Lead, accelerate, transform

Energy efficiency in buildings: insights from a 2022 Australian delegation to Germany

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About the Energy Efficiency Council

The Energy Efficiency Council is Australia's industry association for energy management, energy efficiency and demand response. The Energy Efficiency Council is a not-for-profit membership association for businesses, universities, governments and NGOs.

Founded in 2009, the Energy Efficiency Council's members are diverse, but are united by a common cause: building a sophisticated market for energy management products and services that delivers:

- Healthy, comfortable buildings;
- Productive, competitive businesses; and
- An affordable, reliable and sustainable energy system for Australia.

The Energy Efficiency Council's job is to make Australia a global leader in smart energy management. To this end, the Council works with its members and partners to:

- Drive ambitious government policy by advocating for smart energy management policies and programs that deliver for all Australians;
- Support business decision making and growth with trusted, impartial information on energy so that businesses have confidence making the right energy management investments; and
- Ensure quality with standards and professional development by supporting standards development and benchmarking for the sector, and training and professional development for professionals across Australia.

The Energy Efficiency Council is a national organisation with headquarters in Melbourne.

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1 Introduction

A delegation of Australian energy efficiency policy, finance and industry experts embarked on a tour and bilateral knowledge exchange to Germany from 27 – 30 June 2022. The delegation was funded by the German government, organised by the Renewables Academy (RENAC) with adelphi and led by the Energy Efficiency Council's (EEC) CEO Luke Menzel under the umbrella of the Australia-Germany Energy Partnership.

The tour and knowledge exchange focused on Germany's policy framework for energy efficiency in buildings**.** It involved meetings with the German Federal Ministry for Economic Affairs and Climate Action (BMWK), KfW (the German Development Bank) and the German Heat Pump Association together with site visits of major urban redevelopment projects and individual deep renovation projects. The delegation also attended a part of the German Business Initiative for Energy Efficiency (DENEFF) Conference.

The tour and knowledge exchange built on a suite of collaboration initiatives previously undertaken by the Australia-Germany Energy Partnership including reports outlining opportunities for collaboration between Germany and Australia on energy efficiency in buildings[1] and Germany's approach to financing solutions for efficient residential buildings through the KfW development bank.[2]

This report shares observations and insights made by the Australian delegates. It is intended to provide Australian policy makers and other interested stakeholders with new perspectives on ways Australian energy efficiency policies and programs in commercial and residential buildings could be strengthened. The report has been developed through a series of facilitated meetings with the delegates.

The report begins with an overview of the tour including the meetings and site visits that were undertaken. It is then structured around four themes that were identified by delegates as having relevance to the Australian energy efficiency policy context in buildings. The themes are:

- The critical role government leadership to drive energy efficiency improvement in buildings;
- Features of a comprehensive ecosystem to accelerate residential energy efficiency;
- The importance of aligning workforce development with targeted policies and programs; and
- Characteristics of an integrated transformation approach to the market development of heat pumps.

[1] Energy Efficiency Council (EEC) 2021, *Further, faster, together: Opportunities for collaboration between Germany and Australia on energy efficiency in buildings*, EEC, Melbourne.

[2] Teichmann, F; Baldauf, I and Gebhardt, T 2022: *Germany's Efficiency Funding. Financing Solutions for Efficient Residential Buildings by KfW Bank*. adelphi, Berlin.

2 Overview of delegate meetings and site visits

The tour and knowledge exchange took place between Monday 27 June and Thursday 30 June 2022 in Berlin, Germany. Delegates included representatives from the EEC, Property Council, Clean Energy Finance Corporation (CEFC), ClimateWorks Centre, Climate-KIC Australia, Brighte Capital, Stiebel Eltron, RACE for 2030, Victorian and NSW Governments (see Appendix A for a complete delegate list).

Day 1 involved meetings with policy makers at the German Federal Ministry for Economic Affairs and Climate Action (BMWK). The meetings allowed delegates to explore energy efficiency policy issues in detail including the history and influences on energy efficiency and climate policy development in Germany.

On day 2 the delegates met with the personnel responsible for the design and delivery of energy efficiency financing programs that are delivered through the Deutsche Kreditanstalt für Wiederaufbau (the German Development Bank - KfW). These discussions provided important insights into the KfW financing program for energy efficiency in buildings that KfW has delivered since 1990.

