

The Senate

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Economics References Committee

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Residential electrification

March 2025

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# Contents

<b>Members</b> .....	<b>iii</b>
<b>Terms of reference</b> .....	<b>ix</b>
<b>Abbreviations and acronyms</b> .....	<b>xi</b>
<b>Executive summary</b> .....	<b>xiii</b>
<b>List of recommendations</b> .....	<b>xvii</b>
<b>Chapter 1—Introduction</b> .....	<b>1</b>
Conduct of the inquiry .....	2
Public hearings .....	2
Acknowledgments .....	2
Structure of the report .....	2
<b>Chapter 2—Opportunities</b> .....	<b>3</b>
Overview .....	3
Electrification and household energy efficiency .....	3
Energy use in Australian households .....	4
Energy efficiency of electric household appliances .....	6
Electrification and emissions reduction .....	8
Residential electrification as a cost-effective option for decarbonisation .....	12
Economic opportunities of residential electrification .....	14
Reducing rising costs of energy for Australian households .....	14
Job creation .....	17
Scaling up domestic capacity and improved energy security .....	21
<b>Chapter 3 – Consumer barriers and supports</b> .....	<b>25</b>
The high upfront costs of electrification .....	25
Support for overcoming the high upfront costs of electrification .....	27
Barriers for low-income households .....	30
Supports are needed for low-income households .....	32
Barriers to electrification for renters .....	33
Supports to increase renters’ access to the benefits of electrification .....	35
Supports for people living in social housing .....	38
Coordination of residential electrification supports .....	39

The need for a broad ecosystem of electrification supports .....	39
Improved, national coordination of electrification efforts.....	40
<b>Chapter 4—Building design and appliance standards .....</b>	<b>43</b>
Design standards and other requirements for new residential builds.....	43
Gas connections for new properties .....	43
Electrification and related upgrades for existing buildings.....	46
The electrification challenge for multi-unit and strata buildings .....	47
Targeted initiatives for rental properties.....	50
Material gas disconnection fees .....	52
Enabling a coordinated approach to energy efficiency upgrades.....	53
Supporting electrification through enhanced appliance standards.....	53
Utilising solar panels and battery storage systems .....	55
Challenges of rooftop solar for apartment complexes.....	57
Utilising the energy storage potential of electric vehicles.....	58
The promise of virtual power plants.....	59
The rollout of smart energy meters .....	60
Improving energy efficiency disclosure and performance .....	61
<b>Chapter 5—Residential electrification and the grid.....</b>	<b>63</b>
Main types of transition investment .....	66
Costs of rooftop solar in electrification.....	67
Ensuring the stability and reliability of the grid .....	69
Importance of battery storage in managing grid stability.....	69
Role of technology .....	71
Role of battery storage in grid management.....	71
Investments in grid infrastructure needed to support electrification .....	72
Wiring upgrades .....	72
Optimal timeframe for residential electrification.....	73
Expediting residential electrification to address environmental challenges.....	73
The complexity of transitioning to widespread household electrification.....	75
Staggered approach.....	76
<b>Chapter 6—Conclusion and recommendations.....</b>	<b>79</b>
Promoting electrification.....	79

Leveraging rooftop solar.....	80
Avoiding labour shortfalls.....	81
<b>Government senators' additional comments.....</b>	<b>83</b>
<b>Senator Pocock's additional comments.....</b>	<b>89</b>
<b>Appendix 1—Submissions and additional information.....</b>	<b>93</b>
<b>Appendix 2—Public hearings and witnesses.....</b>	<b>101</b>



# Terms of reference

Australia's residential electrification efforts, with particular reference to:

- (a) the economic opportunities of household electrification, including but not limited to:
  - (i) long-term reduction of energy price inflation,
  - (ii) long-term employment opportunities, and
  - (iii) the scaling up of domestic capacity;
- (b) the macro-barriers to increasing the uptake of home electrification;
- (c) the total upfront cost and longer-term benefits of household electrification and alternative models for funding and implementation;
- (d) the marginal cost of abatement for household electrification compared to alternative sectors and options to decarbonise the economy;
- (e) the optimal timeline for household electrification accounting for the likely timing of decarbonising electricity;
- (f) the impacts and opportunities of household electrification for domestic energy security, household energy independence and for balance of international trade;
- (g) the impacts of household electrification on reducing household energy spending and energy inflation as a component of the consumer price index;
- (h) solutions to the economic barriers to electrification for low-income households;
- (i) the effectiveness of existing Australian Federal, state and local government initiatives to promote and provide market incentives for household electrification;
- (j) Australia's current standing against international standards, particularly with respect to the uptake of rooftop solar, batteries and electric household appliances; and
- (k) any other matters.



# Abbreviations and acronyms

AATSE	Australian Academy of Technological Sciences and Engineering
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ANU	Australian National University
APGA	Australian Pipelines and Gas Association
ARENA	Australian Renewable Energy Agency
BESS	Battery energy storage system
CEFC	Clean Energy Finance Corporation
CER	consumer energy resources
CIS	Capacity Investment Scheme
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	Department of Climate Change, Energy, Environment and Water
DER	distributed energy resources
DNSP	Distribution Network Service Provider
EV	electric vehicle
ETUA	Electrical Trades Union of Australia
GEMS Act	Greenhouse and Energy Minimum Standards Act 2012
GW	gigawatt
HIA	Housing Industry Association
ICL	Income contingent loan
IEEFA	Institute for Energy Economics and Financial Analysis
MEA	Master Electricians Australia
NECA	National Electrical and Communications Association
NEM	National Electricity Market
OCNA	Owners Corporation Network of Australia
PIAC	Public Interest Advocacy Centre
Pj	Petajoule
RCAC	reverse cycle air conditioners
RMIT	Royal Melbourne Institute of Technology
SEC	Smart Energy Council
SRES	Small-scale Renewable Energy Scheme
TWh	Terawatt hour
UNSW	University of New South Wales
VPP	virtual power plant



# Executive summary

Residential electrification is an increasingly important feature of Australia’s energy system. Electrification has the potential to improve household energy efficiency, reduce emissions from residential energy use and lower energy costs for consumers. It remains costly, acting as a barrier to entry for most Australians, with a very long return on investment period.

A key concern is the cost-of-living crisis Australia finds itself within, which has been articulated as ‘Australia’s worst ever hidden recession’,<sup>1</sup> and ‘the recession you have when you’re not having a recession’.<sup>2</sup> The International Monetary Fund released its updated World Economic Outlook in October 2024, with Australia’s inflation expected to continue rising into 2025.<sup>3</sup> Energy efficiency is an inappropriate standalone measure. Households and governments should be focused on the delivered cost of energy.

In general, residential electrification describes the replacement of household appliances powered by fossil fuels with energy efficient electric appliances, such as induction cooktops, electric water heaters and reverse cycle air conditioners. Often, residential electrification is combined with the installation of so-called consumer energy resources (CERs) which allow households to generate and store clean energy, such as rooftop solar and battery energy storage.

Australians are increasingly electrifying their homes. For instance, over four million rooftop solar systems are installed on Australians’ homes—with a total generation capacity of almost 25 GW, exceeding that of Australia’s coal-fired power stations.<sup>4</sup>

Yet, despite the significant opportunities attributed to residential electrification, the committee heard that many Australians face barriers to electrifying their homes. Indeed, inquiry participants’ evidence suggests there is considerable value in governments of all levels working to coordinate Australia’s electrification transition.

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<sup>1</sup> Leith van Onselen, ‘[Australia’s “worst ever” hidden recession](#)’, *Macrobusiness*, 26 November 2024..

<sup>2</sup> Katee Ainsworth, ‘[Real per capita income lower than past three recessions](#)’, *ABC News*, 16 January 2025.

<sup>3</sup> International Monetary Fund, *World Economic Outlook: Policy Pivot, Rising Threats*, October 2024, p. 123.

<sup>4</sup> Department of Climate Change, Energy, Environment and Water (DCCEEW), *Annual climate change statement 2024*, November 2024, p. 25.

## **Australia can benefit from increased electrification**

Residential electrification technologies available today are a valuable tool for reducing emissions and improving the reliability of Australia’s energy system.

The energy efficiency benefits of electrification are particularly significant in Australia given the large amount of energy used in households. Residential buildings use around a quarter of all electricity in Australia and account for 10 per cent of emissions.<sup>5</sup> Gas is also used extensively, with around 30 per cent of energy used in the residential sector coming from gas in 2022–23.<sup>6</sup> Currently, over five million households are connected to gas and use some 13 million gas appliances.<sup>7</sup>

In some cases, the committee heard that heat pump technologies for space and water heating can be several times more efficient than their gas-powered counterparts.<sup>8</sup>

Evidence from inquiry participants also highlighted several other opportunities associated with residential electrification. For instance, the committee heard that the efficiency of electric appliances can result in reduced household energy costs and offset energy price inflation. Further, the manufacture and installation of residential electrification technologies is anticipated to create thousands of new jobs.

## **Many Australians face barriers to electrifying their homes**

Notwithstanding these opportunities, electrifying households on a national level is a challenging task and many Australians face barriers to electrifying their homes.

For instance, while installing energy efficient electric appliances can reduce a households’ energy costs, the upfront costs of purchasing and installing those appliances remains prohibitive for many people. Indeed, the committee heard that replacing gas appliances for heating and cooking with electric equivalents costs, on average, upwards of several thousand dollars per household.

Moreover, the upfront costs of electrifying a household are exacerbated by any wiring upgrades needed to support the additional demand of electric appliances and by any fees that apply for a property to be disconnected from the gas network. Costs can rise even further for households seeking to instal CERs. For instance, installation

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<sup>5</sup> See, DCCEEW, *Residential buildings*, 14 March 2025, [www.dcceew.gov.au/energy/energy-efficiency/buildings/residential-buildings#:~:text=Residential%20buildings%20are%20responsible%20for,total%20carbon%20emissions%20in%20Australia](http://www.dcceew.gov.au/energy/energy-efficiency/buildings/residential-buildings#:~:text=Residential%20buildings%20are%20responsible%20for,total%20carbon%20emissions%20in%20Australia) (accessed 17 March 2025).

<sup>6</sup> See, DCCEEW, *Australian Energy Update 2024: Table H*, August 2024.

<sup>7</sup> Monash University, *Switching on: Benefits of household electrification in Australia*, October 2023, p. 21.

<sup>8</sup> Institute for Energy Economics and Financial Analysis, *Submission 22*, p. 8.

of a battery energy storage system with an average capacity of between 8–10 KW can cost between \$8000 to \$13 000.

Despite many government programmes encouraging residential electrification, the committee heard that further—and better targeted—financial supports are needed to help Australians electrify their homes. In particular, many inquiry participants submitted that, without improved supports, Australians on lower incomes risk being left behind in the electrification transition.

The committee also heard that well-considered policies are needed to ensure Australians who rent, or who live in apartments or strata properties, can access the benefits of electrification. For instance, landlords are not currently incentivised to electrify their investment properties given that the energy cost savings primarily benefit the tenant. Additionally, apartment and strata property owners face unique challenges in electrification upgrades that involve common property interests.

More broadly, inquiry participants gave evidence that a lack of centralised information on residential electrification means that many consumers are not aware of the options available to electrify their homes.

### **Other macro-barriers to electrification in Australia**

Inquiry participants also stressed the need for building standards to be factored into residential electrification programmes. For instance, for residential electrification to be effective, many inquiry participants considered that electrification must be pursued alongside improvements to the thermal efficiency of Australian homes.

Australian homes are often poorly insulated. Recent analysis suggests that a typical Australian home built prior to 2010 had a median energy star rating of only 2.8, compared to a median rating of 5.9 for homes built after 2010.<sup>9</sup> Indeed, the benefits of electrification in improving household energy efficiency and reducing emissions risk being offset if a dwelling has poor thermal efficiency.

Furthermore, the quality of electric appliances installed needs to be prioritised. The committee heard that, in some instances, appliance subsidies encouraged the installation of low-cost appliances which were not suited to the household's intended use or had a poor energy efficiency rating. Given the typically long lifespan of household appliances, small differences in energy efficiency can have a significant cumulative impact on appliances' emission and energy cost reduction benefits.

Alongside consumers, electricians and installers will be at the forefront of Australia's residential electrification transition. However, there is currently a nationwide

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<sup>9</sup> CoreLogic, *Amped Up: How energy resilient are Australian homes?*, December 2024, p. 4.

shortage of electricians,<sup>10</sup> which is likely to worsen in the coming years. Indeed, the committee heard that to meet the current electrical work plus the additional pipeline of work in the renewable energy sector, Australia will need an additional 35 000 qualified electricians by 2030. Given that just over half of trainee electricians finish their apprenticeship, training of some 70 000 electrical apprentices will need to commence over the next five years.<sup>11</sup>

Importantly, electrification will also have significant implications for Australia's energy grid. Significant distribution and wiring upgrades are needed to support the increase in renewables in the grid, including the significant generation capacity of rooftop solar. At the same time, Australia's demand for electricity is anticipated to increase. To continue to meet demand, it is estimated that the supply capacity of the National Electricity Market—which delivers 80 per cent of Australia's electricity—will need to almost triple by 2050.<sup>12</sup>

### **Better national coordination needed**

As considered in the committee's report, the mix of opportunities and barriers associated with residential electrification in Australia show that there could be a role for governments to adopt policies that support and coordinate Australia's transition to residential electrification.

At the national level, effective policies will make it easier for Australians to electrify their property and provide certainty for those making considerable investments to support Australia's decarbonisation efforts. Implemented well, such policies will improve the quality of Australia's electrification transition and compound the benefits experienced by Australians.

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<sup>10</sup> See, Jobs and Skills Australia, *Occupation shortage list*, n.d., [www.jobsandskills.gov.au/data/occupation-shortages-analysis/occupation-shortage-list](http://www.jobsandskills.gov.au/data/occupation-shortages-analysis/occupation-shortage-list) (accessed 9 December 2024).

<sup>11</sup> See, Mr Neil Johns, Director, Policy, Technical and Safety, National Electrical and Communications Association, *Committee Hansard*, 21 February 2024, p. 10.

<sup>12</sup> See, Australian Energy Market Operator, *2024 Integrated system plan*, June 2024, p. 7.

# List of recommendations

## Recommendation 1

- 6.7 The committee recommends that the Australian Government, in coordination with state and territory governments, should promote households to uptake consumer energy resources, including rooftop solar, home batteries, bi-direction electric vehicle chargers and home energy management systems. In conjunction with those efforts, households should be promoted to participate with aggregators which can operate distributed assets in a coordinated fashion in response to grid and market conditions.

## Recommendation 2

- 6.14 The committee recommends that the Australian Government, in coordination with state and territory governments, should prioritise investment in technologies that extend and improve the system value of rooftop solar, such as home batteries and home energy management systems.

## Recommendation 3

- 6.15 The committee recommends that the Australian Government, in coordination with state and territory governments, should prioritise how community batteries can spread the benefits of rooftop solar to consumers who are unable to install their own systems, such as renters, apartment dwellers or low-income earners.

## Recommendation 4

- 6.21 The committee recommends that the Australian Government and state and territory governments consider cost-effective local tuition for apprentices, such as electrical apprentices.



# Chapter 1

## Introduction

1.1 On 14 June 2023, the Senate referred an inquiry into Australia’s residential electrification efforts to the Senate Economics References Committee (committee), with the following terms of reference:

- (a) the economic opportunities of household electrification, including but not limited to:
  - (i) long-term reduction of energy price inflation,
  - (ii) long-term employment opportunities, and
  - (iii) the scaling up of domestic capacity;
- (b) the macro-barriers to increasing the uptake of home electrification;
- (c) the total upfront cost and longer-term benefits of household electrification and alternative models for funding and implementation;
- (d) the marginal cost of abatement for household electrification compared to alternative sectors and options to decarbonise the economy;
- (e) the optimal timeline for household electrification accounting for the likely timing of decarbonising electricity;
- (f) the impacts and opportunities of household electrification for domestic energy security, household energy independence and for balance of international trade;
- (g) the impacts of household electrification on reducing household energy spending and energy inflation as a component of the consumer price index;
- (h) solutions to the economic barriers to electrification for low-income households;
- (i) the effectiveness of existing Australian Federal, state and local government initiatives to promote and provide market incentives for household electrification;
- (j) Australia’s current standing against international standards, particularly with respect to the uptake of rooftop solar, batteries and electric household appliances; and
- (k) any other matters.<sup>1</sup>

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<sup>1</sup> *Journals of the Senate*, No. 50, 14 June 2023, pp. 1449–1450.

## Conduct of the inquiry

- 1.2 The committee published details of the inquiry on its webpage and called for written submissions by 29 December 2023.<sup>2</sup> The committee also wrote to relevant stakeholders to invite them to make a submission.
- 1.3 The committee received 236 submissions, as well as additional information and answers to questions on notice, as listed at **Appendix 1**.
- 1.4 The committee was due to report on the last sitting day of 2024, however this was extended to, in turn, 5 December 2024, 31 January 2025, and 31 July 2025.<sup>3</sup>

## Public hearings

- 1.5 The committee held three public hearings, as noted below.

**Table 1.1 Public hearings**

Date	Location
22 November 2023	Parliament House, Canberra
21 February 2024	Parliament House, Canberra
22 March 2024	Parliament House, Canberra

- 1.6 Details of the witnesses who appeared at the hearings is listed at **Appendix 2**.

## Acknowledgments

- 1.7 The committee thanks the many inquiry participants who provided substantial evidence on the range of issues relevant to residential electrification in Australia.

## Structure of the report

- 1.8 The committee's report is structured as follows:
  - **Chapter 1**—outlines the scope and conduct of the inquiry;
  - **Chapter 2**—sets out the opportunities of residential electrification in Australia, particularly in reducing emissions and energy costs;
  - **Chapter 3**—considers the barriers for consumers in electrifying their homes, including supports needed for households to electrify;
  - **Chapter 4**—discusses the appliance standards and building design issues impacting residential electrification outcomes;
  - **Chapter 5**—looks at the impacts of electrification on the energy grid; and
  - **Chapter 6**—provides the committee's views and recommendations.

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<sup>2</sup> See, Senate Economics References Committee, [Residential Electrification](#), n.d. (accessed 9 June 2024).

<sup>3</sup> See, *Journals of the Senate*, No. 146, 28 November 2024, p. 4495; *Journals of the Senate*, No. 147, 4 February 2024, p. 4647.

# Chapter 2

## Opportunities

2.1 Throughout the inquiry, the committee received considerable evidence on the range of opportunities associated with residential electrification in Australia. In particular, this chapter outlines evidence from inquiry participants on:

- the role of electrification in improving household energy efficiency; and
- the economic opportunities of electrification.

### Overview

2.2 In general, inquiry participants expressed strong support for increased residential electrification in Australia. The committee heard that electrification improves household energy efficiency and, in doing so, creates consumer benefits and national benefits. For instance, the City of Sydney submitted that the benefits of electrification include:

... better energy performance, lower greenhouse gas emissions, improved air quality and human health, lower running costs, and enabling the renewable energy transition. It also improves domestic fuel security and reliance on imported fossil fuels.<sup>1</sup>

2.3 Inquiry participants often emphasised that residential electrification benefits both the environment and the economy. By replacing gas appliances with energy efficient electric appliances, and installing consumer energy resources,<sup>2</sup> household energy use can be made significantly more efficient, reducing both carbon emissions and household energy costs. Further, the committee heard that electrification is anticipated to create thousands of jobs in appliance installation and manufacturing and will strengthen domestic energy security.<sup>3</sup>

### Electrification and household energy efficiency

2.4 This section outlines evidence on household energy use and the role of electrification in improving energy efficiency. In particular, the section outlines:

- the significant amount of energy used by households;
- the energy efficiency of electric household appliances; and
- the role of electrification in reducing carbon emissions.

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<sup>1</sup> City of Sydney, *Submission 25*, p. 2.

<sup>2</sup> Note, consumer energy resources (CERs) are technologies which allow consumers to generate and manage their own energy use, including rooftop solar systems and battery energy storage systems.

<sup>3</sup> See, for example, Mr Chris Lehmann, National Advocacy Manager, Master Electricians Australia, *Committee Hansard*, 21 February 2024, p. 18.

## Energy use in Australian households

2.5 Households use a significant proportion of Australia's energy. Indeed, the residential sector is Australia's fourth largest consumer of energy, after the transport, manufacturing and mining sectors, as shown in **Figure 2.1**.<sup>4</sup>

**Figure 2.1 Australian total energy consumption, by industry in 2022–23**

	2022–23 PJ	2022–23 share (per cent)	2022–23 growth (per cent)	10 year average annual growth (per cent)
<b>Transport</b>	1,603.6	41.1	12.2	0.3
<b>Manufacturing</b>	786.7	20.2	-2.5	-2.0
<b>Mining</b>	514.1	13.2	5.6	3.0
<b>Residential</b>	484.2	12.4	-2.6	0.6
<b>Commercial</b>	308.1	7.9	4.1	0.4
<b>Agriculture</b>	105.9	2.7	-7.6	0.6
<b>Construction</b>	36.6	0.9	-1.5	1.6
<b>Water and Waste</b>	16.7	0.4	-6.5	2.5
<b>Other</b>	44.5	1.1	-2.3	-1.8
<b>Total</b>	<b>3,900.4</b>	<b>100.0</b>	<b>4.5</b>	<b>0.1</b>

Source: Department of Climate Change, Energy, the Environment and Water, *Australian Energy Update 2024*, August 2024, p. 21.

2.6 In 2022–23, the residential sector used 484.2 petajoules of energy (PJ).<sup>5</sup> Of that:

- electricity accounted for 52 per cent (249.8 PJ);
- gas accounted for 30 per cent (147.1 PJ);
- renewables accounted for 15 per cent (71.5 PJ); and
- oil accounted for 3 per cent (15.8 PJ).<sup>6</sup>

2.7 In addition to the large amount of total energy used in the residential sector, households also accounted for a large proportion of national gas use. In 2022–23, the residential sector accounted for 26 per cent of national gas use, significantly more than any other sector.<sup>7</sup> Yet, compared to the prior year, factors including warmer weather, cost pressures and electrification contributed to an 11 per cent decline in residential gas use in 2022–23.<sup>8</sup>

<sup>4</sup> Department of Climate Change, Energy, the Environment and Water (DCCEEW), *Australian Energy Update 2024*, August 2024, p. 11.

<sup>5</sup> Note, a petajoule is equal to 1 million billion joules and equivalent to the annual electricity use of 41 182 households. See, DCCEEW, *Guide to the Australian Energy Statistics*, August 2024, p. 18.

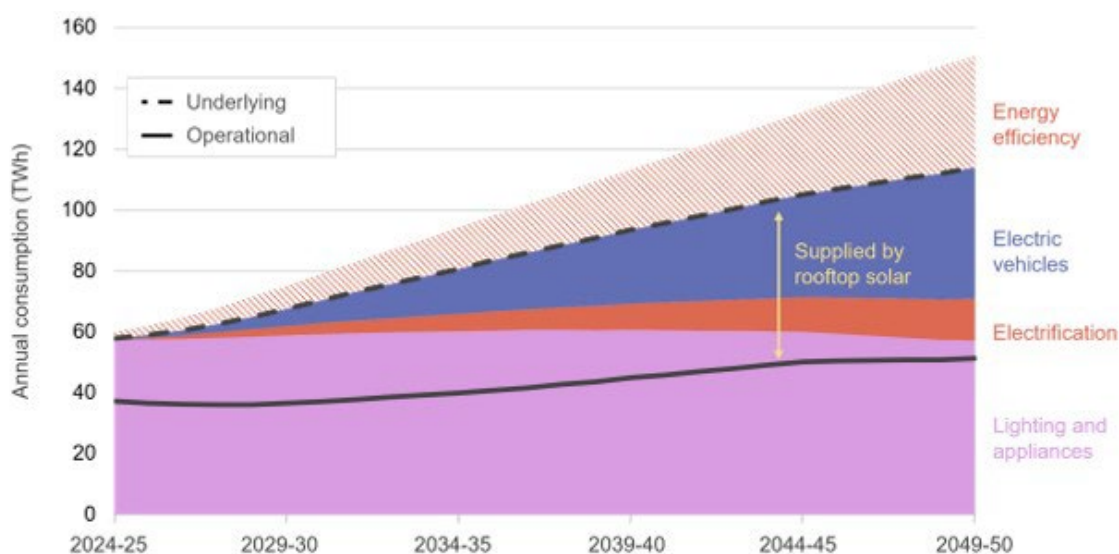
<sup>6</sup> See, DCCEEW, *Australian Energy Update 2024: Table H*, August 2024.

<sup>7</sup> See, DCCEEW, *Australian Energy Update 2024: Table H*, August 2024.

<sup>8</sup> See, DCCEEW, *Australian Energy Update 2024: Table H*, August 2024; DCCEEW, *Australian Energy Update 2024*, August 2024, p. 19 (citing the Australian Energy Market Operator (AEMO)).

- 2.8 Nonetheless, gas appliances remain a common feature in Australian households. More than five million households are connected to the gas network,<sup>9</sup> and collectively own an estimated 13 million gas appliances.<sup>10</sup> Moreover, households spend an estimated \$1.8 billion on new gas appliances each year.<sup>11</sup>
- 2.9 However, energy efficient electric appliances are starting to replace household gas appliances. For instance, while around half of Australia’s hot water systems are powered by gas, Rheem Australia submitted that sales of electric heat pumps are ‘growing at a rapid rate’ and will become ‘water heating system of choice for the majority of new builds, particularly when combined with a rooftop solar’.<sup>12</sup>
- 2.10 While the increased use of residential electric appliances and electric vehicles (EVs) is anticipated to drive up underlying electricity consumption, modelling by the Australian Energy Market Operator (AEMO) suggests that this increased demand for electricity will be offset by investments in rooftop solar and energy efficiency, as seen in **Figure 2.3**.<sup>13</sup>

**Figure 2.3 Residential electricity consumption, National Electricity Market (TWh, 2024–25 to 2049–50)**



Source: Australian Energy Market Operator, *2024 Integrated system plan*, June 2024, p. 26.

<sup>9</sup> See, Climate Council of Australia, *Submission 9*, p. 11.

<sup>10</sup> Monash University, *Switching on: Benefits of household electrification in Australia*, October 2023, p. 21.

<sup>11</sup> See, Institute for Energy Economics and Financial Analysis (IEEFA), *Submission 23*, p. 10.

<sup>12</sup> Rheem Australia, *Submission 113*, pp. 2–3.

<sup>13</sup> AEMO, *2024 Integrated system plan*, June 2024, p. 26.

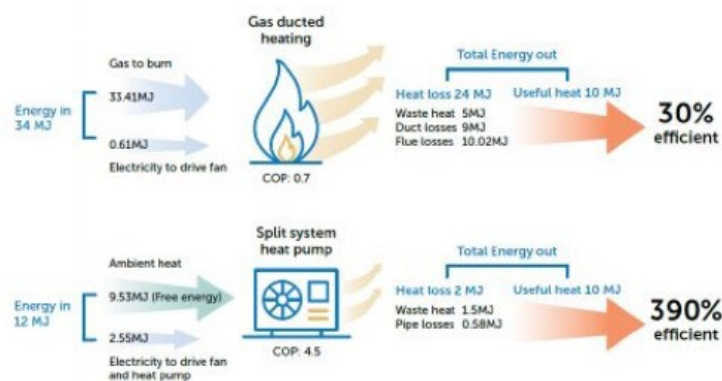
2.11 Further, AEMO noted that while households would continue to ‘draw electricity either direct from their rooftop solar, from the grid, from their household or community batteries, or even from EVs that are able to discharge their batteries ... there will be big swings in demand across the day...’.<sup>14</sup> The challenges associated with managing demand variability in Australia’s electricity grids are considered in further detail in **Chapter 5**.

