increasing renewable energy supply
- build on existing mechanisms such as the Wholesale Demand Response Mechanism in the National Energy Market incentivises small and large-scale demand response appropriate to the scale of the opportunities available.

A new coordination mechanism tied in to existing institutions and bodies will help drive energy performance action.

Much of the NEPS can be delivered through existing structures, including the Energy and Climate Change Ministerial Council and the Building Ministers Meeting. Recently enhanced duties for the Climate Change Authority (CCA) and federal government obligations under the Climate Change Act will also support the ability to track the impacts of policies in relation to energy performance and emissions reductions.

However, to gain full effect from the NEPS and ensure energy performance improves in line with rates that support least-cost pathways, Climateworks proposes an additional mechanism for accountability. We suggest the Ministerial Council creates a taskforce across governments reporting to them with a focus on energy performance in service of the wider energy and climate targets – or a similar mechanism that creates a group with a focus on energy performance that feeds in to existing structures.

Climateworks also sees the power of increased information transparency as part of implementation and tracking of the NEPS. This would help amplify the signal from targets setting within the NEPS and support the development of energy market design and investment decisions. This transparency would also support wider decision making to guide technology development and uptake. For instance, within the energy market increased data transparency and further modelling would allow foresight into likely energy system changes thus improving planning and investment allocation and changes to market design. For example, different scenarios for demand under different rates of energy efficiency improvement or different daily load profiles can provide guidance to energy agencies and the market on appropriate levels of new energy capacity required.

Setting energy efficiency targets creates focus and provides a signal to accelerate action.

Climateworks' modelling shows that net zero emissions can be achieved most cost-effectively only with significant levels of energy savings. This will help contain the growth in energy consumption and the associated investment in energy networks and increase in energy bills. Climateworks argues that energy efficiency targets will play an important role to put the necessary focus on energy savings and accelerate government, business and consumer efforts to save energy. Several jurisdictions have already set energy efficiency targets alongside reduction targets. The EU has for example set a target of reducing energy consumption by at least 32.5 per cent by 2030 (compared to projections of the expected energy use in 2030), with a clause for a possible upwards revision by 2023[13]. Member countries are required to establish a 10-year integrated national energy and climate plan for 2021–2030, outlining how they will contribute to the 2030 targets for energy efficiency, renewable energy and greenhouse gas emissions. Germany is rated by the American Council for an Energy Efficient Economy (ACEEE) as a global leader in advancing energy efficiency and praised for a

[13] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-targets_en

national 50 per cent reduction target in primary energy use by 2050, with a national Energy Efficiency Strategy to 2050[14].

According to the American Council for an Energy-Efficient Economy (ACEEE), international best practice consists of setting mandatory targets that require energy savings of more than one per cent of a country's overall energy consumption per year (in absolute terms). Lower targets or intensity targets, although useful, are not seen as effective at containing growth in energy demand and achieving maximum benefits for consumers and the grid. The ACEEE also highlights that targets are most effective if they are set nationally and by sector to maximise benefits across the economy, particularly for households.

In addition to energy efficiency (savings) targets, technology uptake targets for energy-efficient technologies can be useful to drive market uptake of energy-efficient appliances. As an example, the 2022 REPowerEU plan proposes the following heat pump targets: doubling annual sales, adding 10 million hydronic heat pumps in the next five years, and adding a total of 30 million hydronic heat pumps by 2030[15]. The UK's Boiler Upgrade Scheme included in the Ten Point Plan for a Green Industrial Revolution plans to install 600,000 heat pumps per year by 2028.

We would suggest applying the principle of technology uptake targets to a 'thermal shell first' approach as well as to appliances. Targets and implementation mechanism to support them can help create a market for appropriate materials and products, for both new construction and retrofitting existing buildings. Examples of materials and products that improve building energy efficiency include double or triple glazing; solar shading devices; insulation products for floor, wall, and roofs; light-coloured materials on external shells; and ventilation fans with heat recovery. Targets for increased use of testing technologies such as air-tightness tests can drive energy efficiency innovation in the market.

Technology uptake targets may also be useful to drive innovation and transition in the industrial sectors. This could tie in with the broader industry policy and initiatives. Examples of this existing work include plans for the Low Emissions Technology Roadmap and integrate in with the mandates for ARENA, CEFC and funding initiatives such as the National Reconstruction Fund and Powering the Regions as well numerous state and territory initiatives such as NSW's Net Zero industry and innovation program.

Governance for monitoring progress

Importantly, a mechanism for monitoring the achievement of targets and instigating 'course correction' actions, if needed, would improve implementation of the NEPS. German ministries are required to produce a yearly report on the progress made against targets and the plan of action to stay on track with the targets. As mentioned earlier, as part of the Climate Change Act, the Climate Change Authority is tasked with providing Annual Progress Reports to the government on progress towards achieving Australia's emissions reduction targets, and to identify where further action is needed. And the government has a duty to respond to these. The Climate Change Authority is currently establishing[16] the leading indicators to track progress, and Climateworks recommends that these include progress towards achieving energy efficiency targets.

Recommendations for governance and targets

In line with international best practice, Climateworks recommends that the NEPS:

[14] Subramanian, S., H. Bastian, A. Hoffmeister, B. Jennings, C. Tolentino, S. Vaidyanathan, and S. Nadel. 2022. 2022 International Energy Efficiency Scorecard. Washington, DC: American Council for an Energy-Efficient Economy. www.aceee.org/research-report/i2201.

[15] https://energy.ec.europa.eu/communication-repowereu-plan-com2022230_en

[16] https://www.climatechangeauthority.gov.au/news/authority-releases-advice-annual-climate-change-statement

- sets 2050 and 2030 national energy efficiency targets (in absolute terms), with yearly savings of at least 1 per cent of Australia's overall energy consumption
- uses existing structures, such as the Energy and Climate Change Ministerial Council and Building Ministers Meetings to deliver the strategy across federal, state and territory governments
- creates a cross-government taskforce under and reporting to the Council to oversee implementation of the NEPS framework – or similar mechanism that provides focus on demand-side action with an explicit connection to governance for the wider energy system transformation
- includes consumer perspectives within the taskforce – for instance by including consumer representatives or having a dedicated stakeholder group that is consulted on actions to deliver the NEPS and reports on progress
- sets out a process for the urgent development of 2050 and 2030 sectoral performance metrics and/or targets for residential buildings, commercial buildings, industry and transport to ensure energy efficiency targets are met. These would link to existing initiatives and legislation and governance structures – for example, building targets aligned to the Trajectory for low carbon buildings, in agreement with Building Ministers and Energy Ministers, together with the ABCB
- considers the use of performance measures on technology uptake as part of these measures, and life-time emissions and cost reductions as key metrics
- sets out how the work connects with plans to improve energy efficiency and energy performance in transport
- sets out how energy performance improvement can fully contribute to the broader energy transformation and provide benefits for consumers of energy and the affordability and reliability objectives of the NEO
- includes clear direction for the market and governments (including the energy agencies) on how to incorporate and incentivise demand-side changes into existing and emerging mechanisms and processes (such as the Powering the Regions Fund, Integrated System Plan and the Capacity Investment Mechanism).

1.

Buildings

Introduction

The recommendations contained in this submission are derived from research conducted at Climateworks Centre. This includes quantitative modelling published in Decarbonisation Futures reports, and new research being undertaken in collaboration with CSIRO and Strategy Policy Research analysts. This new research is referred to as 'Renovations Pathways'[17].

The Renovation Pathways project provides analysis of existing residential building stock and case studies of Class 1a buildings (detached homes, and townhouses) and Class 2 buildings (units and apartments), in total representative of 80 per cent of homes across Australia. The primary objective of the research is to enable the kick-start and scaling up of energy efficiency renovations of Australia's existing building stock.

The National Energy Performance Strategy is a clear opportunity to support changes in buildings that put Australia on track to achieving net zero. A key step is to normalise zero carbon buildings by 2030.

Buildings are the source of 20 per cent of Australia's emissions and consume over half of Australia's electricity[18]. Climateworks modelling of 1.5 degree Celsius and 2 degree Celsius scenarios for Australia shows the building sector can achieve zero carbon by 2035[19]. Acting fast to decarbonise the building sector is key to achieving Australia's climate targets in a cost-effective manner. This reflects the fact that all technologies necessary to reduce energy demand and fully electrify and decarbonise buildings energy consumption are cost effective and readily available. These include low carbon construction materials for a 'thermal shell first' approach to reduce energy demand, energy efficient fixed appliances in buildings, and the technologies available to generate and store renewable energy on-site for an efficient, renewable energy grid.

To support the building sector to get to zero carbon by 2035, it will be important to normalise zero carbon buildings by the early 2030s, across new and existing building stocks. This is in line with the recommendations of the International Energy Agency for buildings in its Net Zero by 2050 Roadmap[20].

Coordination across policy, finance, data and consumer behaviour in the next three years can catalyse the changes required to reap the benefits of increased energy performance in buildings – for both emissions reductions and benefits to consumers. While the market is not there yet, the majority of technologies are. Time is ripe to make zero carbon buildings the norm by 2030, and readily achievable if adequately incentivised and supported by policy and finance mechanisms. The National Energy Performance Strategy (NEPS) is a clear opportunity to put Australia on track.

To do so, Climateworks recommends the NEPS sets out what policies and initiatives could catalyse changes in the building sector and the processes needed to work across federal, state and territory governments, consistent with achieving:

- a least-cost pathway for the building sector in line with Australia's targets and implementation of the Paris Agreement
- sectoral performance metrics in support of the suggested energy efficiency targets in the NEPS – see previous section
- the 2019 Trajectory for Low Energy Buildings
- zero carbon building stocks in the 2030s, as recommended by the IEA.

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[17] Further details of the Renovation Pathways project can be found here.

[18] https://www.climateworksaustralia.org/wp-content/uploads/2020/04/Decarbonisation-Futures-March-2020-briefing-slide-pack.pdf

[19] ClimateWorks Australia, 2020, Decarbonisation Futures: Solutions, actions and benchmarks for a net zero emissions Australia, available at https://www.climateworkscentre.org/wp-content/uploads/2020/04/Decarbonisation-Futures-March-2020-full-report-.pdf

[20] IEA (2021), Net Zero by 2050, IEA, Paris https://www.iea.org/reports/net-zero-by-2050, License: CC BY 4.0

A comprehensive policy package is key to improving thermal shell and appliance efficiency and electrification

A suite of comprehensive policies can support consumers and industry to move to zero carbon building stock. This transformation will result in buildings that are healthier and more comfortable to live and work in. Moving to a zero carbon building stock will be most effective if a tailored and coordinated mix of mandatory and persuasive interventions target different groups of building owners and users.