A site visit to "House of the Future" followed. This is a residential apartment building in Berlin-Lankwitz that acts as a demonstration project. Built in 1955 the building was renovated in 2017 with the goal of reducing heating operating costs by more than two thirds. This outcome was achieved, and the building is almost 100 per cent self-sufficient in heat and electricity.

The delegation also participated in a guided tour of the German Bundestag which incorporates a unique combination of energy technologies including biodiesel, photovoltaics and geothermal heat and cold storage.

On day 3 a site visit to the Tegel development project was undertaken. The Tegel development project involves the transformation of 500 hectares of the former Berlin Tegel airport into a research & industrial park, a new residential district and a 200- hectare landscape zone. The site visit was followed by attendance at the German Business Initiative for Energy Efficiency (DENEFF) Conference.

The final day of the tour involved a visit to the EUREF-Campus in Berlin-Schöneberg. This urban redevelopment project began in 2007 and has become a centre for innovation and communication in the energy sector where more than 5,000 people work, research and study in more than 150 enterprises, institutions and start-ups in the areas of energy, mobility and sustainability.

Following the EUREF-Campus site visit, a meeting was held with the German Heat Pump Association. In the afternoon a final site visit was undertaken of the cooperative residential quarter "Märkische Scholle" which was built in 1930 and comprehensively renovated in 2014. The site includes innovative initiatives such as heat recovery, geothermal storage and the active involvement of an energy manager.

3 Theme 1: The critical role of government leadership to drive energy efficiency improvement in buildings

3.1 Background to the German approach

Efficiency first is one of the guiding principles of the German Energy Transition (Energiewende) which aims to remove Germany's reliance on fossil fuels and nuclear power. Since 2006, Germany's funding for energy efficiency upgrades as implemented through the KfW is estimated to have contributed to the development of around 6.5 million jobs and a reduction of 13 million tonnes of annual CO_2 emissions. Overall, Germany has been able to reduce its emissions by 232 million tonnes of CO_2 equivalent between 2006 and 2021.[3]

Germany's focus on energy efficiency in buildings has helped to shape the European Union's Energy Performance of Buildings Directive (EPBD) which provides a legislative framework for EU Member states to decarbonise new and existing buildings. At the same time, Germany aims to go beyond the requirements of the EPBD by implementing a comprehensive policy framework that combines ambitious targets and accountability with financial incentives, innovative demonstration projects, minimum standards that increase in stringency over time, and industry-wide capacity building to address market barriers to energy efficiency.

Germany's approach to setting and maintaining accountability through targets was of particular interest to the delegation.

That is because ambitious, legislated targets for emissions reduction form the foundation for German policy development. By establishing sector-specific targets and requiring relevant ministries to be accountable to achieve them, the German approach helps to ensure that policy development for energy efficiency is based on achieving specific outcomes (the target) rather than solely focusing on the cost-effectiveness of individual policies.

In 2021 the first amendment to the Climate Targets, outlined in the 2019 Climate Action Law, was passed. This amendment established a target of net zero by 2045, supported by interim targets of reducing emissions by at least 65 percent by 2030 compared to 1990 levels, and 88 percent by 2040. The German building sector is required to reduce greenhouse gas emissions by over 43 percent from 2020 to 2030 (Figure 1). Accountability for the buildings sector target has been allocated to the ministry responsible for buildings: the Federal Ministry for Housing, Urban Development and Building (BMWSB).

Germany is further reinforcing the focus on energy efficiency through the development of a new Energy Efficiency Act that will provide legislative energy efficiency targets for primary and final energy consumption for 2030, 2040 and 2045. The target will inform specific savings obligations for the public sector, buildings and industry subject to a given, defined minimum economic viability. The federal and state governments will be required to implement measures to achieve those targets. The regulatory framework for buildings will remain the Building Energy Law (GEG) that will be updated in 2023.

[3] German Environment Agency (UBA) 2022, *Trend tables: Greenhouse gas emissions by sector*, UBA, Berlin.