### Energy efficiency of electric household appliances

2.12 Many inquiry participants provided evidence on the role of electrification in improving household energy efficiency.<sup>15</sup> The Institute for Energy Economics and Financial Analysis (IEEFA) submitted that the efficiency of electric appliances compared to gas appliances increases when considering the ‘lifetime energy consumption of both appliances, and associated emissions given likely changes to the emissions intensity of electricity production’. Based on key assumptions regarding yearly gas use and the emissions intensity of gas, IEEFA found that the ‘lifetime emissions for gas cooktops, heating systems and hot water systems are up to 4.9 times that of their efficient electric counterparts’.<sup>16</sup>

2.13 Several other inquiry participants highlighted the efficiency benefits of heat pump technologies.<sup>17</sup> For example, Beyond Zero Emissions submitted that a home using reverse cycle air conditioners might use just 2.55 MJ of electricity to create the same amount of heat as a home with a gas-fired central heating system using 34 MJ of gas, as shown in **Figure 2.4**.<sup>18</sup>

**Figure 2.4 Space heating relative efficacy – gas ducted heating vs split system heat pump**



Source: Beyond Zero Emissions, *Submission 19*, p. 3.

<sup>14</sup> AEMO, *2024 Integrated system plan*, June 2024, p. 26.

<sup>15</sup> See, for example, Climate Council of Australia, *Submission 9*, p. 3.

<sup>16</sup> IEEFA, *Submission 23*, p. 10.

<sup>17</sup> See, for example, Infrastructure Victoria, *Submission 18*, p. 2.

<sup>18</sup> Beyond Zero Emissions, *Submission 19*, p. 2.

2.14 At the same time, some inquiry participants cautioned that variations in the efficiency of electric appliances can have a significant impact on overall residential electrification outcomes. The Ai Group, for example, submitted that there is a ‘wide gulf in systemic impacts between low-quality and high-quality electrification’.<sup>19</sup> The Ai Group considered an example of the electrification of households and light commercial gas users in NSW:

Current annual gas usage from these customers is around 35 petajoules (PJ). If customers electrify with appliances that are no more efficient than typical gas heaters, replacing that annual energy with electricity would require around 10 terawatt hours (TWh) of generation – about 14% of currently projected statewide electricity demand in 2030.<sup>20</sup>

2.15 Additionally, the Ai Group submitted that the efficiency of appliances has an even greater impact in periods of peak electricity demand. The Ai Group concluded that ‘the more efficient electric appliances are, and the better their operation is coordinated with the state of the wider energy system, the higher their systemic benefits and the lower their systemic costs’.<sup>21</sup> Issues relating to appliance standards are considered further in **Chapter 4**.

2.16 While much of the evidence regarding appliance efficiency focused on heat pumps, several submitters pointed to the importance of utilising a range of residential electrification technologies. For example, Infrastructure Victoria submitted that ‘[r]ising energy demand, coupled with meeting greenhouse gas emissions targets, means no single solution can deliver net zero emissions in Victoria’.<sup>22</sup> Similarly, Rheem Australia submitted that:

... no single technology is a silver bullet in the electrification of residential water heating. Rather, the future should include a range of products, including heat pump water heaters, grid-connected electric water heaters and solar water heaters.<sup>23</sup>

2.17 Many inquiry participants made recommendations in support of the uptake of residential electrification technologies. These recommendations, which are considered further in later chapters, were broadly aimed at:

- encouraging consumers to consider replacing gas appliances with electric appliances;<sup>24</sup>

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<sup>19</sup> Ai Group, *Submission 133*, p. 4.

<sup>20</sup> Ai Group, *Submission 133*, p. 4.

<sup>21</sup> Ai Group, *Submission 133*, p. 4.

<sup>22</sup> Infrastructure Victoria, *Submission 18*, p. 2.

<sup>23</sup> Rheem Australia, *Submission 113*, p. 1.

<sup>24</sup> See, for example, Strata Partners, *Submission 136*, p. 4.

- financial assistance for households to upgrade their appliances, particularly low-income households;<sup>25</sup>
- incentives for landlords to electrify rental properties;<sup>26</sup> and
- tailored assistance to support the electrification of apartments.<sup>27</sup>

### **Electrification and emissions reduction**

2.18 Given the efficiency of electric household appliances, inquiry participants considered electrification to be an important avenue to reducing emissions from household energy use.<sup>28</sup> For instance, the DCCEEW submitted:

Electrification is a key component to improve energy performance for consumers, as the efficiency of electric technologies is generally higher than fossil fuel-based alternatives, and switching to renewable-generated electricity delivers emissions abatement.<sup>29</sup>

2.19 IEEFA similarly suggested that the efficiency of electric appliances over gas appliances meant that ‘electrifying a household today will lead to immediate avoided emissions’.<sup>30</sup> IEEFA added:

... a home with a gas ducted heating system, gas instantaneous hot water system and [a] gas cooktop emits approximately 3.6 tonnes of carbon dioxide equivalent (CO<sub>2</sub>-e) a year from burning fossil gas. If the same amount of useful energy were delivered by reverse-cycle air conditioners, a heat pump hot water system and induction cooktop, this would convert to 2.2 tonnes CO<sub>2</sub>-e/pa based on Australia’s current average electricity emissions intensity.<sup>31</sup>

2.20 The Australian Academy of Technological Sciences and Engineering (AATSE) told the committee that ‘[e]lectrification coupled with the uptake of clean energy is vital to drive down carbon emissions’ and ‘is an essential cornerstone of Australia’s strategy to achieve net zero emissions by 2050, if not sooner’.<sup>32</sup> Further, energy software company Evergen considered that electrification ‘will

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<sup>25</sup> See, for example, Australian Academy of Technological Sciences and Engineering (AATSE), *Submission 5*, p. 3; Climate Council of Australia, *Submission 9*, p. 4; Asthma Australia, *Submission 39*, p. 7; ACT Council of Social Service, *Submission 14*, p. 3; Beyond Zero Emissions, *Submission 19*, p. 1.

<sup>26</sup> See, for example, Asthma Australia, *Submission 39*, p. 6.

<sup>27</sup> See, for example, City of Sydney, *Submission 25*, p. 3.

<sup>28</sup> See, for example, Rewiring Australia, *Submission 132*, p. 6.

<sup>29</sup> DCCEEW, *Submission 226*, p. 6.

<sup>30</sup> IEEFA, *Submission 23*, p. 10.

<sup>31</sup> IEEFA, *Submission 23*, p. 10.

<sup>32</sup> Mr Peter Derbyshire, Director of Policy and International Affairs, AATSE, *Committee Hansard*, 22 March 2024, p. 8.

be critical' to meeting Australia's climate commitments and 'transitioning to a 1.5 degree economy'.<sup>33</sup>

- 2.21 Further, inquiry participants noted that energy efficient electric technologies that reduce household emissions are widely available today. For example, Evergen told the committee that a number of electrification technologies are available 'off the shelf' and, as such, contended that with the right supports the electrification of households 'can be implemented relatively easily and quickly'.<sup>34</sup> Mr Luke Menzel, CEO of the Energy Efficiency Council, expressed a similar view:

There are many challenges on our journey to net zero emissions, and there are a number of sectors for which the technology is nascent, unproven or yet to be developed. The good news for this committee is that households are not one of those sectors. We have safe, reliable and efficient technology—induction cooktops and heat pumps for space heating and cooling and for hot water—that is ready to go and commercially available and that, indeed, many Australians are already using and benefiting from.<sup>35</sup>

### *Electrification alongside renewable energy*

- 2.22 While residential electrification technologies have the potential to significantly reduce emissions, the committee also received evidence on the need to progress electrification alongside the development of renewable energy.<sup>36</sup> For example, AATSE explained that:

It is important for Australia to prioritise investments in residences that rely heavily on renewable energy sources for their electricity supply. If a residence primarily relies on non-renewable energy, it won't effectively reduce carbon emissions or lead to noticeable decreases in household power bills, especially if those residences have poor energy performance.

...

Combining rooftop solar generation and battery storage with electric appliances allows for more significant integration of renewable energy into the residential sector. It reduces reliance on fossil fuels and contributes to greenhouse gas emissions reduction. By generating electricity through rooftop solar panels, households can become more self-sufficient and reduce reliance on the grid. This can lead to energy cost savings and greater energy independence. Since electric appliances can be more energy-efficient than their gas counterparts, their use can lead to reduced energy consumption and lower utility bills for consumers.<sup>37</sup>

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<sup>33</sup> Evergen, *Submission 22*, p. [2].

<sup>34</sup> Evergen, *Submission 22*, p. [2].

<sup>35</sup> Mr Luke Menzel, Chief Executive Officer, Energy Efficiency Council, *Committee Hansard*, 22 November 2024, p. 1.

<sup>36</sup> See, for example, Infrastructure Victoria, *Submission 18*, p. 3.

<sup>37</sup> AATSE, *Submission 5*, p. 3.

- 2.23 Further, Mr Peter Derbyshire, Director of Policy and International Affairs at AATSE, told the committee that there is a strong pipeline of renewable energy infrastructure developments in Australia:

Renewable energy sources have been on a significant upward trajectory in Australia, with solar electricity generation growing by 25 per cent in the 2021-22 year and being 14 times higher than a decade ago. As of January this year, there were 81 renewable energy projects under construction or due to start construction soon in Australia, encompassing wind, solar, hydro and bioenergy. Looking into the future it has been forecasted that Australia's renewable energy capacity is set to expand by 85 per cent to reach 40 gigawatts by 2027.<sup>38</sup>

- 2.24 The Australian Energy Market Operator (AEMO) also recently reported Australia's energy transition as being 'well underway'. In doing so, AEMO observed that coal power stations continued to be retired and that renewables delivered almost 40 per cent of the NEM's total energy in 2023. Further, AEMO noted the growing capacity of renewables:

The level of renewable energy injected into the grid regularly sets new records. On 24 October 2023, 72.1% of total NEM generation came from renewable sources, a new record for a 30-minute period. At maximum available output from wind and solar generation, plus the actual dispatched output from other renewable sources, renewable potential represented 89.9% of the total NEM supply at that time (nearing the current record of 99.7% renewable potential observed on 1 October 2023).<sup>39</sup>

- 2.25 Moreover, AEMO reported that it will soon 'regularly face times when the power system is able to be supplied entirely by renewable energy, which will have implications for system security and strength'. According to AEMO, the NEM is 'among the first systems in the world facing the challenge of securely handling a high-renewables system'.<sup>40</sup> Inquiry participants' evidence on the challenges of integrating household electrification with an increasingly renewable energy system are considered further in **Chapter 5**.

*What is the role of residential gas?*

- 2.26 Several industry bodies recognised that reductions in carbon emissions from electrification were contingent on the broader removal of fossil fuels from Australia's electricity supply. Energy Networks Australia (ENA) observed that '[e]lectrification to decarbonise only makes sense if our electricity supply is largely renewables and if coal is removed from the system'.<sup>41</sup>

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<sup>38</sup> Mr Derbyshire, AATSE, *Committee Hansard*, 22 March 2024, p. 8.

<sup>39</sup> AEMO, *2024 Integrated System Plan for the National Electricity Market*, June 2024, p. 29.

<sup>40</sup> AEMO, *2024 Integrated System Plan for the National Electricity Market*, June 2024, p. 29.

<sup>41</sup> Energy Networks Australia, *Submission 61*, p. 3.

2.27 However, some industry bodies also emphasised the complex challenge of removing coal and gas power from Australia's energy system. For instance, electricity, solar and gas provider AusNet Services told the committee:

I think we're highlighting in our submission that a mass decommissioning of the gas network will be very difficult from a resourcing perspective and also the capital cost-recovery considerations that need to be managed over the remaining life of the gas network. So, essentially, if the gas network is decommissioned over a managed and longer period of time, that gives more opportunity to manage those cost impacts of the last customers that remain on the gas network which could include a large proportion of the more vulnerable customers.<sup>42</sup>

2.28 Further, some industry bodies argued in favour of using 'renewable gas' to meet the energy requirements of households.<sup>43</sup> For example, the Australian Gas Infrastructure Group argued that without a 'well-planned renewable dual fuel system, we are removing well-established system reliability and security of supply benefits that we potentially take for granted today...'.<sup>44</sup> The Australian Pipelines and Gas Association also considered that incorporating 'renewable gas' in the energy system would lower the costs of decarbonisation for Australia households:

Residential gas use is responsible for around 2% of emissions in Australia and represents one of the most costly and challenging sectors to decarbonise. The gas infrastructure sector can play a major role in supporting least cost decarbonisation of household energy use.

In many circumstances, individual households will face lower decarbonisation costs by using renewable gas to replace their natural gas use rather than electrifying their gas demand. Beyond individual household costs, it is apparent that a future integrated energy system delivering renewable electricity and renewable gas to meet Australia's energy needs is highly likely to be lower cost than a single energy system delivering only electricity.<sup>45</sup>

2.29 The APA group also suggested that as renewable energy generation is increased and 'fossil fuels are displaced from the economy':

... gas infrastructure becomes key to providing back-up generation as periods of low wind and solar availability require significant volumes of dispatchable resources to be available to support the reliability and security of the system.<sup>46</sup>

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<sup>42</sup> Ms Charlotte Eddy, General Manager, Regulation and Policy (Distribution), AusNet Services, *Committee Hansard*, 22 November 2023, p. 12.

<sup>43</sup> See, Energy Networks Australia, *Submission 61*, p. 4.

<sup>44</sup> Australian Gas Infrastructure Group, *Submission 44*, p. 2.

<sup>45</sup> Australian Pipelines and Gas Association, *Submission 79*, p. 4.

<sup>46</sup> APA Group Limited, *Submission 29*, p. 4.

2.30 Mr Rainer Korte, Chief Operating Officer of energy transmission and infrastructure services provider ElectraNet, told the committee that while getting consumers off gas could play a role in Australia's energy transition, this should be a less of priority than increasing uptake of electric technologies. Mr Korte explained:

There's no doubt that residential electrification over time and getting residential customers off gas can also play a part, but in the current scheme of things that's only going to give you a small benefit compared to focusing on those areas that will really deliver the greatest benefit and progress towards the transition to zero emissions. That's just something I would offer in response to your question. When it comes to residential customers, I think the greatest near-term benefits are available through rooftop solar and batteries, energy-efficient practices and purchasing an electric vehicle. Those things are going to have a greater impact than getting them off gas immediately, although obviously in the long term the push to electrification may also lead to that outcome. I think customers should be encouraged to take those steps so that they feel comfortable to move to electrification.<sup>47</sup>

### **Residential electrification as a cost-effective option for decarbonisation**

2.31 The committee heard from several submitters that residential electrification is one of the most cost-effective opportunities to reduce carbon emissions.<sup>48</sup> For example, the Public Interest Advocacy Centre submitted that:

Efficient household electrification is a key part of the lowest cost pathway for decarbonising the energy system and improving long term energy affordability and equity. Early-adopting households with the means to do so are already demonstrating the significant cost, health and sustainability benefits efficient electrification can enable.<sup>49</sup>

2.32 The IEEFA also argued that, given households use 11 per cent of fossil fuel gas and that electric household appliances are mature and cost-effective technologies, 'decarbonising residential fossil gas as early as possible makes economic sense'.<sup>50</sup> The IEEFA noted that 'conventional marginal abatement cost curves typically show residential electrification as one of the lowest-cost (often negative-cost) decarbonisation option'.<sup>51</sup> Further, IEEFA added that more recent and sophisticated models, which consider interactions between different decarbonisation options, also found that 'residential electrification is one of the lowest-cost decarbonisation options', particularly when:

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<sup>47</sup> Mr Rainer Korte, Chief Operating Officer, ElectraNet, *Committee Hansard*, 22 November 2023, p. 9.

<sup>48</sup> See, for example, AATSE, *Submission 5*, p. 1; Energy Efficiency Council, *Submission 47*, p. 3.

<sup>49</sup> Public Interest Advocacy Centre, *Submission 59*, p. 1.

<sup>50</sup> IEEFA, *Submission 23*, p. 9.

<sup>51</sup> IEEFA, *Submission 23*, p. 9.

- the marginal cost of abatement for electrification decreases as the emissions intensity of the electricity supply decreases; and
- increased household energy efficiency measures are also likely to reduce the required investment in electrification.<sup>52</sup>

2.33 In contrast, Dr Robert Barr, Director of Electric Power Consulting, told the committee that he did not consider that the case for electrification driving down emissions had been made. Rather, Dr Barr prioritised getting emissions down in the grid first and considered it ‘premature to go ahead with the electrification at the present time, particularly in New South Wales and Victoria’. Additionally, Dr Barr commented that:

It's a very difficult task, getting emissions levels down. I think in the 2030s it would be moving towards nuclear. We've got to patch the system up and we've got to keep the system going until we reach that time when we can bring online some nuclear power stations, which could actually drive emissions down to the levels that would make electrification worthwhile.<sup>53</sup>

2.34 Additionally, Dr David Sweetin, Director of Sweeting Consulting, argued that it would be difficult to reduce energy prices when transmission costs had increased. Further, Dr Sweeting commented on the costs associated with firming systems, particularly replacing batteries after an estimated lifespan of ‘at best, 10 years’. Dr Sweeting concluded that ‘[y]ou can't think of these renewables as just a capital cost. They're almost a running cost, because they fail so much’.<sup>54</sup>

2.35 Other submitters argued for a holistic approach to emissions reduction. For instance, energy infrastructure business APA Group argued that ‘... greater emissions reductions will be achieved through a whole of system approach to decarbonisation, rather than focusing on the electrification of a particular group of consumers.’<sup>55</sup> APA Group cited commissioned research on the role of gas infrastructure in Australia’s energy transition which found that:

... adopting a whole-of-system approach will support the decarbonisation of the economy at least cost. Adopting this whole-of-system approach, there are three actions that will contribute most to emissions reduction in Australia: i) retiring coal-fired generation; ii) electrification of light vehicles; and iii) decarbonising industrial gas loads.<sup>56</sup>

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<sup>52</sup> IEEFA, *Submission 23*, p. 9.

<sup>53</sup> Dr Robert Barr, Director, Electric Power Consulting, *Committee Hansard*, 22 November 2023, p. 20.

<sup>54</sup> Dr David Sweeting, Director, Sweeting Consulting, *Committee Hansard*, 22 November 2023, p. 20.

<sup>55</sup> APA Group Limited, *Submission 29*, p. 4.

<sup>56</sup> APA Group Limited, *Submission 29*, p. 4.

## **Economic opportunities of residential electrification**

2.36 Many inquiry participants pointed to what they considered were the economic benefits of residential electrification. As outlined in the following section, the committee heard that:

- by making household energy use more efficient, electrification can help reduce the rising costs of energy faced by consumers;
- the scale of the residential electrification transition has the potential to create thousands of jobs in the electrical sector; and
- residential electrification has the potential to distribute electricity generation at the household level and scale up domestic energy capacity.

## **Reducing rising costs of energy for Australian households**

2.37 The committee received a range of evidence on the costs and benefits associated with residential electrification. In particular, the committee heard that energy efficient electric appliances can directly reduce households' costs and, more broadly, reduce households' exposure to energy price inflation.

2.38 By international standards, Australian households face high energy costs. Dux Hot Water noted that, in August 2020, the International Energy Agency reported that household electricity prices in Australia were the ninth most expensive of 36 selected Organisation for Economic Co-operation and Development members and 78 per cent more expensive than in the United States. Dux Hot Water further pointed to evidence that 'energy poverty' was a growing problem in Australia.<sup>57</sup>

2.39 Alongside rising energy costs, households are also experiencing historically high rates of inflation across a range of essential goods and services. The Climate Council of Australia (Climate Council) argued that the reliance on costly fossil fuels in Australia, alongside poor energy efficiency in Australian homes, was 'driving up energy costs' and contributing to cost of living challenges.<sup>58</sup>

2.40 According to the IEEFA 'households that consume gas are more exposed to energy price inflation than if those loads were switched to electricity'.<sup>59</sup> Indeed, analysis submitted by IEEFA found that the consumer price index for electricity as a household fuel increased by 11 per cent between September 2017 and July 2023, compared with a 35 per cent increase for 'Gas and other fuels', as shown below in **Figure 2.4**.

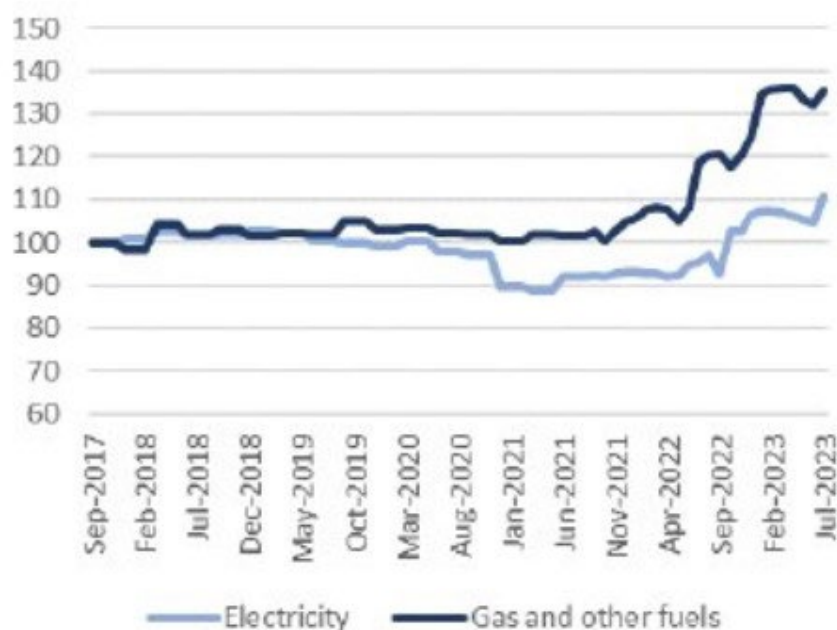
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<sup>57</sup> Dux Hot Water, *Submission 8*, p. [3].

<sup>58</sup> Climate Council of Australia, *Submission 9*, p. 3.

<sup>59</sup> IEEFA, *Submission 22*, p. 3.

**Figure 2.5 Consumer price index of electricity compared with gas and other household fuels, 2017–23**



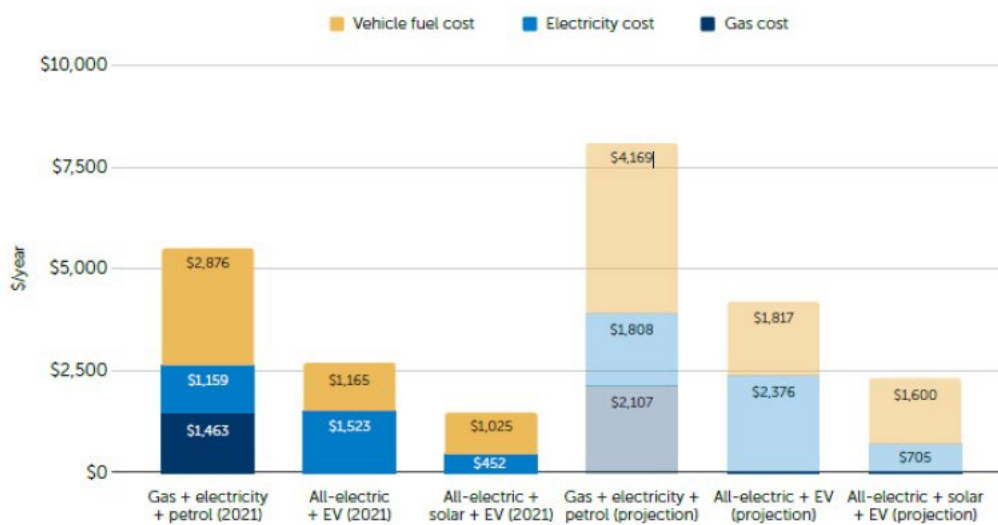
Source: Institute of Energy Economics and Financial Analysis, *Submission 23*, p. 3.

- 2.41 The committee heard from several submitters that replacing gas appliances in households with electric equivalents can result in cost savings for consumers and ease cost of living pressures.<sup>60</sup>
- 2.42 The Energy Efficiency Council (EEC) described electric household technologies as a ‘powerful antidote to cost-of-living pressures’. Further, Mr Luke Menzel, Chief Executive Officer of the EEC told the committee that:
- New homes cost the same to build and are cheaper to run when they are all electric as compared to dual-fuel homes, and existing households that go all electric will be better off over 10 years, even when you account for the capital costs—and, of course, there are a number of incentive schemes and programs around the country that can help households defray those costs.<sup>61</sup>
- 2.43 Based on several price assumptions, Beyond Zero Emissions’ modelling shows projected household energy savings from all-electric homes, particularly when combined with solar PV, as shown below in **Figure 2.5**.

<sup>60</sup> See, for example, Green Building Council of Australia, *Submission 75*, p. [6].

<sup>61</sup> Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2024, p. 1.

**Figure 2.6 Beyond Zero Emissions modelling of energy cost savings for electrified households**



Source: *Beyond Zero Emissions, Submission 19, p. 2.*

- 2.44 Several other submitters also considered that household electrification would have positive price impacts for consumers. For example, using energy prices current at the time of its submission, IEEFA found that using electricity to run efficient appliances is 43 to 77 per cent cheaper than gas in Australia.<sup>62</sup> Similarly, Strata Partners submitted that:

Savings achieved by upgrading hot water systems to a heat pump which typically achieve an average annual saving of \$420 per dwelling per couple. The payback period of a heat pump system being between 3–5 years (faster for larger families or higher use cases) while the lifespan of this system can be up to 15 years.<sup>63</sup>

### ***Reducing energy price inflation***

- 2.45 Additionally, several submitters considered that residential electrification would reduce energy price inflation in Australia.<sup>64</sup>
- 2.46 For instance, the Australian Renewables Academy submitted that electrification ‘will provide a buffer against energy price inflation by enabling homeowners to generate and manage their own power supply’.<sup>65</sup> Further, Tesla’s submission noted that the use of home battery technology will compound the benefits of

<sup>62</sup> IEEFA, *Submission 23*, p. 8.

<sup>63</sup> Strata Partners, *Submission 136*, p. 3.

<sup>64</sup> See, for example, *Rewiring Australia, Submission 132*, pp. 6, 53 and Zero Emissions Noosa (ZEN) Inc, *Submission 107*, p. 11.

<sup>65</sup> Australian Renewables Academy, *Submission 2*, p. 2.

household electrification, including by reducing costs associated with upgrading Australia's energy system.<sup>66</sup>

2.47 However, Housing Institute Australia cautioned that the increasing proportion of energy costs in household budgets is 'unlikely to be alleviated' in circumstances where there are:

- reduced competition from disincentives for hydrogen and biofuels;
- pecuniary externalities which 'negatively affect customers remaining on traditional fuels, e.g. gas'; and
- 'increased capital costs and increased fixed costs for distribution networks offset or outpace savings in the energy component'.<sup>67</sup>

2.48 The committee also heard from several submitters of the disproportionate impacts high-energy costs have on low-income households.<sup>68</sup> As discussed further in **Chapter 3**, submitters strongly argued that policy measures are needed to ensure households are not priced out of the electrification transition.

### **Job creation**

2.49 Several inquiry participants considered that the transition to residential electrification will create many new jobs.<sup>69</sup> Evidence to the committee contained a range of estimates of the numbers of jobs that would be created, however it is clear that residential electrification and, more broadly, the transition to renewable energy, are anticipated to have considerable labour market benefits.

2.50 Globally, the International Energy Agency (IEA) has estimated that '[a]round 9-30 jobs would be created for every million dollars invested in energy efficiency measures in the buildings sector'.<sup>70</sup> The IEA reported that jobs created in construction would be 'mostly local', while jobs in manufacturing and the industrial sector would be 'created by increased demand for building materials and equipment such as insulation, efficient glazing and heat pumps ...'<sup>71</sup>

2.51 In Australia, employment opportunities are also anticipated to be created across a range of sectors. As Bank Australia submitted:

Residential electrification also involves opportunities for job creation across a range of sectors, including construction, engineering and project management. The Federal Government should also consider how the

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<sup>66</sup> Tesla, *Submission 42*, p. [3].

<sup>67</sup> Housing Institute Australia, *Submission 65*, p. 3.

<sup>68</sup> See, for example, Energetic Communities, *Submission 73*, p. 4.

<sup>69</sup> See, for example, Mr Derbyshire, AATSE, *Committee Hansard*, 22 March 2024, p. 8.

<sup>70</sup> International Energy Agency (IEA), *Sustainable recovery: World Energy Outlook Special Report*, June 2020, p. 69.