Our research shows the scale of reduction in energy demand and reduction in demand peaks from improving the thermal shell of buildings. This can reduce the associated strain on the grid and ultimately reduce energy bills, but these actions currently tend to be overlooked in comparison to approaches focusing on electrification and appliances. For instance, South Australia, world leader in solar and wind generation, still relies on gas generation of electricity in winter, and the poor energy efficiency of its buildings makes this harder to resolve.[21] Delivering energy efficient buildings to reduce energy demand whilst electrifying buildings will reduce required investments in energy supply and distribution, as well as use of heating and cooling appliances themselves and ultimately, lower energy bills/cost of living and increase disposable income. It will also improve occupant health.

Climateworks recommends that the NEPS outlines a policy package for buildings that prioritises energy efficiency of the thermal shell, alongside catalysing the use of more energy efficient appliances, electrification and other measures, to encourage space efficient buildings. These policies and market incentives are now urgently needed to allow full deployment of available thermal shell upgrades and appliance technologies at a rapid pace and at scale.

Critically, if Australia adopts a national definition for zero carbon buildings, this will provide greater clarity for governments and the market. This definition would also improve government abilities to implement policies in line with IEA recommendations on enabling new and existing building stocks to achieve this standard for residential and non-residential buildings. The necessary policy package is detailed in the next section.

Government can use existing mechanisms to achieve the transition to zero carbon buildings. Key mechanisms for collaboration between the federal and state and territory governments already exist, for example through the Buildings and Energy and Climate Change Ministerial Councils and through processes such as the National Construction Code. Using these forums and processes will allow the achievement of timely change, including by setting and agreeing on zero carbon building standards and their adoption by all states and territories as the goal for buildings by 2030. Consultation and engagement with key built environment professional organisations would be critical to instil confidence across the sector and with trades involved in both retrofitting and new buildings, in order to advance buy-in for rapid adoption.

Committing to all new buildings being zero carbon by 2030 at the latest

Climateworks has established a definition for energy efficient, zero carbon and resilient buildings through an extensive literature review and consultation of industry, research and government experts as part of the Renovations Pathways project[22]. We define zero carbon and resilient buildings as having all of the below:

- **Form** (i.e. building's shape and its orientation to the sun) designed to protect occupants' health and comfort and to suit local climate and local site conditions, including flooding, bushfire, and cyclones AND
- **Thermal shell** (i.e. external walls, ground floor and roof) designed, constructed and upgraded using a 'thermal shell first' approach to maximise the performance of the building form and

[21] Pears, Alan. 2023. "South Australia may lead world in wind and solar, but leaky buildings will cause problems." RenewEconomy. January 16, 2023. https://reneweconomy.com.au/south-australia-may-lead-world-in-wind-and-solar-but-leaky-buildings-will-cause-problems/#google_vignette.

[22] Renovation Pathway project https://www.climateworkscentre.org/project/renovation-pathways/

materials, and to reduce the size and use of appliances whilst maintaining safe indoor temperatures[23] AND
- **Materials** (i.e. all components used in a building plus its external spaces and structures on site) are selected to minimise the overall embodied energy of the development, calculated over their lifecycle (design life) or are reclaimed materials, and are durable AND
- **Appliances and services** (i.e. fixed appliances) are highly energy efficient and optimised for a renewable energy grid (i.e. minimising energy demand and operable at times of peak solar generation), and completely electrified, being fully powered by carbon-free renewable energy generated/stored on-site or purchased from a renewable energy source AND
- **Operation** of energy efficient building design features and appliances are user-friendly on a day-to-day basis and based on occupancy AND
- **User needs** (i.e. control of building to minimise operational costs, safety during maintenance, and health and comfort) are prioritised during design and construction and are appropriate for the building's function, occupancy, and geographic location AND
- **Resilience** (i.e. the ability to protect occupants during acute event stresses and shocks, and recover from such events) is integrated into building design to keep occupants cool in summer and warm in winter and reasonably able to cope with extreme weather events (e.g. bushfire, flooding).

A significant portion of homes that will be standing in 2050 are yet to be built. Ensuring that all new buildings are zero carbon is therefore an important element in ensuring Australia meets its net zero emissions target. If new homes are built to zero carbon standards this will reduce the number of homes requiring renovations for energy efficiency in the future, or the amount of carbon sequestration required to counterbalance remaining emissions.

While the National Construction Code was recently updated to reflect an increase in home energy requirements, standards for new homes still fall short of ensuring all new homes are highly energy efficient, zero carbon and resilient. In order to normalise zero carbon buildings in the 2030s, Australia's National Construction Code will need to be updated to require all new buildings to be zero carbon from 2030 (at the latest) onwards.

In line with the IEA's recommendation that governments act decisively before 2025 to ensure that zero carbon building codes are implemented by 2030, the European Union has moved to require zero emissions buildings to be the norm by 2030, and by 2027 for government buildings[24]. Australia is losing out on the benefits of improving building energy performance, through the currently slow and incremental approach to upgrading standards. Climateworks recommends the commitment made by Energy Ministers in 2019 to implement the Trajectory for Low Energy Buildings[25] is developed into a more comprehensive outcomes-based approach, that sets targets, timings and metrics to deliver on the net zero commitment. The NEPS represents an opportunity to lay steps towards setting a zero carbon building standard and its implementation by 2030.

Recommendations for new buildings

To ensure a zero carbon standard for new buildings relevant to all climate zones is implemented by 2030 at the latest, and to support industry in this transition, Climateworks recommends that the NEPS:

[23] Safe indoor temperatures are defined by World Health Organisation. For minimum temperatures see WHO (2018) Housing and health guidelines. Available at: https://apps.who.int/iris/bitstream/handle/10665/275839/WHO-CED-PHE-18.03-eng.pdf For maximum temperatures see WHO (*n.d.*) Heat and Health, available at: https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health

[24] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/nearly-zero-energy-buildings_en

[25] https://www.energy.gov.au/government-priorities/energy-ministers/energy-ministers-publications/trajectory-low-energy-buildings

- sets the process to agree on the definition for zero carbon buildings by end of 2023. We recommend considering the definition developed by Climateworks Centre in conjunction with key stakeholders to establish this standard[26] (see page 15 above).
- establishes the process that would set up a phased adoption of this standard by 2030. Phasing would involve ramping up from the existing 7 star NatHERS standard towards a zero carbon building standard in 2030, using the 2025 and 2028 updates of the National Construction Code. Climateworks recommends that NCC 2025 introduces the zero carbon standard definition as a voluntary standard and plans for it to become mandatory with NCC 2028 (at the latest), with a maximum of 2 years for implementation. This will allow early-moving building developers to refer to a national standard as early as 2025 for zero carbon buildings.
- affirms the government's commitment to working with the Building Ministers Meeting, Energy and Climate Change Ministerial Council and Australian Building Codes Board for action in the building sector in line with cost-effective action to meet Australia's targets.
- sets out how the NatHERS will be updated to include calculations and a star rating aligned to zero carbon, in addition to the methods applied to calculate star ratings used at present.
- sets out near-term financial incentives to support early movers to build or renovate to the zero carbon and resilient building standard, prior to the standard being made mandatory. Examples could include new homes being built under the National Housing Accord, specifically the 10,0000 new affordable homes. Support for early movers will help build market and supply chains.
- sets out a process to develop mid to long-term financial incentives for zero carbon compliant buildings in collaboration with federal, state and territory governments and the investment community.

Defining and orchestrating Australia's national renovation pathway

Existing homes are estimated to be on average 1.5 stars NatHERS (out of a possible 10), versus an average 6 stars for new homes[6]. Energy efficiency provisions were first introduced in Australia in 2003, which means that the vast majority of buildings constructed prior to this date are likely to be below 4 stars. This has major health implications: Australia has double the rate of cold-associated deaths as Sweden,[27] with building quality implicated as a causal factor.

Improving energy efficiency and electrifying buildings will also deliver major socio-economic benefits for households. In economic terms, energy efficiency and electrification of existing buildings will also reduce required investments in energy supply and distribution[28]. In Australia, a large-scale retrofit program could create up to 100,000 jobs per year.[29]

As most existing buildings will still be standing in 2050 and improving building energy performance is central to cost-effective emissions reductions, a major renovation effort is needed to upgrade existing homes to a level as close as possible to zero carbon and to the resilient definition listed. A review of policy for retrofitting existing homes suggests that incremental changes to mandatory regulation take too much time to deliver sufficient impact.[30] Conversely, a combination and the orchestration of mandatory and persuasive interventions, including regulation and financial incentives, together with consumer information, has been proven to be most effective. The NEPS, therefore, provides the opportunity to outline a process to implement a policy package in support of a national renovation

[26] Definition developed as part of Renovation Pathway Project, for further details see https://www.climateworkscentre.org/project/renovation-pathways/

[27] Gasparrini, Antonio, Yuming Guo, Masahiro Hashizume, Eric Lavigne, Antonella Zanobetti, Joel Schwartz, Aurelio Tobias, et al. 2015. "Mortality Risk Attributable to High and Low Ambient Temperature: A Multicountry Observational Study." *The Lancet* 386 (9991): 369–75.

[28] Boehm, S., K. Lebling, K. Levin, H. Fekete, J. Jaeger, R. Waite, A. Nilsson, J. Thwaites, R. Wilson, A. Geiges, C. Schumer, M. Dennis, K. Ross, S. Castellanos, R. Shrestha, N. Singh, M. Weisse, L. Lazer, L. Jeffery, L. Freehafer, E. Gray, L. Zhou, M. Gidden, and M. Gavin. 2021. State of Climate Action 2021: Systems Transformations Required to Limit Global Warming to 1.5°C. Washington, DC: World Resources Institute: https://doi.org/10.46830/wrirpt.21.00048.

[29] Beyond Zero emissions, 2020, *The Million Jobs Plan,* Accessed: https://bze.org.au/wp-content/uploads/2020/11/BZE-The-Million-Jobs-Plan-Full-Report-2020.pdf

[30] van der Heijden, Jeroen. 2014. Governance for Urban Sustainability and Resilience: Responding to Climate Change and the Relevance of the Built Environment. Edward Elgar Publishing.

pathway. It is also the time to set out options for complementary, mandatory and persuasive mechanisms to achieve the scaling up of energy efficient and zero carbon renovations of existing buildings. For optimal results, these should be planned and timed to mutually reinforce each other, as shown in Figure 3 below. In particular, optimal results would be achieved if this pathway combines direct government support for low-income households, with positive financial incentives for early movers, to kick-start and build up the renovation market and supply chain and regulatory incentives that will progressively bring the whole market to the required standard.