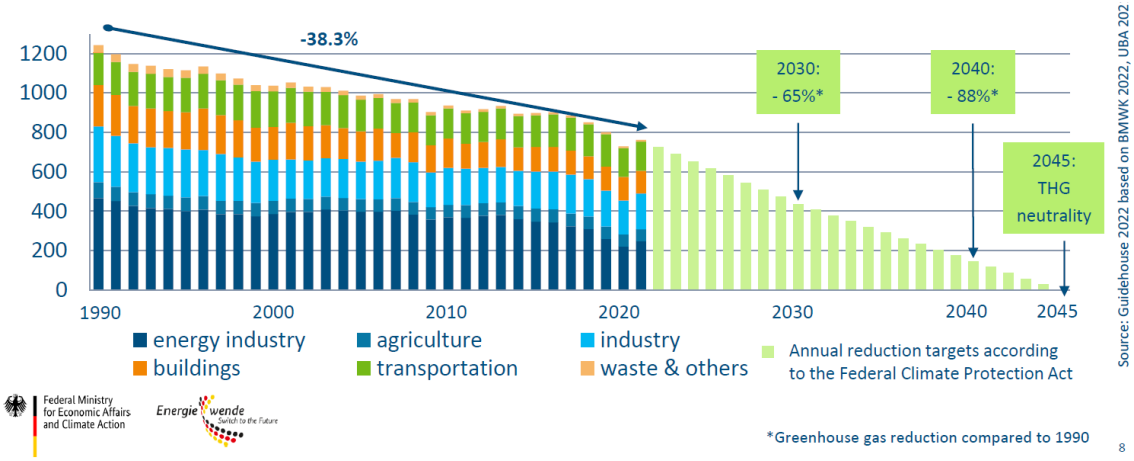

Figure 1: Greenhouse gas emissions and reduction targets in Germany.[4]

Each year, the BMWSB is required to review its building policies to determine the extent to which it will achieve their target. Where it is found that the trajectory towards the target is insufficient, then existing policies must be adjusted and/or new policies developed.

In 2021 this evaluative approach led to important policy adjustments. For example, a review highlighted that financial incentives for energy efficiency in new buildings could be reduced by increasing the stringency of minimum standards. At the same time, it was highlighted that the take-up of finance for renovating existing buildings had been limited and therefore warranted a greater focus through financial incentives, information measures and capacity building.

3.2 Considerations for energy efficiency in buildings in Australia

Delegates drew on the German experience to consider ways in which Australian governments could enhance their own approach to leadership for energy efficiency in buildings. Several opportunities were identified including:

- Establishing sector-specific emissions reduction targets;
- Reviewing policies against sector-specific targets on an annual basis to ensure that targets are achieved; and
- Utilising government procurement to help shift the market to support more energy efficient buildings and appliances.

[4] Presentation by Beatrix Massig, Deputy Head of Division for Climate and Energy Cooperation with Industrialized Countries/Hydrogen Initiatives, 27 June 2022, *Introduction to the German Energy Transition Australian Energy Efficiency Delegation*.

4 Theme 2: Features of a comprehensive ecosystem to accelerate residential energy efficiency

Residential buildings present unique challenges for the development of effective energy efficiency policies. For example:

1. A residential market mostly based on individual owners makes scaling change particularly challenging;
2. Local context (including climate, architectural style, and constituent priorities) is especially influential for residential buildings, elevating the importance of a customised approach;
3. Smaller buildings (with smaller budgets) can make it more difficult to achieve cost-effective project results with a customised approach;
4. Poorly designed policies risk exacerbating housing affordability issues or slowing economic growth;[5]
5. Compared to new buildings, the renovation of existing buildings can present particular difficulties given the variety of building characteristics, scale of renovations and constraints on access to funding; and
6. The policy landscape for buildings is typically complex due to varied influence and interest across multiple levels of government (federal, state, local) and government departments (e.g. planning, environment, energy).

4.1 Background to the German approach

Despite these challenges, Germany has demonstrated that residential energy efficiency can be improved through the consistent application of policy and finance to guide development of an 'ecosystem' of stakeholders and programs. The 'ecosystem' includes:

- Carefully targeted incentives;
- Access to cost-effective funding;
- Progressive development of skills in the workforce; and
- A system to support consumer confidence in the products and services they are purchasing.