<sup>71</sup> IEA, *Sustainable recovery: World Energy Outlook Special Report*, June 2020, p. 71.

stimulation of this employment market could provide equitable social outcomes, such as creating employment in communities affected by the decarbonisation of the energy sector.<sup>72</sup>

- 2.52 Similarly, the Australian Renewables Academy also submitted that the transition to residential electrification would generate jobs, including in regional Australia:

Transitioning to a clean energy economy will generate thousands of new jobs nationwide. This will be particularly prevalent in the installation, maintenance, and ancillary industries related to renewable energy infrastructure. Furthermore, the design, installation and maintenance of energy-efficient and smart homes can be a significant source of employment, especially in regional areas.<sup>73</sup>

- 2.53 The committee heard a range of estimates regarding the number of jobs associated with residential electrification. For instance, the AATSE told the committee that the ‘transition to residential electrification is poised to create approximately 20,000 full-time jobs, highlighting the economic benefits that this shift can provide’.<sup>74</sup>

- 2.54 Beyond Zero Emissions told the committee that, based on modelling of the electrification of 5 million residential homes and the replacement of 12 million fixed gas appliances, an estimated 87 500 jobs will be required to replace gas fired heating systems, gas fired hot water systems, gas cooktops and ovens, insulation, and solar panels and batteries.<sup>75</sup>

- 2.55 Further, the Electrical Trades Union of Australia (ETUA) submitted that, based on 2019 analysis by Green Energy Markets, ‘residential efficiency upgrades had the potential to generate over 34,000 job-years for Australian workers’.<sup>76</sup> Equivalent upgrades in commercial buildings were ‘anticipated to provide opportunities for a further 47,545 job-years’.<sup>77</sup> The ETUA added that the analysis did not factor in the:

... the employment opportunities of electrification initiatives such as rooftop solar and battery installations, EV charging installations, and the rollout of smart meters, which should provide thousands of further opportunities for skilled Australian tradespeople in the coming decade.<sup>78</sup>

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<sup>72</sup> Bank Australia, *Submission 90*, p. 3.

<sup>73</sup> Australian Renewables Academy, *Submission 2*, p. 2.

<sup>74</sup> Mr Derbyshire, AATSE, *Committee Hansard*, 22 March 2024, p. 8.

<sup>75</sup> See, Beyond Zero Emissions, *Submission 19*, p. 3.

<sup>76</sup> Electrical Trades Union of Australia, *Submission 105*, p. 3.

<sup>77</sup> Electrical Trades Union of Australia, *Submission 105*, p. 3.

<sup>78</sup> Electrical Trades Union of Australia, *Submission 105*, p. 3.

2.56 Master Electricians Australia (MEA) noted that electricians trained and employed by small to medium enterprises would undertake the majority of the work associated with residential electrification in Australia. The MEA noted that the benefits of this include ‘local employment and training for skilled occupations, leading to well-paid careers and employment’.<sup>79</sup>

2.57 Similarly, AEMO also considered that:

NEM regions are forecast to need over 60,000 people in jobs to build and maintain energy infrastructure over the next 20 years. As both global trade and Australian policies press for low emission products, new opportunities may emerge in hydrogen, data services, agriculture, aluminium and steel production and minerals processing.<sup>80</sup>

### *Jobs in manufacturing*

2.58 The committee also received evidence that the transition to electrification presents a significant opportunity to create jobs in local manufacturing.

2.59 For instance, the Climate Council submitted that ‘Australia is rich in many raw materials for manufacturing the components of an all-electric home’ and that ‘[r]ather than sending our minerals offshore as lower-value raw materials, there is a huge opportunity to boost processing and advanced manufacturing at home’.<sup>81</sup> Research by Beyond Zero Emissions suggests that supporting manufacturing supply chains for a range technologies that underpin residential electrification will have significant economic benefits. For instance, Beyond Zero Emissions research has variously suggested that:

- Australia could build a ‘5GW solar supply chain, creating 5,820 jobs and adding \$21 billion to GDP by 2035’;<sup>82</sup>
- ‘driving demand and local supply of heat pumps could reduce emissions by 11% and benefit the Australian economy by generating \$28.9 billion in revenue and creating at least 18,000 jobs by 2030’;<sup>83</sup> and
- ‘an Australian lithium battery industry could deliver over \$57 billion in GDP and 44,000 jobs in 2035 alone’.<sup>84</sup>

2.60 SunDrive Solar, a solar technology company in Sydney, submitted that manufacturing advanced solar photovoltaic cells will have a range of benefits, including ‘creating thousands of jobs (particularly in transitioning regional

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<sup>79</sup> Master Electricians Australia, *Submission 10*, p. 4.

<sup>80</sup> Australian Energy Market Operator, *2024 Integrated system plan for the National Electricity Market*, June 2024, p. 8.

<sup>81</sup> Climate Council of Australia, *Submission 9*, p. 14.

<sup>82</sup> Beyond Zero Emissions, *Solar supply chains: Briefing paper*, April 2024, p. 4.

<sup>83</sup> Beyond Zero Emissions, *Heat pumps supply chains: Briefing paper*, February 2024, p. 1.

<sup>84</sup> Beyond Zero Emissions, *Battery supply chains: Briefing paper*, November 2023, p. 3.

areas)<sup>.85</sup> SunDrive Solar estimated that installing 60GW of solar each year for the next 30 years, to help reach our Net Zero by 2050 target, would create up to 60 000 jobs in Australia.<sup>.86</sup> Further, SunDrive Solar emphasised the view that a ‘domestic solar manufacturing industry would reduce costs for consumers and ensure sovereign capability’.<sup>.87</sup>

### ***Workforce shortfalls could impede electrification efforts***

2.61 While electrification is expected to create new jobs, the increased demand from households to electrify is also anticipated to exacerbate Australia’s workforce shortages, particularly for qualified electricians.

2.62 For instance, the National Electrical and Communications Association (NECA) told the committee that some 35 000 additional electricians are required by 2030 to satisfy the current workload plus the renewable energy sector.<sup>.88</sup> Mr Neil Johns, Director, Policy, Technical and Safety at NECA explained that:

We need 35,000 electricians to be trained and in place by 2030. That sounds a long way away, but it's only five years. We're already halfway through our first intake of apprentices. Based on the number of apprentices entering into the system and those qualifying—I could argue that while NECA has a 92 per cent completion rate, the average completion rate for an electrician is around 52 per cent. You have to put something like 70,000 young men and women through the training system to get 35,000 electricians. That is a huge task that we require.

2.63 To address the abovementioned issues, inquiry participants made several proposals to improve workforce capacity. For example, Mr Marc England, Chief Executive Officer, Ausgrid, told the committee that policies to ‘encourage and enable private enterprise to develop those trained skills and develop people leaving school at 16, leaving school at 18 to even university graduates’ will help to develop skills needed to the energy transition.<sup>.89</sup>

2.64 The Electrical Trades Union (ETU) advocated for measures to increase the participation and retention of women in trade jobs. Dr Katie Hepworth, National Policy Director of the ETU, outlined that while there are examples or

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<sup>85</sup> SunDrive Solar, *Submission 115*, p. 1.

<sup>86</sup> Note, SunDrive cited data from Net Zero Australia that 1900 GW of solar is needed to reach net zero and, with around 30 GW installed, an additional 60 GW of solar would need to be installed each year for the next 30 years to reach net zero. See, SunDrive Solar, *Submission 115*, p. 2.

<sup>87</sup> SunDrive Solar, *Submission 115*, p. 3.

<sup>88</sup> Mr Neil Johns, Director, Policy, Technical and Safety, National Electrical and Communications Association, *Committee Hansard*, 21 February 2024, p. 10.

<sup>89</sup> Mr Marc England, Chief Executive Officer, Ausgrid, *Committee Hansard*, 22 November 2023, p. 16.

programs to help women enter trade workforce, efforts are also needed to ‘make sure women stay in the trades once they get there’.<sup>90</sup> Dr Hepworth elaborated:

There are really significant issues with completion rates for all genders but also women staying in the trades once they get there. What we’ve seen is that you really need those supports and multiple women starting on a site to really keep them attached to the industry once they get through. We’ve made different proposals around exemplar projects where the government can incentivise higher targets on major construction projects or major infrastructure targets for women to allow a larger cohort of women to move through their apprenticeship and stay onsite as they go through, noting that really leads to the cultural change that you need to keep women attached to the industry.<sup>91</sup>

2.65 To help support the electrification workforce, Rewiring Australia recommended:

- providing funding for energy transition registered training organisations;
- requiring government-funded projects and companies in receipt of government funding to ‘deliver on training mandates’;
- funding supports for apprentices to improve completion rates; and
- improving the attraction and retention of apprentices and trainees.<sup>92</sup>

### **Scaling up domestic capacity and improved energy security**

2.66 Evidence from several inquiry participants outlined that the transition to residential electrification could enhance Australia’s domestic energy capacity and improve energy security.

2.67 For example, Zero Emissions Noosa submitted that:

... scaling up domestic capacity for renewable energy production is another significant economic opportunity presented by household electrification. By increasing our domestic capacity, Australia can not only meet its own energy needs but also potentially export renewable energy, creating a new source of national income.<sup>93</sup>

2.68 Other inquiry participants considered that domestic capacity would be enhanced by increasing the manufacturing capabilities needed to support electrification technologies. For instance, the Australian Renewables Academy submitted that the development of local battery storage, energy management

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<sup>90</sup> Dr Katie Hepworth, National Policy Director, Electrical Trades Union, *Committee Hansard*, 21 February 2023, p. 15.

<sup>91</sup> Dr Hepworth, Electrical Trades Union, *Committee Hansard*, 21 February 2023, p. 15.

<sup>92</sup> Rewiring Australia, *Submission 132*, p. 5.

<sup>93</sup> Zero Emissions Noosa (Zen) Inc, *Submission 107*, p. 11.

systems, and electric vehicle technology could reduce dependence on imports and expand Australia's industrial capacity.<sup>94</sup>

- 2.69 Additionally, the ACT Government submitted residential electrification has the potential to stimulate domestic manufacturing for locally supplied products such as LED lighting:

Programs that incentivise households to switch from gas to electricity or be more energy efficient can provide confidence to and stimulate the market and helps to scale up domestic capacity to locally supply products to households. An increase in demand for products can help to embed these products into the market. Examples of this in the ACT have been LED lighting in small to medium businesses via the Energy Efficiency Improvement Scheme and solar panel installation via the Sustainable Household Scheme.<sup>95</sup>

- 2.70 Inquiry participants also emphasised the potential for residential electrification technologies to improve energy security. For instance, Beyond Zero Emissions submitted that residential electrification including solar panels and batteries could act as a buffer against energy price volatility as well as supporting energy security in the case of extreme weather events. Beyond Zero Emissions cited storms in South Australia in 2016 which caused widespread blackouts, and noted that extreme weather events will be an increasing part of life in Australia. According to Beyond Zero Emissions, increasing Australia's energy independence would be a climate change adaption that could improve community resilience.<sup>96</sup>
- 2.71 Master Electricians Australia was of the view the best way to improve domestic energy security would be to distribute generation assets throughout the electricity grid and avoid 'concentrating generation and transmission bottle necks in a smaller number of large renewable energy zones.' They further stated that consumer energy sources could build resilience in the network, working in a similarly distributed manner as the modern internet operates.<sup>97</sup>
- 2.72 The Conservation Council ACT Region submitted that '[w]ith an abundance of solar energy, electrification is an easy pathway to domestic energy security as well as energy resilience for individual households'.<sup>98</sup>

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<sup>94</sup> Australian Renewables Academy, *Submission 2*, p. 2.

<sup>95</sup> ACT Government, *Submission 31*, p. 6.

<sup>96</sup> Beyond Zero Emissions, *Submission 19*, p. 9.

<sup>97</sup> Master Electricians Australia, *Submission 10*, p. 6.

<sup>98</sup> Conservation Council ACT Region, *Submission 52*, p. 5.

2.73 In its submission, APGA also addressed the question of energy security, but argued that this would be improved ‘through the deployment of parallel and complimentary renewable gas and renewable electricity supply chains’.<sup>99</sup>

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<sup>99</sup> Australian Pipeline and Gas Association, *Submission 79*, p. [41].



# Chapter 3

## Consumer barriers and supports

3.1 As outlined in the previous chapter, electrification presents a significant opportunity to improve residential energy efficiency. Yet the committee also received evidence that Australians can face significant barriers to accessing the benefits of electrification.<sup>1</sup> As considered in this chapter, such barriers can include or relate to:

- the high upfront cost of energy efficient electric technologies;
- the tenure type of Australia’s residential dwellings; and
- the awareness of consumers on the options to electrify.

3.2 Further, this chapter considers inquiry participants’ evidence on the role of supports to assist Australians to overcome barriers to electrification.

### **The high upfront costs of electrification**

3.3 The upfront cost of installing energy efficient electric appliances is a major barrier to electrification for many households.<sup>2</sup> Electric appliances often cost more than gas appliances and can be unaffordable for many consumers even if they believe that electric appliances can reduce their energy costs over time.<sup>3</sup>

3.4 Inquiry participants provided a range of evidence on the upfront costs for households to electrify. For instance, the committee heard that the retail cost of a 170-litre electric heat pump for residential water heating ranged from \$1888 to \$5340, while an equivalent gas appliance retailed for \$1245 to \$1950.<sup>4</sup>

3.5 For households seeking to install multiple electric appliances, the costs can be significantly higher. Indeed, the committee heard that:

- replacing gas, water, room heating and cooking appliances with electric alternatives can cost a household upwards of \$7800 ‘depending on the chosen brand, model, and installation costs’;<sup>5</sup> and

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<sup>1</sup> See, for example, Grattan Institute, *Submission 36*, p. 2; Battery Storage and Grid Integration Program, ANU, *Submission 43*, p. 5; Jewish Climate Network, *Submission 28*, pp. 3, 4; Public Interest Advocacy Centre (PIAC), *Submission 59*, p. 7.

<sup>2</sup> See, for example, Wangaratta Landcare & Sustainability Inc, *Submission 45*, p. 2; Newtown Climate, *Submission 76*, p. 2; Johns Lyng Energy Services, *Submission 88*, [p. 1]; Australian Parents for Climate Action (APCA), *Submission 94*, p. 6.

<sup>3</sup> Newtown Climate, *Submission 76*, p. 2.

<sup>4</sup> Beyond Zero Emissions, *Submission 19*, pp. 3–4.

<sup>5</sup> Climate Council, *Submission 9*, p. 15.

- electrifying space heating, water heating and cooking appliances of an average Victorian household can cost \$11 300 before government rebates.<sup>6</sup>
- 3.6 At the upper end of the cost estimates, Dr Saul Griffith, Co-Founder and Chief Scientist at Rewiring Australia, told the committee that electrifying a household can cost as much as \$20 000 to \$60 000, depending on the extent of the upgrades.<sup>7</sup> As Dr Griffith explained:
- If your water heater goes today, you have a choice of buying a \$1,000 gas heater tomorrow or a \$2½ thousand electric heat pump. If you have to buy a car tomorrow, you have a choice between a \$40,000 petrol car and a \$55,000 electric car. What I'm talking about is what they call the 'green premium', so it's the slightly more expensive piece. You need an extra thousand for the water heater and an extra \$10,000 for each of the vehicles. You need about \$10,000 for a solar system and another \$10,000 for a battery.<sup>8</sup>
- 3.7 On top of the costs of upgrading to electric appliances, consumers can face significant costs to upgrade the capacity of their home's electrical system. The committee heard that '[u]pgrading wiring and switchboards can add approximately \$5,000 to household electrification and may not be viable for some older houses'.<sup>9</sup> Professor Ty Christopher, Director of the Energy Futures Network at the University of Wollongong, explained that:
- It is common for consumers seeking to electrify their homes to be faced with the need to upgrade their home switchboards, home internal wiring and even their 'consumers mains', which are the wires connecting the home to the electricity network in the street. The costs associated with internal home wiring upgrades can often cause consumers to adopt 'like for like' appliance replacement options, thereby impeding the home electrician journey.<sup>10</sup>
- 3.8 Moreover, Australians seeking to install consumer energy resources (CERs)—such as rooftop solar or battery energy storage systems (BESS)—face significant additional costs.<sup>11</sup> Master Electricians Australia, for instance, submitted that the cost to install a household BESS ranged from 'approximately \$1000 to \$1300 per KW'.<sup>12</sup> With the average home battery being 8–10 KW, an Australia household can expect to face an approximate BESS cost of \$8000 to \$13 000.<sup>13</sup>

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<sup>6</sup> Institute for Energy Economics and Financial Analysis (IEEFA), *Submission 23*, p. 7.

<sup>7</sup> Dr Saul Griffith, Co-Founder and Chief Scientist, Rewiring Australia, *Committee Hansard*, 22 March 2024, p. 2.

<sup>8</sup> Dr Griffith, Rewiring Australia, *Committee Hansard*, 22 March 2024, p. 2.

<sup>9</sup> City of Greater Bendigo, *Submission 87*, p. 3.

<sup>10</sup> Professor Ty Christopher, *Submission 227*, p. 5.

<sup>11</sup> Zero Emissions Noosa, *Submission 107*, p. 6.

<sup>12</sup> Master Electricians Australia, *Submission 10*, p. 5.

<sup>13</sup> Master Electricians Australia, *Submission 10*, p. 5.

### Support for overcoming the high upfront costs of electrification

3.9 The committee heard that access to government programs and grants are crucial to enabling household electrification.<sup>14</sup> In particular, inquiry participants told the committee that while electrification technologies can help to significantly reduce future household energy costs, more supports are needed to help households overcome the upfront costs associated with electrifying, particularly for those on lower-incomes.<sup>15</sup> For example, the Australian Energy Council submitted that:

The challenge is less about cost efficiency over time and more about how to support households with the initial upfront cost hurdle, especially for low-income earners. Government subsidies and rebates are one way to cushion these costs and such policies have successfully incentivised early uptake of electric appliances in overseas jurisdictions.<sup>16</sup>

3.10 Many other inquiry participants considered that well designed financial supports are needed to help reduce the upfront costs of electrification for consumers and increase the uptake of electric appliances by Australian households.<sup>17</sup>

3.11 Other submitters advocated for more financial incentives to promote residential electrification, often in the form of grants, subsidies or tax deductions.<sup>18</sup> For example, the Jewish Climate Network recommended financing models to cover the up-front costs of electrification upgrades noting these are low effort for consumers, reducing barriers to entry.<sup>19</sup> Similarly, Johns Lyng Energy Services, advocated for ‘more government incentives and programs that make renewable energy systems more accessible and affordable for everyone’. It suggested models such as rebates for reducing fossil fuel energy supply or grants to support the investment in energy-efficient technologies.<sup>20</sup>

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<sup>14</sup> Evoenergy, *Submission 35*, p. 8.

<sup>15</sup> See, for example, Dr Griffith, *Rewiring Australia, Committee Hansard*, 22 March 2024, p. 2; Professor Ken Baldwin, Fellow, Australian Academy of Technological Sciences and Engineering (AATSE), *Committee Hansard*, 22 March 2024, p. 9; IEEFA, *Submission 23*, p. 4; Brighte, *Submission 98*, p. 5.

<sup>16</sup> Australian Energy Council, *Submission 91*, p. 5.

<sup>17</sup> See, for example, ACT Government, *Submission 31*, p. 11; Evoenergy, *Submission 35*, p. 1; Victorian Greenhouse Alliances, *Submission 38*, pp. 2–3; Asthma Australia, *Submission 39*, p. 4; Energy Efficiency Council, *Submission 47*, p. 10; PIAC, *Submission 59*, p. 8; Environment Victoria, *Submission 86*, p. 14; Zero Emissions Noosa, *Submission 107*, p. 12; Johns Lyng Energy Services, *Submission 88*, p. [1]; Climate Council of Australia, *Submission 9*, p. 15; *Rewiring Australia, Submission 132*, p. 29.

<sup>18</sup> See, for example, Tesla, *Submission 42*, p. [7].

<sup>19</sup> Jewish Climate Network, *Submission 28*, p. 3.

<sup>20</sup> Johns Lyng Energy Services, *Submission 88*, p. [1];

3.12 Additionally, the committee heard that options to decrease consumer financing costs may help to make residential electrification technologies more cost competitive while they gain commercial scale.<sup>21</sup>

### *Existing support programs*

3.13 The committee heard that there are a range of existing Commonwealth, state and territory government-funded incentives and other initiatives aimed at reducing the barriers to residential electrification in Australia.<sup>22</sup> Inquiry participants expressed a range of views on the design of those supports. Subsidisation of any product by the Government risks driving market distortion and renewable energy is no exception.

3.14 For example, the committee heard that the Small-scale Renewable Energy Scheme (SRES) has been key to accelerating the uptake of rooftop solar.<sup>23</sup> The Clean Energy Council (CEC), which has accreditation functions under the SRES, submitted that rooftop solar in Australia ‘has been built off the back of a very successful [SRES] program’. The CEC said that the SRES, in addition to helping reduce the upfront cost of rooftop solar, had also helped build a ‘very strong’ industry compliance program.<sup>24</sup>

3.15 However, some inquiry participants argued in favour of extending the scope of the SRES to incorporate battery energy storage systems (BESS).<sup>25</sup> For instance, Evergen submitted that the current gap in support for households to install BESS should be addressed by including BESS in the SRES.<sup>26</sup>

3.16 Other inquiry participants raised concerns regarding the design of existing electrification support initiatives.<sup>27</sup>

3.17 For instance, the committee heard that the interaction between various financial incentive schemes has resulted in an over-subsidisation of certain appliances which, in turn, has led to inappropriate or poor-quality appliances being

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<sup>21</sup> Australian Banking Association, *Submission 93*, p. 4.

<sup>22</sup> See, for example, DCCEEW, *Submission 226*, pp. 7–9; Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 1; Tesla, *Submission 42*, pp. 6–7; Rewiring Australia, *Submission 132*, p. 1.

<sup>23</sup> Note, the SRES ‘supports electrification by providing a financial incentive for households, small businesses, and community groups to install small-scale renewable energy systems (including solar water heaters)’. See, DCCEEW, *Submission 226*, p. 8.

<sup>24</sup> Clean Energy Council, *Submission 37*, p. 8.

<sup>25</sup> See, for example, Tesla, *Submission 42*, p. [5]; Solar Citizens, *Submission 81*, p. 11.

<sup>26</sup> See, for example, Evergen, *Submission 22*, pp. [1] and [6].

<sup>27</sup> See, for example, BOOMPower, *Submission 55*, p. [2].

installed in Australian households. As Mr Chris Taylor, Managing Director of Rheem Australia (Rheem) outlined in evidence to the committee:

The key issue that we have at the moment is oversubsidising at a federal and a state level and in some cases then some additional subsidies such as a third one in Victoria, for example, which would be Solar Victoria. What you have is a scenario where you have multiple schemes overlaying each other to the point where we get products down to virtually free for imported products versus products that are manufactured in Australia that don't get down to free. Free might sound like a good thing but actually when you're up against free it's very difficult to sell the value of the additional quality, longevity and functionality.<sup>28</sup>

- 3.18 Further, Rheem contended that when an appliance is effectively made free, consumers have less of a stake in the appliance. In turn, consumers can be 'more susceptible to the sorts of high-pressure sales tactics, misleading advertising or activity by unscrupulous providers that we're seeing in the market that a number of the state regulators are very busy trying to stamp out'.<sup>29</sup>
- 3.19 To remedy these issues, Rheem argued that setting a minimum out-of-pocket cost for consumers would 'help to protect consumers' and ensure a positive consumer experience.<sup>30</sup> At the same time, Rheem emphasised its support for schemes that make electrification upgrades accessible for Australians.<sup>31</sup>

#### *Low, zero interest and income contingent loan schemes*

- 3.20 Further to the supports discussed above, several inquiry participants considered that residential electrification loan schemes could help to reduce the upfront costs for households to electrify while minimising costs to government.<sup>32</sup>
- 3.21 For instance, the Climate Council of Australia explained that low and zero-interest loans would be beneficial for both consumers and governments:

Government incentives can play an essential role in removing this cost barrier. Low and zero-interest loan schemes can be beneficial because they address households' upfront purchase and installation costs and are more affordable for governments to provide at scale than direct grants.<sup>33</sup>

- 3.22 Inquiry participants also provided a range of evidence on the design features of such loan schemes. Newtown Climate, for instance, submitted that a loan scheme should have interest rates fixed at zero or below the rate of the

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<sup>28</sup> Mr Chris Taylor, Managing Director, Rheem Australia, *Committee Hansard*, 21 February 2024, p. 23.

<sup>29</sup> Mr Ben Teeger, General Counsel and General Manager, Corporate Affairs, Rheem Australia, *Committee Hansard*, 21 February 2024, p. 24.

<sup>30</sup> Mr Teeger, Rheem Australia, *Committee Hansard*, 21 February 2024, p. 24.

<sup>31</sup> Mr Teeger, Rheem Australia, *Committee Hansard*, 21 February 2024, p. 24.

<sup>32</sup> See, for example, Newtown Climate, *Submission 76*, p. 4.

<sup>33</sup> Climate Council of Australia, *Submission 9*, p. 15.

Consumer Price Index, and that loan amounts should be uncapped or ‘set high enough to allow complete electrification of a family home with the most energy efficient technology’.<sup>34</sup>

3.23 However, the committee also heard that loans with low or no interest rates may not be ‘attractive or accessible to all homes, particularly those on low, fixed or precarious incomes’.<sup>35</sup>

3.24 Like several other inquiry participants, Rewiring Australia considered that an income contingent loan (ICL) scheme, similar to Australia’s HECS-HELP student loan scheme, could help address the equity issue in the transition to electrification.<sup>36</sup> Rewiring Australia summarised how an ICL scheme for residential electrification would work:

Under this policy option, government-supported household electrification loans would be repaid by income tax withholding with repayments required only after a certain income threshold has been met, with the loans secured against the upgraded property. By requiring the upgraded home as security, the loan can be repaid out of settlement funds on the transfer of title, minimising unpaid debts while ensuring access for all homeowners in Australia.<sup>37</sup>

3.25 In giving evidence to the committee, Dr Griffith noted that that the ‘lowest cost’ implementation of a financing program for residential electrification can be achieved by leveraging the cheap administrative costs of Australia’s tax system and using the low marginal borrowing rate available to the Australian Government.<sup>38</sup>

### **Barriers for low-income households**

3.26 While people on low incomes would likely benefit the most from reduced household energy costs, the high upfront costs of electric appliances mean that they face some of the greatest barriers to accessing the benefits of electrification.<sup>39</sup>

3.27 Australians on low incomes face several existing and entrenched energy-related disadvantages, including being more likely to live in poor energy performing homes, having less access to rooftop solar, and spending an average of four

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<sup>34</sup> Newton Climate, *Submission 76*, p. 1.

<sup>35</sup> Rewiring Australia, *Submission 132*, pp. 30–31.

<sup>36</sup> See, for example, Professor Baldwin, AATSE, *Committee Hansard*, 22 March 2024, p. 9; Jewish Climate Network, *Submission 28*, p. 3; Rewiring Australia, *Submission 132*, pp. 30–31.

<sup>37</sup> Rewiring Australia, *Submission 132*, p. 30.

<sup>38</sup> Dr Griffith, Rewiring Australia, *Committee Hansard*, 22 March 2024, p. 3.

<sup>39</sup> See, Australian Council of Social Service (ACOSS), *Submission 112*, p. 2.

times more of their income on energy bills.<sup>40</sup> The Australian Conservation Foundation (ACF) noted that:

Household energy costs have been estimated to account for 6.4% of income for Australia's poorest households, compared with just 1.5% for high-income households (ACOSS 2018). This is attributed to not just their lower incomes, but due to living in less expensive but poorer quality homes and owning or using inefficient appliances.<sup>41</sup>

- 3.28 Recent cost of living pressures, including increasing costs for gas, petrol and electricity disproportionately affect low-income households and further exacerbate the disadvantages they face in accessing residential electrification.<sup>42</sup> For example, the ACF submitted that:

While up-front costs are a barrier, electrification clearly reduces long term energy costs. However, cost of living challenges for households, especially vulnerable households, acts as a barrier to investment, as household prioritise food, rent and just keeping on top of utilities for example. Without assistance for the upfront costs, this is an opportunity lost and an inequity.<sup>43</sup>

- 3.29 Concerningly, the unaffordability of electric appliances for low-income households risks worsening social inequality in Australia. As Dr Griffith outlined:

You have a choice of buying a cheap machine upfront, but then you have to feed it expensive petrol, diesel or gas into the future, or you can buy a slightly more expensive machine upfront and feed it very, very cheap electricity into the future, with zero emissions.