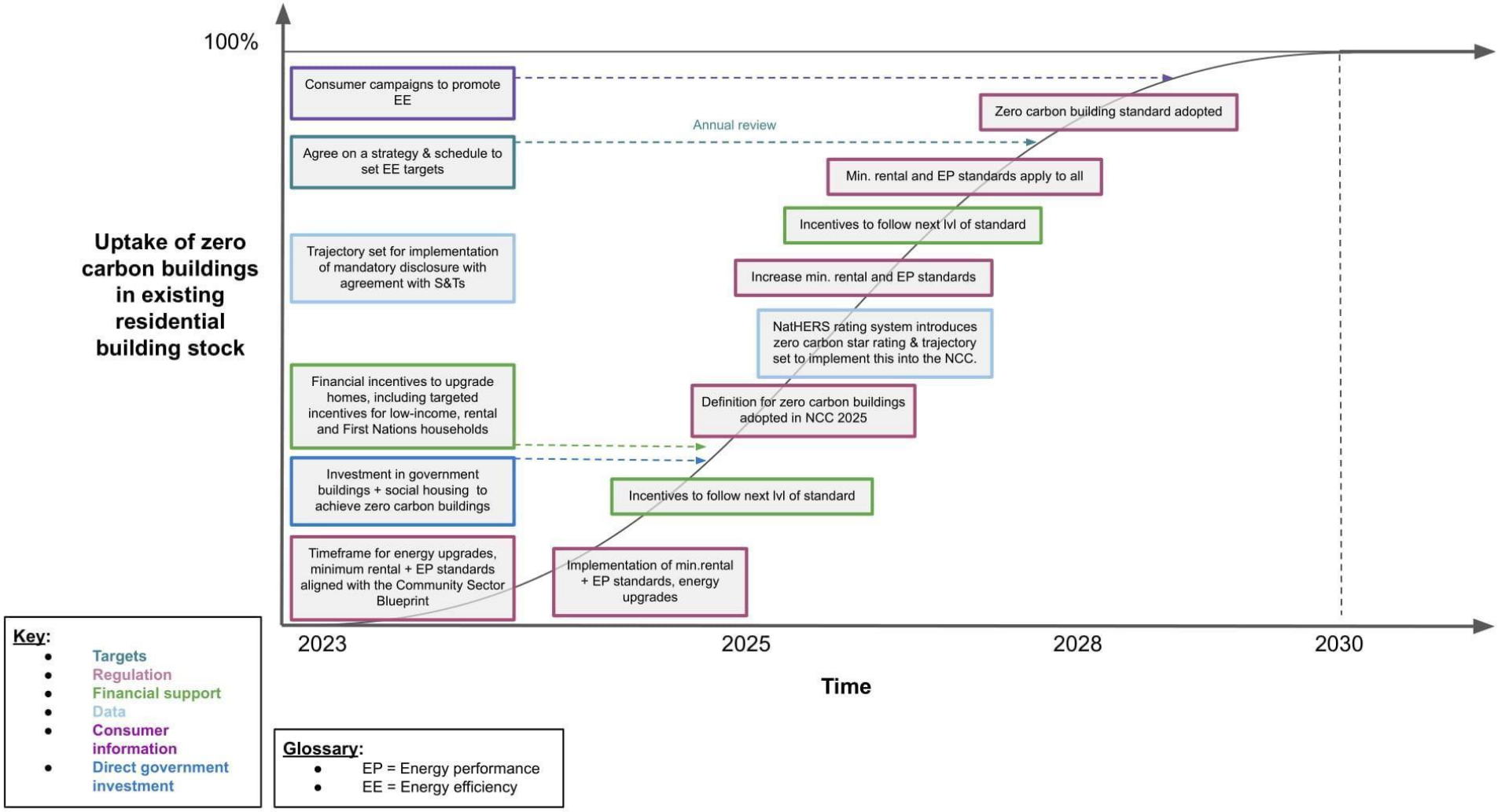

FIGURE 3 COORDINATED TRAJECTORY TOWARDS ZERO CARBON RESIDENTIAL BUILDING STOCK

Recommendations for designing Australia's national renovation pathway

Climateworks recommends that the NEPS sets a process with timeframes to establish a comprehensive policy package for improving energy performance in buildings. In addition, Climateworks recommend the NEPS includes the options for mandatory and persuasive mechanisms to massify the energy efficiency and zero carbon renovation of existing buildings. This includes committing to a long-term effort and establishing short, medium and long term goals. Climateworks views that an effective policy package would include the following timeframes and goals:

Short term focus on:

- setting up appropriate energy efficiency targets and governance (see section on targets).
- designing national legislation aiming to normalise zero carbon and resilient buildings by 2030. This includes updating the NCC as per recommendations for new buildings and major renovations, and introducing new regulations for existing buildings including minimum rental standards by 2025.
- update minimum energy performance standards for appliances through the Greenhouse and Energy Minimum Standards Act and set in place a plan for ongoing updates by end 2023
- prioritising direct government investment and funding towards upgrading social housing and supporting low income households and using this as an opportunity to stimulate and improve supply chains, skills and materials. Also investing in upgrading government assets to stimulate the market and lead by example.
- incentivising upgrades through financial incentives (targeted tax rebates, subsidies, loans) and working with banks on normalising energy upgrade requirements for mortgages (and consider establishing an opt out approach, rather than opt in). Financial incentives should be designed in conjunction with a ratcheting up standard, to incentivise early movers to build above standard.
- improving data collection and consumer information on energy performance. This includes rolling out a national mechanism to record and monitor energy use in buildings by 2025 and providing prospective buyers and tenants with information about the relative performance of a property at point of sale or lease. It also includes information and awareness raising campaigns to support households.

Medium term focus on working with states and territories to

- expand effective policies that have been implemented in some states (e.g. ACT rental standards, etc.)
- ratchet up standards in combination with adapting financial subsidies to focus on most vulnerable households and incentivise to build above standard.
- review performance against set targets and take corrective action where needed.

Ensuring major renovations comply with minimum NCC standards and a zero carbon standard

Progress towards achieving zero carbon buildings can also be made through better enforcement and implementation of building standards. Coordination is needed between levels of government to address the apparent lack of applications for building permits for major renovations which would trigger NCC compliance.

In 2022, across Australia, only 5,549 building permit certificates across Australia were obtained for buildings undergoing renovations - a number which is substantially lower than the number of buildings

being renovated.[31] Of this small number of permitted buildings undergoing renovations, the majority of permits (around 80 per cent) were for renovations within Victoria. To address the gap between actual renovation activity and building permit applications, a review is needed. Following this review, Climateworks recommends the development of a collaborative plan, agreed across all states and territories, to reduce disincentives to compliance.

Incentives can unlock the full benefit of energy efficiency renovations

An effective policy package would include a range of different mechanisms to support and motivate the diversity of agents in the renovation market – on both supply and demand sides – and target support where it is most needed. The federal government can play a critical role to orchestrate these mechanisms and support interventions delivered at all levels of government. This can ensure that interventions are coordinated and attractive to largest possible numbers of property developers, owners, and tenants, across all states and territories.

Climateworks' Renovation Pathways research project analyses the costs and benefits of various energy efficiency renovation measures, across a set of 16 building archetypes representing 80 per cent of housing stock around Australia[32]. Energy efficiency renovation levels were established through CSIRO 2021/2 research with RMIT, under a project funded by Race for Homes 2030 (currently under peer review, to be published in 2023). They are defined as follows:

'Basic renovations' means

1) sealing any gaps in the building's thermal shell to achieve an infiltration of 0.5 ACH

2) using curtains or heavy drapes in winter

3) providing windows with shading via roller shutters in summer and

4) installing roof insulation above ceilings, to achieve a roof insulation level of R3.0.

'Intermediate renovations' means: basic renovations plus

5) installing improved glazing to increase thermal performance of window

6) installing floor insulation at ground floor or above undercroft parking, to achieve an insulation level of R2.0.

'Advanced renovations' incorporates basic and intermediate renovations plus

7) achieving an infiltration of 0.2 ACH

8) installing double glazing with 'thermally broken' window frames

9) installing blow-in wall insulation to achieve a wall insulation level of R2.0 and

10) adding ventilation with heat recovery.

[31] CSIRO. 2019. "Energy Rating – National Overview." Australian Housing Data. May 21, 2019. https://ahd.csiro.au/dashboards/energy-rating/energy-rating-national-overview/.

[32] The project uses models of the real homes, from datasets managed by CSIRO in the Australian Housing Data Portal, which were reduced to 0 stars NatHERS to create the 'base condition' before undertaking analysis applying three different levels of energy efficiency upgrades to the homes. The archetypes in Renovation Pathways are defined by combinations of the most common types of floors, walls, and roofs in residential buildings in Australia, affecting the energy efficiency of a building's thermal shell. The top 16 archetypes were selected according to their prevalence in the Australian Housing Data Portal, managed and compiled by CSIRO to represent the maximum number of homes possible, using NCC building use classifications, Class 1a (detached homes, townhouses,) and Class 2 buildings (units and apartments in multi-storey developments). 11 archetypes represent above 80 per cent of the Australian residential building stock of Class 1a building uses (a single detached house or single dwelling in a group of attached dwellings such as a townhouse, row house). 5 archetypes represent 80 per cent of Class 2 buildings. The wall, floor and roof combinations selected tested to represent 80 per cent of the existing residential building stocks are 3 x external wall constructions (lightweight, concrete, cavity brick); 3 x ground floor construction (Concrete slab on ground, suspended concrete, suspended timber); 2x roof construction (framed or concrete).