At the centre of the German approach is a funding program that is provided by the German Development Bank, KfW.[6] Key features of the approach are:

1. Customers renovating an existing house or building a new house can access **funding** for individual measures or for renovating/building towards a specific Efficiency House Standard;
2. For renovation towards Efficiency House Standard, a **long-term renovation roadmap** is developed following an assessment/evaluation of the building and its components by an approved energy efficiency expert. The roadmap outlines individual packages of concrete renovation measures and the associated financial costs and benefits of each. Customers can take the renovation roadmap (or 'buildings passport') to retail banks to apply for funding of one or more of the individual packages. The roadmap is valid for up to 15 years, and a performance bonus of 5 percent is paid following confirmation of successful implementation of each package of renovation measures. The implemented activities are documented in the house's 'passport'. The passport for each property is publicly available;
3. A wide network of **certified energy efficiency experts** supports customers to identify energy efficiency measures, apply for funding and ensure the adherence to quality standards; and

[5] Clark, W. 2021, *Finance, economics, and energy: SMC green development* in: Sustainable Mega City Communities, Butterworth Heinemann, Oxford.
[6] Teichmann, F; Baldauf, I and Gebhardt, T 2022: *Germany's Efficiency Funding. Financing Solutions for Efficient Residential Buildings by KfW Bank*. adelphi, Berlin.

4. Through the KfW's on-lending principle, **retail banks** across Germany offer the federal funding for efficiency measures.

A central principle of the program is that the more ambitious the investment, the higher the available funding.

KfW has established a framework and rules through which the financial institutions can provide funding to customers. The financial institutions then promote the KfW funding products to their customers and manage administration of the loan. This means that the financial institutions benefit from accessing funding at the same costs as the government.

Importantly, a recent review of the program found that most of the funding has been provided for new buildings rather than renovations of existing buildings. This has led to several changes in the program. For example, there will be an increase in the stringency of the minimum standard for new buildings in recognition that the financial incentives have provided adequate assistance and lead-time for the market to adapt. Also, future funding rounds will have a greater focus on funding for renovation projects.

4.2 Considerations for residential energy efficiency in Australia

Delegates drew on the German experience to identify the characteristics of an 'ecosystem' that would support improvements in residential energy efficiency in Australia. These are summarised in Table 1.

Table 1: Ecosystem characteristics and considerations

Aspect	Characteristics and considerations
Government policy and program coordination	• Support aligned systems, policies and protocols to facilitate access to funding for consumers at a reduced cost; • Ambition and resourcing requirements should be contextualised within a buildings sector target for contribution to economy-wide net zero final and interim targets; • A feedback loop that draws on data from residential energy efficiency initiatives will be beneficial to review and refine programs while informing complementary policy development; • Assessors should be accredited in a manner similar to the approach adopted by the National Australian Built Environment Rating System (NABERS); and • Information on the funding, certification of assessors, database of assessors and of accredited products and services should be easily accessible and provided in a central location.
Disclosure	Mandatory disclosure is essential to provide transparency for consumers, particularly when combined with other measures such as access to finance. The concept of a 'buildings passport' is useful as it: • Provides the flexibility to update the energy efficiency status of a building over time rather than a one-off 'snapshot' at point of sale; • Can encourage improvement over time through staged investment by including discrete packages of work that will improve building performance; and • Can encourage appropriate sequencing of efficiency upgrades (e.g. insulation first then 'right sizing' heating/cooling appliances).
Finance	Access to low-cost finance or grants are essential to leverage disclosure to ensure that it leads to home upgrades.

	A consistent framework can facilitate comparison between offerings provided by retail banks.
Stakeholders	A central funding body (e.g. Clean Energy Finance Corporation (CEFC) or the National Housing Finance and Investment Corporation (NHFIC) for social housing) could: • Provide low-cost finance to retail banks; • Create rules for use of that finance; and • Accredit assessors (or accreditation could be managed by government as is done in Germany). Assessors can: • Measure building performance; • Identify improvement packages; • Create and update the building passport; and • Provide confidence that the energy efficiency performance is achieved through verifying that the work has been done. Product/service suppliers can: • Provide the products and services outlined in the roadmap. Trades are critical and can: • Ensure they have the specialist skills required and can clearly communicate opportunities for households.
'One stop shop'	Focus on streamlining the process for consumers. This could include a web portal that provides: • A list of energy assessors; • A list of accredited trades/products that are available under low coast finance or grants; • Home ratings (estimated or actual); • A way of comparing one home with others; and • A list of financial providers.
Infrastructure	The 'Rewiring the nation' program is focused on the electricity grid but it could also target home infrastructure requirements (switchboards, electricity demand, solar, batteries etc.) since this can also be a barrier.

5 Theme 3: The importance of aligning workforce development with targeted policies and programs

5.1 Background to the German approach

To accelerate energy efficiency and decarbonise the built environment, the number of skilled workers and trained professionals in the buildings sector will need to increase considerably. The delegation found that the German approach to workforce development had been particularly effective.