That financing problem is not really a problem for the upper echelons of Australia's economic strata. ... the wealthier people I've met in Australia who have already gone through this household electrification report that their energy bills are practically zero. The richest members of our society now have a way to lower their cost of living even further. But the poorest members of our society struggle to get access to the finance that would enable them to upgrade their lives to a zero-emission, all-electric life.<sup>44</sup>

- 3.30 Moreover, inquiry participants warned that low-income households that cannot afford to stop using fossil fuels will be disproportionately impacted by energy price inflation. For instance, **Figure 3.1** submitted by Rewiring Australia highlights the increasing trajectory of Australian household spending on gas and petrol, alongside the financed cost of solar and battery technologies.

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<sup>40</sup> See, ACOSS, *Submission 112*, p. 5.

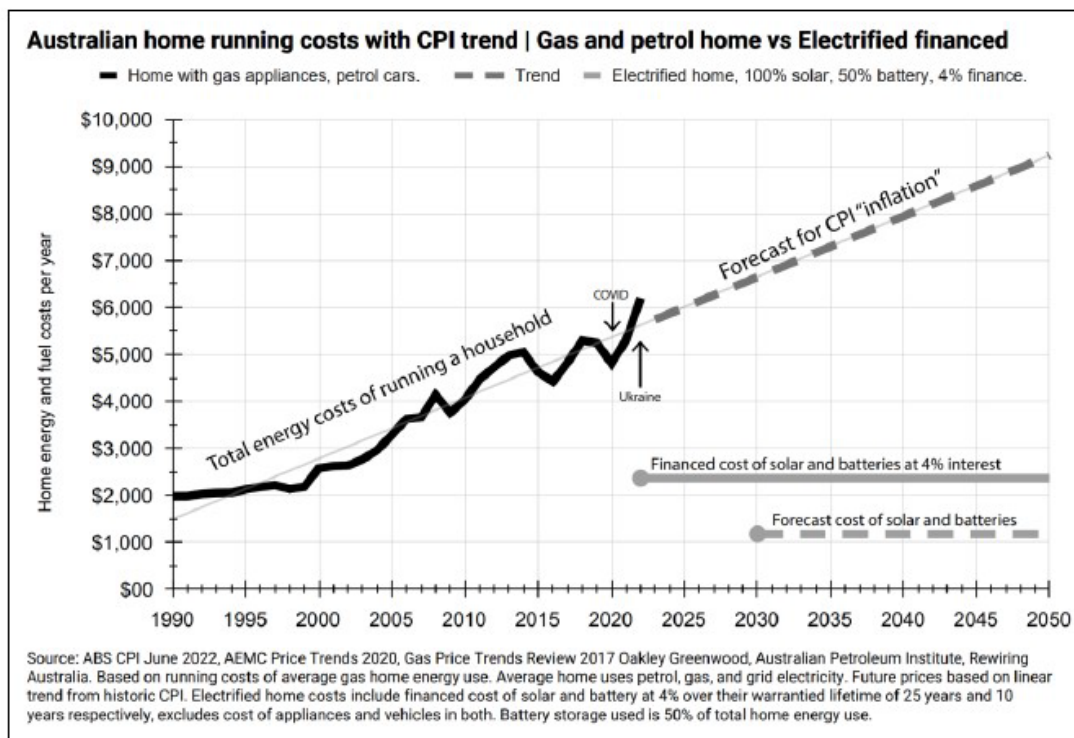
<sup>41</sup> See, for example, Australian Conservation Foundation (ACF), *Submission 53*, p. 10; Infrastructure Victoria, *Submission 18*, p. 4.

<sup>42</sup> See, Energetic Communities, *Submission 73*, p. 3.

<sup>43</sup> ACF, *Submission 53*, p. 9.

<sup>44</sup> Dr Griffith, Rewiring Australia, *Committee Hansard*, 22 March 2024, p. 2.

**Figure 3.1 Trajectory of household spending on energy**



Source: Rewiring Australia, *Submission 132*, p. 17.

3.31 Further still, the committee heard that low-income households who remain on the gas network will pay an increased proportion of gas infrastructure costs.<sup>45</sup> As such, Mr Luke Menzel, Chief Executive Officer, Energy Efficiency Council, suggested that careful consideration needs to be given to managing the transition to residential electrification:

Thinking at the systems level also means thinking carefully about the future of the gas grid and how we successfully phase that down. It also means thinking about those vulnerable Australians that don't necessarily have the capital or the wherewithal to pursue an electrification agenda and could end up being left behind and bearing the costs of a gas grid as more well-to-do Australians electrify. So this is a good idea, but the transition needs careful management if we're to derive the full benefits from the electrification journey.<sup>46</sup>

### Supports are needed for low-income households

3.32 Inquiry participants often highlighted the need for Australia's residential electrification supports to be designed in a way that specifically assist low-income households to overcome barriers to electrification.

<sup>45</sup> See, Infrastructure Victoria, *Submission 18*, p. 2; Energy Efficiency Council, *Submission 47*, p. 10; Environment Victoria, *Submission 86*, p. 14.

<sup>46</sup> Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 1.

- 3.33 Indeed, the committee heard that existing financial supports for electrification can fail to reach low-income households. For instance, Rewiring Australia told the committee that while it strongly supported disbursements from the Rewiring the Nation Fund to support small scale upgrades for households, it remained 'cautious' as it considered the initiative to be a 'concessional version of commercial lending' which would 'not reach low-income households, disadvantaged communities, or social housing'.<sup>47</sup> Further, Rewiring Australia considered that while the Household Energy Upgrades Fund (HEUF), the National Energy Transformation Partnership and the Clean Energy Finance Corporation will be an 'excellent partner' in financing electrification supports, the supports are 'inherently not scalable to reach in particular the priority beneficiaries who should be the lower income households who can't go to market'.<sup>48</sup>
- 3.34 Additionally, the UTS Institute for Sustainable Futures expressed the view that:
- ... without a regulatory nudge, households that seek a small amount of finance for the purposes of sustainability retrofitting their home will be driven into financial products with higher interest rates and shorter terms to make repayments. For low-income households, this risks being exposed to what we're calling a net zero poverty premium.<sup>49</sup>

### **Barriers to electrification for renters**

- 3.35 Alongside the high upfront costs of electrification, tenure type is one of the most significant barriers to residential electrification in Australia.<sup>50</sup> In particular, the committee received evidence that, despite many renters living in properties with low energy efficiency, renters have limited agency to upgrade their homes and landlords are not incentivised to electrify their properties.
- 3.36 Currently, around a third of Australian households rent privately and people on low incomes are also more likely to be renters.<sup>51</sup>
- 3.37 A disproportionate number of Australian renters live in properties with low energy efficiency ratings, which exacerbates the housing inequality and energy

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<sup>47</sup> Mr Dan Cass, Co-Founder and Executive Director, Rewiring Australia, *Committee Hansard*, 22 March 2024, p. 4.

<sup>48</sup> Mr Cass, Rewiring Australia, *Committee Hansard*, 22 March 2024, p. 4.

<sup>49</sup> Mr Gordon Noble, Research Director, UTS Institute for Sustainable Futures, *Committee Hansard*, 22 March 2024, p. 10.

<sup>50</sup> See, for example, South Australian Council of Social Service, *Submission 51*, p. [6]; Brotherhood of St Laurence, *Additional information 103.1*, p. 5; Solar Citizens, *Submission 81*, p. [2]; Dr Sangeetha Chandrashekeran, *Submission 100*, p. [2]; Angus Thompson, *Submission 221*, p. [1].

<sup>51</sup> ACOSS, *Submission 112*, p. 7.

affordability stress they can experience.<sup>52</sup> For instance, the Australian Council of Social Service submitted:

People who are financially disadvantaged, especially those who rent, are more likely to live in poor energy performing homes, less likely to have rooftop solar, and spend on average four times more of their income on energy bills, after they have deprived themselves of energy and other essential services.<sup>53</sup>

3.38 Moreover, people who live in social housing are even more likely to live in properties with low energy efficiency compared with private renters.<sup>54</sup>

3.39 The committee heard that current rental laws make it difficult for renters to make electrification upgrades as renters have minimal or no ability to make changes to their homes.<sup>55</sup> Further, the committee heard that while many renters reported experiencing poor housing conditions, they were unwilling to ‘raise improvements with their landlord out of fear of rent increases or eviction’.<sup>56</sup>

3.40 Some inquiry participants also viewed current policy settings as inadequate to encourage landlords to make energy efficiency upgrades to their rental properties.<sup>57</sup> Indeed, several submitters considered that there is ‘split incentive’ between renters and landlords, which adds to the barriers to residential electrification in Australia.<sup>58</sup> As SA Power Networks outlined:

‘Split incentives’ are one of the biggest barriers to Australian energy consumers participating in, and receiving the benefits of, the energy transition and electrification. These occur when those responsible for paying for energy bills (the tenant) are not the same entity as those making capital investment decisions (the landlord). Even though upgrades would in many cases provide a significant net benefit for the tenant, the split incentives act as a barrier to unlocking this potential for a significant number of residents and businesses.<sup>59</sup>

3.41 While landlords determine the type of appliances to install and pay the upfront capital costs, renters pay the operating costs for those appliances inclusive of

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<sup>52</sup> See, for example, Infrastructure Victoria, *Submission 18*, p. 4; ACF, *Submission 53*, pp. 8 and 12; APCA, *Submission 94*, p. [7].

<sup>53</sup> ACOSS, *Submission 112*, p. 5.

<sup>54</sup> See, ACTCOSS, *Additional information 14.1*, p. 28.

<sup>55</sup> ACF, *Submission 53*, p. 5.

<sup>56</sup> Brotherhood of St Laurence, *Additional information 103.1*, p. 5.

<sup>57</sup> See, for example, ACF, *Submission 53*, p. 5.

<sup>58</sup> See, for example, Professor Baldwin, *Committee Hansard*, 22 March 2024, pp. 8–9; Dr John Shiel, *Submission 72*, p. [2]; Environment Victoria, *Submission 86*, p. 15; APCA, *Submission 94*, p. 7; SA Power Networks, *Submission 99*, pp. 2, 9; Mr Alan Pears, *Submission 138*, p. [10].

<sup>59</sup> SA Power Networks, *Submission 99*, p. 9.

any potential cost.<sup>60</sup> The committee was advised that this dynamic can create a ‘perverse incentive’ for landlords to under-invest in the energy efficiency of their properties.<sup>61</sup> For instance, while about 30 per cent of all residential properties have rooftop solar installed, less than 5 per cent of rental properties have solar.<sup>62</sup> Rewiring Australia explained:

When an owner-occupier installs solar, they benefit from lower bills and might typically recover the whole investment within 5 years. The incentives to make these kinds of cost-saving investments don’t necessarily translate for renters because running costs are not borne by the landlord. Further, savings are almost entirely hidden from renters until they occupy a house, which prevents landlords from recouping the benefits of cheaper energy through higher rents.<sup>63</sup>

3.42 The City of Greater Bendigo submitted that while there are mechanisms to pass on the costs of electrification upgrades to tenants, such as energy update agreements, these mechanisms ‘can be complicated to administer and have experienced low take up’.<sup>64</sup>

### **Supports to increase renters’ access to the benefits of electrification**

3.43 Many inquiry participants considered that additional and better targeted supports are needed to overcome the barriers to the electrification for renters.

3.44 For instance, the ACF submitted that the barriers facing renters are ‘unlikely to change without significant supportive policy, changes to tax law, or mandatory energy efficiency standards that include electrification outcomes’.<sup>65</sup> Without such changes, the ACF cautioned that renters would ‘likely to miss out on the more impactful opportunities for electrification, emission reduction and improved affordability and health’.<sup>66</sup>

3.45 Inquiry participants made a range of recommendations aimed at increasing the electrification of Australia’s rental stock. For example, Mrs Davina Rooney, Chief Executive Officer, Green Building Council of Australia, told the committee that introducing a national policy to require all new homes to be electric is one

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<sup>60</sup> See, ACOSS, *Submission 112*, p. 11; Rewiring Australia, *Submission 132*, p. 35.

<sup>61</sup> Rewiring Australia, *Submission 132*, pp. 34–35.

<sup>62</sup> Rewiring Australia, *Submission 132*, p. 35.

<sup>63</sup> Rewiring Australia, *Submission 132*, p. 35.

<sup>64</sup> City of Greater Bendigo, *Submission 87*, p. [5].

<sup>65</sup> ACF, *Submission 53*, p. 5.

<sup>66</sup> ACF, *Submission 53*, p. 5.

of the main ways in which electrification outcomes can be improved for renters.<sup>67</sup> Mrs Rooney argued that the benefits of such a policy are twofold:

- (i) the issue of access to electrified properties is resolved for future renters; and
- (ii) the electrification requirement would become normalised such that tradespeople are aware of appliance standards and well positioned to recommend appropriate replacement appliances.<sup>68</sup>

3.46 For current rental properties, several inquiry participants called for additional financial supports to improve renters' access to the benefits of electrification.<sup>69</sup> For instance, SA Power Networks proposed that a targeted scheme to help rental households could 'provide eligible households with access to energy efficiency upgrades, a solar system or battery at their home in exchange for a fixed fee'.<sup>70</sup> This fee 'could be financed through the financial benefit realised through such upgrades and be added to a property charge paid for by the tenant (such as the distribution component of the electricity bill)'.<sup>71</sup>

3.47 SA Power Networks noted that pilot programs for fixed fee installations have been successfully trialled in the United States and demonstrated a way to 'effectively and equitably assigns the costs and benefits of these installations'.<sup>72</sup>

3.48 While preferencing an ICL scheme, Rewiring Australia submitted that an 'interim alternate' option could include 'on-bill financing' through which loans are made for the purchase of electric appliances and the loans repaid via electricity bills.<sup>73</sup> Rewiring Australia noted that on-bill financing:

... could be applied to any housing ownership category. However, it is a particularly attractive option for renters to fund solar installations and possibly home batteries. These investments will immediately bring down the cost of energy bills that are paid for by tenants. Ideally repayment terms would utilise concessional finance and be set up for the life of the asset (which may cover multiple tenants) which would minimise the capital

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<sup>67</sup> Mrs Davina Rooney, Chief Executive Officer, Green Building Council of Australia, *Committee Hansard*, 22 March 2024, p. 14.

<sup>68</sup> Mrs Rooney, Green Building Council of Australia, *Committee Hansard*, 22 March 2024, p. 14.

<sup>69</sup> See, for example, Energy and Water Ombudsman NSW, Energy and Water Ombudsman Queensland and Energy and Water Ombudsman South Australia, *Submission 85*, p. 8.

<sup>70</sup> SA Power Network, *Submission 99*, p. 9.

<sup>71</sup> SA Power Network, *Submission 99*, p. 9.

<sup>72</sup> SA Power Network, *Submission 99*, p. 9.

<sup>73</sup> Rewiring Australia, *Submission 132*, p. 32.

repayments and allow for some immediate energy bills savings to be realised by tenants.<sup>74</sup>

- 3.49 Rewiring Australia proposed that on-bill financing could work particularly well for solar panels and gave an example of financing a 6 KW rooftop solar system with an upfront cost of \$7000. Financed over 10 years at 9 per cent interest, Rewiring Australia submitted that repayments for the solar system would be \$100 per month while the expected energy bill savings would be \$160 per month.<sup>75</sup>
- 3.50 However, Rewiring Australia noted that on-bill financing would probably not be suitable for renters seeking to upgrade to electric household appliances, as this is the responsibility of landlords. Further, Rewiring Australia indicated that on-bill financing should be ‘deployed carefully’, taking into account energy bills being an ‘existing point of financial distress for many households’ and that ‘tenants must have transparency around repayment obligations’.<sup>76</sup>

***Further options to help improve renters’ access to residential electrification***

- 3.51 Submissions from inquiry participants raised several other options to help improve renters’ access to the benefits of residential electrification in existing properties. Examples of those options include:
- developing a strategy that supports renters’ access to the benefits of electrification and encourage rental providers to electrify;<sup>77</sup>
  - including minimum standards for energy efficiency in rental standards;<sup>78</sup>
  - creating tax incentives, including instant asset write offs, to encourage landlords to make certain electrification upgrades to rental properties;<sup>79</sup>
  - developing measures to increase the transparency of energy costs for renters;<sup>80</sup>
  - ensuring electrification ‘makes better use of daytime generation of solar through demand response, especially for households that cannot install solar, such as renters’;<sup>81</sup> and

<sup>74</sup> Rewiring Australia, *Submission 132*, p. 32.

<sup>75</sup> Rewiring Australia, *Submission 132*, p. 32.

<sup>76</sup> Rewiring Australia, *Submission 132*, p. 32.

<sup>77</sup> See, for example, ACF, *Submission 53*, p. 2; Newton Climate, *Submission 76*, p. 4.

<sup>78</sup> Infrastructure Victoria, *Submission 18*, p. 34.

<sup>79</sup> See, for example, Infrastructure Victoria, *Submission 18*, p. 34; Energy and Water Ombudsman NSW, Energy and Water Ombudsman Queensland and Energy and Water Ombudsman South Australia, *Submission 85*, p. 8.

<sup>80</sup> Infrastructure Victoria, *Submission 18*, p. 34.

<sup>81</sup> ACF, *Submission 53*, p. 10.

- longer-term lease arrangements under which landlords and tenants could come to agreement on paying for electrification upgrades.<sup>82</sup>

3.52 Some of these options are explored further in **Chapter 4**, in the context of building design and standards.

### **Supports for people living in social housing**

3.53 Several inquiry participants provided evidence on the merits of supports to ensure social housing tenants have equitable access to the benefits of electrification.

3.54 For instance, the Energy Efficiency Council (EEC) argued that ‘[i]nvesting in the efficient electrification of community, social and public housing – including Indigenous housing – is a clear responsibility for governments’.<sup>83</sup> In doing so, the EEC noted ‘[s]ocial housing tenants are unable to undertake electrification activities themselves and must not be left behind by the residential electrification wave’.<sup>84</sup>

3.55 Further, the committee heard that there are considerable economic benefits for social housing tenants. Rewiring Australia, for instance, submitted that the ‘electrification of public and community housing would deliver meaningful financial benefits to people living on low-income, as they spend disproportionately and significantly more of their income on electricity bills’. Further, Rewiring Australia called for increased government investment in the electrification of social housing:

Direct Government investment is needed to drive electrification of social housing. Through investing in public and community housing stock, electrification upgrades would drive demand and expansion of the supply chain, creating jobs and demand for skilled tradespeople, in addition to delivering economic and health benefits.

Rewiring Australia welcomed the government’s investment of \$300 million in the 2023-24 Federal budget in partnership with states and territories to electrify social housing. Funding of this scope needs to be continued into future budgets and a target should be set to electrify all social housing by 2030.<sup>85</sup>

3.56 Solar Citizens submitted in support of rolling out rooftop solar to social housing properties, supported by household batteries, to ‘bring lower energy costs to low-income households and stability support to the energy grid’.<sup>86</sup> Based on its

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<sup>82</sup> See, Dr John Shiels, *Submission 72*, pp. [3–4].

<sup>83</sup> Energy Efficiency Council, *Submission 47*, p. 9.

<sup>84</sup> Energy Efficiency Council, *Submission 47*, p. 9.

<sup>85</sup> Rewiring Australia, *Submission 132*, p. 37.

<sup>86</sup> Solar Citizens, *Submission 81*, p. [6].

2023 report *Solar potential of NSW social housing*, Solar Citizens submitted that ‘on average social housing residents stood to save \$860 in energy costs per year’.<sup>87</sup> Further, Solar Citizens submitted:

For social housing residents in separate houses, annual savings would average \$1,092 per year. The government’s outlay for the cost of the panels would be returned in tenant energy bill savings after the first 3.7 years of the solar panels’ expected life-cycle of around 20 years.<sup>88</sup>

3.57 Several other submitters also called for increased government funding and initiatives to support the electrification of Australia’s social housing stock.<sup>89</sup>

### **Coordination of residential electrification supports**

3.58 Throughout the inquiry, the committee received important evidence on the interoperability and coordination of supports for residential electrification. In particular, the committee heard that:

- there is a need for a broad ecosystem of electrification supports; and
- there is a need for improved, national coordination of electrification efforts.

### **The need for a broad ecosystem of electrification supports**

3.59 Several inquiry participants pointed out the importance of having a multi-faceted, broad ecosystem of incentives to support electrification.<sup>90</sup>

3.60 For instance, Ms Alison Scotland, Executive Director of the Australian Sustainable Built Environment Council, spoke to the need for a broad ecosystem of incentives to encourage electrification at a public hearing of the inquiry:

We need the regulations to support it. We need the minimum standards even for rental properties. Note that we’ve got owner occupied as well as rental, so we need a good mix of different policy levers to encourage that electrification.<sup>91</sup>

3.61 Similarly, Dr Griffith argued in favour of a ‘systems approach’ to designing residential electrification supports, in which incentives for each system participant are considered alongside the partnerships needed to support the incentives. Dr Griffith elaborated:

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<sup>87</sup> Solar Citizens, *Submission 81*, p. [2].

<sup>88</sup> Solar Citizens, *Submission 81*, p. [2].

<sup>89</sup> See, for example, City of Sydney, *Submission 25*, p. 6; Lighter Footprints, *Submission 26*, p. 8; Asthma Australia, *Submission 39*, p. 7; National Electrical and Communications Association, *Submission 56*, p. 8; Public Interest Advocacy Centre, *Submission 59*, p. 9; Peoples Climate Action Coalition, *Submission 70*, p. 4; ACOSS, *Submission 112*, p. 14.

<sup>90</sup> See, for example, Ms Alison Scotland, Executive Director, Australian Sustainable Built Environment Council (ASBEC), *Committee Hansard*, 22 March 2024, p. 6.

<sup>91</sup> Ms Scotland, ASBEC, *Committee Hansard*, 22 March 2024, p. 6.

... but you'd need a systems approach. You'd need to think somewhat carefully about the incentives for each of the players. We need a partnership between the household and the distribution grid and the retailer. We need a partnership with the banks. We need a partnership with the government to figure out how to incentivise all four components of that system so that—I would argue—most of the savings go to the household but all of the other players remain incentivised. That's critical.<sup>92</sup>

3.62 Similarly, Mr Tennant Reed, Director of Climate Change and Energy at Australian Industry Group (Ai Group), contended that a wholistic to approach is needed to residential electrification in Australia.

There's a lot that can be done, but multiple elements of standards, of the financial incentives that customers see and that networks and retailers see, and education—all these things need to come together to realise all that potential.<sup>93</sup>

### **Improved, national coordination of electrification efforts**

3.63 Other inquiry participants noted inefficiencies with regard to the complex, disparate, and sometimes duplicative landscape of electrification incentive schemes across Australian jurisdictions.

3.64 For instance, IEEFA and the Property Council of Australia described the current approach to promoting electrification uptake in Australia as 'patchwork', noting the differing approaches and policies across the federal, state, territory and local governments.<sup>94</sup> Further, the Property Council of Australia advocated for leadership at the national level to address the current 'fragmented and uncoordinated' approach to electrification of residential, and other asset classes in Australia.<sup>95</sup>

3.65 Several other inquiry participants also considered that there is a greater need for national coordination. For example, evidence from Ms Scotland highlighted the importance of coordination and leadership:

We're always big on having that national coordination, because at the moment the market is trying to respond, and it really is a piecemeal approach. We're seeing different but complementary approaches across the states and territories towards incentives to electrify. But, from an ASBEC point of view, we believe that coordination, the indications and the positive reinforcement from a national level need to happen.<sup>96</sup>

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<sup>92</sup> Dr Griffith, *Rewiring Australia, Committee Hansard*, 22 March 2024, p. 4.

<sup>93</sup> Mr Tennant Reed, Director, Climate Change and Energy, Australian Industry Group, *Committee Hansard*, 22 November 2023, p. 6.

<sup>94</sup> IEEFA, *Submission 23*, p. 13; Property Council of Australia, *Submission 89*, p. [3].

<sup>95</sup> Property Council of Australia, *Submission 89*, pp. [3–4].

<sup>96</sup> Ms Scotland, ASBEC, *Committee Hansard*, 22 March 2024, p. 6.

3.66 The Public Interest Advocacy Centre (PIAC) called for increased leadership from the Australian Government to ‘co-ordinate national action’ on residential electrification. PIAC considered that such leadership could:

... provide certainty and robust policy signals initiating planning and regulatory reforms, implementation of improved standards, signals and incentives for investment, and implementation and co-ordination of supports to target disadvantaged households.<sup>97</sup>

3.67 Further, PIAC considered that the Australian Government should seek to exercise such leadership through the National Energy Transformation Partnership (NETP). While acknowledging much of the work of implementing residential electrification efforts will be undertaken by state and local government jurisdictions, PIAC proposed that the Australian Government could exercise valuable leadership through the NETP by making ‘efficient electrification as a more significant priority workstream for the Partnership’.<sup>98</sup>

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<sup>97</sup> Public Interest Advocacy Centre, *Submission 59*, p. 5.

<sup>98</sup> Public Interest Advocacy Centre, *Submission 59*, p. 11.



# Chapter 4

## Building design and appliance standards

4.1 As set out in Chapter 2, the process of household electrification presents significant economic opportunities, including in relation to the long-term reduction of energy price inflation, long-term employment opportunities, and the scaling up of domestic capacity.

4.2 At the same time, there are barriers that will need to be overcome in order to capture and fully realise the opportunities of household electrification. As set out in Chapter 3, some of these barriers relate to consumer uptake of electrification. This chapter considers the following topics:

- building design standards, including the importance of thermal efficiency in buildings in relation to successful residential electrification;
- appliance standards, and the importance of having transparent consumer information regarding the energy efficiency of appliances;
- the unique challenges in electrifying apartments and strata title properties;
- the broad utilisation of solar panels and battery storage systems;
- the rollout of smart energy meters; and
- improving energy efficiency disclosure and performance.

### Design standards and other requirements for new residential builds

4.3 A number of inquiry participants highlighted the importance of ensuring standards for new residential construction supported the larger process of household electrification. For example, the Australian Academy of Technological Sciences and Engineering submitted that national standards should ensure new residential (and commercial) constructions were fully electrical, and incorporated appropriate supporting technologies:

Ensuring full electrification and incorporating appropriately sized rooftop solar generation, batteries and energy-efficient standards are of relevance to Australia's high-priority investment agenda for new residential and commercial constructions. This should be established through codification and legislation nationwide, including for social housing and privately owned housing. Requiring new buildings to be electrified avoids the additional expense of retrofitting electric appliances and removing gas appliances later.<sup>1</sup>

### Gas connections for new properties

4.4 Recently, some state and territory governments have moved to ban gas connections. In the ACT, regulations were made to prevent new gas connections to residential buildings, commercial land-use zones, and community facility

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<sup>1</sup> Australian Academy of Technological Sciences and Engineering (AATSE), *Submission 5*, p. 2.

zones from December 2023.<sup>2</sup> In Victoria, Australia's 'largest gas connected market', new residential gas connections were banned from 1 January 2024,<sup>3</sup> before that decision was overturned. A welcome reversal. Labor Premier Jacinta Allan was cited in Sky News as saying:

I'm wanting to be really clear that Victorians can continue to keep cooking with gas on their existing gas stove, and if they need to replace it, they will be able to do so.<sup>4</sup>

4.5 Australian Energy Producers Chief Executive Samantha McCulloch said:

Australia's energy regulators, gas users and producers have been urging state and federal governments to urgently remove barriers to new gas supply to avoid gas shortfalls that are forecast to hit Victoria and NSW as soon as 2027.<sup>5</sup>

4.6 Several inquiry participants submitted in support of extending bans on new gas connections.<sup>6</sup> For example, the Public Interest Advocacy Centre (PIAC) proposed an 'immediate moratorium and ban on new connections to residential developments'. The PIAC argued that such an action 'ensures the challenge of efficient electrification is only as big as it is today'.<sup>7</sup> Further, the Climate Council of Australia submitted that:

Currently over 240,000 homes are under construction (ABS 2023), and many of them are being equipped with gas connections. Additionally, for most existing homes, there is no obligation to replace gas appliances with electrical ones when they reach the end of their life, often leading to the installation of new gas appliances when replacements are necessary.