Whilst Renovation Pathways research is still underway, preliminary analysis of the data shows the following results:

1. Basic renovations and intermediate renovations are most cost-effective, at the societal level. On average, the net benefit of renovations from a societal perspective is significantly higher (depending on the degree of renovation)[33] than it is for householders – reflecting the additional societal value created in terms of avoided greenhouse gas emissions and avoided electricity infrastructure costs. Other likely benefits – such as improved climate resilience and avoided health system costs and productivity losses – were not able to be quantified readily, but would add to the societal value of these investments.
2. The cost-benefit at the private householder level is also positive for basic renovations, meaning that overall households would be better off financially, as well as achieving a reduction in emissions and reducing energy demand through these 'basic' energy efficiency upgrades. This renovation level has the highest benefit-cost ratio for householders and therefore it should be expected that – in the absence of mandatory and persuasive incentives – this is the level most households would choose. If a higher societal benefit is sought, many households will need incentives and support to undertake higher levels of renovation. In addition, the split incentive for landlords/ investors and renters means that the benefit for investors is weak, as it is the end-user who will fully reap the benefits of any capital investment, rather than investors themselves.
3. The highest level of renovation, 'advanced renovations' provides the largest energy and greenhouse gas emissions savings, and is cost-effective for some of the housing archetypes but not all[34]. Although the advanced level of renovations is not the most cost effective overall, it is the level consistent with current national climate targets and achieving emissions savings that meet the Australian government's commitment to a 43 per cent reduction in emissions on 2005 levels by 2030 and net zero by 2050.

Climateworks recommends that policy options suggested for inclusion in the NEPS have a focus on a 'thermal shell first' approach. Options could include:

- targeted incentives for upgrading homes to garner renovation action to reduce energy demand through improved energy efficiency in all homes (class 1a detached dwellings and townhouses, and class 2 units and apartments)
- regulatory or other policy interventions to induce a more appropriate level of household investment, as the analysis reveals renovation levels provide greater benefits to society than they do for individual households
- additional and targeted policies are likely to be required, in order to achieve sufficient change in the rental market, as well as targeted support and mandatory energy efficiency disclosures to 'nudge' building owners to understand and take action
- increasing education and awareness of energy efficiency incentives available to both landlords and owner-occupiers alike. Further details of potential incentives are provided in the following sections.

Key success factors for a national support program

Several jurisdictions have implemented programs aiming at incentivising and supporting households, businesses and the construction industry to build or retrofit at a higher standard than the minimum requirement. Having conducted an extensive literature review of existing programs, including the German KfW, the French Climate and Resilience Law & Habiter Mieux aid, and the UK Heat and Building Strategy, Climateworks identifies the following criteria as key to the successful outcome of a renovation support program:

[33] For instance, intermediate renovation upgrades have an average net present value on a societal basis nearly 4 times higher than on a private/householder basis; while the societal net benefit of basic and advanced renovations are both around double their equivalent values on a private/householder basis.

[34] The advanced renovation cost benefit analysis is assuming renovations are undertaken at a time where the homes does not require any maintenance or work to resolve other needs such as structural remediation, or desire for cosmetic upgrades. If these renovations are to be carried out as part of a deep renovation for structural and other repairs to the thermal shell, it is expected the benefits at both households and society will be considerably more cost effective. This calls for incentives to carry out advanced energy efficiency renovations whenever households plan to undertake other modifications to the home.

- Long term commitment, including through a secured national budget, to the program. For example, Germany's KfW program has been underway for more than 15 years. It has had a consistent approach to improving residential energy efficiency, including through incentives, skill development and targeted funding, providing households and businesses with confidence in the program.[35]
- Differentiated and tailored approach for households, landlords and businesses with tailored support (financial or technical).
- 'One-stop shops', compiling qualified assessors, home assessments, and financial incentives in one place improve the accessibility and uptake of retrofit programs.
- Highly developed and tailored financial products, providing a variety of options suitable for different household types (ie. subsidies, zero interest loans, etc.). For example, the UK Heat and Buildings Strategy outlines different financial products for different target groups, including subsidies for low-income households (e.g. the Boiler Upgrade Scheme) and private finance for all households (e.g. green loans and mortgages).[36]
- Data collection and disclosure, ideally through a 'buildings passport', renovation roadmaps and energy performance assessments. For example, the European Energy Performance of Buildings Directive (EPBD) created Energy Performance Certificates (EPCs). These indicate the energy consumption level of the building and must be issued when a building is constructed, sold, or let.
- Government policy and program coordination across regulation and incentives. For example, the French Climate and Resilience Law contains a ratcheting mechanism, with minimum rental standards increasing over time.[37] This is combined with the 'Habiter Mieux' program which provides financial incentives for landlords to increase the energy efficiency of their rental properties (after obtaining an energy assessment) to be above the minimum standard.[38]

Low income households

Upgrading the housing stock of low income households would reduce the need for high energy use, improve thermal comfort and reduce poor health and wellbeing.

Low income households are more likely to live in homes with poor energy performance.[39] These households are less likely to have the disposable income to make the necessary energy efficiency upgrades to their homes, trapping occupants in a cycle of high energy bills and living in discomfort.

Energy poverty occurs when energy bills comprise a high proportion of an individual's income, or when energy consumption is reduced due to high costs, which in turn negatively impacts health and wellbeing.[40] A recent report conducted in the Kimberley region uncovered that public housing tenants typically spend up to 15 per cent of their income on energy bills, in contrast to government employees in the same region only spending 0.8 per cent.[41]

Investment in upgrading the housing stock of low-income households will result in a reduction of energy bills and alleviation of energy poverty. Modelling indicates that targeted investment in energy

[35] Energy Efficiency Council. 2022. "Lead, Accelerate, Transform – Energy Efficiency in Buildings: Insights from a 2022 Australian Delegation to Germany." https://www.eec.org.au/uploads/Projects/Lead%20accelerate%20transform%20-%20Energy%20efficiency%20in%20buildings%20-%20insights%20from%20a%202022%20Australian%20delegation%20to%20Germany%20Dec%202022.pdf.
[36] Secretary of State for Business, Energy and Industrial Strategy. 2021. "Heat and Buildings Strategy." UK Government. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1044598/6.7408_BEIS_Clean_Heat_Heat___Buildings_Strategy_Stage_2_v5_WEB.pdf.
[37] Jousseaume, Marion. 2022. "The French Climate and Resilience Law." Centre de Politique Européenne. https://www.cep.eu/fileadmin/user_upload/cep.eu/Studien/cepInput_Franzoesisches_Klima-_und_Resilienzgesetz/cepInput_The_French_Climate_and_Resilience_Law.pdf.
[38] "Living better: an aid from Anah for energy renovation." n.d. Agence Nationale pour l'information sur le Logement. Accessed January 3, 2023. https://www.anil.org/habiter-mieux-aide-anah/.
[39] Baker, Emma, Laurence H. Lester, Rebecca Bentley, and Andrew Beer. 2016. "Poor Housing Quality: Prevalence and Health Effects." Journal of Prevention & Intervention in the Community 44 (4): 219–32.
[40] "Energy Poverty," Energy, accessed January 10, 2023, https://energy.ec.europa.eu/topics/markets-and-consumers/energy-consumer-rights/energy-poverty-eu_en.
[41] Kimberley Community Legal Services, "Stuck in the Heat: Lived Experiences of Public Housing Tenants in the Kimberley," 21.

efficiency for low income households can yield annual savings of $1,139, equating to a reduction in percentage of income spent on energy bills from 6.4 per cent to 4.1 per cent.[42]

Low income individuals are also more likely to suffer from ill health,[43] which can be worsened by poor housing conditions. Upgrading the housing stock of low income households is vital for improving thermal comfort and enhancing health outcomes for vulnerable Australians. As shown in the Sustainability Victoria 'Healthy Homes' program, energy efficiency upgrades had significant positive impacts for low-income households, including improvements in indoor winter temperatures and quality of life, while lowering gas use and healthcare costs.[44] Benefits from improved health for individuals also brings benefits to the wider economy.

The European Commission published a 'Recommendation on energy poverty', which provides guidance on topics relevant to energy poverty, such as measurement indicators and best practice.[45] The recommendation discusses how renovation strategies can contribute to the EU's energy efficiency targets. Setting energy efficiency targets for Australia and implementing renovation strategies for low income households will not only accelerate the transition towards net zero, but also reduce energy poverty and improve wellbeing for low income households.

Implementing effective incentive schemes to target low income households is essential for successfully upgrading the housing stock.

The lack of upfront capital is a barrier for low income households to make energy efficiency upgrades. A range of financial incentive schemes have been adopted across Australia and internationally to combat this barrier, including grants and loans.

Certain states, such as Victoria, have subsidies targeted towards low-income owner-occupier households, such as the Home Heating and Cooling Upgrades program and Solar Victoria. As of March 2021, over 130,000 households have participated in the Solar Homes program, equating to a reduction of 750,000 tonnes of CO2-e during this period.[46] In addition to these schemes which target heating, cooling, and renewable energy generation, energy efficiency improvements to the thermal shell are also important measures for reducing energy consumption in homes.

Zero interest loans for energy efficiency upgrades have been implemented in Australia in the ACT, and in countries within the EU. While some recommend that governments pivot their focus from grants to loans, as loans leverage more private finance per public funds spent,[47] loans are not effective incentives for debt averse low-income households.

In the EU, debt aversion among low income households was shown to reduce uptake of zero interest loans for energy efficiency upgrades.[48] Therefore, zero interest loan schemes such as the ACT Sustainable Household Scheme may not be effective for these specific households but could be directed to households less likely to be debt-averse. Climateworks recommends governments instead develop grants to support low-income homeowners to undertake energy efficiency upgrades.

Programs that target non-owner-occupier low income households are also vital to ensuring equitable improvements to housing stock. The Victorian government energy efficiency in social housing

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[42] Australian Council of Social Service, "Affordable, Clean Energy for People on Low Incomes," January 2019, https://www.acoss.org.au/wp-content/uploads/2019/02/FINAL-Report-Affordable-clean-energy-for-people-on-low-incomes_web.pdf.
[43] Tanya Mather et al., "Variation in Health Inequalities according to Measures of Socioeconomic Status and Age," *Australian and New Zealand Journal of Public Health* 38, no. 5 (October 2014): 436–40.
[44] Sustainability Victoria, "The Victorian Healthy Homes Program: Research Findings."
[45] European Commission. 2020. "EUR-Lex – 32020H1563 – EN – EUR-Lex." EUR-Lex Access to European Law. October 14, 2020. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020H1563&qid=1606124119302.
[46] Solar Victoria, "Solar Homes Program Reporting," Solar Victoria, accessed January 16, 2023, https://www.solar.vic.gov.au/solar-homes-program-reporting.
[47] Jan Rosenow, Florian Kern, and Karoline Rogge, "The Need for Comprehensive and Well Targeted Instrument Mixes to Stimulate Energy Transitions: The Case of Energy Efficiency Policy," *Energy Research & Social Science* 33 (November 1, 2017): 95–104.
[48] Joachim Schleich, Corinne Faure, and Thomas Meissner, "Adoption of Retrofit Measures among Homeowners in EU Countries: The Effects of Access to Capital and Debt Aversion," *Energy Policy* 149 (February 1, 2021): 112025.

program has invested in improving public, community and Aboriginal housing properties through upgrades to heating and cooling systems, draught sealing and insulation.[49] Upgrades to existing social housing is crucial, as tenants have less agency over decisions regarding the energy efficiency of their homes, and lack the capital to make upgrades themselves. Renters are discussed in more depth in the next section of this submission.