In particular, Germany has developed its workforce for building energy efficiency through consistent, long-term energy efficiency policies combined with a flexible education and training system. Accredited organisations are providing training and in Germany building assessors are required to hold a university degree.

5.2 Considerations for workforce development in Australia

Delegates noted that Australia has had mixed success developing the skills required for energy efficiency in buildings and there is a significant shortfall in the skills available to deliver on net zero targets. A contributing factor has been the start/stop and 'one-off' nature of energy efficiency programs – which makes it difficult for businesses and individuals to invest in skills and training due to inconsistencies in the requirements for those skills.

Several opportunities to improve workforce development for energy efficiency in Australia based on the German experience were considered by delegates. These include:

- Long-term policy can help to create demand by:
    - Signalling that there will be market growth;
    - Providing businesses and individuals with the time to develop skills and expand the workforce; and
    - Developing the training infrastructure for skills development;
- As policies are developed, they should be supported by a training plan with competencies linked to long-term needs;
- Workforce development should be approached as a 'reimagining of roles' rather than just improving skills within existing demarcations. The most prominent example of this is that heat pump installations require a combination of specific electrical and plumbing skills;
- Skills and training development for energy efficiency in buildings can be accelerated through changes in the traditional vocational training system in conjunction with appliance-specific, manufacturer-led training;
- Training approaches that could be applied include:
    - On-the-job, tangible/practical training ('learning by doing');
    - Training that is supported by clear performance standards and feedback;
    - Opportunities to apply skills soon after they are developed to ensure they are reinforced and practiced; and
    - Alignment of training with practical support material, e.g., use of templates for different building types which can be used to highlight what is possible;
- The range of additional expertise required is substantial and includes:
    - Plumbers: decommissioning gas and supporting the installation of heat pumps;
    - Electricians: for hot water, electrification, induction cooktops, and heating and cooling ;
    - Thermal performance specialists: for insulation and draught proofing;
    - Assessors;
    - Architects/Designers; and
    - Builders: managing quality and performance outcomes;

- Energy management systems, integration of appliances with each other;
- Auditing and verification;
- Salespeople (e.g., for appliances).

Delegates also noted that capacity-building for policy makers is also necessary. This was underscored by the value participants gained from participating in the delegation. As well as learning from German policy makers, the tour provided delegates with the time and opportunity to learn from one another throughout the trip and during the follow-up review sessions.

Workforce development and skills shortages will continue to be an ongoing challenge for both Germany and Australia in the coming years. It presents an area of mutual interest and learning that could be further explored through the Australian-German Energy Partnership.

6 Theme 4: Characteristics of an integrated transformation approach to the market development of heat pumps

Heat pumps are a highly efficient form of electrical heating and cooling technology. They can deliver nearly zero emissions energy services when combined with electricity from renewable energy sources. Therefore, policies that are focused on the supply and deployment of heat pumps in the buildings sector can make a substantial contribution towards achieving net zero and interim emission reduction targets.

Delegates noted that a particular strength of the German approach to the market development of heat pumps has been the integrated approach that has been adopted. The German approach encompasses the development of local manufacturing, strong performance standards, accelerating market uptake through carefully targeted incentives and the provision of ongoing support for skills development.

6.1 Background to the German approach

Germany experienced a high level of growth in the manufacture and installation of heat pumps during the oil crisis of the 1970s.[7] Market growth declined soon after due to the normalisation of energy prices together with consumer discontent due to poor quality heat pumps and installations.

The establishment of the German Heat Pump Association in 1993 played a key role in restarting market growth by developing quality standards and labelling, promoting the benefits of heat pumps and leveraging EU energy labelling requirements when they were introduced in 2013.

Since then, the uptake of heat pumps also increased due to technology improvements that have enhanced energy efficiency and reduced operating costs for consumers on the one hand, and incentive programs and standards on the other.

Acknowledging that heat pumps are an essential technology to reduce energy demand and to achieve emissions reduction targets, in 2021 the German government set a target for the installation of 6 million heat pumps by 2030.

In summary, lessons learned from German experience include that:

- Energy prices are a key driver for changed behaviour;
- Consistent political support and funding for renewable energy/heat pumps is needed to achieve sustainable growth;
- Quality standards for the appliance and installation are essential to build consumer confidence in the technology;
- Combining traditional 'plumbing' and 'electrical' skills in a single package lowers the cost and efficiency of installation;
- There is a risk to the supply/availability of heat pumps due to the concentration of manufacturing in a few countries. Supply risk is expected to rise as demand increases globally; and
- An industry-led approach (e.g. role of the German Heat Pump Association) combined with government incentives and coordination can have impact and be cost effective.