This approach poses challenges because retrofitting homes to be all-electric is more complicated than starting afresh. To address this issue, it is essential to ban new gas connections while also implementing supportive programs to remove existing connections.<sup>8</sup>

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<sup>2</sup> The Hon Shane Rattenbury MLA, Minister for Water, Energy and Emissions Reduction, 'Regulation to prevent new gas connections starts in December', *Media release*, 30 November 2023.

<sup>3</sup> Dux Hot Water, *Submission 8*, p. [2].

<sup>4</sup> Patrick Hannaford, "Victorians can keep cooking with gas": Premier Jacinta Allan seeks to reassure public while continuing with gas substitution roadmap', *Sky News*, 9 September 2024.

<sup>5</sup> Australian Energy Producers, 'Victorian Government finally takes steps to support new gas supply', *Media release*, 10 December 2024.

<sup>6</sup> For example, see: Energy Consumers Australia, *Submission 24*, p. 6; City of Sydney, *Submission 25*, p. 3; Lighter Footprints Inc, *Submission 26*, p. 9; Energetic Communities, *Submission 73*, p. 6; Australian Parents for Climate Action, *Submission 94*, p. 7; Rewiring Australia, *Submission 132*, p. 40; Phil Browne, *Submission 135*, p. 2.

<sup>7</sup> Public Interest Advocacy Centre, *Submission 59*, p. 6.

<sup>8</sup> Climate Council of Australia, *Submission 9*, pp. 15–16.

4.7 In her evidence to the committee, the National Policy Director at the Property Council of Australia, Ms Francesca Muskovic, argued that state and territory governments needed to ban new gas connections to:

... avoid expansion of the distributive gas network, which will become a stranded asset in the coming decades. We also need a national plan for the phase-out of fossil gas in existing buildings and appliances.<sup>9</sup>

4.8 Green Building Council Australia noted that many regions in the United States and Europe were also blocking new gas connections and equipment in buildings. Reflecting on the domestic environment, the Green Building Council Australia also stated that many new homes across Australia were already reaping the benefits of highly efficient all-electric appliances and that 'we should not be locking new homes into a reliance on gas appliances which can have negative cost and health impacts'.<sup>10</sup>

4.9 Notwithstanding the support for gas bans, some submitters noted the potential for adverse consequences. For example, Seeley International, an Australian air conditioning and gas appliance manufacturer, submitted that gas bans 'add to cost of living pressures' and contribute to a short-term increase in emissions.<sup>11</sup> APA Group submitted that a 'whole-of-system approach to decarbonisation will achieve greater emissions reductions than focusing on the electrification of a specific consumer group'.<sup>12</sup> The APA Group further stated that '[g]as infrastructure has an essential role to play in helping Australia achieve least cost decarbonisation through supporting renewable generation and facilitating distribution of renewable gases'.<sup>13</sup>

4.10 The Housing Industry Association (HIA) expressed the view that bans on gas and solid fuels implemented by some states and local governments:

... reduce options available under the national changes, place pressure on supply chains, discourage innovation, complicate application of the standards and the removal of fuel sources concentrate risks associated with predictable disruptions.<sup>14</sup>

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<sup>9</sup> Ms Francesca Muskovic, National Policy Director, Property Council of Australia, *Committee Hansard*, 22 March 2024, p. 19.

<sup>10</sup> Green Building Council Australia, *Submission 75*, p. [3].

<sup>11</sup> Seeley International, *Submission 110*, pp. [5–6].

<sup>12</sup> APA Group Limited, *Submission 29*, p. 3.

<sup>13</sup> APA Group Limited, *Submission 29*, p. 3.

<sup>14</sup> Housing Industry Association, *Submission 65*, p. 7.

4.11 According to the Australian Pipelines and Gas Association, the relatively low rate of emissions attributable to household gas use calls into question recent government decarbonisation strategies focusing on gas use reduction.<sup>15</sup>

### **Electrification and related upgrades for existing buildings**

4.12 As was observed in the *National Energy Performance Strategy (2024)*, much of the opportunity for energy performance in Australia:

... lies in retrofitting existing homes. Most of Australia's 10.9 million dwellings were built before minimum energy efficiency standards were introduced for houses in 2003, and for apartment buildings in 2005.<sup>16</sup>

4.13 The HIA also noted it was likely the greatest opportunity for emissions and bill savings could be found in the eight to 10 million existing homes, most of which would have a one- or two-star energy rating. Realising these opportunities, it argued, required that people were able to make informed choices about their dwellings, and, to this end, argued in favour of mandatory disclosure of energy ratings for existing homes.<sup>17</sup> This issue is discussed further later in this chapter.

4.14 At the same time, evidence to the inquiry highlighted the high costs and practical challenges involved in electrifying and improving the efficiency of existing buildings. The National Electrical and Communications Association drew out the differences between new and existing builds in this respect:

For new builds, the cost of mandating electrification is relatively minor as those buildings will be engineered, specified and built to be electrified and, in many cases, will include advanced functions to manage the demand and CER.

For existing buildings with ageing infrastructure, the costs are going to be considerable, including the replacement of non-electrical appliances, design and installation of additional building and wiring to cater for other equipment, and switchboard modifications, just to name a few.<sup>18</sup>

4.15 This was also raised by Green Building Council Australia, which noted the following in its submission to the inquiry:

The electrification of homes and commercial buildings will require the replacement of millions of gas appliances for cleaner, healthier and more efficient electric equipment. During the initial phases of the transformation, the upfront capital cost can impede take-up and so a successful strategy will

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<sup>15</sup> Australian Pipelines and Gas Association, *Submission 79*, p. [21–22].

<sup>16</sup> Department of Climate Change, Energy, the Environment and Water, *National Energy Performance Strategy*, April 2024, p. 21 (citing RACE for 2030 Cooperative Research Centre, *Enhancing home thermal efficiency*, May 2023).

<sup>17</sup> Mr Simon Croft, Chief Executive, Industry and Policy, Housing Industry Association, *Committee Hansard*, 22 March 2024, p. 13.

<sup>18</sup> Mr Kent Johns, Head of Government Relations and Regulatory Affairs, National Electrical and Communications Association, *Committee Hansard*, 21 February 2024, p. 8.

include funding options to support households to access the retrofits they need.<sup>19</sup>

- 4.16 In relation to upgrading and retrofitting existing buildings, the committee heard that there are particular challenges regarding the electrification of multi-dwelling apartment buildings, strata arrangements and renters, as discussed further below.<sup>20</sup>

### **The electrification challenge for multi-unit and strata buildings**

- 4.17 A large and growing proportion of Australians live in multi-residential buildings subject to strata. As the Owners Corporation Network of Australia (OCNA) advised the committee, there are nearly 360 000 strata schemes in Australia, of which half have been built since 2000. Over 2.5 million people, and 13 per cent of all households, live in strata apartments, and the proportion of people in strata apartments continues to increase.<sup>21</sup>

- 4.18 A June 2023 report co-authored by six academics from the University of New South Wales and the Royal Melbourne Institute of Technology, titled *Delivering sustainable apartment housing: new build and retrofit*, argued the sustainability of apartment developments, and retrofits, needed to be considered separately to other residential buildings typologies. It noted that this was because:

... the production, consumption, management and exchange of apartments differs in three important ways: i) apartments in Australia are typically provided as speculative strata titled developments; ii) the apartments themselves are physically inter-dependent; and iii) they are usually jointly owned and managed. Each of these differences has important implications for the transition towards more sustainable apartment living.<sup>22</sup>

- 4.19 Of course, there is also considerable diversity across strata schemes. The Chair of the OCNA, Mr Fred Tuckwell, told the committee that, although, only three per cent of strata schemes are made up of 50 or more households, these larger schemes nonetheless house 36 per cent of all strata residents in large and often

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<sup>19</sup> Green Building Council Australia, *Submission 75*, pp. [4–5].

<sup>20</sup> For example, see: Battery Storage and Grid Integration Program, ANU, *Submission 43*, pp. 5–6; Mr Luke Menzel, Chief Executive Officer, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 2; Mr Fred Tuckwell, Chair, Owners Corporation Network of Australia (OCNA), *Committee Hansard*, 21 February 2024, pp. 1–2; ACT Government, *Submission 31*, p. 11; Evoenergy, *Submission 35*, p. 5; Victorian Greenhouse Alliances, *Submission 38*, p. 4; Wangaratta Landcare & Sustainability Inc, *Submission 45*, p. 2; Public Interest Advocacy Centre, *Submission 59*, pp. 9–10; Environment Victoria, *Submission 86*, p. 15; and Mr Alan Pears, *Submission 138*, pp. [10 and 11].

<sup>21</sup> Mr Tuckwell, OCNA, *Committee Hansard*, 21 February 2024, p. 1.

<sup>22</sup> Hazel Easthope, Jasmine Palmer, Andrea Sharam, Megan Nethercote, Gloria Pignatta, and Laura Crommelin, *AHURI Final Report No. 400—Delivering sustainable apartment housing: new build and retrofit*, June 2023, p. 2.

complex apartment buildings.<sup>23</sup> This diversity, he argued, would need to be taken into account in designing policies to facilitate electrification and related building improvements:

The administration, management and maintenance of medium and larger buildings generally requires professional expertise. The remaining 97 per cent are smaller buildings. They are often self-managed and utilise minimal professional assistance and have their own set of complex issues. This wide variety of schemes requires different approaches, funding models and incentives to make any material changes.<sup>24</sup>

4.20 The Chief Executive Officer of the Energy Efficiency Council, Mr Luke Menzel, was asked about the challenges of electrifying multi-unit residential dwellings. He explained:

It's one of the great challenges of the whole electrification agenda—what to do about those multi-unit residential dwellings. There are a range of challenges. There's a technology challenge where you've got that centralised building plan. It's not as simple to swap out the larger kit that sits within plant rooms in large apartment blocks as it is to switch out that smaller consumer-grade technology. This is a challenge that's being faced around the world.<sup>25</sup>

4.21 Mr Menzel also noted that in addition to the technological challenges associated with electrifying multi-residential buildings, strata corporations—where there are multiple decision-makers—presented further challenges. He told the committee:

For apartment buildings in particular, we would recommend a series of pilot programs and engagement to learn how one both engages with those owners but also finds out how to effectively roll out those technology programs within that particular cohort. We need to learn how to do it, and often, when we get asked some of those curlier questions where there isn't a simple answer, we need to do a bit of learning by doing and invest in that learning journey so we can then scale it up. I don't have the confidence to say this is definitely the solution on apartments at this point; industry and government need to work together to solve that. That's the case even when we look around the world; governments around the world are grappling with this exact question.<sup>26</sup>

4.22 These issues were summarised by the Battery Storage and Grid Integration Program at the Australian National University, which explained that multi-dwelling buildings and strata arrangements:

... pose unique challenges of multi-ownership, a mix of owner-occupiers and renters, a mix of private and common energy usage, relatively small

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<sup>23</sup> Mr Tuckwell, OCNA, *Committee Hansard*, 21 February 2024, p. 1.

<sup>24</sup> Mr Tuckwell, OCNA, *Committee Hansard*, 21 February 2024, p. 1.

<sup>25</sup> Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 2.

<sup>26</sup> Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 2.

land area to occupant ratio affecting ability to install [Distributed Energy Resources] infrastructure, and embedded energy networks (including regulation).<sup>27</sup>

4.23 Newtown Climate's submission also discussed the various challenges for Australians who choose to live in apartment buildings. In particular, it highlighted there are:

... complicated strata and planning rules which can prevent electric vehicle charging (even where residents have access to an off-street parking space) and the installation of rooftop solar (even where there would be a significant financial benefit to individual residents and/or to the strata corporation).<sup>28</sup>

4.24 Mr Neil Roberts from the National Electrical and Communications Association explained that the costs of electrifying existing strata accommodation were often very high:

In strata accommodation the costs can run away pretty quickly on an existing residential block, in particular if you have centralised gas water heating or space heating. By the time you're replacing plant of that size and integrating complexity into the building, electrification of those devices can incur considerable cost. Once you start exceeding the maximum allowable demand for that service, switchboard construction and installation and all of the activity around that, the costs can be quite considerable.<sup>29</sup>

4.25 Mr Tuckwell of OCNA suggested that strata owners would require substantial incentives and financial support to map and realise their upgrade paths over the next 10 to 20 years. He added that strata owners should be on a 'level playing field' with owners of standalone properties in terms of the costs of electrification, and used the example of the cost of installing an electric vehicle charging facility:

For example, electric vehicle charging for a standalone homeowner costs about \$2,000. A strata owner needs to pay the same \$2,000 for what's generally referred to as the last mile of the connection plus approval costs, building infrastructure upgrade costs and potentially building supply upgrade costs. Solar is another example, where only 0.06 of strata have solar. We do welcome the recent government funding programs for solar installation in apartment buildings. We think governments need to understand the strata environment and engage directly with owner corporations and support their committees to lead that change, which we are in a welcome position to assist.<sup>30</sup>

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<sup>27</sup> Battery Storage and Grid Integration Program, Australian National University, *Submission 43*, pp. 5–6.

<sup>28</sup> Newtown Climate, *Submission 76*, p. 3.

<sup>29</sup> Mr Neil Roberts, Director, Policy, Technical and Safety, National Electrical and Communications Association, *Committee Hansard*, 21 February 2024, p. 9.

<sup>30</sup> Mr Tuckwell, OCNA, *Committee Hansard*, 21 February 2024, pp. 1–2.

4.26 Mr Thomas Belsham, also representing the OCNA, said that governments working with, and providing clear guidelines to, strata owners would help both owners and suppliers navigate the challenges of electrifying apartment buildings:

Strata is complex and difficult decision making. It's slow sometimes. The suppliers and service providers need some confidence that they'll actually be able to service this community well.<sup>31</sup>

4.27 Mr Tuckwell and Mr Belsham also told the committee that certain technologies, including the use of battery technologies, would be important in helping with the electrification of strata buildings.<sup>32</sup>

### **Targeted initiatives for rental properties**

4.28 As noted in Chapter 3, renters comprise one in three Australian households and often live in houses with very poor energy performance. They are often unable to make changes to homes because they do not own them and are more likely to be on lower incomes relative to homeowners.<sup>33</sup>

4.29 Given this, some submitters called for additional or more targeted initiatives and other reforms, to support rental households and the electrification of rental properties.<sup>34</sup> For example, Bank Australia told the committee that interventions to drive electrification uptake by landlords will benefit renters and stimulate consumer demand more widely.<sup>35</sup>

4.30 The ACT Government suggested that consideration should be given to developing national minimum energy efficiency standards for rental properties similar to the recent ACT reforms, and offering instant asset write-offs for landlords to reduce economic barriers to electrification for low income households.<sup>36</sup> The ACT Government also aligned itself with a recommendation from the Grattan Institute that:

... the Commonwealth institute instant asset write-offs for landlords by changing the effective life years of these products, such as heat pump water heaters, efficient electric heating and induction cook tops, from 12 years to zero years in the ATO's depreciation schedule.<sup>37</sup>

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<sup>31</sup> Mr Belsham, OCNA, *Committee Hansard*, 21 February 2024, p. 4.

<sup>32</sup> Mr Tuckwell, OCNA, *Committee Hansard*, 21 February 2024, p. 2.

<sup>33</sup> Climate Council of Australia, *Submission 9*, p. 17.

<sup>34</sup> For example, see: Asthma Australia, *Submission 39*, pp. 5–6; City of Sydney, *Submission 25*, p. 6; Bank Australia, *Submission 90*, p. 3; and AATSE, *Submission 5*, p. 3.

<sup>35</sup> Bank Australia, *Submission 90*, p. 3.

<sup>36</sup> ACT Government, *Submission 31*, p. 11.

<sup>37</sup> ACT Government, *Submission 31*, p. 12 [citation used within quote omitted for clarity].

4.31 The ACT Government argued this model would be a simple way to incentivise landlords to electrify and effectively target renters—a difficult to reach cohort who make up 31 percent of Australian households.<sup>38</sup>

4.32 Rewiring Australia, similarly recommended this model and cited research from the Grattan Institute:

A clear way to incentivise landlords to upgrade to electric appliances is by providing an instant write off for any new appliances that replace gas. This would allow landlords could claim a tax deduction for the full cost of the new appliance. The Grattan Institute published modelling that found an instant asset write-off would substantially close the cost gap for water heaters and cooktops and cost a maximum of \$384 million over five years.<sup>39</sup>

4.33 Other submitters also recommended instant asset write-offs to financially incentivise private landlords to replace gas appliances with electric ones.<sup>40</sup>

4.34 The National Electrical and Communications Association noted the lack of existing incentives encouraging landlords and body corporates to invest in electrification, and, along with the Climate Council of Australia, recommended the ACT's model requiring energy efficiency standards for rental homes as an effective solution.<sup>41</sup>

4.35 Mr Luke Menzel, Chief Executive Officer of the Energy Efficiency Council, also outlined the important role of minimum rental standards:

There will inevitably also be a role for minimum rental standards in this space. Ultimately, governments can do a lot in terms of making it straightforward for landlords to make these sorts of upgrades, but over the long-term there is an expectation placed on landlords that this is effectively the thermal performance, the energy performance, that we're looking for from our housing stock. It is likely where particularly state governments will need to go, noting they have the levers in that space.<sup>42</sup>

4.36 For its part, the Public Interest Advocacy Centre outlined that a combined approach of establishing energy efficiency standards for rentals, along with incentives for landlords, is needed:

The Commonwealth government can work through the National Energy Transformation Partnership to provide strong policy signals for reform in the rental sector. This should prioritise a policy commitment to implement mandatory energy efficiency standards for rentals, including requirements

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<sup>38</sup> ACT Government, *Submission 31*, p. 12

<sup>39</sup> Rewiring Australia, *Submission 132*, p. 35 [citation used within quote omitted for clarity].

<sup>40</sup> For example, see: Rewiring Australia, *Submission 132*, p. 35; and Environment Victoria, *Submission 86*, p. 15.

<sup>41</sup> National Electrical and Communications Association, *Submission 56*, pp. 8, 14 and 15; Climate Council of Australia, *Submission 9*, pp. 17 and 20.

<sup>42</sup> Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 2.

for electrification. Incentives for landlords should only be considered to facilitate the implementation of standards but could make up part of a suite of policies addressing the barriers to rental properties efficiently electrifying. The Commonwealth government could be a leader in this space by requiring all new housing stock enabled by Commonwealth funding is efficient and electric.<sup>43</sup>

### **Material gas disconnection fees**

4.37 The committee received evidence that fees charged by network providers to disconnect gas from residential properties can be a significant barrier for consumers seeking to electrify. Indeed, on top of the cost of buying electric appliances, disconnecting properties can be time consuming and expensive.<sup>44</sup>

4.38 Gas disconnection rates are determined by the Australian Energy Regulator (AER) and can vary between jurisdictions and networks. As noted by the Climate Council, the AER found that some households are choosing to close off the supply of gas at the meter only—instead of paying for permanently abolishing the connection by removing network assets and disconnecting from the mains.<sup>45</sup>

4.39 The Institute for Energy Economics and Financial Analysis also noted this, indicating that consumers may choose to ‘quietly’ cancel their retail gas plan while the physical connection remains active. It highlighted that, in extreme cases, permanently abolishing a gas connection could cost consumers up to \$2 500, and that it presented a ‘significant barrier for consumers to electrify’.<sup>46</sup> It also raised the safety issues with such an approach:

This poses a safety hazard, as gas is still present in the service line and may escape or enter the property, particularly if there is damage or degradation to the infrastructure.<sup>47</sup>

4.40 Doctors for the Environment Australia submitted that the gas disconnection fee in NSW ‘is over \$1100 to remove a meter’ and suggested that such a fee ‘may well contravene competition rules as it is a barrier to competition between gas and electricity networks as domestic energy suppliers’.<sup>48</sup>

4.41 This issue was also raised by the peak body for the clean energy industry in Australia, the Clean Energy Council, which stated the following:

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<sup>43</sup> Public Interest Advocacy Centre, *Submission 59*, p. 9.

<sup>44</sup> Climate Council of Australia, *Submission 9*, p. 16.

<sup>45</sup> Climate Council of Australia, *Submission 9*, p. 16.

<sup>46</sup> Institute for Energy Economics and Financial Analysis (IEEFA), *Submission 23*, p. 5.

<sup>47</sup> IEEFA, *Submission 23*, p. 5 (citing the Victorian Energy Safety Commission).

<sup>48</sup> Doctors for the Environment Australia, *Submission 6*, p. 3.

... monetary incentives and rebates are still required to encourage CER [consumer energy resources] uptake and abandon gas. Of these incentives is the need for rebates to help cover the heavy costs of disconnecting houses from gas. Currently, the upfront costs of disconnecting from gas are currently acting as a barrier to households wanting to reduce their energy costs and emissions.<sup>49</sup>

### **Enabling a coordinated approach to energy efficiency upgrades**

4.42 It was noted during the inquiry that there was a definite role for government to coordinate the rollout of energy efficiency upgrades. Dr Katie Hepworth, a national policy director at the Electrical Trades Union, said the following:

[T]here is a role ... for an entity within government that coordinates the rollout of energy efficiency upgrades. I know that this has been discussed at various levels of government, both state and federal. That could help consumers coordinate the different trades that are required and can alert consumers to the different trades that might be required when they embark down the path of an energy efficiency upgrade.

For example, in buying an induction stove, that might require an upgrade of the switchboard and installation of a smart meter. That could involve removal of asbestos and cutting into engineered stone. There is a role for entities within government that can provide a coordination role that helps consumers roll that out so it's not leaving it down to the selected appliance, and those decisions. Often there are unintended or surprise costs that come with that upgrade.<sup>50</sup>

### **Supporting electrification through enhanced appliance standards**

4.43 A number of witnesses highlighted that there were significant opportunities for the government to support household electrification through policy and programs—specifically those related to appliance standards. For example, in its submission the ACT Government emphasised the potential of reforms to the national product energy efficiency regulations through the proposed review of the *Greenhouse and Energy Minimum Standards Act 2012* (GEMS Act).<sup>51</sup>

4.44 The Public Interest Advocacy Centre said that comprehensive, co-ordinated reform was urgently required to enable efficient household electrification within targeted timeframes. It also said that a priority area of action was improved appliance standards and robust compliance.<sup>52</sup>

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<sup>49</sup> Clean Energy Council, *Submission 37*, p. 5.

<sup>50</sup> Dr Katie Hepworth, National Policy Director, Electrical Trades Union, *Committee Hansard*, 21 February 2024, p. 15.

<sup>51</sup> ACT Government, *Submission 31*, p. 3.

<sup>52</sup> Public Interest Advocacy Centre, *Submission 59*, p. 6.

4.45 Rewiring Australia recommended the regulatory standards for appliances, including GEMS Act and Australian Standards technical standards, be harmonised and updated to encourage electrification.<sup>53</sup>

4.46 When asked how the Australian Government could play a positive role in supporting electrification and the levers it could utilise, Dr Mark Dean from the Australian Manufacturing Workers' Union submitted that a key approach could be for the government to 'commit to quite high national energy performance standards for appliances[.]' He argued that this would send a signal throughout the industry that high-quality appliances were the 'norm' and that this would bring costs down.<sup>54</sup> Dr Dean also said that:

... it's now on the government to pull levers like providing a regulatory standard, providing a strategy to show a roadmap for the industry to head towards, and then by providing that initial push and derisking for the industry through government procurement.<sup>55</sup>

4.47 The Electrical Trades Union of Australia stated:

If households are to reap the benefits of “electrifying everything” then consumers must be able to access appliances that meet minimum efficiency standards and allow for demand management functionality. Currently in Australia, these appliances are limited in their availability and, where available, are prohibitively expensive.

Implementing a residential electrification initiative can play an important role in improving access in a manner complementary to any future efforts to improve Australian appliance standards. Structuring appliance standards into the eligibility criteria for any government incentives or assistance would send a strong signal to suppliers and manufacturers that Australia’s demand profile for their goods is changing, whilst making high-quality products more affordable for Australian consumers.<sup>56</sup>

4.48 The Chief Executive Officer of the Energy Efficiency Council, Mr Luke Menzel, advised ‘[T]here is something to be said for making sure that the appliances we're putting in are not just efficient but have the capabilities we need to interact with the high-penetration renewable-energy system’ such as hot water systems that are operating in the middle of the day.<sup>57</sup> He explained:

... in Victoria, the old state electricity commission rolled out electric resistive heaters that turned on in the middle of the night to take advantage of the excess coal-fired generation existing in the grid at that time. That was a sensible thing to do at that point of our journey; as we're transitioning the

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<sup>53</sup> Rewiring Australia, *Submission 132*, p. 4.

<sup>54</sup> Dr Mark Dean, National Research and Planning Officer, Australian Manufacturing Workers' Union, *Committee Hansard*, 21 February 2024, pp. 15–16.

<sup>55</sup> Dr Dean, Australian Manufacturing Workers' Union, *Committee Hansard*, 21 February 2024, p. 16.

<sup>56</sup> Electrical Trades Union of Australia, *Submission 105*, p. 8.

<sup>57</sup> Mr Menzel, *Committee Hansard*, 22 November 2023, p. 4.

energy system, it becomes more sensible to be using the solar that's on the grid in the middle of the day. If we think about that from a systems perspective, if we think about the interactions between the supply side and demand side, we can make sure that householders are installing appliances with the capabilities we need ... It's not just standards to make sure these appliances are efficient and high quality; it's also making sure they are enabled to interact with this grid and alive to that time of use aspect of their use—noting, of course, that that's all complexity the consumer should never have to deal with. We are not going to a world of prosumers where people are flicking on and off appliances. People shouldn't have to worry about that. This is about smart systems that are automated to interact with the grid in a sensible way and are solving for people having healthy, comfortable homes and homes that are affordable to run.<sup>58</sup>

- 4.49 The National Policy Director of the Electrical Trades Union, Dr Katie Hepworth, similarly noted the need for minimum appliance standards, particularly around smart appliances, explaining:

At the moment there are very few smart appliances entering into the market. The ones that are entering into the market are quite expensive, because they are not dominant. The reason that is an issue for consumers is that they're expected to do the work of managing when they turn on and off their dishwasher to maximise the use of solar and they're required to do all of that thought, thinking and monitoring of when the power prices are lower and how that relates to the generation of domestic solar.

If we put in place minimum appliance standards the idea is that we bring in smart appliances, and that it takes away a lot of that thought process and outsources it to the appliance itself, and that can speak to smart meter rollout and the rest of it. That means you're really taking out that bottom level and with that market signal you are bringing down the cost of those smart appliances because that just becomes the standard that is entering into the Australian market.<sup>59</sup>

## Utilising solar panels and battery storage systems

- 4.50 Australians are world-leaders in rooftop solar penetration having installed over four million residential rooftop solar systems with a total generation capacity of almost 25 GW.<sup>60</sup> However, while the installation of home batteries is growing rapidly, only a small proportion of houses with rooftop solar currently have batteries installed.<sup>61</sup>

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<sup>58</sup> Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 4.

<sup>59</sup> Dr Hepworth, Electrical Trades Union, *Committee Hansard*, 21 February 2024, p. 15.

<sup>60</sup> See, Department of Climate Change, Energy, the Environment and Water, *Residential buildings*, 14 March 2025, [www.dcceew.gov.au/energy/energy-efficiency/buildings/residential-buildings#:~:text=Residential%20buildings%20are%20responsible%20for,total%20carbon%20emissions%20in%20Australia](http://www.dcceew.gov.au/energy/energy-efficiency/buildings/residential-buildings#:~:text=Residential%20buildings%20are%20responsible%20for,total%20carbon%20emissions%20in%20Australia) (accessed 17 March 2025).

<sup>61</sup> See, for example, Clean Energy Council, *Rooftop solar and storage report: July–December 2024*, March 2025, p. 5.