Social housing upgrades can be used to kickstart the market, while simultaneously providing housing for the most vulnerable.

The Housing Australia Future Fund has committed to building 30,000 new social and affordable dwellings.[50] At minimum, these will be built to at least a 7 star standard as per the NCC, or to the minimum standard adopted by each state and territory. Importantly, these new social housing buildings provide an opportunity to build highly efficient homes for the most vulnerable Australians.

Building highly efficient, well performing social housing will future-proof housing stock, negating the need for future retrofitting programs. This will not only provide Australia's most vulnerable housing occupants with the benefits of low energy bills and improvements to health and wellbeing, it will also stimulate and improve supply chains, skills and materials.

Existing social housing could also benefit from energy efficiency upgrades. Victoria currently has the Energy Efficiency in Social Housing Program, which provides a range of upgrades for eligible social housing, including replacing inefficient systems with efficient systems (e.g. reverse cycle air conditioners, heat pump hot water systems) and installing draught sealing and insulation.[51] This not only yields benefits for occupants, it also provides insight and informs the rolling out of an energy efficiency retrofitting program across other building stock.

Investing in technology such as heat pumps for new build and existing social housing would provide case studies on the effectiveness of heat pumps in Australia, while allowing the market to adapt to increased demand, and for supply chains and skills and training to follow. This will be fundamental to kickstarting a renovation wave across existing building stock.

First Nations

First Nations households cumulate vulnerabilities, with increased risk of energy insecurity.

Indigenous Australians are more likely to rent[52] and to be of low income[53] than non-Indigenous Australians, with 2 in 3 First Nations people living in rental accommodation.[54] Of these renters, half live in private rentals, with the other half living in social housing. In remote and very remote areas, the likelihood that First Nations peoples are renting is increased, therefore reducing their agency over the energy efficiency of their homes. Median disposable income for First Nations households is 69 per cent that of non-Indigenous households.[55] And disposable income in Indigenous households declines with remoteness, with a difference of $258 per week between the major cities and very remote areas.

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[49] Victorian Government Department of Families, Fairness and Housing. 2022. "Energy Efficiency in Social Housing." Housing Vic. December 20, 2022. https://www.housing.vic.gov.au/energy-efficiency-social-housing.
[50] Australian Government. n.d. "Budget October 2022-23: Improving Housing Supply and Affordability." https://budget.gov.au/2022-23-october/content/factsheets/download/factsheet_housing.pdf.
[51] Department of Families, Fairness and Housing, State Government of Victoria. 2022. "Energy Efficiency in Social Housing." Housing Vic. 2022. https://www.housing.vic.gov.au/energy-efficiency-social-housing.
[52] "Indigenous Housing," Australian Institute of Health and Welfare, May 31, 2022, https://www.aihw.gov.au/reports/australias-welfare/indigenous-housing.
[53] "2.08 Income," Australian Institute of Health and Welfare, accessed January 4, 2023, https://www.indigenoushpf.gov.au/measures/2-08-income.
[54] "Indigenous Housing."
[55] Francis Markham and Francis Biddle, "Income, Poverty and Inequality" (Australian National University, n.d.), https://openresearch-repository.anu.edu.au/bitstream/1885/145053/1/CAEPR_Census_Paper_2.pdf.

Additionally, Indigenous Australians are three times more likely to live in the poorest quality dwellings than non-Indigenous Australians.[56] As mentioned in previous sections, renters and low income households experience barriers that prevent investment in energy efficient upgrades, leading to a cycle of high energy bills, thermal discomfort and poorer health and wellbeing outcomes. Since upfront investment is required to make energy efficiency upgrades, low income households are less likely to have the additional capital readily available to make needed upgrades and help break this cycle.

Energy insecurity is defined as the "inability to adequately meet basic household energy needs".[57] In remote Indigenous communities, pre-paid electricity meters are common. As such, disconnection commonly occurs upon non-payment; with 91 per cent of households experiencing at least one disconnection in the span of a year. Since remote areas experience more extreme temperatures, and these are worsening due to climate change, this leads to higher electricity consumption to maintain adequate thermal comfort. As a result, extreme temperatures are associated with increased likelihood of disconnection, which can adversely affect health and wellbeing.[58]

Inadequate levels of thermal comfort caused by excessive heat and inadequate thermal comfort within the home can have adverse flow on effects for the health and wellbeing of Indigenous Australians. These include:

- Health: Storage of perishable food and heat-sensitive medication, such as insulin, can be compromised during periods of disconnection.
- Reduced participation in work and school: Extreme temperatures can adversely affect sleep, as anecdotally mentioned in another study on public housing residents in Mildura, Victoria.[59] Lack of sleep due to excessive heat can lead to exhaustion, preventing participation in work and school.
- Overcrowding: Disconnections during extreme temperatures can cause relocation to other households that have not yet been disconnected, which can exacerbate overcrowding issues.[60]

Prioritising improvements to the housing stock occupied by Indigenous Australians will improve outcomes for Aboriginal and Torres Strait Islander people

The National Agreement on Closing the Gap sets out targets to improve life outcomes for Aboriginal and Torres Strait Islander people.[61] Many of the identified issues from extreme heat, electricity disconnection and thermal discomfort hinder progress towards the Closing the Gap targets. For example, target 1 focuses on improving life expectancy of Aboriginal and Torres Strait Islander peoples. Given that high indoor temperature adversely impacts health,[62] improving the housing stock of First Nations peoples would enhance thermal comfort, and could therefore reduce the burden of ill health and disease faced by such communities.

It is crucial to engage with First Nations communities to ensure the benefits of upgrades to building stock and subsequent enhanced energy performance are maximised. The recently published report

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[56] Baker, Emma, Laurence H. Lester, Rebecca Bentley, and Andrew Beer. 2016. "Poor Housing Quality: Prevalence and Health Effects." *Journal of Prevention & Intervention in the Community* 44 (4): 219–32.
[57] Hernández, Diana. 2016. "Understanding 'energy Insecurity' and Why It Matters to Health." *Social Science & Medicine* 167 (October): 1–10.
[58] Longden, Thomas, Simon Quilty, Brad Riley, Lee V. White, Michael Klerck, Vanessa Napaltjari Davis, and Norman Frank Jupurrurla. 2021. "Energy Insecurity during Temperature Extremes in Remote Australia." *Nature Energy* 7 (1): 43–54.
[59] Lander, J., M. Breth-Petersen, R. Moait, C. Forbes, L. Stephens, and M. Dickson. 2019. "Extreme Heat Driven by the Climate Emergency: Impacts on the Health and Wellbeing of Public Housing Tenants in Mildura, Victoria." Mallee Family Care. https://www.malleefamilycare.org.au/MFCSite/media/PDFDocuments/PublicHousing/2019/MalleeFamilyCare_PublicHousing_Report_2019.pdf.
[60] Longden, Thomas, Simon Quilty, Brad Riley, Lee V. White, Michael Klerck, Vanessa Napaltjari Davis, and Norman Frank Jupurrurla. 2021. "Energy Insecurity during Temperature Extremes in Remote Australia." *Nature Energy* 7 (1): 43–54.
[61] Commonwealth of Australia, Department of the Prime Minister and Cabinet. n.d. "Closing the Gap Targets and Outcomes." Closing the Gap. Accessed January 18, 2023. https://www.closingthegap.gov.au/national-agreement/targets.
[62]World Health Organisation. 2018. "High Indoor Temperatures." In *WHO Housing and Health Guidelines*. Geneva: World Health Organization.

by the First Nations Clean Energy Network describes best practice principles for clean energy projects, which could guide future policy interventions.[63]

Potential policy options for low-income and First Nations households

- Design and fund grant programs specifically targeted towards low income households – taking into account their motivators and barriers, to improve access to energy efficiency upgrades and audits, and/or solar PV.
- Invest in upgrading and building highly efficient social housing and improving low income housing, using this to kickstart supply chains and the market. Improving the readiness of the market will enable a renovation wave across existing building stock.
- consider the particular circumstances and vulnerabilities of First Nations Australians, including through responding to and consulting with communities, recognising that investment in renovating homes of First Nations Australians in vulnerable communities will have multiple benefits for these communities in terms of health and social well-being.

Renters

Rental properties can be targeted through a combination of mandatory regulation and persuasive incentives to encourage and motivate landlords to improve their homes and investments for renters and achieve energy efficient rental building stocks.

The majority of existing Australian homes are inefficient and deliver poor energy performance; with average ratings of less than 4 stars. Currently, 1 in 3 Australian households are renting.[64] Analysis of the ACT housing market suggests houses for rent have a much higher likelihood of having an energy rating of 0 in comparison to houses for sale (43 per cent compared to 4 per cent).[65] This highlights the importance of targeting the rental market through specific incentives and regulation.

While renters are responsible for paying their energy bills, they often have little say in the energy efficiency of their homes. Landlords, on the other hand, provide the capital investment to make energy efficiency upgrades and absorb any loss of rental income during upgrades. Landlords and their advisors do not directly benefit from lower energy bills, particularly in a 'tight' rental market with high demand for rental homes. This is known as a 'split incentive'. Currently, landlords do not have sufficiently persuasive incentives to overcome the split-incentive and upgrade their rental properties to make them more energy efficient, leaving renters stuck paying increasingly high energy bills. Research finds that landlords are motivated to address tenants' discomfort through energy efficiency upgrades, but a major issue is that many landlords who use property managers are unaware of tenants' discomfort.[66]

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[63] First Nations Clean Energy Group. 2022. "Aboriginal and Torres Strait Islander Best Practice Principles for Clean Energy Projects." https://assets.nationbuilder.com/fncen/pages/149/attachments/original/1669962706/FNCEN_-_Best_Practice_Principles_for_Clean_Energy_Projects.pdf?1669962706.

[64] "Home Ownership and Housing Tenure."https://www.aihw.gov.au/reports/australias-welfare/home-ownership-and-housing-tenure

[65] Better Renting, "The Energy Efficiency of Rental Properties in the ACT," April 12, 2018, https://d3n8a8pro7vhmx.cloudfront.net/betterrenting/pages/42/attachments/original/1523488292/The_energy_efficiency_of_rental_properties_in_the_ACT.pdf?1523488292.