6.2 Considerations for the Australian heat pump market

Members of the delegation considered some of the ways in which these lessons could be applied in an Australian context by adopting an integrated transformation approach to heat

[7] Presentation by Katja Weinhold and Andre Jacob, 30 June 2022, *Heat Pumps in Germany*.

pumps. These are captured in Table 2. It is important to note that each of these issues should be addressed as part of a comprehensive package rather than applying each one in isolation.

Table 2: Issues and considerations for developing an integrated transformation approach to heat pumps

Issue	Considerations
Role of government	• Signal the role and benefit of heat pumps; • Consider establishing targets for heat pump manufacture and/or deployment; • Address market distortions that increase the cost of heat pumps relative to other options; and • Coordinate an integrated transformation approach.
Role of industry	• Actively promote the benefits of heat pumps; • Maintain data on sales and deployment; and • Develop a partnership with the German Heat Pump Association to align standards, training and other relevant initiatives.
Supply	Support local manufacturing of heat pumps and their component parts to: • Reduce supply bottlenecks;[8] • Create local manufacturing jobs, particularly in regions transitioning from fossil fuel-based industries; and • Create export opportunities.[9]
Quality standards	Develop a performance framework modelled on the German approach.
Application constraints and opportunities	In some applications there is limited experience associated with the use of heat pumps and this can limit their deployment and use. This could be addressed by developing 'templates' to provide guidance on how heat pumps can be installed in different building types and under different circumstances. For example: • Complete system retrofit, decentralised system retrofit and hybrid retrofit in commercial buildings; and • New build, renovation, planned appliance replacement and emergency appliance replacement in residential buildings. These examples should acknowledge electrical infrastructure needs and costs under various circumstances.
Skills	Progressively work towards an 'ideal' qualification that allows an individual to install heat pumps. The goal is to establish

[8] Heat pump manufacture is concentrated in a few countries (primarily China). Significant supply shortages may result as demand for heat pumps accelerates around the world for emission reduction while cooling requirements increase (see for example IEA 2020, *The future of cooling*). Supply may also be preferenced to countries with more ambitious policy signals.

[9] The development of heat pump manufacturing capability aligns with the goals of the Federal Government's National Reconstruction Fund.

	'appliance-specific skills' in which an individual can utilise both electrical and plumbing skills.[10] Working towards this ideal will require efforts to adjust existing trade qualifications together as well as utilising manufacturer-led/appliance-specific training.
Incentives	End users (rebates via retailers) vs installers (utilised more frequently in Germany). Need to consider decision points at various stages in building life cycle: • New build; • Renovation; • Planned appliance replacement; and • Emergency appliance replacement. For example, installers need to have appliances accessible as well as knowledge of white certificates and other financial options available to customers at time of changeover.
Leverage existing policies and programs	• Expand NABERS disclosure for office buildings to other building types; • Modify the National House Energy Rating Scheme (NatHERS) to use cumulative emissions factors (e.g. average over 10 years) rather than current emissions factors; • Adjust the building code to use cumulative emissions factors (e.g. average over 10 years) rather than current emissions factors; and • Utilise public sector purchasing to increase demand and demonstrate heat pump applications.

[10] Often referred to as a 'Zebra' skill set due to the combination of electrical and plumbing skill sets.

7 Appendix A: Delegate list

- Luke Menzel, CEO Energy Efficiency Council
- Grace Tam, Director Debt Markets, Clean Energy Finance Corporation
- Karla Fox-Reynolds, Principal Innovation Projects, Climate-KIC Australia
- Isaac Ward, Head of Energy Team, Brighte
- Francesca Muskovic, National Policy Manager, Property Council
- Carlos Flores, Director, National Australian Built Environment Rating System (NABERS)
- Margot Delafoulhouze, Lead on Cities and Buildings, Climateworks Centre
- Rachel Haley, Manager Sustainable Homes, NSW Office of Energy and Climate Change
- Holly Taylor, Head of Projects, Energy Efficiency Council
- Paul Corkill, Executive Director Policy, Programs and Industry Development, Solar Victoria, Victoria Department of Environment, Land, Water and Planning
- Glenn Day, Director National Sales and Public Affairs, Stiebel Eltron
- Martina Lyons, Market Transformation Lead, RACE for 2030