- 4.51 Home batteries are also growing rapidly, with more than 73 000 systems storing almost 1.1 GW of power. This represents more than eight times the capacity of the former Hazelwood power station and four times the capacity of the Liddell power station.<sup>62</sup>
- 4.52 It was argued during the inquiry that household battery systems could play a more significant role in Australia's energy system in the future by easing minimum operational and peak demand and should be considered a 'key element of household electrification'.<sup>63</sup>
- 4.53 Beyond Zero Emissions argued that many households were not 'reaping the full benefits of their solar system', instead selling their surplus energy cheaply and buying it back at much higher prices during peak times. It submitted that:
- ... [o]ffering financial incentives such as tax deductions or rebates for batteries could help households with the upfront costs, increase energy independence and allow households to participate in virtual power plants.<sup>64</sup>
- 4.54 Professor Lachlan Blackhall, Deputy Vice Chancellor (Research and Innovation) at the Australian National University stated that there were two ways to make batteries more economical:
- The first is to provide a subsidy for the capital expense upfront, and governments nationally have provided those incentives. The other way is to actually realise the revenue stream from the operation of those assets. The first has been done well, the capex subsidy. The second has been done really poorly. The challenge is that for people to actually understand the long-term economics of storage we actually need better investment in paying for the services that actually those batteries can deliver to benefit the grid. For everyone in the community to be able to benefit from storage, we are going to need community batteries. But one way that we could do that, aside from the subsidies which are welcome at the moment to kickstart the community battery industry, is actually to realise the revenues for services. Those revenues could be paid through electricity distribution networks or they could be paid in some way through the retail bill as well. If we think about it that way, there's a combination of ways in which we can actually better reward those assets for the benefits they're providing to our electricity system.<sup>65</sup>
- 4.55 Mr Thomas Belsham, Vice Chair and Treasurer, from the OCNA highlighted the importance of differentiating between behind-the-meter batteries and

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<sup>62</sup> Australian Renewable Energy Agency, *What are virtual power plants and why do they matter?*, 8 February 2021, <https://arena.gov.au/blog/what-are-virtual-power-plants-and-why-do-they-matter/> (accessed 28 February 2025).

<sup>63</sup> See, for example, Evergen, *Submission 22*, p. [2].

<sup>64</sup> Beyond Zero Emissions, *Submission 19*, p. 9.

<sup>65</sup> Professor Lachlan Blackhall, Deputy Vice Chancellor, Research and Innovation, Australian National University, *Committee Hansard*, 21 February 2024, pp. 27–28.

distributor-owned batteries, and the importance of the former. On this, he said the following:

I think it's important to differentiate between behind-the-meter apartment owner scheme owned batteries and distributor energy network owned batteries. I think it's important ... about the cost of energy infrastructure and potentially upgrading transformers, et cetera, to bring more power into the complex through electrification.

If you have a behind-the-meter battery that would actually help to ameliorate some of those costs by shaping or by balancing out the load or energy demand across the actual day. Whereas a battery put in by a network distributor operator will just help on the grid side but won't necessarily directly help some of the cost aspects associated with the apartment owners themselves. I think too much of what we're seeing at the moment is a focus on the actual energy distribution side and not so much necessarily around a battery for the actual scheme as a whole owned and managed by the scheme.<sup>66</sup>

### **Challenges of rooftop solar for apartment complexes**

- 4.56 A number of inquiry participants raised the additional challenges and obstacles that apartment complexes and the strata sector must navigate for the installation of solar panels. For example, the OCNA noted that, although Australia has the highest rate of solar panel penetration in the world—with one in three households having solar panels—strata only represented 0.6 per cent of these installations.<sup>67</sup>
- 4.57 When asked whether he agreed that there is not enough space on a typical apartment building to effectively deliver the solar needed for electrification, the Chief Executive of Industry and Policy at the Housing Industry Association, Mr Simon Croft, said 'yes'. He also noted that residents commonly look to utilise these spaces for, amongst other things, green rooftops and communal spaces—further restricting the area available for the installation of solar panels.<sup>68</sup>
- 4.58 Notwithstanding these issues, the Chief Executive Officer of Green Building Council Australia, Mrs Davina Rooney, suggested that, in her opinion, the limited space for solar installations on rooftops could be solved at the grid level.<sup>69</sup>

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<sup>66</sup> Mr Belsham, *Committee Hansard*, 21 February 2023, pp. 2–3.

<sup>67</sup> Owners Corporation Network of Australia, *Submission 66*, p. 11.

<sup>68</sup> Mr Simon Croft, Chief Executive, Industry and Policy, Housing Industry Association, *Committee Hansard*, 22 March 2024, p. 12.

<sup>69</sup> Mrs Davina Rooney, Chief Executive Officer, Green Building Council of Australia, *Committee Hansard*, 22 March 2024, pp. 14–15.

### Utilising the energy storage potential of electric vehicles

4.59 The potential to harness the significant battery storage capacity of electric vehicles (EVs) via bi-directional charging technology, was raised by inquiry participants as having significant potential in the future. Master Electricians Australia (MEA) highlighted this potential in its submission to the inquiry and stated the following:

As EVs typically have a battery of around 70KW, they have up to 7 times the capacity of a static home battery, as well as the added incentive of having another productive purpose of transport. This makes the economics of battery storage at a household level more attractive.<sup>70</sup>

4.60 Given this, MEA advocated for government procurement policies and consumer incentives to preference bi-directional EVs for passenger vehicles and noted the following benefits:

With bi-directional charge enabled vehicles as the standard for passenger vehicles in Australia, we would have the benefit of both a soak load for periods of daytime oversupply and a massive reservoir of dispatchable power during periods of undersupply.<sup>71</sup>

4.61 Further articulating MEA's position, in his evidence to the committee, Mr Chris Lehmann, a National Advocacy Manager, said the following:

At the moment, every solar panel that goes on a roof without storage to firm it up is actually making the problem worse in terms of grid instability during the day with oversupply and making the evening peak worse. I think the possibility that we can utilise electric vehicles with their massive batteries to be able to help firm the grid by fast-tracking the use of bidirectional EV tariffs could actually be quite a quick win for the grid.<sup>72</sup>

4.62 Professor Blackhall, the Deputy Vice Chancellor (Research and Innovation) at the ANU also raised the potential of utilising EVs for their energy storage capacity:

If you have a significant amount of generation in the community, you also want a significant amount of storage in the community to help soak it up and then to make it available in the evening when the sun isn't available. I'd also include in that discussion around residential storage the importance of electric vehicles. They represent a significant amount of storage. Yes, they are batteries on wheels, but it's really important when we think of the amount of storage that's going to be embedded in households to include EVs as well as stationary residential and community batteries.<sup>73</sup>

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<sup>70</sup> Master Electricians Australia, *Submission 10*, p. 5.

<sup>71</sup> Master Electricians Australia, *Master Electricians Australia Distributed Energy Resources (DER) Policy—Roadblocks and Solutions*, Additional Information, p. [4].

<sup>72</sup> Mr Chris Lehmann, National Advocacy Manager, Master Electricians Australia, *Committee Hansard*, 21 February 2024, p. 19.

<sup>73</sup> Professor Blackhall, Australian National University, *Committee Hansard*, 21 February 2024, p. 27.

### The promise of virtual power plants

4.63 It is recognised that an energy grid with more weather-reliant renewable energy will have more variability and, hence, to keep the grid balanced—and ensure power is available whenever it is needed—network operators have been seeking ways to store renewable energy.<sup>74</sup>

4.64 Given this, virtual power plants (VPPs) are emerging as an important part of the energy mix in Australia, harnessing the collective power of behind-the-meter energy assets. By aggregating thousands of individual home batteries, virtual power plants allow renewable energy to be quickly injected into the grid to address frequency and voltage imbalances, local disruptions, and disturbances—keeping the network stable.<sup>75</sup>

4.65 VPPs were initially proposed in 2003 and, as the name suggests, the aim is to have a system that functions in a similar way to a power plant—but in a virtual manner.<sup>76</sup> As described by five scholars in a joint submission to the inquiry:

... a VPP is considered a flexible representation of an aggregated portfolio of distributed and highly renewable type energy resources and energy storage systems. Through aggregation embedded in VPPs, renewable and storage systems participate in trading in the electricity market and provide network services and grid support.<sup>77</sup>

4.66 The joint submission also noted that the VPP platform has the following key benefit:

... one of the critical benefits of the VPP is that energy storages may be equipped with emergency outage functions which can solely (in the evening/night) or in combination with the working rooftop photovoltaic systems (during the day) continue supplying the VPP customers even during a network outage. This is a significant reliability improvement, which is unavailable for customers without a battery energy storage system.<sup>78</sup>

4.67 Beyond Zero Emissions also emphasised the potential role of VPPs and the proposed expansion of existing projects:

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<sup>74</sup> Australian Renewable Energy Agency, *What are virtual power plants and why do they matter?*, 8 February 2021 (accessed 27 February 2025).

<sup>75</sup> Australian Renewable Energy Agency, *What are virtual power plants and why do they matter?*, 8 February 2021 (accessed 27 February 2025).

<sup>76</sup> Associate Professor Farhad Shahnia, Dr Arash Vahidnia, Associate Professor Gm Shafiullah, Dr Moayed Moghbel, Professor Tania Urnee, *Submission 40*, p. 6.

<sup>77</sup> Associate Professor Farhad Shahnia, Dr Arash Vahidnia, Associate Professor Gm Shafiullah, Dr Moayed Moghbel, Professor Tania Urnee, *Submission 40*, p. 6.

<sup>78</sup> Associate Professor Farhad Shahnia, Dr Arash Vahidnia, Associate Professor Gm Shafiullah, Dr Moayed Moghbel, Professor Tania Urnee, *Submission 40*, pp. 7 and 8.

Virtual power plants (VPPs) can play a large role in adapting to a more distributed electricity system. For example, Origin Energy is expanding its Loop VPP from 200MW to 2 GW, and increased household batteries could make this happen faster.<sup>79</sup>

## The rollout of smart energy meters

4.68 Inquiry participants raised the importance of the broader rollout of smart energy meters—devices with digital two-way communication systems that measure when consumers use electricity and how much they use. They record energy use in at least 30-minute intervals and can transmit the information to the consumer’s retailer on a daily basis. Retailers can also read smart meters remotely.<sup>80</sup>

4.69 In her evidence to the inquiry, the General Manager of Regulation and Policy (Distribution) at AusNet Services, Ms Charlotte Eddy, articulated the importance of smart meters:

They're important for a couple of reasons. Firstly, they provide us with really granular data on when customers are using energy, which is important for us to understand and analyse what an electrified household looks like, as opposed to a dual fuel household. So we're able to factor in the likely shift from dual fuel to electrified when we're planning our network. Secondly, they also allow us to develop pricing structures that can target time of use by customers, so we can provide them with pricing signals to use energy outside of peak times.<sup>81</sup>

Another big consideration that we're looking at through our smart meter analysis is the difference in network demand caused by seven-star homes, the new energy efficient standard, and existing housing stock. We're seeing a real difference between the impact on peak demand of all electric homes that have that seven-star efficiency standard compared to those without.<sup>82</sup>

4.70 On 28 November 2024, the Australian Energy Market Commission (AEMC) made a final ruling requiring universal smart meter deployment across the National Electricity Market by 2030. The Chair of the AEMC, Anna Collyer, said the reform recognised smart meters as essential infrastructure for transitioning to a renewable energy system and achieving Australia’s net zero emissions

<sup>79</sup> Beyond Zero Emissions, *Submission 19*, p. 9.

<sup>80</sup> NSW Government, *NSW Climate and Energy Action—Using smart meters*, [www.energy.nsw.gov.au/households/guides-and-helpful-advice/being-more-energy-efficient/measuring-your-usage/using-smart#:~:text=A%20smart%20meter%20is%20a,can%20read%20the%20meter%20remotely](http://www.energy.nsw.gov.au/households/guides-and-helpful-advice/being-more-energy-efficient/measuring-your-usage/using-smart#:~:text=A%20smart%20meter%20is%20a,can%20read%20the%20meter%20remotely). (accessed 28 February 2025).

<sup>81</sup> Ms Charlotte Eddy, General Manager, Regulation and Policy (Distribution), AusNet Services, *Committee Hansard*, 22 November 2023, p. 11.

<sup>82</sup> Ms Eddy, AusNet Services, *Committee Hansard*, 22 November 2023, p. 12.

targets. She also stated that '[s]mart meters are the digital foundation needed for a modern, connected and efficient energy system'.<sup>83</sup>

### **Improving energy efficiency disclosure and performance**

4.71 During the inquiry, it was noted that many Australian homes rate poorly on energy performance and, therefore, use more energy than necessary. It was also noted that there was a general lack of transparency regarding the energy efficiency of homes, making it difficult for purchasers and renters to make informed choices. These issues are further discussed below.

4.72 In its submission to the inquiry, the Climate Change Council stated that 'too many Aussie homes rate poorly on energy performance, using more energy than necessary'. It noted that, although from October 2023 the minimum energy standard for new homes is 7 stars, homes built before 2003 were constructed without any minimum standard—resulting in homes that are more expensive to run and that add to the climate challenge.<sup>84</sup>

4.73 Mr Menzel highlighted the lack of transparency in Australia around the energy efficiency of buildings, and contrasted this with other comparable developed countries in Europe:

At the moment, when you are looking to move into a rental property or if you are buying what for most Australians is the biggest investment of their life, the family home, you have no insight into the energy performance of that home. That goes to its energy efficiency, its thermal performance and to the state of the appliances in that home. That is not the case in most other developed countries. Indeed, every European country has a requirement to disclose the performance of homes at point of sale and lease.

In thinking about how we can activate the market around some of these upgrades, obviously government has a role, as I think this committee recognises, but we also want to provide consumers and householders with information so they can make good decisions. Having that label on the front of homes when you buy them or on rental properties actually incentivises the right types of investments in terms of both electrification and energy efficiency, and you actually start seeing energy efficiency and electrification being valued in the market.<sup>85</sup>

4.74 The Chief Executive Officer of the Green Building Council of Australia, Mrs Davina Rooney, highlighted for the inquiry the benefits of having energy efficiency information available:

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<sup>83</sup> Australian Energy Market Commission, *AEMC finalises landmark reform to accelerate smart meter rollout*, 28 November 2024, [www.aemc.gov.au/news-centre/media-releases/aemc-finalises-landmark-reform-accelerate-smart-meter-rollout](http://www.aemc.gov.au/news-centre/media-releases/aemc-finalises-landmark-reform-accelerate-smart-meter-rollout) (accessed 27 February 2025).

<sup>84</sup> Climate Council of Australia, *Submission 9*, p. 11.

<sup>85</sup> Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 4.

In all markets where this information is available, we see people start to upgrade their homes because these properties are worth more. The example that I should give is disclosure in office buildings with NABERS—the National Australian Built Environment Rating System. We've had mandatory disclosure there for a decade. The statistics show that we have an over 40 per cent reduction in energy across that cohort as people have sought to make their products better now that the information is disclosed. So Australia has a lot of clear examples from other market sectors, and international examples in housing, that what we measure we manage. There are very clear local and international examples that disclosure leads to better outcomes.<sup>86</sup>

...

This increases information, reduces the confusion in the market and helps the government do its job of transitioning Australian homes. The sooner we get those clear market signals in place the better, because this is a whole-of-Australia challenge.<sup>87</sup>

4.75 Ms Alison Scotland, Executive Director, Australian Sustainable Build Environment Council, also commented on this issue and stated the following:

... we know the energy performance of our own refrigerators, but we don't know the energy performance of our homes. I think that is one of those incredibly basic needs across the country. If we look at the ACT, this is something that you have as a community already. It's part of your way of life. You have the energy performance of the house when you are buying or when you're renting, and you've got that system in place. You also have a very clear mandate from government that they are moving away from gas. Those clear policy intentions give markets certainty.<sup>88</sup>

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<sup>86</sup> Mrs Rooney, Green Building Council of Australia, *Committee Hansard*, 22 March 2024, pp. 15–16.

<sup>87</sup> Mrs Rooney, Green Building Council of Australia, *Committee Hansard*, 22 March 2024, p. 16.

<sup>88</sup> Ms Alison Scotland, Executive Director, Australian Built Environment Council, *Committee Hansard*, 22 March 2024, p. 7.

# Chapter 5

## Residential electrification and the grid

- 5.1 As discussed in the previous chapter, residential electrification has significant implications for building and appliances standards that impact energy efficiency behind the meter.
- 5.2 However, the committee also received evidence that residential electrification will also have significant implications on energy infrastructure in front of the meter—that is, the utility side of Australia’s electricity grid. As outlined in this chapter, inquiry participants gave evidence on the following grid implications of electrification:
- managing the challenge of variable electricity demand;
  - the importance of battery storage in managing grid stability; and
  - the investments in grid infrastructure needed to support electrification.
- 5.3 Noting the evidence received during the inquiry, the chapter concludes with consideration of the optimal timeframe for residential electrification.

### Managing the challenge of variable electricity demand

- 5.4 Australia’s electricity grid already faces variable energy demand challenges. Daytime electricity use is generally low, leading to a reduction in daytime energy prices. In the evening or on a particularly hot day, energy demand peaks leading to price increases and potential grid instability.
- 5.5 However, the widescale changes to Australia’s energy use dynamics through electrification are expected to exacerbate the challenge of managing variable electricity demand. In particular, residential electrification will shift households’ energy demand with impacts for both minimum operating conditions and peak demand.<sup>1</sup>

### Consumer energy resources and grid integration

- 5.6 Australia has seen very high levels of uptake of rooftop solar. Today, over four million households have rooftop solar installed with a total generation capacity of almost 25 GW, exceeding that of Australia’s coal-fired power stations.<sup>2</sup>
- 5.7 While rooftop solar in Australia has many considerable benefits, it has also added to the complexity of managing variable electricity demand. Energy generation from solar is generally high during the day and, combined with low daytime electricity use, this can drive down minimum operating conditions.

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<sup>1</sup> Evergen, *Submission 22*, p. [2].

<sup>2</sup> Department of Climate Change, Energy, the Environment and Water (DCCEEW), *Annual climate change statement 2024*, November 2024, p. 25.

Further, the switch to electric appliances is expected to exacerbate maximum demand periods outside of daylight hours.<sup>3</sup>

- 5.8 Indeed, several submitters raised concerns about the implications of the abovementioned situation on the price consumers pay for energy. For example, while supportive of increased electrification in Australia, Energy Flex raised concerns that:

... the renewable energy transition will inevitably lead to intra-day price separation, i.e., prices will crash when renewables are generating and skyrocket when firmed power (whether from storage or flexible (CCS supported) fossil fuel generation). Spot prices in the [National Energy Market] are already exhibiting this trend ...<sup>4</sup>

- 5.9 Australia's electricity system, as Australian Energy Market Operator (AEMO) has explained, was 'originally designed for power to flow from large power stations through a network of substations and power lines into homes and businesses'.<sup>5</sup> However, today 'electricity from millions of rooftop solar systems feed back into the grid'.<sup>6</sup> The committee heard that this can result in a voltage control problem:

[The] Voltage control problem in low voltage electrical distribution networks supplying residential customers has motivated most utilities to adopt solutions such as declining new installations at specific neighbourhoods, rejecting installations of systems larger than 5kW at some other districts, imposing export limits to new installations (i.e., capping the exported surplus energy from the photovoltaic systems into the grid) or emergency shut-down of the systems (i.e., entirely stopping the generation of photovoltaic energy for a period that can vary from minutes to hours). While these approaches help the utilities to mitigate the voltage and frequency problem in their networks, such solutions are uneconomic for the owners of the rooftop photovoltaic systems (i.e., the households who have invested in them).<sup>7</sup>

- 5.10 For several years, AEMO has warned of the challenges of integrating widescale solar into Australia's electricity grids.

Many households and businesses are taking steps to shape their own energy futures. They are adopting innovative ways to reduce and manage their demand, investing in what the industry collectively refers to as 'consumer energy resources' (solar systems, batteries, electric vehicles), and contributing to virtual power plants (VPPs) to bring them together. These

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<sup>3</sup> See, Evergen, *Submission 22*, p. [2].

<sup>4</sup> Energy Flex, *Submission 15*, p. 5.

<sup>5</sup> Australian Energy Market Operator (AEMO), 'Minimum operational demand', *Media release*, 2 December 2024.

<sup>6</sup> AEMO, 'Minimum operational demand', *Media release*, 2 December 2024.

<sup>7</sup> Associate Professor Farhad Shahnia, Dr Arash Vahidnia, Associate Professor Gm Shafiullah, Dr Moayed Moghbel, Professor Tania Urnee, *Submission 40*, pp. 3–4.

innovations and resources – supported by distribution, system operators and third parties – are playing a transformative role in the energy transition and will be a valuable resource in the future energy system. If they are well coordinated (‘orchestrated’), they help deliver reliable and secure energy, offset the need for grid-scale investment, and reduce costs for consumers as well as energy sector emissions. The ISP assumes this orchestration will occur at varying levels across each of AEMO’s scenarios.<sup>8</sup>

- 5.11 In its 2024 Integrated System Plan (ISP), AEMO raised concerns about the risk associated with CERs not being adequately integrated into the existing electricity grid. The ISP noted that without effective coordination with consumer batteries, an additional \$4.1 billion in investment in the grid would be needed, adding to the cost of consumer bills. It went on to say

Ultimately, consumers who own these systems will choose how they are used. They will need transparency and material benefits to ensure they support, with confidence, their systems being coordinated with the power system.<sup>9</sup>

- 5.12 Mr Tennant Reed, Director of Climate Change and Energy of the Australian Industry Group provided more detail on reducing grid demand to prevent problems associated with grid integration. He suggested standards or incentives relating to the timing for charging electric vehicles and heat pump systems to coincide with the middle of the day, the cheapest time for energy usage. He also advocated for capability for less frequent demand stressors on the electricity grid, such as during heat waves or when a large generator fails. He pointed out there was a lot of potential for reducing demand in the grid but this would require bringing together elements like standards, customer education and financial incentives to real its full potential.<sup>10</sup>
- 5.13 Dr Rober Barr of Electric Power Consulting Pty Ltd was of the view that while solar panels and community batteries have provided benefits, there was still a significant need for electricity grid storage to be provided quickly. He told the committee ‘we need to have ... low-emission, dispatchable generation that’s grid connected, with all other things in moderation’.<sup>11</sup>
- 5.14 Mr Neil Roberts, Director of Technical and Safety Policy at the National Electrical and Communications Association, stated that bidirectional electricity flow was an issue being considered by networks. He outlined that different jurisdictions were handling this issue in different ways, with Queensland

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<sup>8</sup> AEMO, *2024 Integrated system plan*, June 2024, pp. 7–8.

<sup>9</sup> AEMO, *2024 Integrated system plan*, June 2024, p. 17.

<sup>10</sup> Mr Tennant Reed, Director, Climate Change and Energy, Australian Industry Group, *Committee Hansard*, 22 November 2023, pp. 5–6.

<sup>11</sup> Dr Robert Barr, Director, Electric Power Consulting Pty Ltd, *Committee Hansard*, 22 November 2023, p. 19.

implementing new metering rules which include network control devices on customer's switchboards which help prevent network collapses. South Australia and Western Australia had similar measures in place but other jurisdictions had taken different approaches. He expressed concerns about this inconsistency between jurisdictions for both communications with customers and what capacity is being built into connection arrangements.<sup>12</sup>

### **Main types of transition investment**

- 5.15 Evidence to the committee noted that the switch to renewable energy sources would require significant investment in transmission grids, making the point that renewable energy sources, particularly wind and solar, were largely being built far from existing infrastructure.<sup>13</sup>
- 5.16 Ms Charlotte Eddy of AusNet Services made the point that widespread electrification would lead to increased demands on the electricity grid and would likely require replacement of significant parts of the network, 'from transformers, right down to street-level or low-voltage investments – for example wires with extra capacity'.<sup>14</sup>
- 5.17 Mr Marc England, Chief Executive Officer of Ausgrid, explained that electrification could be broken into three categories: electrification of transport, electrification of homes, and distributed generation from, for example, solar panels on rooftops. All three, Mr England explained, needed policy clarity in order to be implemented successfully.<sup>15</sup>
- 5.18 Dr David Sweeting, Director at Sweeting Consulting Pty Ltd, warned that the cost of transmission and distribution upgrades could be 'around two and a half to three times the cost of the traditional dispatchable system – before we pay for any solar, any wind or any firming capacity'. He went on to say:

We need to consider these distribution costs and how they're going to impact it and work out how we're going to lower the price of electricity while we increase the total cost of dispatchable generation and the total cost of the transmission and distribution system well above the previous price of electricity.<sup>16</sup>

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<sup>12</sup> Mr Neil Roberts, Director, Policy, Technical and Safety, National Electrical and Communications Association, *Committee Hansard*, 21 February 2024, p. 11.

<sup>13</sup> Australian Academy of Technological Sciences and Engineering, *Submission 5*, p. 1.

<sup>14</sup> Ms Charlotte Eddy, General Manager, Regulation and Policy (Distribution), AusNet Services, *Committee Hansard*, 22 November 2023, pp. 10–11.

<sup>15</sup> Mr Marc England, Chief Executive Officer, Ausgrid, *Committee Hansard*, 22 November 2023, p. 14.

<sup>16</sup> Dr David Sweeting, Director, Sweeting Consulting Pty Ltd, *Committee Hansard*, 22 November 2023, p. 18.

5.19 Dr Sweeting was of the view, however, that the Australian public would be willing to 'co-invest with the government' on the cost of upgrades to the electricity grid, if given the right incentives.<sup>17</sup>

### **Costs of rooftop solar in electrification**

5.20 Several submissions to the inquiry and witnesses at public hearings discussed the costs associated with rooftop solar and its role in residential electrification.

5.21 Dr Tennant Reed, Director of Climate Change and Energy at the Australian Industry Group, argued that household electrification 'done well' could minimise costs or even provide savings for the broader electricity grid. However, there were also risks that poorly done electrification could increase peak demand as well as the infrastructure and generation required to support it.<sup>18</sup>

5.22 Dr Rober Barr, Director at Electric Power Consulting Pty Ltd, cautioned against an overreliance on rooftop solar to provide network support and cost savings to the electricity grid. He told the committee that solar in-and-of-itself did not provide more network support, but does the opposite by creating reverse power flows. He noted that 'this is one of the big costs not included in the Integrated System Plan – the cost of augmentation, particularly in the distribution network, and also...the costs of batteries that need to be there to firm up the solar PV so that it takes some stress off the network'.<sup>19</sup>

5.23 Dr Barr urged moderation in the installation of rooftop solar, explaining that at high levels of uptake it could become counterproductive to electricity supply and highly costly. He stated that there was an 'optimum' level of rooftop solar which Australia was currently very close to achieving.<sup>20</sup>

5.24 Other witnesses at public hearings took a different view. Mr Rainer Korte, CEO of ElectraNet, was of the view that electrification could improve the utilisation of the electricity network by providing more energy on the grid, and by extension lowering the costs of electricity. He pointed out the driver of increased transmission investment was increased peak-time demand and that, so long as new pressures on demand (such as electric vehicle car charging) were managed in such a way as to utilise non-peak demand electricity, this would not meaningfully increase network costs. He pointed out that it was the

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<sup>17</sup> Mr Chris Lehmann, National Advocacy Manager, Master Electricians Australia, *Committee Hansard*, 21 February 2024, p. 18.

<sup>18</sup> Mr Reed, Australian Industry Group, *Committee Hansard*, 22 November 2023, pp. 1–2.

<sup>19</sup> Dr Barr, Electric Power Consulting Pty Ltd, *Committee Hansard*, 22 November 2023, p. 18.

<sup>20</sup> Dr Barr, Electric Power Consulting Pty Ltd, *Committee Hansard*, 22 November 2023, p. 18.

electrification of industrial loads which was more likely to have an impact on the transmission network in the medium term.<sup>21</sup>

5.25 Mr Reed of the Australian Industry Group advised that the amount of additional electricity load which would be generated by electrification of home heating and light transport would not be very large, with the larger impact being peak demands that are placed on the network. He added that the bulk of network costs paid for by households and businesses are distribution network costs, and that this had the greatest potential for future costs either being avoided or incurred.<sup>22</sup>

5.26 Submissions to the inquiry made the point that the move towards residential electrification would require the upgrade of distribution networks and a number of household switchboards.<sup>23</sup>

5.27 Evergen emphasised in its submission the need for adequate planning of widespread electrification in order to ensure that the electrical system remained affordable and reliable. It also submitted:

AEMO has forecast that the electrification of households will be a driver of growth in both minimum operational demand conditions and peak demand. Rooftop PV drives down minimum operational demand during the daylight hours, while maximum demand periods are forecast to frequently occur outside the daylight hours, with the switch to electrification of appliances.<sup>24</sup>

### ***Expensive network and household electrical upgrades***

5.28 Conversely, the Institute for Energy Economics and Financial Analysis submitted that the ‘small number’ of studies which suggest that residential electrification would result in ‘costly impacts on electricity networks’ are ‘likely overstated’.<sup>25</sup>

5.29 The Climate Council noted the costs of maintaining, upgrading and installing gas network assets was also passed on to consumers in the form of supply and usage charges in gas bills, which can make up to 40 to 50 per cent of a household’s gas bill.<sup>26</sup>

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<sup>21</sup> Mr Rainer Korte, Chief Operating Officer, ElectraNet, *Committee Hansard*, 22 November 2023, p. 8.