[66] Lang, Michaela, Rob Raven, and Ruth Lane. 2022. "'I've Never Actually Met Them': What Will Motivate Landlords to Fix Cold and Costly Homes for Renters?" The Conversation, August 18, 2022. http://theconversation.com/ive-never-actually-met-them-what-will-motivate-landlords-to-fix-cold-and-costly-homes-for-renters-188827.

Without easy to understand energy efficiency information for homes, renters are unaware of a home's performance before signing binding rental leases. Information regarding how different constructions keep cool and stay warm in different climates is difficult to understand by most renters, and in particular, by interstate movers or new immigrants. Rental property inspections for prospective tenants also present very limited opportunities to understand whether a rental property will remain within safe indoor temperature ranges in summer and winter, without excessive energy bills or risk to renter health. This asymmetry of information leaves renters stuck paying high energy bills and/or living in discomfort, having to make choices between heating or eating when on limited budgets.

The coupling of two mechanisms could address 'split incentives' through regulation. These are: **mandatory energy efficiency disclosure** for rental homes and **minimum rental standards**, including standards to achieve higher energy efficiency of a home's thermal performance.

A national scheme for **mandatory energy efficiency disclosure** of rental homes would provide comparable information at point of lease or sale, providing renters with more information on the energy efficiency of their prospective homes relevant to how they perform in their geographic location and specific climate zone. For landlords, energy efficiency disclosure information would aid investment decisions and enable landlords to better meet their responsibility to maintain and upgrade their assets.

Mandatory disclosure of energy efficiency information is seen across the EU, first introduced in the Energy Performance Buildings Directive (EPBD) over 20 years ago.[67] Energy performance certificates (EPCs) are obtained at point of sale, lease and construction, and are provided to the occupant to inform understanding and renovation strategies.

An existing precedent of mandatory disclosure policy exists in Australia – for renters in ACT. However, this could be strengthened further and adopted nationally to support all renters and residential landlords around Australia. To strengthen ACT's mandatory disclosure policy, grandfather clauses exempting older properties would be phased out. While the ACT has had a mandatory disclosure scheme in place for rentals since 1997, this only applies to homes with an existing energy rating, such as a NatHERS rating, which only became mandatory in 2003 through adoption by the NCC, referred to then as the BCA. Prior to 2003, not all states and territories had energy rating schemes in place; a situation which created a wide gap between homes with existing ratings and homes without. This is of concern, as data suggests vulnerable households which are most vulnerable to high utility costs, also live in lower socio-economic areas, which tend to have building stocks that pre-date 2003.*[68]*

This 'hole' in policy implementation acts as a disincentive for landlords to undertake assessments, particularly for homes predating 2003.[69] Lower socio-economic areas are more likely to have higher rates of non-disclosure in the ACT.[70] Additionally, prospective renters may not be made aware of the date of construction of a home and the existence of energy rating assessments already undertaken for a rental property. Without an understanding of how a home performs, landlords would remain unaware of tenants' discomfort and are therefore less likely to upgrade the energy efficiency of their

[67] Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the Energy Performance of Buildings. 2002. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:en:PDF.
[68] Franz Fuerst and Georgia Warren-Myers, "Does Voluntary Disclosure Create a Green Lemon Problem? Energy-Efficiency Ratings and House Prices," *Energy Economics* 74 (August 1, 2018): 1–12.
[69] Trevor Lee and Yuelin Wang, "Mandatory Disclosure of Energy Efficiency for Residences – History and Compliance in the A.C.T. Sales and Rental Markets," (Solar2010, the 48th AuSES Annual Conference, 2010) (Solar2010, the 48th AuSES Annual Conference, 2010), 17.
[70] Fuerst and Warren-Myers, "Does Voluntary Disclosure Create a Green Lemon Problem? Energy-Efficiency Ratings and House Prices." *Ibid.*

rental properties.[71,72] The disincentive for landlords of older homes to provide energy efficiency ratings also reduces information at hand for existing and future landlords to understand upgrade opportunities and make informed investment decisions.

A national mandatory disclosure for all homes, regardless of their date of construction, is an opportunity to incentivise landlords into making energy efficiency investments, as well as supporting renters to better manage the risk of poor performing homes, reducing pressure on their budgets and health. A requirement for all homes to have an energy efficiency rating will support landlord's investment decisions and renters alike, particularly for vulnerable and low-income renters residing in older and lower performing homes.

Additional to mandatory disclosure, minimum standards of energy efficiency for all rental properties would ensure rental building stocks are progressively upgraded and optimised to support the energy grid's transition to renewable energy.

Climateworks recommends coordination with all states and territories to adopt minimum rental standards as a high priority and that minimum rental standards align with the Community Sector Blueprint[73] by Healthy Homes for Renters produced by Better Renting, so that the least efficient homes are addressed cost effectively and to alleviate energy stress for low-income households in rented homes. The Community Sector Blueprint for rental standards also provides the framework for setting a long-term trajectory with the aim of providing certainty for landlords, suppliers and renters[7]. As such, a trajectory could be implemented in the announced National Framework for Minimum Energy Efficiency Rental Requirements.

Following international best practice, France's recent rental standards under the French Climate and Resilience Law involve a number of regulatory mechanisms to improve their rental stock's energy efficiency, including rental caps for poor performing properties and a total ban from renting the worst rated properties.[74] Relying on the existing energy rating and disclosure scheme, a ratchet mechanism incorporated into this policy means that as building stocks improve, the mechanism can shift overtime to achieve increasingly improved energy efficient rental building stock. G-rated properties will be included from 2025, F-rated from 2028 and E-rated from 2034.

Targeted financial incentives can complement regulation, incentivise early adopters and encourage landlords to go beyond minimum compliance.

The federal government can provide free or subsidised energy assessments under the National Residential Efficiency Scorecard program. Access to free or subsidised energy assessments for landlords could incentivise them, under the National Residential Efficiency Scorecard Program. Providing assessments for free or at a low cost will not only allow landlords to identify key energy efficiency improvements, but also provide data on the energy efficiency of the existing rental housing stock.

France's National Housing Agency program 'Habiter Mieux' or 'Live Better' provides grants for landlords to undertake energy efficiency upgrades to reach a D rating, which equates to a 35 per cent improvement in energy performance.[75] With the trajectory set in French rental standards, landlords

[71] Lang, Michaela, Rob Raven, and Ruth Lane. 2022. "'I've Never Actually Met Them': What Will Motivate Landlords to Fix Cold and Costly Homes for Renters?" The Conversation, August 18, 2022. http://theconversation.com/ive-never-actually-met-them-what-will-motivate-landlords-to-fix-cold-and-costly-homes-for-renters-188827.

[72] Lang, Michaela, Kun Zhao, Ruth Lane, and Rob Raven. 2023. "Pro-Social Concerns Characterise Landlords' Energy Efficiency Retrofit Behaviour: Evidence and Implications for Energy Efficiency Policy in Victoria, Australia." *International Journal of Housing Policy*, January, 1–23.

[73] Healthy Homes for Renters, Community Sector Blueprint Available at: https://www.healthyhomes.org.au/news/community-sector-blueprint

[74] Marion Jousseaume, "The French Climate and Resilience Law" (Centre de Politique Européenne, January 18, 2022), https://www.cep.eu/fileadmin/user_upload/cep.eu/Studien/cepInput_Franzoesisches_Klima-_und_Resilienzgesetz/cepInput_The_French_Climate_and_Resilience_Law.pdf.

[75] "Living better: an aid from Anah for energy renovation," Agence Nationale pour l'information sur le Logement, accessed January 3, 2023, https://www.anil.org/habiter-mieux-aide-anah/.

have long-term foresight as to when standards for rental properties will increase, and can choose to upgrade their properties to the current minimum standard, or improve their property to a higher standard and future-proof their investment, aided by the financial incentives provided by the Live Better program.

The federal government can build on existing incentive schemes for landlords led by states and territories, such as the subsidy offered by the Victorian government. The Victorian government currently provides a subsidy of up to $1,000 towards upgrading older, inefficient fixed appliances to more efficient ones such as reverse-cycle air conditioners.[76]

Subsidies would also be beneficial if targeted towards upgrading the thermal shell (draft-proofing, air-tightness and ventilation, and insulation) to deliver thermal comfort to rental households who are in energy poverty and who cannot afford to use heating and cooling appliances, and whose homes are too 'leaky' to retain cool and heat provided by appliances. Climateworks recommends that governments undertake further research to determine the most effective financial incentives to motivate landlords to invest in rental homes with energy efficiencies that benefit renters.

Along with regulatory mechanisms, such complementary incentives will encourage landlords to go beyond compliance. It is vital that these financial incentives are made known to landlords, as older studies of Australian landlords found that the majority were largely unaware of the energy efficiency subsidies available to them.[77] At the smaller scale, incentives and education programs should be implemented to empower renters to make small energy efficiency upgrades, such as draught proofing and purchasing energy efficient appliances. However, this alone will not be enough to improve the standard of rental properties to the level needed, and should be combined with other regulations and incentives to improve the quality of rental housing stock at scale.

Potential policy options for rental properties

- Adoption of the forthcoming National Framework for Minimum Energy Efficiency Rental Requirements aligned with the Community Sector Blueprint for rental standards by Healthy Homes for Renters[78].
- Collaboration and agreement to develop and implement a national program for mandatory energy assessments for rental homes, including training of assessors, with data published and accessible for research purposes, and a national roll-out of mandatory energy efficiency disclosure for rental properties.
- Minimum standards identified for rental homes, and collaboration led by federal government to implement these nationally to maximise the impact of the national framework, the federal government could work with states and territory governments to commit to implementing standards in their jurisdiction.
- Targeting and tailoring financial support to have the greatest impact, i.e.:
    - Social housing providers.
    - Private landlords in areas of known low-socio economic status, after an energy efficiency assessment returns a low rating by an accredited assessor.
    - Homes with no prior energy assessment.
    - Apartment and unit complexes (class 2) with strata bodies, as both landlords and renters have the least agency to upgrade these homes.

[76] Victorian Government, "Information for Rental Properties," Home Heating and Cooling Upgrades, January 3, 2023, https://www.heatingupgrades.vic.gov.au/upgrades-rental-properties.
[77] Michelle Gabriel and Phillipa Watson, "Supporting Sustainable Home Improvement in the Private Rental Sector: The View of Investors," *Urban Policy and Research* 30, no. 3 (September 1, 2012): 309–25.
[78] Healthy Homes for Renters, "Community Sector Blueprint: National Framework for Minimum Energy Efficiency Rental Requirements," 2022, https://static1.squarespace.com/static/602f0d14c4c0a77efc25e152/t/638400e8ae6155000101c616/1669595383325/Final+Community+Sector+Blueprint+-+Mandatory+Minimum+Rental+Standards.pdf

General owner-occupier incentives

General households (i.e. not renter or low-income households) could also benefit from targeted incentive programs. This could be through private finance, tax offsets, or other incentives, including:

- Private finance, such as green loans and mortgages, which are vital for the decarbonisation of the buildings sector. This can be achieved through government and private funded green financial products, as described in the UK Heat and Buildings Strategy.[79] Banks and loan requirements will play a key role in mainstreaming energy efficient homes if green loans prioritise zero carbon homes and become the norm rather than the exception.
- Tax offset schemes, such as the Italian Super Eco Bonus scheme, which have been readily taken up by households.[80] The Italian Super Eco Bonus scheme covers energy efficiency upgrades, including insulation, heat pumps, solar panels, and replacing old boilers, providing owners with a tax credit of 110 per cent for these upgrades to their home.
- Other incentives, such as subsidies and rebates. While subsidies and rebates should be provided to the most vulnerable households first, these incentives could also be effective for incentivising upgrades for general owner-occupiers. For example, the Victorian Energy Upgrades program covers certain energy efficiency upgrades, such as draught proofing.[81]

Potential options to support general owner occupiers

- Work with private finance stakeholders to implement attractive private finance schemes and consider further public finance mechanisms including tax offsets and rebates.

Commercial buildings

Increasing the number of existing commercial buildings with disclosed ratings

Whilst the existing NABERS mandatory energy rating disclosure scheme has been successful, and is now replicated internationally, Climateworks recommends a number of improvements to extend the existing program and include an increased number of commercial building spaces.

Current exemptions enable a significant number of commercial buildings to exist without disclosure. In line with the overall key message in Green Building Council of Australia and Property Council of Australia's NEPS submission, Climateworks recommends reducing current exceptions and the ability to apply for exemptions in the national disclosure requirement by :

- Including currently excepted strata titled buildings
- Removing or reducing the minimum floor area thresholds >1000msq.
- For commercial building space in mixed use buildings, removing the minimum of >75 per cent of the building floor area overall.

In addition, Climateworks recommends exploring alternative ratings assessments along with the need to disclose commercial buildings which have been empty for long periods. This is a recommended priority to address, given a growing number of commercial buildings are experiencing vacancy since the start of the pandemic. Removal of these allowances will ensure owner groups will no longer be able to apply for exemptions, and that current laggards upgrade all buildings in their portfolio.

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[79] Secretary of State for Business, Energy and Industrial Strategy. 2021. "Heat and Buildings Strategy." UK Government. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1044598/6.7408_BEIS_Clean_Heat_Heat___Buildings_Strategy_Stage_2_v5_WEB.pdf.

[80] Giuffrida, Angela. 2022. "Italy's Superbonus 110% Scheme Prompts Surge of Green Home Renovations." *The Guardian*, April 13, 2022. https://www.theguardian.com/world/2022/apr/13/italys-superbonus-110-scheme-prompts-surge-of-green-home-renovations.

[81] State Government of Victoria, Department of Energy, Environment and Climate Action. 2022. "Victorian Energy Upgrades for Households." Energy Vic. September 29, 2022. https://www.energy.vic.gov.au/for-households/victorian-energy-upgrades-for-households.

Change of use for commercial buildings in low demand markets.

Real Estate Inventor Trusts (REITs) and owner occupiers who have to date been slow to upgrade existing commercial buildings may now be experiencing 'flight to quality' and are at risk of longer term vacancy or premature obsolescence. A downturn in demand for space in commercial buildings is enabling tenants to relocate to buildings of higher quality, including buildings with higher energy performance ratings[82]. There are several asset management strategies to maximise commercial buildings, as set out in British Council of Offices Mitigating Office Obsolescence[83]. One asset management strategy to address this is for commercial buildings, with long-term low demand, to be transitioned out of the commercial building markets and into higher demand markets such as housing.

Given the potential scale of the problem of vacancy in commercial buildings, change of use developments offer a key opportunity to improve the energy efficiency of commercial building stocks or others, including residential conversions. However, there are cautionary tales in other international jurisdictions, such as the UK, which have transitioned a high number of commercial buildings to residential through relaxing permitted development rights. This has tended to result in poor quality residential conversions, with low levels of energy performance[84]. Climateworks therefore recommends the federal government undertake research to explore lessons learnt in other jurisdictions where regulatory changes now permit rapid and increased conversion rates of commercial buildings to residential use. This can help Australia avoid such adverse outcomes and ensure minimum standards for major renovations are upheld, as required by new buildings, including minimum energy efficiency performance standards.

Recommendation for commercial buildings

- **Create a process to** extend and amend the NABERS energy rating disclosure scheme to be in line with the net zero carbon standard.

[82] CBRE. 2022. "CBRE 2022 NABERhood Watch Report.pdf." https://cbre.vo.llnwd.net/grgservices/secure/NABERhood per cent20Watch.pdf?e=1673582703&h=f0561da4c84d834360e3aca5c770289d.
[83] British Council of Offices, 2021 Mitigating Office Obsolescence. Available at: https://www.bco.org.uk/Research/Publications/Mitigating_Office_Obsolescence.aspx&sa=D&source=docs&ust=1674629045103693&usg=AOvVaw2TyCgoIzkcMIkmKljWweaj
[84] Ferm, Jessica, Ben Clifford, Patricia Canelas, and Nicola Livingstone. 2021. "Emerging Problematics of Deregulating the Urban: The Case of Permitted Development in England." *Urban Studies* 58 (10): 2040–58.

Industry

Energy efficiency is a vital component of industrial decarbonisation. Many of the solutions and technologies are mature and already available for commercial deployment.

Australia currently ranks poorly on industrial energy efficiency, compared to major industrialised countries, sitting at 22nd out of 25 countries assessed (ACEEE 2022), with the country's most recent national industry-focused energy efficiency policy ending in 2014. There are immediate opportunities to build on and coordinate across existing national legislation, and potential initiatives to improve industrial energy efficiency and performance.

Information and recommendations suggested in the Industry section of this submission are based on the work of the Australian Industry ETI. The ETI is a platform for Australia's emissions-intensive industry and related businesses to coordinate learning and action on net zero emissions supply chains. Established in 2019, the initiative has aimed to help Australian heavy industry to realise the opportunities of a decarbonised global economy by working collaboratively to develop pathways and actions towards achieving net zero emissions in critical supply chains by 2050. These pathways have been supported by technical experts informing assumptions and modelling results, leveraging on-the-ground industry experience and strategy, along with investment and government affairs experts informing the actions needed to achieve the transition

Climateworks' scenario analysis with CSIRO in Decarbonisation Futures and for ETI showed the potential for substantial energy efficiency improvements in industry, following least-cost pathways to net zero emissions (Climateworks 2020 and forthcoming).

Energy efficiency gains through technology upgrades to best available options and industrial process optimisation generally have short payback periods, as the costs of upgrade are offset by energy savings, and can be implemented incrementally as maintenance is performed. These technology upgrades often include electrification solutions as well as other forms of upgrades to equipment.

These solutions are mature and available to be taken up in industrial sectors, such as LNG extraction and processing, alumina refining and aluminium smelting, ammonia production and iron ore mining, and steel production. Examples include:

- Steam – increased boiler efficiency, minimised blowdowns, optimised steam distribution.
- Motor drives – energy-efficient motors, variable speed drives, repairs.
- Pumping systems – system control and regulation, optimised motors, and transmission.
- Compressed air systems – reduced leaks, optimised controls, and supply.
- Heating – efficient load management, heat pumps, heat recovery and use. For example, waste heat recovery can improve energy efficiency by up to 10 per cent in LNG processing. It is also applicable to other industries that use mid to high temperature heat in processing. Similarly, heat pumps are a cost-effective way to improve the energy efficiency of industrial processes using low-mid temperature heat.
- Cooling – chillers and cooling systems, improved compressor parts, evaporative cooling.

Other opportunities for cost-effective energy efficiency improvements include metals recycling and incorporating flexibility in processing to match renewable generation. Increased recycling and scrap-based production could reduce steelmaking energy use in Australia as it displaces the need for primary steel production and requires significantly less energy by using the electric arc furnace (EAF) process. Availability of quality scrap is a key limiting constraint in Australia. For aluminium, the energy intensity of primary production is around ten times higher than secondary production which reuses old scrap alongside new. Secondary production also tends to cost less, though as with steel scrap, availability is the key constraint.

Flexibility in industrial processing, to align energy-intensive activities with periods of peak renewable energy generation can improve energy performance

The ability for producers to respond to energy supply peaks is particularly beneficial where renewable energy generation may otherwise be curtailed. This opportunity involves changing the scheduling of operations (or charging for battery powered machinery) to align with solar peaks, to capitalise on PV output or high wind speeds for wind turbines. In some instances, this also allows overall higher throughput – for example, Sun Metals zinc refinery in Queensland was able to increase production by 5 per cent and reduce OPEX by 15 per cent by operating greater smelting capacity during peak PV hours.[85] This approach can also be combined with energy storage, and microgrid installations for industrial processes that don't inherently allow as much flexibility.

The NEPS provides an excellent opportunity to bring greater coordination to these initiatives with respect to energy, and to set out a sector-specific plan for industry. This would assist industry and governments to unlock major opportunities for emissions reduction and stability and cost reductions in the energy system, through improving energy efficiency and demand management.

Climateworks recommends the NEPS sets out a plan to improve industrial energy performance that will:

- Meet a least-cost pathway for the industry sector in line with Australia's targets and implementation of the Paris Agreement;
- Develop sectoral performance metrics in support of the suggested NEPS energy efficiency targets, including electrification targets;
- Build on innovation policy and initiatives to date that have identified likely technologies that unlock major energy performance improvements; and
- Set out policy options and a process to agree energy performance policies as part of a comprehensive policy package for industry beyond current existing initiatives.

Options to support investment in energy efficiency solutions include policy measures, accelerating the development and demonstration of emerging technologies, supporting public and private investment and driving widespread deployment of these technologies.

Climateworks recommends that policies regarding industry and climate commit to targeted measures to reduce barriers and support investment in energy efficiency. Effective policies would ensure coordinated action is taken across economic sectors and can include national and statewide deployment strategies and funding, collaboration support, certification schemes and energy efficiency milestones and targets. Regular reviews of policies and supporting measures will help ensure Australia's uptake of energy efficiency technologies keeps pace with the global transition, builds international competitiveness and mitigates transition risks in a decarbonising global economy.