<sup>22</sup> Mr Reed, Australian Industry Group, *Committee Hansard*, 22 November 2023, p. 5.

<sup>23</sup> Beyond Zero Emissions, *Submission 19*, pp. 3–4.

<sup>24</sup> Evergen, *Submission 22*, p. [2].

<sup>25</sup> Institute for Energy Economics and Financial Analysis, *Submission 23*, p. 5.

<sup>26</sup> Climate Council, *Submission 9*, p. 13.

- 5.30 Energy Flex argued that current household electricity usage, with lower use during the day that peaks in the evening, ‘represents the worst possible profile for a renewable energy system’:

Household use peaks in the evening, as solar generation crashes and wind typically drops off, continues at a relatively high level overnight, peaks again just before solar generation kicks in and then drops off during the day.

Energy Flex went on to say that price inflation of electricity was inevitable if the renewable energy transition occurred without any changes in demand, noting that benefits of cheaper renewable energy would be eaten by the costs of storage (firming).<sup>27</sup>

### **Ensuring the stability and reliability of the grid**

- 5.31 The committee heard some concerns around how the transition toward, or uptake of, electrification may impact the stability and reliability of Australia’s energy grid.<sup>28</sup>

- 5.32 For example, the Institute of Public affairs submitted:

Australia’s electricity network and energy infrastructure are already being put under considerable stress by the rapid and ill-considered decommissioning of coal-fired power stations and installation of variable renewable sources of energy, which create fluctuations that the energy grid is ill-equipped to cope with. Increasing demand even further by pursuing electrification will exacerbate the problem for the energy grid.<sup>29</sup>

- 5.33 Evoenergy, which owns and operates the electricity distribution network in the ACT and gas distribution networks in the ACT and in some local government in NSW, also noted that the pace of the transition is posing planning challenges for both electricity and gas networks.<sup>30</sup>

- 5.34 However, Evoenergy also considered that this also presents opportunities for new technologies and consumer choice to enable wider community participation.<sup>31</sup>

### **Importance of battery storage in managing grid stability**

- 5.35 Evidence to the committee highlighted the important role of batteries to manage increased demand on the energy grid, and how investing in, and incentivising the roll out of these technologies is key to the energy transition.

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<sup>27</sup> Energy Flex, *Submission 15*, p. 3.

<sup>28</sup> See, for example, Institute of Public Affairs, *Submission 32*, pp. 2–3; EvoEnergy, *Submission 35*, p. 1.

<sup>29</sup> Institute of Public Affairs, *Submission 32*, p. 2.

<sup>30</sup> Evoenergy, *Submission 35*, p. 1.

<sup>31</sup> Evoenergy, *Submission 35*, p. 1.

- 5.36 For example, in a joint submission, a group of electrical engineering and energy academics, advised that community battery energy storage systems are a solution to alleviate the strain on the network. They added that ‘appropriate tariff structures and incentives should be developed as they are crucial for the success of these systems’.<sup>32</sup>
- 5.37 Further, Tesla emphasised the need for government support for residential energy storage ‘due to the critical role that behind the-meter assets will play in meeting future capacity requirements’. It specifically called for an extension of the Commonwealth’s Small-Scale Renewable Energy Scheme:
- ... [Tesla] recommends an extension of the Small-Scale Renewable Energy Scheme, offering a financial incentive to install small-scale renewable energy systems through awarding small-scale technology certificates (STCs), to also include small-scale batteries in the program.<sup>33</sup>
- 5.38 At a public hearing, Mr Chris Lehmann, National Advocacy Manager, Master Electricians Australia, similarly emphasised the importance of battery energy storage. While Mr Lehmann noted that the Australian Government is already investing significant amounts of taxpayer money in these technologies, he indicated that moving towards a co-investment model with government and consumers would be preferable.<sup>34</sup>
- 5.39 Specifically, Mr Lehmann suggested that the Australian and state governments should work together to establish a rebate scheme to coinvest with the public to bring extra storage into Australia’s network.<sup>35</sup>
- 5.40 Mr Lehmann provided the following examples:
- A rebate or a grant of anywhere between \$3,000 and \$7,000 has been granted in various jurisdictions across the country to consumers, whether they be business or private consumers, to be able to install battery energy storage. Some jurisdictions have gone down the low-interest loan path, especially for businesses to incentivise them to utilise their existing PV or future PV to offset their running costs and to maybe also be an income source in the evening and export back to the grid.<sup>36</sup>
- 5.41 Several inquiry participants considered that increasing the rate of battery energy storage systems (BESS) in Australian dwellings is an important solution to

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<sup>32</sup> Associate Professor Farhad Shahnia, Dr Arash Vahidnia, Associate Professor Gm Shafiullah, Dr Moayed Moghbel, Professor Tania Urme, *Submission 40*, p. 11.

<sup>33</sup> Tesla, *Submission 42*, p. [5].

<sup>34</sup> Mr Lehmann, Master Electricians Australia, *Committee Hansard*, 21 February 2023, pp. 19–20.

<sup>35</sup> Mr Lehmann, Master Electricians Australia, *Committee Hansard*, 21 February 2023, pp. 19–20.

<sup>36</sup> Mr Lehmann, Master Electricians Australia, *Committee Hansard*, 21 February 2023, p. 19.

managing excess daytime solar energy generation and reducing demand placed on the grid during periods of peak energy use.<sup>37</sup>

- 5.42 However, many inquiry participants also noted the high-cost of installing residential BESS is prohibitive for many Australians.<sup>38</sup> Alternatively, some submitters suggested that community battery energy storage systems could help to 'will absorb the excess electricity produced from distributed rooftop photovoltaic systems within a neighbourhood during the day and provide a steady electricity supply during the network's peak demand (usually in the evening or afternoon) to the same area'.<sup>39</sup>

### **Role of technology**

- 5.43 Mr Marc England, Chief Executive Officer of Ausgrid, was more optimistic about the challenges posed to the electricity grid by increased demand from electrification. He stated that as long as there were consistent and long-term policy signals, electricity suppliers can build their networks to efficiently meet demand. Mr England pointed to overseas examples where technology and data analytics were enabling demand to be spread to lower demand times in the day. Mr England explained that peak loads will need to be managed efficiently in order to ensure 'the lowest cost transition possible'.<sup>40</sup>

### **Role of battery storage in grid management**

- 5.44 In addition to the benefits that household BESS have for consumers, they also play an important role in managing peak electricity demand.

- 5.45 Evergen, an Australian energy management software company, submitted that, compared to a rooftop only solar system, battery storage has two benefits as they:

- reduce solar export, with benefits regarding local network constraints and minimum operational demand conditions; and
- reduce peak demand, via storing PV energy for use during after-sundown peaks.<sup>41</sup>

- 5.46 Mr Rainer Korte, of ElectraNet provided evidence that batteries were going to be a key element in reducing the stresses to the electricity network of peak demand. He stated that if battery resources can be coordinated they could be an

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<sup>37</sup> See, for example, Master Electricians Australia, *Submission 10*, p. 5; Lighter Footprints Inc, *Submission 26*, p. 27.

<sup>38</sup> See, for example, Associate Professor Farhad Shahnia, Dr Arash Vahidnia, Associate Professor Gm Shafiullah, Dr Moayed Moghbel, Professor Tania Urme, *Submission 40*, p. 4.

<sup>39</sup> Associate Professor Farhad Shahnia, Dr Arash Vahidnia, Associate Professor Gm Shafiullah, Dr Moayed Moghbel, Professor Tania Urme, *Submission 40*, p. 5.

<sup>40</sup> Mr Marc England, Chief Executive Officer, Ausgrid, *Committee Hansard*, 22 November 2023, p. 14.

<sup>41</sup> Evergen, *Submission 22*, p. [2].

important addition to addressing the challenges of the switch to renewable and decarbonised energy. There are currently virtual power plants in operation which are starting to perform this role.<sup>42</sup>

5.47 Mr England of Ausgrid took a different view, stating that a significant portion of the storage need required could be provided by the distribution network at a lower cost than the installation of home batteries. He further explained that a medium sized grid battery in the network could offer the same effect to consumers as a home battery for a third of the cost of the home battery. Ausgrid had been trialling this kind of grid-based battery model through a program funded by ARENA, and had found that grid batteries could play an important role in reducing the costs to consumers and allowing more of them to install rooftop solar panels, more generally lowering the costs of transition to renewables and electrification.<sup>43</sup>

5.48 Mr England was able to provide detail on the comparative costs of home batteries compared to a grid battery. Currently, a home battery would cost a consumer \$1 200 per kilowatt hour, whereas a battery put into the grid offered to a consumer to store excess electricity would cost between \$400 and \$500 per kilowatt hour. However, Mr England pointed out that under the current regulatory framework, Ausgrid, as a distributor, would not be able to store batteries in its network without a specific waiver for a specific battery.<sup>44</sup>

### **Investments in grid infrastructure needed to support electrification**

5.49 AiGroup also pointed out that grid infrastructure will require ‘significant investment’ to be able to manage demand and more complicated electrical distribution, and added:

This will require more energy storage and more capability to move electricity around the network. The amount of investment needed could be much larger or much smaller depending on our success in coordinating the transition. National coherence and cooperation will be essential.<sup>45</sup>

### **Wiring upgrades**

5.50 Additionally, significant wiring upgrades to Australia’s electricity grid are also needed to integrate residential electrification technologies. For instance, the electricity grid now needs to support over four million rooftop solar systems

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<sup>42</sup> Mr Rainer Korte, Chief Operating Officer, ElectraNet, *Committee Hansard*, 22 November 2023, p. 9.

<sup>43</sup> Mr England, Ausgrid, *Committee Hansard*, 22 November 2023, pp. 14–15.

<sup>44</sup> Mr England, Ausgrid, *Committee Hansard*, 22 November 2023, p. 15.

<sup>45</sup> AiGroup, *Submission 133*, p. 3.

with a generation capacity of almost 25 GW, exceeding the capacity of Australia's coal-fired power stations.<sup>46</sup>

## Optimal timeframe for residential electrification

### Expediting residential electrification to address environmental challenges

5.51 Many inquiry participants considered that efforts to electrify Australian homes should not be delayed given what they regarded as the environmental imperative to decarbonise.<sup>47</sup>

5.52 For instance, the City of Sydney submitted that '[t]he optimal timeline for household electrification to commence is now'.<sup>48</sup> The Energy Efficiency Council also considered that electrification is a 'task we need to start now', noting that there are some five million homes connected to the gas network and Australia has set an emissions reduction target of net zero by 2050.<sup>49</sup> Further, Environment Victoria submitted that 'delaying residential electrification is a climate change luxury we cannot afford' and maintained that Australia should 'aim for full residential electrification over the next 10 years'.<sup>50</sup>

5.53 While expressing similar views, the Property Council of Australia argued for all new-build homes in Australia to be electrified:

Zero-carbon-ready homes can be delivered today with technology that exists in the market right now, and if the grid decarbonises then the remaining emissions from fossil fuel gas must be eliminated. There's no time for delay. Electrification is the only viable pathway that exists today to do this. In this critical decade, if we know anything about the complexity and time it will take to electrify over five million homes across the country, decisive action and clear direction of travel are needed now. We need to start by making the problem no worse than it already is. This means that, from today, every new home should be all electric.<sup>51</sup>

5.54 Several other submitters supported pursuing an expeditious timeframe for residential electrification given the availability of energy efficient electric

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<sup>46</sup> See, DCCEEW *Annual climate change statement 2024*, November 2024, p. 25.

<sup>47</sup> See, for example, Dr John Shiel, *Submission 72*, p. [2]; Changing Weather, *Submission 102*, p. 32; Phil Browne, *Submission 135*, p. [2]; Alan Pears, *Submission 138*, p. [9]; Nigel Howard, *Submission 177*, p. [3].

<sup>48</sup> City of Sydney, *Submission 25*, p. 7.

<sup>49</sup> Mr Luke Menzel, Chief Executive Officer, Energy Efficiency Council, *Committee Hansard*, 22 November 2023, p. 4.

<sup>50</sup> Environment Victoria, *Submission 86*, p. 10.

<sup>51</sup> Ms Francesca Muskovic, National Policy Director, Property Council of Australia, *Committee Hansard*, 22 March 2024, p. 19.

technologies.<sup>52</sup> Luke Menzel, CEO of the Energy Efficiency Council, told the committee:

We have safe, reliable and efficient technology—induction cooktops and heat pumps for space heating and cooling and for hot water—that is ready to go and commercially available and that, indeed, many Australians are already using and benefiting from.<sup>53</sup>

5.55 Further, Tesla submitted that, ‘once macro-economic barriers and policy uncertainties are addressed’ residential solar, storage, and EV technologies could be rapidly deployed to meet decarbonisation targets.<sup>54</sup>

5.56 The Tasmanian Climate Collective stated it supported the ‘rapid decarbonisation of household electricity as soon as technically possible (based on advice from independent scientists and engineers)’.<sup>55</sup> The Jewish Climate Network expressed a similar view, stating that:

... the optimal timeline for household electrification should be as fast as possible, albeit in conjunction with advice from AEMO and other relevant energy authorities, and in conjunction with policies that fast-track new grid connections and energy infrastructure, as well as large scale energy storage and firming. All of this needs to be done with proper community consultation, especially with Traditional Owners.<sup>56</sup>

5.57 The Institute for Energy Economics and Financial Analysis argued that for ‘each year that a transition to electrification is delayed, consumers may be locking in up to an additional \$1.6 billion in avoidable lifetime costs from gas appliances’.<sup>57</sup>

5.58 In contrast, some inquiry participants did not agree with the case for an urgent residential electrification transition. Dr Barr, for example, called for the government to focus initial efforts on ‘greening the grid’ by reducing the emissions and improving the efficiency of current base-load generation. He stated:

... I don't think we should be going through this electrification transformation, this domestic electrification, until the costs are down low—probably half—and emissions are down to about a third of what they are at the moment. Then it makes sense to start swapping over. Clean the grid up before we do the transfer.<sup>58</sup>

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<sup>52</sup> See, for example, Mr Menzel, Energy Efficiency Council, *Committee Hansard*, 22 November 2024.

<sup>53</sup> Mr Menzel, *Committee Hansard*, 22 November 2024, p. 1.

<sup>54</sup> Tesla, *Submission 42*, p. [5].

<sup>55</sup> Tasmanian Climate Collective, *Submission 63*, p. [3].

<sup>56</sup> Jewish Climate Network, *Submission 28*, p. 5.

<sup>57</sup> Institute for Energy Economics and Financial Analysis, *Submission 23*, p. 10.

<sup>58</sup> Dr Barr, Electric Power Consulting Pty Ltd, *Committee Hansard*, 22 November 2023, p. 20.

5.59 Dr Barr advised that an approach that prioritised ‘greening the grid’ first would be more cost effective. Dr Barr noted that despite the fact that wind and solar are low-cost generation sources, significant costs arise from the storage and transmission of energy from renewables, particularly to meet the energy load demands in wind droughts and when solar output is low.<sup>59</sup> Dr Barr suggested that greening of the grid could include a move towards nuclear in mid-2030’s. He advised:

It's a very difficult task, getting emissions levels down. I think in the 2030s it would be moving towards nuclear. We've got to patch the system up and we've got to keep the system going until we reach that time when we can bring online some nuclear power stations, which could actually drive emissions down to the levels that would make electrification worthwhile.<sup>60</sup>

### **The complexity of transitioning to widespread household electrification**

The optimal timeline for household electrification is complex. As gas prices rise, there is risk that those who cannot electrify without assistance will be left to bear the costs. The optimal timeline for household electrification should include support for those who require assistance to electrify their households.

The optimal timeline for household electrification will vary at a household and jurisdictional level. By setting a clear timeline for the phase out of fossil fuel gas in the ACT, residents and businesses have been given a long lead time to plan and implement their transition to electrification.<sup>61</sup>

5.60 Lighter Footprints Inc. was of the view that ‘the optimal timeframe is for an immediate change’ but was also cognisant that this could be impractical. On that basis they recommended that all new homes be built with a National House Energy Rating Scheme (NatHERS) rating of six or seven and solar panels installed, contending these homes would be cheaper to build and would have lower emissions than other types of homes. They also recommended that it be government policy to transition away from gas in households.<sup>62</sup>

5.61 Transition Kingston was also of the view that the electrification transition should be done as soon as possible.<sup>63</sup>

5.62 Taking a different view, the Australian Gas Infrastructure Group considered that the appropriate timeline for residential electrification would be one that

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<sup>59</sup> Dr Barr, Electric Power Consulting Pty Ltd, *Committee Hansard*, 22 November 2023, p. 20.

<sup>60</sup> Dr Barr, Electric Power Consulting Pty Ltd, *Committee Hansard*, 22 November 2023, p. 20.

<sup>61</sup> ACT Government, *Submission 31*, pp. 10–11.

<sup>62</sup> Lighter Footprints Inc., *Submission 26*, pp. 18–19.

<sup>63</sup> Transition Kingston, *Submission 11*, pp. 2–3.

supported consumer choice in energy supply rather than mandating electrification by a certain time.<sup>64</sup>

5.63 The Investor Group on Climate Change argued that ‘the optimum timeline for ... electrification is one which allows for market entry of sophisticated, data driven enterprises, capable of aggregating residential DERs and scaling their impact’.<sup>65</sup>

5.64 Other submissions noted that availability of labour and savings for consumers would play a large role in determining the timeline for electrification.<sup>66</sup>

5.65 On a similar note, Electric Power Consulting explained that the timeline for residential electrification should

Any timeline for increasing home electrification should be linked to achieving substantially reduced electricity costs and lowering power system carbon emissions. Premature electrification of households will simply put increased burdens on electricity customers and will not achieve the desired lowering of emissions.<sup>67</sup>

### **Staggered approach**

5.66 The National Electricity and Communications Association (NECA) was of the view that the idea timeframe for residential electrification would be ‘within the decade prior to the global net zero target of 2025’.<sup>68</sup> This timeframe would allow for:

- communication and implementation of policy and legislation by government and regulators;
- upskilling an electrical workforce that can perform required installation work as well as maintenance into the future; and
- addressing the high volume of existing installations which will require conversions of some kind. The conversion of existing multi-occupancy buildings is expected to present administrative and engineering challenges in particular.<sup>69</sup>

5.67 The South Australian Council of Social Service (SACOSS) was in favour of ambitious targets for electrification and encouraged the adoption of a timeline developed by the Efficient Electric Homes Collaboration. This timeline could be broadly summarised as:

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<sup>64</sup> Australian Gas Infrastructure Group, *Submission 44*, p. 4.

<sup>65</sup> Investor Group on Climate Change, *Submission 111*, p. [3].

<sup>66</sup> Dr Kevin Cox, *Submission 7*, p. 6.

<sup>67</sup> Electric Power Consulting, *Submission 228*, p. 5.

<sup>68</sup> National Electrical and Communications Association, *Submission 56*, p. 13.

<sup>69</sup> National Electrical and Communications Association, *Submission 56*, p. 13.

- by 2025: all new homes constructed to be electric and energy efficient in order to minimise any future retrofitting requirements;
- by 2030: priority retrofitting of public and community housing. All First Nations remote and regional housing to be electric and energy efficient as well as all low-income owner occupied housing;
- by 2035: all homes to be electric and energy efficient, including all existing homes being retrofitted, including rental properties.<sup>70</sup>

5.68 Energetic Communities was also in favour of the above staged approach with electrification completed by 2035. Their submission stated:

From a household standpoint, electrifying as soon as possible is highly beneficial. However, this is not tenable at scale. The optimal timeline for electrification of all households should be informed from modelling that considers householder health, all housing energy efficiency measures available (building and appliances), the impacts on electricity demand and its ramification on electricity prices, gas prices, gas assets cost recovery, supply chain constraints and development.<sup>71</sup>

5.69 Also supportive of the Efficient Electric Homes Collaboration's staged approach was the Public Interest Advocacy Centre. This organisation emphasised the need for certainty, concrete targets, and strong policy to back electrification. This certainty would allow households to make better investment and purchasing decisions, States and Territories to align with federal government policies, commencement of future planning for existing gas networks to manage the transition and the realisation of reduced emissions.<sup>72</sup>

... housing tenure, age and sector, such as new and existing, owner occupied and rentals, and public, community and Indigenous housing. Targets could, for example, aim to electrify all households by 2035, with new homes under the National Construction Code...being built as all electric by 2025, and existing homes by the later date of 2035.<sup>73</sup>

5.70 Taking a different view, Ms Charlotte Eddy of AusNet Services brought to the committee's attention the difficulties associated with the decommissioning of the existing gas network. She suggested that a longer, managed period of decommissioning would help manage the costs for customers who remain on the gas network, which would likely include more vulnerable customers.<sup>74</sup>

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<sup>70</sup> South Australian Council of Social Service, *Submission 51*, p. 8–9.

<sup>71</sup> Energetic Communities, *Submission 73*, p. 8.

<sup>72</sup> Public Interest Advocacy Centre, *Submission 59*, pp. 1–2.

<sup>73</sup> Australian Conservation Foundation, *Submission 53*, p. 8–9.

<sup>74</sup> Ms Eddy, AusNet Services, *Committee Hansard*, 22 November 2023, p. 12.



# Chapter 6

## Conclusion and recommendations

- 6.1 Australia faces a dual challenge of using its abundant energy resources sustainably while ensuring all people can access affordable energy. Significant progress has been made to decarbonise Australia's energy system, however much work still needs to be done to improve overall energy efficiency.
- 6.2 As considered in this report, residential electrification is a significant measure for achieving better energy outcomes in Australia. With leadership and coordination, residential electrification can improve household energy efficiency and support Australia to meet its nation emission reduction targets.

### Promoting electrification

- 6.3 Many Australian households that have installed energy efficient electric appliances and consumer energy resources are already experiencing the economic and health benefits of the improved energy efficiency in their homes.
- 6.4 However, many households face structural barriers to accessing the benefits of residential electrification. Such barriers can affect people who on low incomes, who rent, who live in apartments (or strata properties), or who do not have enough information to enable them to make a decision to electrify.
- 6.5 The committee recognises that well-designed and tailored supports are needed to help households overcome the barriers to electrification. Indeed, such supports are fundamental to addressing social equity issues in Australia's transition to residential electrification.
- 6.6 In particular, the committee considers that households should be supported to install consumer energy resources in their properties, including rooftop solar, home batteries, bi-direction electric vehicle chargers and home energy management systems.

### Recommendation 1

- 6.7 **The committee recommends that the Australian Government, in coordination with state and territory governments, should promote households to uptake consumer energy resources, including rooftop solar, home batteries, bi-direction electric vehicle chargers and home energy management systems. In conjunction with those efforts, households should be promoted to participate with aggregators which can operate distributed assets in a coordinated fashion in response to grid and market conditions.**

## **Leveraging rooftop solar**

- 6.8 Managing Australia's residential electrification transition will require significant collaboration across the Australian community, with governments, industry bodies, financiers and energy consumers all having a significant role.
- 6.9 In the committee's view, there is significant scope for the Commonwealth Government to coordinate Australia's residential electrification transition, particularly given the difficulty of balancing the pace of the transition to meet emission reduction targets while managing pressures on our energy grid.
- 6.10 In particular, national coordination is needed to manage the rapid uptake of rooftop solar in Australia. As incentives have significantly reduced the cost of installing rooftop solar in recent years, the rate of solar energy in the electricity grid has increased significantly. Indeed, there are now some four million solar systems have been on Australians' roofs with a collective energy generation capacity which exceeds that of coal-fired power stations.
- 6.11 While rooftop solar has undoubtedly helped to decarbonise the electricity grid and reduce households' energy costs, the amount of energy generated by rooftop solar poses significant challenges for grid integration and stability. Today, Australia faces a situation where the energy generation potential of rooftop solar is constrained by capacity limitations of the electricity grid. To maintain grid stability, some electricity network operators are already curtailing the output of rooftop solar and rejecting new supply.
- 6.12 Australia's electricity grid was not designed to support the decentralised and bi-directional energy requirements of rooftop solar. The level of energy production from rooftop solar, particularly during daytime hours when energy generation is highest and energy consumption is generally lowest, has led Australia's energy market regulator to warn of the serious risk of grid instability from excess solar generation. Such instability compounds the already complex challenge of managing variable demand pressures in Australia's electricity grid.
- 6.13 The committee agrees with the evidence from many inquiry participants that battery energy storage systems (BESS) have a significant role in leveraging the benefits of rooftop solar and in addressing issues of grid instability. At the household level, BESS can store excess electricity generated by rooftop solar during the day and enable households to efficiently use that energy during peak evening hours. At the suburb level, community batteries can perform a similar function without each household needing to maintain their own individual BESS.

## **Recommendation 2**

- 6.14 The committee recommends that the Australian Government, in coordination with state and territory governments, should prioritise investment in**

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technologies that extend and improve the system value of rooftop solar, such as home batteries and home energy management systems.

### **Recommendation 3**

- 6.15 The committee recommends that the Australian Government, in coordination with state and territory governments, should prioritise how community batteries can spread the benefits of rooftop solar to consumers who are unable to install their own systems, such as renters, apartment dwellers or low-income earners.**
- 6.16 However, in supporting increased incentives for electrification, the committee notes that consumers must be given genuine choice about the electrification upgrades they may wish to make. This is particularly important for maintaining social license in Australia's transition to Net Zero by 2050.
- 6.17 Further, the committee notes that for many households the most affordable option in the short term will be to maintain their gas appliances. Federal and state governments should be mindful of this when implementing electrification policies and consumers should not be unduly prevented from maintaining gas appliances.
- 6.18 As such, the committee is concerned that approaches of some state and territory governments to ban residential gas connections may be an ideological approach that is not supported by a sound evidence base.

### **Avoiding labour shortfalls**

- 6.19 The success of any efforts to step up the pace and scale of residential electrification in Australia will depend, among other things, on the availability of an appropriately sized skilled workforce to deliver the necessary upgrades to homes and grid infrastructure. The committee heard from multiple witnesses that the significance of the workforce challenge Australia faces, in terms of its impact on larger electrification efforts, should not be underestimated. Australia will need, in particular, more qualified electricians, along with other skilled workers in the renewable and related manufacturing sectors.
- 6.20 The committee believes that the Australian government needs to consider, as a matter of priority and in coordination with states and territories, how to deliver more cost-effective local tuition for apprentices, including electrical apprentices.

### **Recommendation 4**

- 6.21 The committee recommends that the Australian Government and state and territory governments consider cost-effective local tuition for apprentices, such as electrical apprentices.**

**Senator Andrew Bragg**  
**Chair**  
**Liberal Senator for New South Wales**

# Government senators' additional comments

## Introduction

- 1.1 The Australian Government supports residential electrification through a suite of policy initiatives and investments so communities can take advantage of cheaper, cleaner energy to reduce energy bills and reduce emissions. Core recommendations of this inquiry are already underway, backed up by Labor's substantial progress towards 82 percent renewables in the grid by 2030.
- 1.2 The Australian Government's National Energy Performance Strategy (NEPS) provides a long-term framework to manage energy demand, so our community can enjoy the economic, climate and health benefits of improved energy performance.
- 1.3 In July 2024, the Energy and Climate Change Ministerial Council agreed to the release of the National Consumer Energy Resources Roadmap. The Roadmap responds to the need to promote better coordination and optimisation of Community Energy Resources (CER), such as rooftop solar, home batteries and electric vehicles, which will put downward pressure on bills and overall system costs, reduce emissions and broaden access to CER across communities.
- 1.4 The 2023–24 Budget's Energy Savings Package is delivering more than \$1.7 billion for energy saving upgrades for homes, businesses, local governments and social housing. In November 2024, this was supplemented by an additional \$500 million for the Social Housing Energy Performance Initiative (SHEPI).
- 1.5 Government Senators agree that this report proves the Coalition's \$600 billion nuclear scheme fails Australian households, because it will push up power bills by up to \$1200 a year, cut off rooftop solar, and drop a 2 billion tonne emissions bomb on the economy.