Increased public funding is needed in early-stage technology development and demonstration. While Australia has very mature capital markets and private equity industries, these are often not leveraged towards the early-stage financing needed for many emerging decarbonisation technologies. Developing mechanisms to catalyse greater industry investment and to better enable private finance and investment in early stage technologies will help overcome a range of finance related barriers.

Supporting pilots and demonstrations of emerging technologies, and prioritising funding for projects that build capability and expertise are vital for reducing barriers to investment. Efforts to accelerate research, development and demonstration should target and prioritise technologies where:

- Australia has a natural endowment of co-located resources and renewable energy, which can be value-added (such as in the processing of critical minerals and the production of hydrogen, ammonia, decarbonised alumina and green iron);

[85] Australian Renewable Energy Agency (ARENA) 2018, Hybrid power generation for Australian off-grid mines, accessed 14 February 2021, https://arena.gov.au/assets/2018/06/hybrid-power-generation-australian-off-grid-mines.pdf

- There are limited existing alternatives to high-emitting processes (such as CCS for reservoir gas in LNG and alternative technologies for alumina calcination);
- There are risks to the viability of major export and export-exposed industries if solutions are not developed (such as iron ore and green steel);
- Australia has existing strengths that can be turned towards the decarbonisation challenge, such as global centres of excellence.

Financial institutions have a role to play through their stewardship and engagement with industrial companies to align lending and investment with energy efficiency goals and broader emission reductions trajectories. This can be achieved through leveraging credible pathways and benchmarks for industrial transitions and by working with companies, across their portfolio, on their energy efficiency and decarbonisation plans, informed by sectoral roadmaps. In addition, discussing barriers to action for industry and identifying where finance can play a catalytic role in driving uptake of energy efficiency solutions is a vital step in overcoming these barriers.

Electrification and demand management in industry will have a major impact on the future of Australia's energy systems.

When combined with renewable electricity, electrification is a key measure that can enable emissions reduction across all sectors of Australia's economy. Electrification at the scale expected in least-cost pathways to net zero emissions will require a tremendous increase in the supply of reliable, renewable and cost-competitive electricity. Electrification generally increases the energy efficiency of a process and there are mature and commercially available solutions to replace fossil-fuel based technologies in areas such as heating, cooling, pumping, motors and steam production. There are also a range of developing and mature technologies to electrify fossil-fuel use in other industrial applications, such as mechanical vapour recompression in alumina, and electric drives in LNG production.

The scale of energy use in industrial facilities creates opportunities for substantial demand management, such as for aluminium smelters and alumina refineries. For example, smelters could modulate their electricity load when electricity supply is low. Importantly, this type of load balancing can only be provided for short periods of time (up to 3 hours), as longer shutdown periods can lead to fatal damage to plant equipment and significant long-term production losses. However, technologies to extend load balancing periods are currently being investigated. In addition, the use of thermal storage can enable alumina refineries to act like a battery, by drawing heat from thermal storage during periods of low variable electricity supply and 're-charging' the thermal storage during periods of high variable electricity supply.

Market mechanisms to encourage the provision of demand management and load balance would increase the uptake of opportunities and recognise the risk for providing these services. Collaborations between energy providers and industrial facilities could increase uptake and benefits from load balancing. Mechanisms to encourage demand response already exist and have recently been introduced in the Wholesale Demand Response mechanism in the NEM, operated by AEMO.

The scale of renewable energy and other infrastructure needed to support electrification is a critical issue to allow action on energy efficiency and electrification. Heavy industry requires certainty that renewable energy infrastructure and low electricity prices will be available to power electrified technologies after they are deployed, in order to provide the confidence needed for large investments.

Energy market system planning is already undergoing major changes. The National Energy Transformation Partnership and energy agency led processes including the ISP and state led initiatives such as in WA and NSW can help anticipate and enable electrification of heavy industry. The expected introduction of an emissions reduction objective into the National Energy Objectives is likely to help the energy system transform to the future energy system with greater electricity capacity.

Heavy industry supply chains include some of Australia's largest energy users

Companies can be supported to optimise energy usage through investment in technology and infrastructure, continued action by the financial sector to support the significant capital investment

needed, partnerships and collaboration to solve problems that can't be solved alone, and a national alignment of public policy and regulation.

Government program funding that prioritises collaboration between multiple industry partners can help provide supply and demand solutions, shared infrastructure and supply chain level initiatives.

Development of clustered industrial precincts, designed to leverage low-cost renewable energy drawn from proximate renewable energy zones (or equivalent), can reduce regional energy costs through shared access to critical energy and transport infrastructure, inputs and labour sharing, cheaper green hydrogen and circular economy practices.

The scale-up of technologies can be facilitated through regulation, standards and market signals as well as enabling infrastructure, business models, user and customer practices, and technical skills and capabilities. Knowledge and information sharing between key actors in the energy transition is vital to support collaboration and widespread improvements in energy performance.

Barriers to energy efficiency investment for industry range from financial to technological and operational

Even when technologies deliver positive economic returns for installers over their lifecycle, there can be barriers to their uptake. Key financial barriers include significant costs where energy efficiency technologies require the complete replacement of existing assets, rather than retrofit. Even where retrofitting is available, some new technologies can be capital intensive. The financial cost of lost revenue during plant downtime for works may also be a consideration.

The business case for upgrading before assets' end life can dissuade businesses and investors, who lean towards incumbent technology for practical reasons. Despite short payback periods, short term investment in energy efficiency improvements may not be made if current equipment is to be replaced in the foreseeable future.

Technological barriers may include insufficient development or demonstration in similar applications for emerging technologies, which increases risk and challenges for deployment and can delay investment. Even mature technologies can create challenges for deployment when installing into current sites (e.g. lack of physical space to install, requirement of adapting the operational processes). Site by site variation poses another challenge; a site may have specific operational needs and process requirements, so new or mature technology installation will require significant individualised planning. The need for expertise and training to operate new technologies can present a further challenge, as well as updating processes and retraining workforces to enable the transition.

For example, the main challenges to harnessing energy efficient EAF production in steel making are the need for affordable electricity supply and high-quality scrap. The latter is particularly challenging in a highly competitive market characterised by high prices, limited availability, and contamination from elements such as copper and tin. Australia's relatively small population and low annual steel production may also restrict potential for significant increases in local secondary production over the long term. Similarly for aluminium, recycling is currently limited in Australia, in part due to insufficient scale of aluminium production and uncompetitively high labour costs. The small volume of Australia aluminium currently captured for recycling is exported.

Governments already have in place a range of initiatives and policies that could improve energy productivity in industry through upgrading facilities. Nationally these include support for innovation through the CEFC and ARENA and industry focused funds including the National Reconstruction Fund and Powering the Regions.

Supply chains and workforce

Transitioning existing supply chains and skills programs for workers will be essential to ensure the potential benefits from new technologies and process improvements can be unlocked. The remoteness and limited size of Australia's industry subsector – with some notable exceptions – can bring additional challenges for introducing new technologies and processes to improve energy performance.

Governments and energy system planners can work with regional stakeholders to understand regional challenges and optimise for the least-cost pathway to scale renewable energy.

Detailed energy system and infrastructure planning studies, coordinated between industry and energy planners in key regions, could enable better integration of industry's future energy needs with energy planning. This could include regional level scenario planning, that accounts for increasing electrification and demand management, including energy efficiency, electric vehicles and demand response. Holistic regional planning also needs to consider regional workforces as well as supply chain security and social licence of new infrastructure.

Energy efficiency in industry can lead to lower operating costs, but a number of incumbent technologies would need to be retired early, and there is significant uncertainty around what the future technology mix will be. For example, without a clear demand signal that battery electric haul trucks or fuel cell electric haul trucks will become the norm, investing heavily in R&D presents a significant risk for original equipment manufacturers. Successful demonstration of prototypes provides greater certainty and help make the case for high levels of investment.

Public funding for development and demonstration activities can better enable finance and investment in early stage energy efficiency technologies.

Governments' ability to provide funding at lower cost, and absorb higher financial risks brings substantial benefits. Scaling funding through co-investment partnerships between state and territory governments can leverage greater levels of private sector funding. Sources of funding include existing funds such as ARENA, CEFC, the National Reconstruction Fund and the Powering the Regions Fund. Regional roadmaps that include identification of infrastructure that could be shared by multiple stakeholders can help identify and deploy necessary levels of investment.

Supply chain roadmaps for heavy industry can align suppliers, finance, consumers and decision-makers on the vision and milestones for the development of technology solutions, by providing greater clarity and investment confidence. These could be undertaken by a relevant, independent body to complement regional decarbonisation roadmap work, which is already happening in parts of Australia (such as the Western Australian government's planned 'Sectoral emissions reduction strategies'). Equity owners may have a role in connecting industry partners and supply chains, as large financial institutions such as superannuation funds and insurance companies may be stakeholders in many companies within a supply chain.

Possible policy options for the industry sector

- Build a coordinated approach to energy efficiency and management through existing innovation support (including through ARENA, CEFC, National Reconstruction Fund and the Powering the Regions fund and state and territory investment) to
- Further accelerate:
    - Research and development and commercialisation of emerging technologies through support of pilots and demonstrations;
    - Finance mechanisms that link federal, state and territory funding to leverage private investment;

    - Adoption of best available technology for energy efficiency, with a focus on process optimisation in the short term;
    - Increase recycling and secondary production for key metals (including aluminium and steel);
    - Supporting rollout of industrial electrification and demand management through existing industry funding programs, coordination of federal and state deployment strategies and funding, collaboration support and electrification milestones and targets.
- Support early market development through:
    - Supply chain roadmaps for heavy industry to gain alignment from suppliers, finance, consumers and decision-makers on the vision and milestones for the development of technology solutions;
    - Coordinated national and statewide deployment strategies, and procurement criteria for energy efficient products and processes;
    - Credible certification schemes for green products.
- Coordinate:
    - Development of regional roadmaps to understand the opportunities and barriers for technology take-up at a local level;
    - Collaboration between multiple industry partners to build understanding, address common strategic risks, identify shared infrastructure needs and supply chain issues and solutions;
    - Governments and industries work together to identify skill capacity gaps and solutions.
- Strengthen energy market system planning to anticipate and enable electrification of heavy industry, through the National Energy Transformation Partnership and energy agency led processes including the ISP and state led initiatives such as in WA and NSW.
- Track the effectiveness of market incentives for distributed energy storage and industrial demand management services.