## Equitable residential electrification

- 1.6 Residential electrification allows households to benefit from more energy efficient appliances and home environments that reduce energy bills, and when supplied with renewable energy allows for further emissions reductions.
- 1.7 Electrifying a household can entail prohibitive up-front costs for several demographics. This affects renters, people on low incomes including homeowners on low incomes, and those who live in apartment buildings. It is important that as households and the wider economy gradually electrifies that sections of the community are not left behind.
- 1.8 Government Senators are of the view that equity must be a strong consideration in any initiatives to support residential electrification and is encouraged by this focus in government programs to-date.

- 1.9 Government Senators would like to thank the many organisations that submitted and appeared at the public hearings, and for sharing their insights and recommendations to achieve high quality and equitable residential electrification.
- 1.10 Government Senators would also like to acknowledge the long running advocacy work of trade unions, social services organisations, environmental organisations and industry group in seeking a just and equitable transition to the net zero economy, in households and in workplace.
- 1.11 Government Senators similarly acknowledge the important role that highly skilled and qualified tradespeople have in residential electrification and upgrades, and the energy transition more broadly. There is an important need to increase the number of people taking up the electrical trades and to support them in completing their apprenticeships.

### **Coordination of electrification**

- 1.12 Many of the Chair's recommendations call for coordination between the federal, state and territory governments particularly with regards to the uptake of in-home and community infrastructure.
- 1.13 Government Senators note this coordination work is already underway. The Australian Government established the Energy and Climate Change Ministerial Council in September 2022. This provides the forum for states and territories to work together on priority issues of national significance and key reforms in the energy and climate change sectors. The coordination between the Commonwealth and States and Territories is exemplified by the numerous joint initiatives already supporting electrification, reducing energy bills, rolling out community batteries, and making important investments in social housing upgrades.
- 1.14 Initiatives delivered by the Federal Government, and those being delivered in partnership with state and territory governments including:

### **Household upgrades and energy bills**

- 1.15 The Energy Bill Relief Fund extension announced in the 2025–26 Federal budget will take another \$150 directly off household energy bills, in addition to the \$300 that has already been provided to all Australians in the 24–25 financial year, and the up to \$250 provided to eligible households in the 23–24 financial year.
- 1.16 The \$1.3 billion Household Energy Upgrades Fund (HEUF), including \$1 billion for the Clean Energy Finance Corporation (CEFC) to unlock energy performance upgrades and bring down bills for over 110 000 Australian homes. These loans, delivered in partnership with participating lenders, are facilitating investment in battery-ready solar, better insulation, and energy efficient home appliances.

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- 1.17 \$36.7 million to update and expand the Nationwide House Energy Rating Scheme (NatHERS) so that existing homes can receive energy ratings, and updates to the Your Home website providing information for builders, buyers and renovators on sustainable and energy efficient homes, including free energy-efficient house plans.
- 1.18 \$15.2 million for the NEPS to improve energy performance, address demand side action, improve energy affordability and reliability and ultimately reduce emissions from homes, across the economy and in the energy system.

### **State and territory social housing upgrades**

- 1.19 The \$800 million Social Housing Energy Performance Initiative (SHEPI) is delivering thermal upgrades, new energy efficient appliances and solar panels and batteries for social housing, in collaboration with state and territory governments.

### **Community solar banks and batteries**

- 1.20 The \$100 million Community Solar Banks program that is helping 25,000 renters, apartment dwellers and low-income households access the benefits of rooftop solar when they are unable to install their own infrastructure.
- 1.21 The \$200 million Community Batteries for Household Solar program is delivering 400 community batteries around Australia, to store excess solar energy for families and households to use during peak periods.

### **Small business and community**

- 1.22 \$314 million for the Small Business Energy Incentive is supporting small businesses to claim tax deductions on electrification and energy efficient upgrades.
- 1.23 \$150 million directly off small business energy bills, in addition to the two payments of \$325 that have already been cut from bills through rounds in the 23–24 and 24–25 financial years as part of the expanded Energy Bill Relief Fund.
- 1.24 \$56.7 million for the Energy Efficiency Grants for Small and Medium Sized Enterprises program is supporting businesses to upgrade or replace inefficient equipment and implement other energy efficiency activities.
- 1.25 \$100 million for the Community Energy Upgrades Fund (CEUF) which is assisting local governments with matched funding to undertake energy efficiency and electrification upgrades on council owned or operated facilities.
- 1.26 \$47.7 million to support structural reform to the energy market in partnership with jurisdictions and market bodies, targeted at unlocking the benefits of CER, like lower wholesale prices and higher returns for households exporting rooftop solar and batteries to the grid.
- 1.27 In Western Australia, the Australian Government is contributing funding to Project Jupiter in association with Western Power. It will integrate distributed

energy resources (DER) such as rooftop solar and residential batteries at scale within WA's main electricity system, the South West Interconnected System (SWIS), accelerating opportunities for WA households to join virtual power plants (VPPs) and participate in the energy transition.

- 1.28 For the first time under his Ministerial referral powers, Minister Bowen recently asked the Australian Renewable Energy Agency (ARENA) to consider funding for more community electrification demonstration projects across the country. This followed the \$5.4 million in funding that the Government contributed through ARENA for the Electrify 2515 project, which is the latest in at least 49 projects in which ARENA has invested more than \$144 million over six years to help homes reduce their energy bills through electrification and other energy smart improvements.

### **Importance of highly skilled electrical tradespeople**

- 1.29 The Chair's call for governments to 'consider cost-effective local tuition for apprentices' but fails to provide any further detail.
- 1.30 Government Senators note that to meet skilled labour demands there is a clear need to increase the number of electrical tradespeople and the number of apprentices completing their qualifications.
- 1.31 Further, federal, state and territory government initiatives are already encouraging the take up of electrical trades, and particularly women to take up electrical trades.
- 1.32 This includes the Federal Government's New Energy Apprenticeships Program which provides up to \$10 000 to 10 000 apprentices who undertake their apprenticeship in a new energy occupation, and the National Skills Agreement with all levels of government.
- 1.33 It also includes federal, state and territory Free Tafe programs allowing over 100,000 people every year the opportunity to up-skill in new courses, undertake apprenticeships and pre-apprenticeships with no tuition costs. Government Senators note that legislation to make this scheme permanent was recently opposed by the Coalition in the Federal Parliament
- 1.34 Government Senators stress that 'cost effective local tuition' cannot simply mean cheaper, or the removal of free, tuition. Further, high quality training must not be undermined, or apprenticeship completion rates risked, by 'cost effective local tuition'.
- 1.35 Government Senators also welcome the Federal Government's announcement of the development of a national licensing scheme for electrical trades people and is encouraged that this reform will allow for high standards to be applied in high-demand sectors across the country without unnecessary barriers.

## **Importance of renewable energy to residential electrification**

- 1.36 The benefits of residential electrification are significantly increased when it is complemented by increasing rates of renewable energy into the national energy grid. This allows for households to benefit from cheaper energy bills and reduced emissions.
- 1.37 There is little benefit to electrification if energy generated from fossil fuels is powering new induction cook tops and new heat pump hot water units well into the future. This energy supply must be gradually replaced with reliable, renewable energy, which is already happening under this government.
- 1.38 Importantly, for residential electrification to be cost effective and generate a return on investment, energy bills need to be kept as low as possible. This can only be achieved with increasing the cheapest form of energy generation, renewable energy.
- 1.39 Government Senators welcome that the Federal Government is on track to reach its target of 82 percent renewable electricity generation by 2030, that a record 46 percent of electricity in the grid was generated by renewables in the last quarter of 2024, and that the amount of solar, wind and other renewables that came online in 2024 reached 7.5 GW in capacity, an increase on 5.3 GW in 2023.
- 1.40 Government Senators are concerned about the impact the Coalition's \$600 billion taxpayer funded nuclear scheme would have on communities and households across the country. The independent research of the Commonwealth Scientific Industrial and Research Organisation and Australian Energy Market Operator has confirmed that nuclear is the most expensive form of energy generation, up to six times more expensive than firmed renewables.
- 1.41 Government Senators note with concern that experts have identified that the Coalition's nuclear scheme would junk household solar systems, forcing owners across the National Electricity Market to switch off their home solar around 67 percent of the time.
- 1.42 Government Senators note the Coalition's nuclear nonsense will extend the life of coal generation beyond its needs, increase energy bills by up to \$1200 a year and drop a 2 billion tonne emissions bomb on the economy.

**Senator Jess Walsh**  
**Deputy Chair**  
**Labor Senator for Victoria**



# Senator Pocock's additional comments

## Introduction

- 1.1 Residential electrification and improving energy efficiency in Australian homes should be at the centre of Australian energy policy. Evidence to this inquiry underscores the urgency and opportunity of accelerating these initiatives to enhance energy affordability, improve public health, stimulate economic growth, and reduce carbon emissions.
- 1.2 We need to move faster and go further, which requires ambition from both major parties—ambition has been sadly lacking to date.
- 1.3 I support the recommendations made by the Chair’s Report and the convincing evidence contained within the report. However, I would like to emphasise that household electrification and the benefits it offers must be available to all Australians. Renters, those who live in apartments and low-income households need substantial attention to ensure that household electrification does not worsen inequality.

## Clear and ambitious national targets and ambitious investment

- 1.4 The Committee heard evidence that indicates that clear targets stimulate investment and provide market certainty. Beyond Zero Emissions recommends electrifying 5 million homes by 2035 to capture significant economic and environmental benefits, highlighting substantial employment opportunities associated with this transition.<sup>1</sup> The Grattan Institute emphasizes the necessity of setting clear end dates for gas connections to facilitate orderly transitions,<sup>2</sup> echoed by ATSE's call for immediate action and defined national benchmarks to expedite residential electrification.<sup>3</sup>
- 1.5 A broad coalition of 69 groups have come together under the banner *Renew Australia For All* to call for an immediate \$5 billion investment in electrification and home energy efficiency, and a \$50 billion investment over the next 10 years.<sup>4</sup>
- 1.6 The UTS Institute for Sustainable Futures highlights affordable credit and regulatory support as key to overcoming cost barriers for households.<sup>5</sup> Similarly, the Grattan Institute and the Institute for Energy Economics and

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<sup>1</sup> Beyond Zero Emissions, *Submission 42*.

<sup>2</sup> The Grattan Institute, *Submission 28*.

<sup>3</sup> Australian Academy of Technological Sciences & Engineering, *Submission 5*.

<sup>4</sup> Renew Australia for All - <https://renewaustraliaforall.org/wp-content/uploads/2024/09/Renew-Australia-for-All-Explainer-A4.pdf>

<sup>5</sup> UTS Institute for Sustainable Futures, *Submission 21*.

Financial Analysis reinforce the critical role of upfront financial support to mitigate initial capital costs and incentivize consumer uptake.<sup>6</sup>

### **Recommendation 1**

**1.7 That the Australian Government establish clear national targets for household electrification, including an initial goal of electrifying at least 5 million homes by 2035, aligned with Australia's commitment to reach 82% renewable energy by 2030.**

### **Recommendation 2**

**1.8 That the Australian Government invest in an ambitious program of household electrification and energy efficiency upgrades consisting of \$5 billion investment immediately and \$50 billion over the coming 10 years.**

### **Recommendation 3**

**1.9 That the investment in Recommendation 2 financial incentives, including rebates and low-interest financing, to reduce upfront costs associated with household electrification technologies.**

### **Household electrification for all, not the privileged few**

1.10 Household electrification is not equally available to all Australian households. Renters, apartment dwellers and households with lower incomes all find it more difficult to electrify. Submitters including the Battery Storage and Grid Integration Program (ANU) recommending tailored solutions to address the unique barriers faced by these groups.<sup>7</sup> The Smart Energy Council supports this approach, emphasizing the need to empower renters with better incentives and transparency on energy efficiency.<sup>8</sup>

1.11 There are various policy options available to provide more equitable access to household electrification for rental properties. Climateworks proposes ensuring rental properties achieve minimum energy performance standards and require disclosure of energy efficiency ratings at the point of sale.<sup>9</sup> Other submitters, such as the Australian Academy of Technological Sciences and Engineering proposed tax changes to provide incentives to owners of rental properties.<sup>10</sup> One

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<sup>6</sup> See, for example, The Grattan Institute, *Submission 28*; IEEFA, *Submission 23*.

<sup>7</sup> BSGIP, *Submission 42*.

<sup>8</sup> Smart Energy Council, *Submission 32*.

<sup>9</sup> Climateworks, *Submission 20*.

<sup>10</sup> Australian Academy of Technological Sciences and Engineering, *Submission 5*.

solution is to make capital gains tax and negative gearing tax benefits contingent on properties having rooftop solar and a household battery.

- 1.12 Various submitters proposed ways to increase the availability of household electrification to low-income households. Climateworks Centre supports targeted financial support, including low-interest financing specifically designed to overcome financial hurdles faced by low-income households.<sup>11</sup>

#### **Recommendation 4**

- 1.13 The Australian Government develops policies to ensure that rental properties, multi-dwelling structures and low-income households have equal access to household electrification.**

#### **Household batteries in the Small-scale Renewable Energy Scheme (SRES)**

- 1.14 Helen Haines MP's submission demonstrates how integrating batteries into the SRES could substantially reduce battery costs, enhance energy security, and lower household energy expenses.<sup>12</sup>

#### **Recommendation 5**

- 1.15 Expand the SRES to include home battery systems, significantly reducing their installation cost and promoting widespread adoption.**

#### **Address skills shortages and build domestic supply chains**

- 1.16 Beyond Zero Emissions points to current skills shortages as significant barriers to scale and highlights the job creation potential of comprehensive workforce strategies.<sup>13</sup> IEEFA and the Smart Energy Council similarly advocate proactive investment in workforce and local manufacturing capabilities.<sup>14</sup>

#### **Recommendation 6**

- 1.17 Establish a workforce development programs and enhance domestic supply chains for key electrification technologies.**

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<sup>11</sup> Climateworks, *Submission 20*.

<sup>12</sup> Dr Helen Haines MP Independent Federal Member for Indi, *Submission 17*.

<sup>13</sup> Beyond Zero Emissions, *Submission 42*.

<sup>14</sup> Institute for Energy Economics and Financial Analysis (IEEFA), *Submission 23*, Smart Energy Council, *Submission 32*.

## **Reform of the governance of the National Electricity Market and energy market rules**

1.18 I provided extensive additional comments to a recent report from the Select Committee on Energy Planning and Regulation in Australia. My proposed pathway for reform is contained within those comments

### **Recommendation 7**

**1.19 Commence a process to reform the design of the National Energy Market in accordance with my additional comments to the recent report from the Select Committee on Energy Planning and Regulation in Australia.**

### **Conclusion**

1.20 These recommendations, backed by extensive expert submissions, provide a clear, comprehensive strategy to rapidly accelerate household electrification and energy efficiency across Australia. Their implementation will deliver substantial economic, environmental, and social benefits, positioning Australia as a global leader in the sustainable energy transition.

**Senator David Pocock**  
**Independent Senator for the Australian Capital Territory**

# Appendix 1

## Submissions and additional information

- 1 Laundry Association Australia
- 2 Australian Renewables Academy
  - Additional Information 1
- 3 Hyundai Motor Company Association
- 4 Energy Equality Regional Alliance
- 5 Australian Academy of Technological Sciences and Engineering
- 6 Doctors for the Environment Australia
- 7 Dr Kevin Cox
- 8 Dux Hot Water
- 9 Climate Council of Australia
- 10 Master Electricians Australia
  - Additional Information 1
  - Additional Information 2
- 11 Transition Kingston
- 12 Victorian Greenhouse Alliances
- 13 Kylea Tink MP Independent Member for North Sydney
- 14 ACT Council of Social Service
  - Additional Information 1
- 15 Energyflex
- 16 Sustainable Upper Ovens
- 17 Dr Helen Haines MP Independent Federal Member for Indi
- 18 Infrastructure Victoria
- 19 Beyond Zero Emissions
- 20 Climateworks Centre
- 21 UTS Institute for Sustainable Futures
  - Additional Information 1
- 22 Evergen
- 23 Institute for Energy Economics and Financial Analysis (IEEFA)
- 24 Energy Consumers Australia
  - Additional Information 1
  - Additional Information 2
- 25 City of Sydney
- 26 Lighter Footprints Inc
- 27 AusNet
- 28 Jewish Climate Network
- 29 APA Group Limited
- 30 Allgas Energy Pty Limited

- 31 ACT Government
- 32 Institute of Public Affairs
  - Additional Information 1
  - Additional Information 2
- 33 Clean Energy Regulator
- 34 Smart Energy Council
- 35 Evoenergy
- 36 Grattan Institute
- 37 Clean Energy Council
- 38 Victorian greenhouse Alliances
- 39 Asthma Australia
- 40 A/Prof F Shahnia, Dr A Vahidnia, A/Prof G Shafiullah, Dr M Moghbel and Prof T Urmee
- 41 Mr Robert Cruikshank
- 42 Tesla
- 43 Battery Storage and Grid Integration Program, ANU
- 44 Australian Gas Infrastructure Group
- 45 Wangaratta Landcare & Sustainability Inc
- 46 Australian Institute of Architects
- 47 Energy Efficiency Council
  - Additional Information 1
- 48 Climate Action Burwood/Canada Bay
- 49 Australian Sustainable Built Environment Council (ASBEC)
- 50 Venus Bay Community Centre
- 51 South Australian Council of Social Service
- 52 Conservation Council ACT Region
- 53 Australian Conservation Foundation
- 54 Voices for Power (Sydney Community Forum)
- 55 BOOMPower
- 56 NECA
- 57 ClearSky Solar Investments
- 58 ATCO
- 59 Public Interest Advocacy Centre
- 60 Flow Power
- 61 Energy Networks Australia
- 62 Smarter Communities
- 63 Tasmanian Climate Collective
- 64 Ampersand Engineering Pty Ltd
- 65 Housing Industry Association
- 66 Owners Corporation Network of Australia
- 67 Australian Electric Vehicle Association
- 68 Illawarra Knitting Nannas Against Greed
- 69 Electrify Canberra

- 
- 70 Peoples Climate Action Coalition
- 71 Dr Julie Mulhauser
- 72 Dr John Shiel
- 73 Energetic Communities
- Additional Information 1
- 74 Uniting Church in Australia, Synod of Victoria and Tasmania
- 75 Green Building Council of Australia
- 76 Newtown Climate
- 77 Australian Energy Market Commission
- 78 Master Builders Australia
- 79 Australian Pipelines and Gas Association
- 80 Ms Anna Nadolny, Australian National University - College of Engineering, Computing & Cybernetics
- 81 Solar Citizens
- 82 1 Million Women
- 83 Transgrid
- 84 Solar Analytics
- 85 Energy & Water Ombudsman NSW, Energy & Water Ombudsman QLD, and Energy & Water Ombudsman SA
- Additional Information 1
- 86 Environment Victoria
- Additional Information 1
  - Additional Information 2
  - Additional Information 3
- 87 City of Greater Bendigo
- 88 Johns Lyng Energy Services
- 89 Property Council of Australia
- 90 Bank Australia
- 91 Australian Energy Council
- 92 Boundless Earth
- 93 Australian Banking Association
- 94 Australian Parents for Climate Action
- Additional Information 1
- 95 Australian Competition and Consumer Commission (ACCC)
- 96 Victorian Council of Social Service
- 97 Energy and Water Ombudsman Victoria
- 98 Brighte
- 99 SA Power Networks
- 100 Dr Sangeetha Chandrashekeran
- Additional Information 1
- 101 Coalition for Community Energy

- 102 Changing Weather
- 103 Brotherhood of St Laurence
  - Additional Information 1
- 104 Farmers for Climate Action
- 105 Electrical Trades Union of Australia
- 106 Solutions for Climate Australia
- 107 Zero Emissions Noosa (ZEN) Inc.
- 108 Mr Lucas Turner
- 109 Ausgrid, Endeavour Energy and Essential Energy - NSW DNSPs
- 110 Seeley International
- 111 Investor Group on Climate Change
- 112 Australian Council of Social Service
- 113 Rheem Australia
- 114 Future Battery Industries
- 115 Sundrive
- 116 Mr Peter Meers
- 117 Mr Wayne Crawford
- 118 Name Withheld
- 119 Name Withheld
- 120 Mr William Thomas
- 121 Name Withheld
- 122 Mr Ekkehard Groskreutz
  - Additional Information 1
- 123 Name Withheld
- 124 Mr Luke Silcock
- 125 Ms Helen Carter
- 126 Mr Jim Allen
- 127 Name Withheld
- 128 Name Withheld
- 129 Mr Scott Banner
- 130 Mr Richard Costello
- 131 Ms Carolyn Eccleston
- 132 Rewiring Australia
- 133 AiGroup
- 134 Dr Marcus Rutherford
- 135 Mr Phil Browne
- 136 Strata Partners
- 137 Mr Cornelis Johannes Gerardus De Groot
- 138 Mr Alan Pears
- 139 Ms Sofahnya Olsen
- 140 Mr John Pettit
- 141 Mr Murray Sayle
- 142 Mr Gerry Harris

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143	Lee Jeffery
144	Claire Chatfield
145	Cally Jackson
146	Mr Richard Warren
147	Ian Kruger
148	Jane Fisher
149	Marion Ferguson
150	David Baird
151	Graeme Walters
152	Dogan Ozkan
153	Confidential
154	Rob Hillman
155	Jonathan Peter
156	David Froggatt
157	James FiltzSimons
158	Louise Holmes
159	Bernard Terry
160	Geoff Wallage
161	Tim Martin
162	Alexandra Balabin
163	Peter Temby
164	Martha Hills
165	Jeff Dunn
166	David Billington
167	Eileen Whitehead
168	Jennifer Taylor
169	Richard Weatherhead
170	Confidential
171	Rosemary Morrow
172	Maureen Corbett
173	Ms Janet Brunckhorst
174	Mr Peter Aubourg
175	Mr Tom Rohling
176	Name Withheld
177	Mr Nigel Howard
178	Confidential
179	Confidential
180	Ms Denise Farrier
181	Mr John Naylor
182	Mr Jack Gilding
183	Nakeshia Mason
184	Gary McGowan
185	John Nightingale

- 186 Jim Tippet
- 187 Meg Butterfield
- 188 John Markwell
- 189 Sandor Galos
- 190 Anne Lenert
- 191 Sally Wilson
- 192 Sandra Englart
- 193 Paul Rees
- 194 Thomas Staiger
- 195 Ray Calaby
- 196 Stuart Absalom
- 197 Jerry Cook
- 198 Geraldine Marston
- 199 Heather Loomed
- 200 Jennifer Purse
- 201 Mark Cramond
- 202 Dieter Liebrich
- 203 Mal Mobbs
- 204 Bob Phillips
- 205 Nigel Treloar
- 206 Margaret Fisher
- 207 John Gardner
- 208 Gary Saunders
- 209 Elizabeth Honey
- 210 Colleen Fleming
- 211 Ruth O'Reilly
- 212 Chris Charlton
- 214 Jan Dann
- 215 Julie Barnes
- 216 Phillip Baron
- 217 Jon Othitis
- 218 Brett Clowes
- 219 Katelyn Woods
- 220 Andrea Harrison
- 221 Angus Thompson
- 222 Fiona Webb
- 223 Wayne Murphy
- 224 Belinda Wright
- 225 Mark Munro
- 226 Department of Climate Change, Energy, the Environment and Water
- 227 Professor Ty Christopher
- 228 Dr Robert Barr - Electric Power Consulting
- 229 CSIRO

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- 230 Dr David Sweeting - Sweeting Consulting  
231 Confidential  
232 Confidential  
233 Name Withheld  
235 Net Zero Initiative - The University of Sydney  
236 Council Alliance for a Sustainable Built Environment

**Answer to Question on Notice**

- 1 Answer to a question on notice from Ausnet, asked by Senator David Pocock at a public hearing in Canberra on 22 November 2023 (received 6 December 2023).
- 2 Answer to a question on notice from Ausgrid, asked by Senator Andrew Bragg at a public hearing in Canberra on 22 November 2023 (received 6 December 2023).
- 3 Answer to a question on notice from the Australian Industry Group (Ai Group), asked by Senator Andrew Bragg at a public hearing in Canberra on 22 November 2023 (received 6 December 2023).
- 4 Answers to questions on notice from Australian Academy of Technological Sciences & Engineering (received 8 March 2024)
- 5 Answer to a written question on notice from the Australian Prudential Regulation Authority, Asked by Senator Andrew Bragg on 22 March 2024 (received 12 April 2024)
- 6 Answer to a question on notice from Mr Gordon Noble, asked by Senator Andrew Bragg at a public hearing in Canberra on 22 March 2024 (received 22 March 2024)



## Appendix 2

### Public hearings and witnesses

*Wednesday 22 November 2023*

Committee Room 2S3

Parliament House

Canberra

*Energy Efficiency Council*

- Mr Jeremy Sung, Head of Policy
- Mr Luke Menzel, Chief Executive Officer

*AiGroup*

- Mr Tennant Reed, Director, Climate Change and Energy
- Mr James Thompson, Lead, Standards and Product Regulation

*Electranet*

- Mr Rainer Korte, Chief Operating Officer
- Mr Simon Appleby, Head of Corporate Affairs

*AusNet*

- Ms Charlotte Eddy, General Manager

*Ausgrid*

- Mr Marc England, Chief Executive Officer
- Mr Alex McPherson, Acting Group Executive, Market Development and Strategy

*Electric Power Consulting*

- Dr Robert Barr, Director

*Sweeting Consulting*

- Dr David Sweeting, Director

*Wednesday 21 February 2024*

Committee Room 2S1

Parliament House

Canberra

*Owners Corporation Network of Australia*

- Mr Fred Tuckwell, Chair
- Mr Thomas Belsham, Director, Vice Chair and Treasurer

*Australian Electric Vehicle Association*

- Ms Jennifer Neil-Smith, New South Wales Branch Treasurer
- Dr Peter Campbell, ACT Branch Committee Member

*National Electrical and Communications Association*

- Mr Kent Johns, Head of Government Relations and Regulatory Affairs
- Mr Neil Roberts, Director, Policy, Technical and Safety

*Electrical Trades Union of Australia*

- Dr Katie Hepworth, National Policy Director

*Australian Manufacturing Workers Union (no submission)*

- Dr Mark Dean, National Research and Planning Officer

*Master Electricians Australia*

- Mr Chriss Lehmann, National Advocacy Manager

*Rheem Australia*

- Mr Chris Taylor, Managing Director
- Mr Scott Ostini, General Manager, Energy Solutions and Transformation
- Mr Ben Teeger, General Counsel and General Manager, Corporate Affairs

*Australian National University*

- Ms Heather Logie, Deputy Head, Battery Storage and Grid Integration Program
- Professor Lachlan Blackhall, Deputy Vice Chancellor, Research and Innovation

*Friday 22 March 2024*

Main Committee Room  
Parliament House  
Canberra

*Rewiring Australia*

- Dr Saul Griffith, Co-Founder and Chief Scientist
- Mr Dan Cass, Co-Founder and Executive Director

*Australian Sustainable Built Environment Council (ASBEC)*

- Ms Alison Scotland, Executive Director

*Australian Academy of Technological Sciences and Engineering*

- Mr Peter Derbyshire, Director of Policy & International Affairs
- Professor Ken Baldwin, ATSE Fellow

*UTS Institute for Sustainable Futures*

- Mr Gordon Noble, Research Director

*Housing Industry Association*

- Mr Simon Croft, Chief Executive, Industry & Policy
- Mr Shane Keating, Executive Director, Building Policy

*Green Building Council of Australia*

- Mrs Davina Rooney, Chief Executive Officer
- Mrs Katy Dean, Senior Policy Advisor

*Master Builders Australia*

- Ms Alex Waldren, National Director, Industry Policy
- Mr Max Rafferty, National Technical Policy Manager

*Property Council of Australia*

- Ms Francesca Muskovic, National Policy Director